

SECONDARY 4

Express Exam Paper

Science Chemistry

1	CHIJ Katong Convent	SA1
2	Mayflower Secondary	SA1
3	Pasir Ris Crest	SA1
4	Psir Ris Secondary	SA1
5	West Spring Secondary	SA1
6	Bedok Green Secondary	SA2
7	Bedok South Secondary	SA2
8	Bendemeer Secondary	SA2
9	Bukit Batok Secondary	SA2
10	Geylang Methodist	SA2

Name:		Class:	
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CHIJ KATONG CONVENT MID-YEAR EXAMINATIONS 2018 Secondary Four Express and Secondary Five Normal (Academic)

SCIENCE (CHEMISTRY, BIOLOGY)

5078/01

Duration: 1 hour

Paper 1 Multiple Choice

Classes: 403, 404, 405, 501 and 502

Additional Materials: Optical Answer Sheets

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, registration number and class on all the work you hand in. Do not use staples, paper clips, highlighters, glue or correction fluid/ tape.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Optical Answer Sheet.

Complete the Chemistry and Biology sections on two separate Optical Answer Sheets provided.

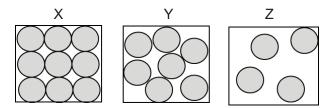
Read the instructions on the Optical Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

A copy of the Data Sheet is printed on page 16. A copy of the Periodic Table is printed on page 17.

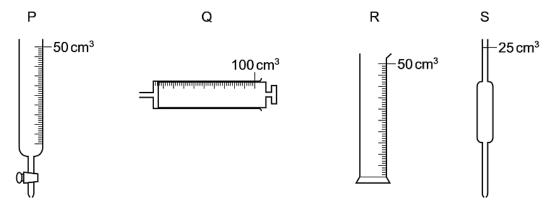
The use of an approved scientific calculator is expected, where appropriate.

1 Diagrams X, Y and Z represent the three states of matter.



Which change occurs during boiling?

- A X to Y
- B Y to Z
- C Z to X
- **D** Z to Y
- **2** P, Q, R and S are pieces of apparatus.

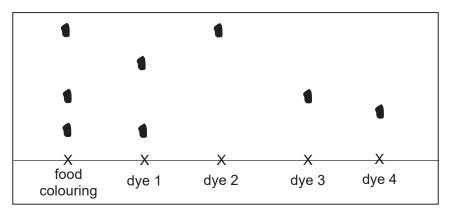


Which row describes the correct apparatus for the measurement made?

	apparatus	measurement made
Α	Р	15.60 cm ³ of acid to be added to alkali in a titration
В	Q	1 cm ³ of acid to be added to calcium carbonate in an experiment
С	R	75 cm ³ of gas given off in a thermal decomposition reaction
D	S	20.0 cm ³ of alkali to be used in a titration

- 3 Which method of separation should be used to obtain pure water from copper(II) sulfate solution?
 - **A** crystallisation
 - B evaporation to dryness
 - **C** filtration
 - **D** simple distillation

4 A food colouring is compared with four different dyes. The chromatogram produced is shown in the diagram.



Which dyes does the food colouring contain?

- A 1 and 2 only
- **B** 1 and 3 only
- C 2 and 3 only
- **D** 2 and 4 only

5 The table shows the boiling points of acetone and water.

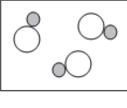
substance	boiling point/ °C
acetone	56
water	100

A sample of water was found to contain a small amount of acetone.

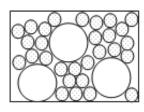
What could be the boiling point of the water sample?

- **A** 56 °C
- **B** 78 °C
- **C** 100 °C
- **D** 104 °C

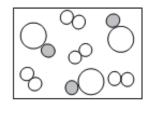
6 Which diagram shows a mixture of two compounds?



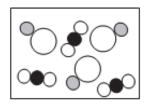
Α



В



C



D

- 7 Which statement about an atom is correct?
 - A The nucleon number is smaller than the proton number.
 - **B** The nucleon number is the sum of the number of protons and electrons.
 - **C** The number of proton always equals the number of electrons.
 - **D** The number of proton always equals the number of neutrons.
- 8 How many hydrogen atoms are there in 4 moles of ammonia gas?
 - **A** 1.5 x 10²³ atoms

CHIJ Katong Convent Mid-Year Exams 2018

- **B** 1.8 x 10²⁴ atoms
- **C** 2.4 x 10²⁴ atoms
- **D** 7.2 x 10²⁴ atoms
- **9** 20 cm³ of carbon monoxide was burnt in 40 cm³ of oxygen.

The equation of the reaction is shown.

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

What is the total volume of gas remaining at the end of the reaction?

- **A** 20 cm³
- **B** 40 cm³
- **C** 60 cm³
- **D** 80 cm³
- 10 Due to acid rain, the acidity of the soil is increased, making it unsuitable for plant growth.

Which substance is used by farmers to decrease the acidity in the soil?

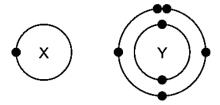
- A calcium carbonate
- B calcium hydroxide
- C calcium nitrate
- D calcium sulfate
- 11 An unknown oxide was added separately to hydrochloric acid and aqueous sodium hydroxide. The pH of the resulting solution was measured and shown in the table.

chemical	pH of resulting solution
hydrochloric acid	7.0
sodium hydroxide	7.0

What could the unknown oxide be?

- A aluminium oxide
- **B** carbon monoxide
- **C** potassium oxide
- D sulfur dioxide

12 The electronic structures of atoms X and Y are shown.



What is the formula of the covalent compound formed between X and Y?

- A XY₅
- B XY₃
- C XY
- $D X_3Y$
- 13 The table shows the properties of substances J, K, L and M.

substance	density/ g/dm ³	melting point/ °C	electrical conductivity in solid state
J	2.1	115	poor
K	5.7	232	good
L	6.3	1326	poor
M	19.3	1064	good

Which substances are metals?

- A J and K only
- **B** J and L only
- C K and M only
- **D** L and M only
- 14 The table shows the electronic configuration of four elements, P, Q, R, S.

element	electronic configuration
Р	2.2
Q	2.8
R	2.8.2
S	2.8.7

Which statement is correct?

- A P and R are in the same group.
- **B** Q and R have the same number of electron shells.
- **C** Q and S are in the same period.
- **D** R and S have the same number of valence electrons.

15 The table shows the results of some halogen displacement experiments.

halide solution halogen added	Х	Υ	Z
X		✓	*
Υ	×		*
Z	✓	✓	

Key:

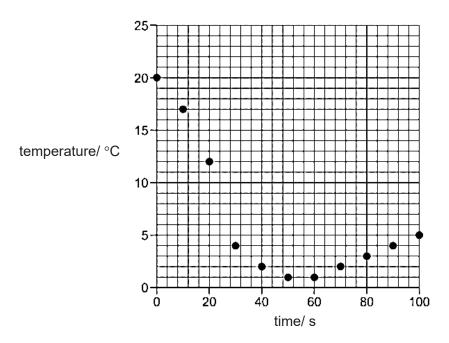
✓ visible reaction

× no visible reaction

What row shows the order of halogens in increasing reactivity?

	lowest -		→ highest
Α	X	Υ	Z
В	Υ	X	Z
С	Υ	Z	X
D	Z	X	Υ

Solid hydrated sodium carbonate was added to aqueous citric acid. The mixture was stirred and the temperature was recorded every 10 seconds. The results are shown on the graph



Which row describes the reaction?

	reaction type	energy change
Α	neutralisation	endothermic
В	neutralisation	exothermic
С	precipitation	endothermic
D	precipitation	exothermic

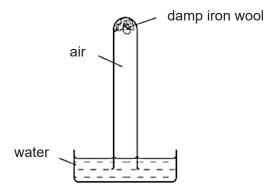
- 17 Which process is endothermic?
 - condensation
 - В freezing
 - C photosynthesis
 - rusting
- 18 The effect of temperature on the rate of the reaction between zinc and hydrochloric acid can be investigated by measuring the production of gas.

Which equipment is not required for the investigation?

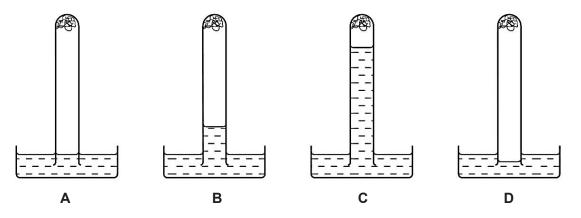
- Α condenser
- В gas syringe
- C stopwatch
- thermometer
- 19 The element vanadium, V, forms several oxides.

Which reaction shows oxidation taking place?

- A $VO_2 \rightarrow V_2O_3$
- $\begin{array}{c} V_2O_5 \rightarrow VO_2 \\ V_2O_3 \rightarrow VO \end{array}$ В
- C
- $V_2O_3 \rightarrow V_2O_5$
- 20 The apparatus shown is set up and left for a week.



Which diagram best shows the level of the water at the end of the week?



Data Sheet Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

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	2		C C C	71	4	ত	Sllon 28	32	Se	germanlum 73	20	S	ទ	118	83	g G	lead	207	114	ie ;	Terovium	ı
	=		B B	=	13	AI	auminum 27	31	Sa	gallum 70	48	Ę	India	2	2	1	malleu	24				1
		E)						30	7	85 di	48	8	cadmium	715	8	F	mercury	201	112	5	хрешапш	·
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Group								27	ර	Spair 59	45	듄	modium	103	11	H	Indum	192	109	W	memerum	-
		1 H Nydrogen 1	Υä					26	e e	<u>5</u> 8	4	S	nthenlum	5	78	ő	osmium	190	108	¥	nassium	ı
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			umber ool	nass				24	ပ်	chromium 52	42	W	molyboenum	8	74	>	tungsten	18	108	ගී	seatorgium	
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			proton	relativ				22	=	ttanium 48	40	72	Ziconium	5	72	Ξ	hamium	178	104	赱	Rutherlandium	
		86		_				21	လွ	scandlum 45	39	>	E I	3	57-71	lanthanoids			89 - 103	activoids		
	=		4 Be beryllum	В	12	Mg	magnesium 24	20	င္မ	calclum 40	38	ঠ	strontum	33	28	Ba	parlum	137		Ra	Ladum	ı
	_	-2	3 Li Ithlum	-			sodium 23	19	×	potassium 39	37	82	mpgn	8	8	క	caesium	133	87	Ľ,	ITANCIUM	Ė

71 Lu lufetum 175	103 Lr Iamrendum -
70 Yb ytterblum 173	102 No nobelium
E9 Tm Tuffum 169	101 Md mendelevum
68 Er erblum 167	100 Fm femium
67 Ho holmium 185	99 Es enstenium -
68 Dy dysprosium 183	98 Cf calfornum
65 Tb terblum 159	97 Bk berkelum
64 Gd gadolnium 157	Cm curtum
63 Eu europlum 152	95 Am americum
62 Sm samarlum 150	94 Pu plutontum
81 Pm promethlum	93 Np neptunlum
80 Nd neodymum 144	92 U uranlum 238
59 Pr praseodymium 141	91 Pa protectnium u 231
Se Ce 58	90 Th thorium 232
57 La lanthanum 139	89 Ac Mulum

actinoids

The volume of one mole gas is 24 dm³ at room temperature and pressure (r.t.p.).

lame:	(Class:
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CHIJ KATONG CONVENT MID-YEAR EXAMINATIONS 2018 Secondary Four Express and Secondary Five Normal (Academic)

SCIENCE (CHEMISTRY)

5078/03

Paper 3 Chemistry Duration: 1 hour 15 minutes

Classes: 403, 404, 405, 501 and 502

Candidates answer on the Question Paper. No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and registration number on all the work you hand in. Write in dark blue or black pen on both sides of the paper. You may use a soft pencil for any diagrams or graphs. Do not use staples, paper clips, highlighters, glue or correction fluid/ tape.

Section A

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer any two questions.

Write your answers in the spaces provided on the Question Paper.

A copy of the Data Sheet is printed on page 15. A copy of the Periodic Table is printed on page 16.

At the end of the examination, hand in:

- (a) Section A;
- (b) Section B separately.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

FOR EXAM	INER'S USE
Paper 1	/ 20
Paper 3	
Section A	/ 45
Section B	/ 20
TOTAL	/ 85

Section A [45 marks]

Answer all the questions in the spaces provided.

1 Substances can be classified as elements, compounds or mixtures. Complete Table 1.1 to describe the following substances.

Table 1.1

substance	classification (element, compound or mixture)	atoms found within the substance
hydrogen sulfide	compound	hydrogen, sulfur
brass		
limestone	compound	

[3]

[Total: 3]

- 2 Iron is the fourth most common element in the Earth's crust and it is also believed to form a large extent of the Earth's core.
 - (a) Pure iron can be prepared by the thermal decomposition of iron pentacarbonyl. Fig. 2.1 shows the structure of iron pentacarbonyl.

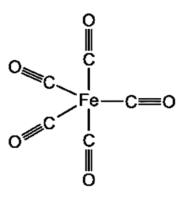


Fig. 2.1

Write the chemical formula for iron pentacarbonyl. [1]

(b) (i) Iron metal oxidises partially to form iron(II) oxide.

Predict the electrical conductivity of this compound by including the condition under which conductivity is observed or not at all.

[41]

[2]

2 (b) (ii) Complete Table 2.1 to show the number of electrons, neutrons and protons in iron(II) ion and oxide ion.

Table 2.1

	number of protons	number of neutrons	number of electrons
⁵⁶ ₂₆ Fe ²⁺	26		
¹⁶ ₈ O ²⁻		8	

	(c)	(i)	$^{54}_{26}$ Fe and $^{56}_{26}$ Fe are two common isotopes of iron.
			Define isotopes.
			[1]
		(ii)	These iron isotopes have different physical properties but exhibit same chemical properties.
			Explain this observation.
			[1]
			[Total: 6]
3			olourless solution of copper(I) chloride is left in a beaker for a period of time, the following akes place.
			$2CuCI(aq) \rightarrow CuCI_2(aq) + Cu(s)$
	(a)	Calc	ulate the oxidation state of copper in CuCl and CuCl ₂ .
		oxida	ation state of copper in CuC/
		oxida	ation state of copper in $CuCI_2$
	(b)	Expl	ain, in terms of change in oxidation states, why CuC/ is both oxidised and reduced in this tion.
			[2]

3	(c)	Desc	cribe one observation in this reaction.
			[1]
			[Total: 5]
4	(a)	Nam	e the pieces of apparatus most suitable to complete the following laboratory procedures:
		(i)	separate a precipitate from a solution,
			[1]
		(ii)	measure exactly 25.30 cm ³ of solution into a conical flask,
			[1]
		(iii)	measuring the mass gained in a reaction,
			[1]
		(iv)	bubbling gas into a test-tube containing solution.
			[1]
	(b)		omatography can be used to separate the coloured pigments extracted from lavender ers. The apparatus used is shown Fig. 4.1.
		After	a few minutes, the solvent vapour fills the whole chromatography jar.
			lid
			chromatography paper
			start line solvent
			Fig. 4.1
			cribe what happens to the movement and arrangement of the solvent particles as they ome a vapour.
			[2]

[Total: 6]

5

As	olution	n of nitric acid is prepared by diluting 0.15 mol to make 100 cm³ of solution.
(a)	Calc	culate the concentration of this solution in mol/dm³ and g/dm³.
		concentration = mol/dm³ [1]
		concentration = g/dm³ [1]
(b)	The follo	chemical equation for the reaction between nitric acid and potassium carbonate is as ws:
		$2HNO_3 + K_2CO_3 \rightarrow 2KNO_3 + CO_2 + H_2O$
		cm³ of 0.5 mol/dm³ nitric acid is added to an aqueous solution containing 0.02 mol of ssium carbonate.
	(i)	Calculate the number of moles of nitric acid.
		number of moles =[1]
	(ii)	State the limiting reactant in this reaction.
		[1]
	(iii)	Calculate the number of moles of potassium nitrate formed.
		number of moles =[1]
		[Total: 5]

6 Fig. 6.1 describes some of the properties and reactions of several substances.

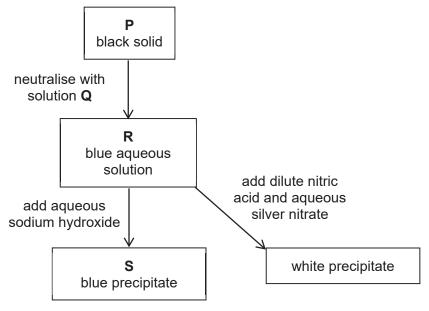


Fig. 6.1

(a) Identify P, Q, R and S.

r	
Q	
R	
S	[4]

(b) Write the ionic equation for the reaction of **R** with aqueous silver nitrate.

[1]

[Total: 5]

7 (a) Lithium, sodium and potassium belong to Group I of the Periodic Table.

Table 7.1 shows the observations when these three metals react with water.

Table 7.1

Group I metal	observation
lithium	reacts quickly
sodium	reacts violently
potassium	reacts very violently

	(i)	Describe and explain the reactivity of Group I metals down the group.
		[3]
	(ii)	Rubidium is located below potassium in Group I.
		Predict what would happen when rubidium reacts with water.
		[1]
	(iii)	Name the gas evolved when Group I metals react with water.
		[1]
(b)	Gro	up 0 elements are also known as noble gases.
	(i)	State one physical property of noble gases.
		[1]
	(ii)	Using your knowledge of electronic structures, explain why elements in Group 0 are unreactive.
		[1]
		[Total: 7]

The petrol burnt in car engines react with air to form a mixture of gases.

Table 8.1 shows the composition of the mixture of all the gases coming from car exhaust fumes.

Table 8.1

gas	% of gas in the exhaust fumes
carbon dioxide	15
carbon monoxide	3
hydrocarbons	2
hydrogen	1
oxides of nitrogen	1
oxygen	1
water vapour	18
gas W	59

(a)	Identify gas W .		[1]
(b)	The amount of carbon dioxide er of the gas in the atmosphere.	mitted by vehicles contributes to the inc	creasing concentration
	Explain why this is a global conc	eern.	
			[2]
(c)	Explain why carbon monoxide is	Ç	
			[1]

[Total: 8]

8 (d	I) Wate	er is one	of the m	naior hv-nr	oducts in th	e combustion	of petrol in vehicles

Draw a 'dot and cross' diagram of water, showing only the arrangement of electrons on the valence shells.

(e) The combustion of petrol is exothermic.

(i) Define exothermic.

[1]

(ii) Give another example of an exothermic reaction.

[1]

Ν	lame: ˌ	()	Class:
		Section B [20 marks] Answer any two questions in this section. Write your answers in the spaces provided.	
9	Мас	gnesium sulfate is formed from the reaction between a metal, M and an acid, N.	
	(a)	Name M and N.	
		M	
		N	[2]
	(b)	Write the balanced chemical equation for the reaction between M and N.	
			[1]
	(c)	Describe how pure crystals of magnesium sulfate can be prepared using metal M	and acid N.
			[4]
	(d)	Magnesium sulfate can also be prepared using acid N and another substance.	
		Name this substance.	
			[1]

9	(e)	The miss	labels on two bottles, one containing acid N and the other containing aqueous ammonia, were sing.
		(i)	Briefly describe a method you would use to distinguish between the two solutions.
			[1]
		(ii)	State the result you would expect for acid N using the method described in (e)(i).
			[1]
			[Total: 10
10	Iron	is a r	netal that is commonly used in the construction of ships and bridges.
	(a)		is extracted from haematite using carbon in a blast furnace. Impurities from the iron are oved using limestone.
			cribe how limestone is used to remove impurities from iron and include suitable chemical ations in your answer.
	(b)	Whe	en iron is exposed to the environment for some time, it starts to rust.
		(i)	Bridges made of iron are painted to prevent rusting.
			Explain how the layer of paint prevents iron from rusting.
			[41]
			[1]

10	(b)	(ii)	Some ships that are made of iron prevent rusting by attaching blocks of zinc to its surface. After some time, it was observed the block of zinc corroded instead of iron.
			Explain how attaching blocks of zinc help to prevent the ship from rusting.
			[1]
		(iii)	Predict what happens when blocks of silver metal are attached to the iron surface of the ship instead of zinc.
			[1]
		(iv)	It was observed that ships in the sea tend to corrode more quickly than bridges.
			Suggest a reason to explain this phenomenon.
			[1]
	(c)	In a	ddition to the production of iron using the blast furnace, iron is also obtained through recycling.
		Give	e two reasons why it is important to recycle metal.
		1	
		2	
			[2]
			[Total: 10]

- 11 Egg shells are made up mainly of calcium carbonate. A pupil carried out an experiment to react egg shells with excess dilute hydrochloric acid. The gas that was produced was measured at a regular time interval to investigate the speed of the reaction.
 - (a) Predict the solubility of this gas in water.

F /	
17	
 1.7	

(b) Complete the diagram in Fig. 11.1 to show the apparatus which could be used to measure the volume of gas produced.

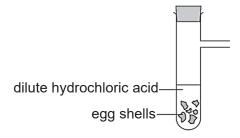


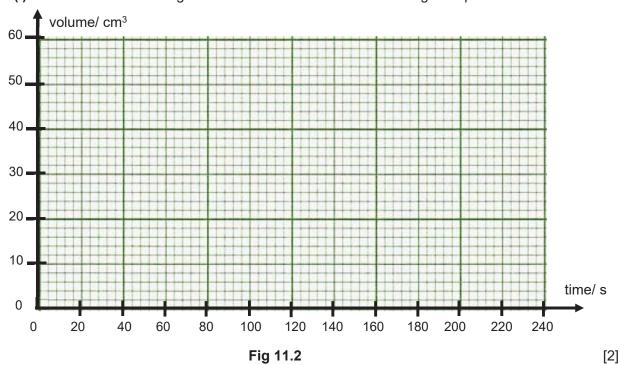
Fig. 11.1 [2]

(c) The results of this experiment are shown in Table 11.1.

Table 11.1

time/ s	0	20	40	60	140	180	200	220
volume of gas/ cm ³	0	14	25	32	48	50	50	50

(i) Plot the results on Fig. 11.2 and draw a smooth curve through the points.



11	(c)	(ii)	Explain why no further measurements were taken after 220 seconds.
			[41
			[1]
		(iii)	Using the graph drawn in (c)(i) , estimate the volume of gas evolved for the first 100 seconds.
			[1]
		(iv)	Calculate the average speed of reaction in cm 3 / s for the first 10 seconds of the reaction. (Average speed = $\frac{\text{final volume - initial volume}}{\text{duration concerned}}$)
			cm ³ / s [2]
		(v)	The experiment is repeated with crushed egg shell. On the same axes in Fig. 11.2, draw the graph you would expect for the second experiment. Labelled the graph as 'Q'. [1]

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[Total: 10]

Data Sheet Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

:	0	2 He helium 4	Ne Ne 20	18	Ā	argon 40	36	궃	krypton 8.4	5 2	4 %	xenon	131	98	몬	radon	1				
1	\		9 Tuonine	17	Ö	chlorine 35.5	35	늅	bromine	3 2	3 ⊢	iodine	127	85	¥	astatine	1	-			
	N		8 O oxygen	16	တ	sulfur 32	34	Se	selenium 70	2 2	4 e	tellurium	138	84	8	polonium	I	116	<u></u>	livermorium	1
:	>		7 N nitrogen 14	15	<u>α</u>	phosphorus 31	33	As	arsenic 75	2 4	် လိ	antimony	122	83	面	bismuth	508	-			
,6	>		6 C carbon	14	:ō	silicon 28	32	ලී	germanium 73	2 4	ខ្លួ	ţį	119	82	운	lead	202	114	Ħ,	flerovium	L
25.			S B B ±	13	ΑI	aluminium 27	34	Ga	gallium 70	5 6	₽ ⊑	indium	115	84	ï	thallinm	204	48			2
							30	Zu	Zinc	3 8	8 8	cadmium	112	80	뫈	mercury	201	112	ర్	copernicium	1
							59	ਟ	copper	5 5	Å Å	silver	108	79	Au	plog	197	111	Rg	roentgenium	ī
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		1 H hydrogen 1				100 H	56	ā	<u>ਹ</u> ਪ	3	# 22 #	ruthenium	101	9/	ő	osmium	190	108	¥.	hassium	1
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			number bol mass				54	ර්	chromium 52	3 5	% ₩	molybdenum	8	74	≥	tungsten	184	106	ß	seaborgium	
		Key	proton (atomic) number atomic symbol name relative atomic mass				23	>	vanadium 5.1	5 =	₹ 8	niobium	83	23	д	tantalum	18	105	<u>පි</u>	dubnium	Ĺ
			proton atc				72	F	titanium	2 5	7 4	zirconium	91	7.5	ቿ	hafnium	178	104	ጅ	Rutherfordium	L
						Andrew Comment Charles	21	လွ	scandium 45	2 8		yttrinm	88	12-29	lanthanoids			89 - 103	actinoids		
-			3 4 Li Be lithium beryllium 7 9	12	Mg	magnesium 24	20	ප	calcium	P o	გ დ	strontium	88	99	8	barinm	137	88	Вa	radium	1
		الموادة موريون مر	3 Li lithium 7	F	Na	sodium 23	19	¥	potassium 30	3 6	, 윤	rubidium	82	22	ර	caesium	133	87	<u></u>	francium	1

1.1	3	Iutetiun	175	103	ڬ	lawrenciu	1
70	Λb	ytterbium	173	102	2	nobelium	1
69	ᆵ	thulium	169	101	Βd	mendelevium	1
68	ய்	erbinm	167	100	Æ	ferminm	ı
		Ť.		10.00	ß	.≘	
99	۵	dysprosium	163	86	ರ	californium	1
65	2	terbium	129	26	益	berkelium	1
64	පි	gadolinium	157	96	S	curium	ı
					Am		
62	Sm	samarium	150	94	S	plutonium	1
61	P	promethium	-	63	S	neptunium	ı
09	온	neodymium	144	76	>	uranium	238
හු	፫	praseodymium	141	હ	g	protactinium	234
28	පී	cerium	140	06	£	thorium	232
22	Ē	lanthanum	139	88	Ac	actinium	ı

lanthanoids

actinoids

The volume of one mole of any gas is $24\,\mathrm{dm}^3$ at room temperature and pressure (r.t.p.).

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CHIJ Katong Convent

4E/5N Science Chemistry Mid-Year Exam 2018

Answer scheme

Paper 1

1	2	3	4	5	6	7	8	9	10
В	Α	D	С	D	D	С	D	С	В
11	12	13	14	15	16	17	18	19	20
Α	D	С	Α	В	Α	С	Α	D	В

Paper 3

Section A

					-()	
Qn			An	iswers		
1		substance	(elemen	sification t, compound nixture)	atoms found within the substance	
		hydrogen sulfide brass	cor	npound ixture	hydrogen, sul	
		limestone	^	npound	calcium, carb oxygen	
2a	Fe(CO) ₅		>//		U	_
2b(i)	OR `	xide conducts electrici		(S)		
2b(ii)		þi	nber of otons	number of neutrons	number of electrons	
	56 Fe 24 26 30 24					
		16803	8	8	10	
2c(i)	Isotopes are <u>atoms of the same element</u> with the <u>same number of protons</u> but <u>different number of neutrons.</u>					
2c(ii)	As the isotopes have the same number of valence electrons, they possess the same chemical properties.					
3a	oxidation state of copper in $CuCI = +1$ oxidation state of copper in $CuCI_2 = +2$					
3b	CuC/ is oxidised to CuC I_2 as the oxidation state of Cu increases from +1 in CuC/ to +2 in CuC I_2 .					
	CuC/ is reduced to Cu as the oxidation state of Cu decreases from +1 in CuC/ to 0 in Cu.					

3c	The colourless solution turns blue OR
	A pink/ brown/ reddish-brown solid is formed.
4a(i)	filter funnel
.,,	
4a(ii)	burette
4a(iii)	electronic balance
4a(iv)	delivery tube/ teat pipette
4b	When the solvent particles become a vapour, they are moving at <u>high speeds</u> in <u>all directions</u> and spaced <u>far</u> apart.
5a	Concentration of HNO ₃ in mol/dm ³ = $0.15 \div \frac{100}{1000} = \frac{1.5 \text{ mol/dm}^3}{1000}$
	Concentration of HNO ₃ in g/dm ³ = 1.5 x 63 = 94.5 g/dm^3
5bi	Number of moles of HNO ₃ = $\frac{100}{1000}$ x 0.5 = $\frac{0.05 \text{ mol}}{0.05 \text{ mol}}$
5bii	Potassium carbonate / K ₂ CO ₃
5biii	$\frac{\text{Mole ratio}}{\text{K}_2\text{CO}_3: \text{KNO}_3} = 1:2$
	Number of moles of KNO ₃ = $0.02 \times 2 = 0.04 \text{ mol}$
6a	P: copper(II) oxide / CuO Q: hydrochloric acid / HC/ R: copper(II) chloride / CuC/ ₂ S: copper(II) hydroxide / Cu(OH) ₂
6b	Ag+ (aq) + Ct (aq) - AgCt(s)
7ai	The reactivity of Group I metals increases down the group.
	Down the group, there are more filled electron shells between the nucleus and the
	valence electron.
	Hence, there is a greater tendency to lose the valence electron to attain the noble gas electronic configuration.
7aii	It reacts explosively.
7aiii	Hydrogen gas
7bi	Noble gases are/ have colourless odourless gases at room temperature and pressure OR have low melting and boiling points insoluble in water poor conductors of electricity low densities (any one)

7bii	They have <u>fully-filled valence electron shells</u> and already achieved a stable noble gas electronic configuration.
8a	nitrogen/ N ₂
8b	Carbon dioxide is a greenhouse gas / causes climate change / causes global warming.
	This results in ice caps melting (or rise in sea levels) / increased flooding / desertification / increased death of corals.
8c	It is formed due to incomplete combustion.
8d	Key i. electron from O X: electron fro
8ei	A reaction/ a change in which heat is given out to the surroundings.
8eii	Rusting, respiration, neutralisation or any acceptable answer.

Section B

Qn	Answers					
9a\ \	M: magnesium					
	N: sulfuric acid					
9b	$Mg + H_2 SO_4 \rightarrow MgSO_4 + H_2$					
9с	Step's for making crystals:					
	Add <u>excess</u> magnesium metal to a test tube containing sulfuric acid and stir.					
	2. <u>Filter</u> to obtain the filtrate, which is magnesum sulfate solution, and remove the					
	excess magnesium metal residue.					
	CACCOO Magnesiam metarresidae.					
	3. Heat the filtrate till it is saturated.					
	4. Allow the saturated solution to cool so that the salt can crystallise.					
	5. Filter to collect the crystals. Wash the crystals with a little cold distilled water to					
	remove impurities and dry between sheets of filter paper.					
9d	Magnesium oxide / magensium carbonate/ magnesium hydroxide					
9ei	Add a few drops of universal indicator solution into each solution. OR					
	Dip a piece of red and blue litmus paper into each solution.					
9eii	The solution will turn from green to red. OP					
9eli	The solution will turn from green to red. OR					
	The red litmus paper will remain red and the blue litmus paper will turn red.					
10a	Limestone is first decomposed by heat to produce carbon dioxide and calcium					
100	oxide.					
	$CaCO_3$ (s) \rightarrow CaO (s) + CO ₂ (g)					

	Calcium oxide reacts with the impurities from iron, which is sand, to form molten
	<u>slag</u> .
	CaO (s) + SiO ₂ (s) \rightarrow CaSiO ₃ (I)
10bi	Paint serves as a protective layer that prevents iron from coming into contact with water and oxygen.
10bii	Zinc is more reactive than iron, hence zinc will react with water and oxygen first.
10biii	The ship will rust.
10biv	The presence of sodium chloride in seawater results in the increase of the speed of rusting.
10c	 ✓ Recycling helps to conserve finite/ non-renewable metal ores. ✓ Recycling helps to save energy, hence less fossil fuels are burnt for energy production. ✓ Recycling helps to save cost of extracting metals. ✓ Recycling reduces pollution as recycling metals creates less pollutants than extracting metals from its ores. ✓ Recycling reduces the need of landfills for metal extraction wastes
11a	The gas (carbon dioxide) is slightly soluble/ insoluble in water.
11b	a labelled gas syringe
	dilute hydrochloric acid egg shells
11c(i)	volume/ cm³
6	.1
955	
5	
4	07
\wedge	
7	
4	
9	
	0 20 40 60 80 100 120 140 160 180 200 220 240 time/s
44 (")	
11c(ii)	All the egg shell (calcium carbonate) had been used up.
11c(iii)	Based on students' graph, Acceptable range of 41 – 43 cm ³

11c(iv)	Based on students' graph
	average speed = volume at 10 sec - volume at 0 sec 10 sec
11c(v)	a graph with a higher gradient but same final volume

Name	Reg. No	Class





Science (Chemistry) (with Biology/Physics Component)

5076/1 5078/1

Paper 1

SEMESTRAL ASSESSMENT ONE

May 2018 **1 hour**

Additional Materials: Electronic calculator OTAS Answer Sheet

INSTRUCTIONS TO CANDIDATES:

Do not open this booklet until you are told to do so.

Write your name, index number and class in the spaces at the top of this page and on any separate answer paper used.

Write in soft pencil.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **twenty** questions on this paper. Answer **all** questions.

For each question, there are four possible answers A, B, C and D.

Choose the **one** you consider correct and record your choice in **soft pencil** on the OTAS answer sheet.

Read carefully the instructions on the answer sheet.

At the end of the examination, hand in your OTAS sheet and question paper separately.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 9.

This question paper consists of **9** printed pages.

Setter: Mr Timothy Chen Vetter: Mdm Jarina Banu

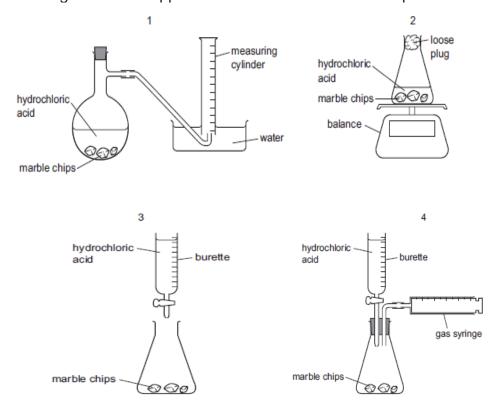
Paper 1 (Multiple Choice Questions)

Answer all the questions on the OTAS.

21 A student follows the rate of the reaction between marble chips, CaCO₃, and dilute hydrochloric acid, by measuring the amount products produced or the amount of reactants reacted.

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

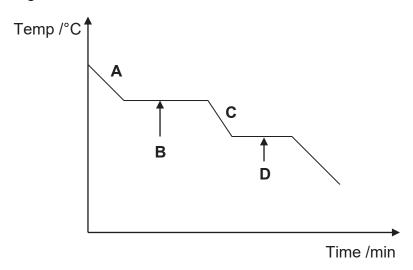
Which diagrams show apparatus that is suitable for this experiment?



- **A** 1 and 2
- **B** 2 and 4
- **C** 1, 2 and 4
- D All of the above

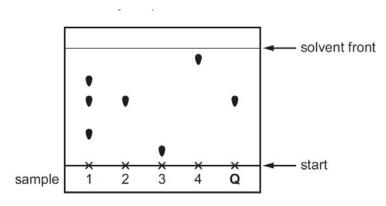
22 A gas is being cooled to room temperature.

Which part of the cooling curve below shows that both the gas and liquid exist together?



Four samples are spotted onto chromatography paper. It is known that one of these samples is pure compound **Q**. A separate sample of pure compound **Q** is also spotted onto the paper. The paper is placed in a solvent.

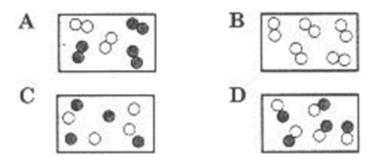
The diagram shows the chromatogram produced.



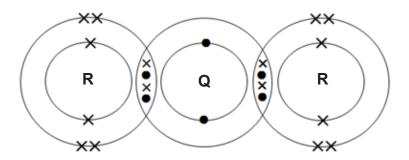
Which statement is correct?

- A Sample 2 has travelled the furthest and sample 3 is pure compound **Q**.
- B Sample 3 has travelled the furthest and sample 2 is pure compound **Q**.
- **C** Sample 4 has travelled the furthest and sample 1 is pure compound **Q**.
- **D** Sample 4 has travelled the furthest and sample 2 is pure compound **Q**.

24 Which diagram shows a compound made up of two different elements?



- 25 Which statement about the particles, F-, Ne and Na+ is correct?
 - **A** They all contain more electrons than protons.
 - **B** They all contain more neutrons than protons.
 - **C** They all contain the same number of electrons.
 - **D** They all contain the same number of protons.
- **26** The figure below shows a compound formed by elements **Q** and **R**.



Which of the following is true?

- A The compound has a low boiling point.
- **B** The compound has mobile electrons and therefore can conduct electricity.
- C The atoms of **R** gain electrons from the atom of **Q** to form an ionic compound.
- **D** The atoms of \mathbf{Q} and \mathbf{R} share valence electrons to form a covalent compound with formula $\mathbf{Q}_2\mathbf{R}$.
- **27** Which statement is correct about all ionic compounds?
 - A They are formed when metals share electrons with non-metals.
 - **B** They conduct electricity in the molten state.
 - **C** They conduct electricity in the solid state.
 - **D** They dissolve in water.

28 Nitrogen monoxide and oxygen react to form nitrogen dioxide.

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

What is the maximum volume of nitrogen dioxide that could be obtained when 1 dm³ of nitrogen monoxide reacts with 2 dm³ of oxygen?

- **A** 1.0 dm^3
- **B** 2.0 dm^3
- **C** 3.0 dm^3
- **D** 4.0 dm^3
- 29 Which sample contains the most atoms?
 - **A** 0.5 moles of water
 - **B** 0.5 moles of ammonia
 - **C** 1.0 moles of carbon dioxide
 - **D** 2.0 moles of hydrogen chloride
- **30** A household cleaning compound is used to remove calcium carbonate from bathroom surfaces.

Bubbles of gas can be seen forming when it is applied to the surface.

What is the pH of this cleaning compound?

- **A** pH 2
- **B** pH 7
- **C** pH 10
- **D** pH 14
- The table shows the results of adding dilute nitric acid and aqueous sodium hydroxide to four oxides.

Which is the result obtained for aluminium oxide?

	dilute nitric acid	aqueous sodium hydroxide
Α	reaction	reaction
В	reaction	no reaction
С	no reaction	reaction
D	no reaction	no reaction

- A bottle of magnesium carbonate has been contaminated with sodium chloride. How can the pure magnesium carbonate be obtained from this mixture?
 - A Add acid to the mixture, filter then collect the residue.
 - **B** Add acid to the mixture, filter then evaporate the filtrate.
 - **C** Add water to the mixture, filter then collect the residue.
 - **D** Add water to the mixture, filter then evaporate the filtrate.
- Which reagent can be used to react with dilute hydrochloric acid to prepare silver chloride?
 - A solid silver
 - B solid silver oxide
 - **C** solid silver carbonate
 - D aqueous silver nitrate
- 34 The results of experiments involving four metals, W, X, Y and Z, and their ions are shown.

$$Y(s)$$
 + $Z^+(aq)$ \rightarrow $Y^+(aq)$ + $Z(s)$ $W(s)$ + $X^+(aq)$ \rightarrow no reaction $Z(s)$ + $X^+(aq)$ \rightarrow $Z^+(aq)$ + $X(s)$

What is the order of reactivity of the four metals, most reactive to least reactive?

- $A \qquad W \to X \to Y \to Z$
- $B \hspace{1cm} X \to W \to Z \to Y$
- $\textbf{C} \hspace{1cm} Y \rightarrow Z \rightarrow X \rightarrow W$
- $\textbf{D} \hspace{1cm} Z \to Y \to W \to X$
- **35** Element **Z** is in the same group of the Periodic Table as bromine but has a lower boiling point.

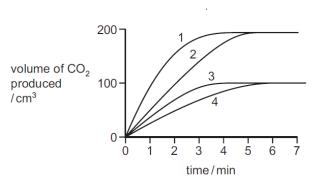
Which statement about **Z** is correct?

- A It can displace bromine from an aqueous solution of potassium bromide.
- **B** It has a proton number greater than 35.
- **C** It is a solid at room temperature.
- **D** It loses an electron when it reacts with a metal.
- **36** Which change always occurs when a metal atom is oxidised?
 - **A** It combines with oxygen.
 - **B** It gains electrons to form a negative ion.
 - **C** It loses electrons to form a positive ion.
 - **D** It gains protons to form a positive ion.

37 In four separate experiments, 1, 2, 3 and 4, nitric acid was added to excess marble chips and the volume of carbon dioxide formed was measured.

In all four experiments the same volume of nitric acid was used. Its concentration, or temperature, or both concentration and temperature, were changed.

The results of the experiments are shown on the graph.



Which statement is correct?

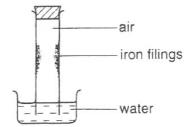
- A lower concentration of acid was used in experiment 3 than in experiment 1.
- **B** Experiment 4 was faster than experiment 3.
- C The acid used in experiment 2 was of a lower concentration than in experiment 1.
- **D** The temperature of the acid was the same in experiments 1 and 2.
- 38 The elements helium, argon and neon are noble gases.

Which statement is correct?

- **A** All these elements have an octet configuration.
- **B** Argon is used to react with impurities in the manufacture of steel.
- C Helium is used in balloons as it is more dense than air.
- **D** Neon is used in light bulbs to give an inert atmosphere.

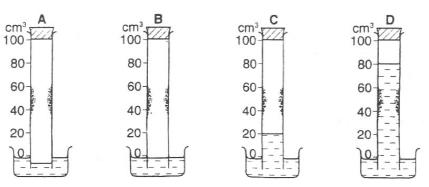
39 The inside of a tube is coated with iron filings. The tube is placed in a trough of

Water as shown.



Which diagram represents the likely appearance of the apparatus after one

week?



- **40** When a volcano erupts, which gas is produced in significant amounts?
 - A carbon monoxide
 - **B** methane
 - **C** oxides of nitrogen
 - **D** sulfur dioxide

-- End of paper 1 --

The Periodic Table of Elements

	0	5	မ -	helium 4	10	Ne	neon	70	18	Ā	argon	40	36	궃	krypton	8	54	×e	xenon	131	98	R	radon	10				
	N				6	ш	fluorine	19	17	Ö	chlorine	35.5	35	ğ	bromine	8	53	ш	iodine	127	85	Αt	astatine	F				
	١٨				8	0	oxygen	16	16	S	sulfur	32	34	Se	selenium	79	52	Te	tellurium	128	84	Ъ	polonium	Ç	116	_	ivermorium	Ĩ
	^				7	z	nitrogen	14	15	₾	shoophorus	31	33	As	arsenic	75	51	Sp	antimony	122	83	<u>.</u>	bismuth	209				
	\ 				9	ပ	carbon	12	14	S	silicon	28	32	g	germanium	73	20	Sn	ij	119	82	Ър	lead	207	114	F <i>l</i>	flerovium	Ŀ
	=				5	В	boron	11	13	Αľ	aluminium	27	31	Ga	gallium	20	49	Ĭn	indium	115	81	Ë	thallium	204				
													30	Zu	zinc	65	48	ප	cadmium	112	80	Ĥ	mercury	201	112	ర్	copernicium	ľ
													59	రె	copper	64	47	Ag	silver	108	6/	Αn	plog	197	Ξ	&	roentgenium	Ī
Group													28	z	nickel	29	46	Pd	palladium	106	8/	五	platinum	195	110	Os	darmstadtium	Ü
Gro													27	රි	cobalt	29	45	R	rhodium	103	2.2	<u>1</u>	iridium	192	109	Mt	meitnerium	Ŀ
		-:	E .	nyarogen 1									26						-						108			
														Mn	manganese	22	43	ျ	technetium	i	75	Re	rhenium	186	107	윰	bohrium	Ī,
				5.	nmber	pol		mass					24	ర	chromium	25	42	Mo	molybdenum	96	74	≯	tungsten	2 8	106		E	Ţ.
				Key	proton (atomic) number	omic sym	name	ve atomic					23	>	vanadiu	51	41	g	niobium	93	73			- 1	105	6	dubnium	Ē
				9	proton	atc	Post	relat						ï		48	_	Zr	zirconium	91	72		hafnium		104	圣	Rutherfordium	1
				ş									21	Sc	scandium	42	39	>	yttrium	88	17-73	lanthanoids			89 - 103	actinoids		
					4	Be	beryllium	מ	12	Mg	magnesium	24	20	స్త	calcium	40	38	ഗ്	strontium	88	99	Ba	barium	137	88	Ra	radium	Ţ
	_				က	<u></u>	lithium 7	,	Ξ	Na	sodium	23	19	¥	potassium	39	37	&	rubidium	85	25	క్ర	caesium	133	87	ĭ	francium	T

		384				E	
71	n L	lutetium	175	103	ئ	lawrenciun	1
70	Υp	yfferbium	173	102	8	nobelium	1
69	Ε	thulium	169	101	Md	mendelevium	1
68	щ	erbium	167	100	Fm	fermium	J
29	운	holmium	165	66	Es	einsteinium	J
99	ò	dysprosium	163	86	ರ	californium	
65	П	terbium	159	26	益	berkelium	1
64	ලි	gadolinium	157	96	Cm	curium	1
63	En	europium	152	92	Am	americium	ĵ
62	Sm	samarium	150	94	Pu	plutonium	J
61	Pm	promethium	1	93	å	neptunium	1
09	No			92			
69	Ą	praseodymium	141	91	Ра	protactinium	231
58	Ö	cerium	140	90	드	thorium	232
22	Ľa	lanthanum	139	88	Ac	actinium	
lanthanoids				actinoids			

The volume of one mole of any gas is $24\,\mathrm{dm}^3$ at room temperature and pressure (r.t.p.).

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Name		Reg. No	Class
	Ī		



4EX/5NA

Science (Chemistry)

[65 marks]

5076/3 5078/3

SEMESTRAL ASSESSMENT ONE

May 2018

1 hour 15 minutes

Additional Materials: Electronic calculator

INSTRUCTIONS TO CANDIDATES:

Do not open this booklet until you are told to do so.

Write your name, index number and class in the spaces at the top of this page and on any separate answer paper used.

Write in dark blue or black pen on both sides of the paper. You may use a soft pencil for any diagrams, graphs or tables or rough working. Do not use staples, paper clips, highlighters, glue or correction fluid.

FOR EXAMINER'S USE					
Section	Marks				
Paper 1 MCQ	/ 20				
Paper 3 Section A	/ 45				
Paper 3 Section B	/ 20				
Paper 5	/15				
Total	/ 100				

Section A

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer all questions on the spaces provided.

Answers any **two** questions out of the three questions given.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

A copy of the Periodic Table is printed on page 13.

The use of an approved scientific calculator is expected, where appropriate.

This question paper consists of **13** printed pages.

Setter: Mr Timothy Chen Vetter: Mdm Jarina Banu

Paper 3

Section A (45 marks)

Answer **all** questions in the spaces provided.

1 The apparatus shown in Fig 1.1 can be used to separate a mixture of 3 liquids, **A**, **B** and water.

A has a boiling point of 50 °C while **B** has a boiling point of 78 °C.

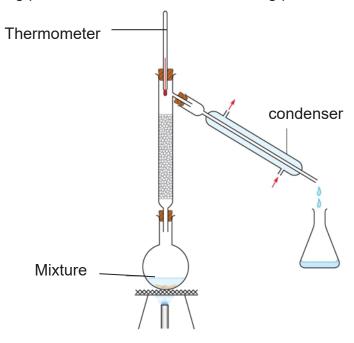


Fig. 1.1

(a)	State the name of this method of separation.
	[1]
(b)	What is the purpose of the water in the condenser?
	[1]
(c)	Predict the temperature of the thermometer when the first distillate appears in the beaker.
	Explain why.
	13.

2 Table 2.1 shows the number of protons, electrons and neutrons of five particles Q to V.

Table 2.1

Particle	Number of protons	Number of neutrons	Number of electrons
Q	5	5	4
R	7	7	10
S	8	8	8
Т	9	11	9
U	10	10	10
V	16	16	16

3 Fig. 3.1 shows the extraction of iron from iron ore.

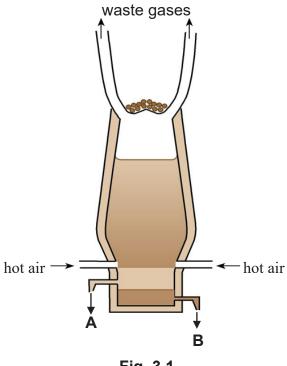


Fig. 3.1

(a) Haematite is the source of iron produced in the Blast Furnace.

	(i)	Name the reducing agent for the reduction of haematite.
		[1
	(ii)	With the aid of a chemical equation, describe how your answer in 3(a)(i reduces haematite to molten iron.
		[3]
	(iii)	Besides haematite, name the other 2 raw materials that are added to the Blast Furnace.
		[2]
(b)	Name	e product A and state its usefulness as a substance floating above product B
		[2]

Iron can be used to make stainless steel.

(c)

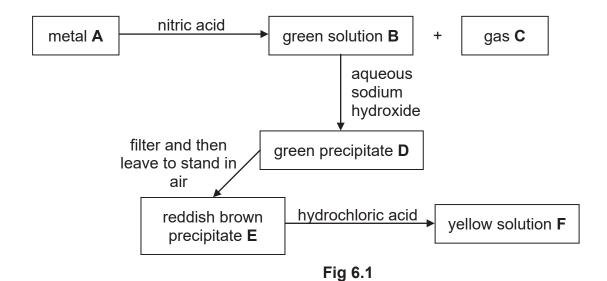
			ess steel can be made by adding elements such as chromium and nickel to improve its strength.					
		(i)	What is the name given to mixtures such as stainless steel?					
		(ii)	Explain, in terms of the arrangement of atoms, why stainless steel is harder than pure iron.					
			[2]					
4	A stu	ıdent tit	trates 25.0 cm³ an alkali of metal X , X OH, with sulfuric acid.					
	He re	ealizes	that 20.0 cm ³ of 0.2 mol/dm ³ of sulfuric acid is required to neutralize the acid					
	The chemical equation for the reaction is shown below:							
			$2XOH + H2SO4 \rightarrow X2SO4 + 2H2O$					
	(a)		an indicator that can determine the endpoint of the reaction and describe the change seen.					
			[2]					
	(b)	(i)	Calculate the number of moles present in 20.0 cm ³ of the sulfuric acid used.					
			mol [1]					

	(ii)	Determine the concentration, in mol/dm³, of X OH used.
		mol/dm³ [2]
	(iii)	If the concentration of X OH used is 12.8 g/dm³, calculate the relative mass
	()	of X OH and, hence, determine the identity of X .
		Relative mass of XOH:
(c)	When	X OH is added to ammonium chloride, a gas is formed.
	Name	the gas formed and describe how to test for its identity.
		[2]

5

Hyd	rogen o	can form compounds with both metals and non-metals.						
For	exampl	le, it can form lithium hydride with lithium and also ammonia with nitrogen.						
(a)	What	hat is the bonding found in lithium hydride?						
		[1]						
(b)	(i)	Draw the dot-and-cross diagram to show the arrangement of valence electrons found in lithium hydride and ammonia in the space below.						
		Lithium hydride:						
		[2]						
		Ammonia:						
		Auminoria.						
		ro						
	(ii)	Explain, in terms of bonding, why lithium hydride exist as a solid while ammonia exist as a gas at room temperature.						
		[3]						

6 Fig. 6.1 describes the reactions of metal A.



(a)	Identify	the	following	substances.
-----	----------	-----	-----------	-------------

Α	
В	
С	
D	
E	
F	

(b)	Describe how to test for gas C that is formed in the above reactions.	
		[4

[6]

Paper 3 Section B (20 marks)

Answer any **two** questions in this section. Write your answer in the spaces provided.

7	(a)	(i)	Name an element from Period 3 and explain how the electronic structure of the element can be used to determine the group the element belongs.	his
				.[3]
		(ii)	Moving from Group I to Group VII across period 3, the character of the elements change.	
			Describe and explain this change.	
				.[ၖ
	(b)		element with an atomic number of 87 is extremely rare and only about 30 g exi ighout the Earth crust.	ist
		Write	ict one physical and one chemical property of this element. e a balanced chemical equation, with state symbols, to represent the chemical erty that you have described.	
				[4]

8

Coal contains sulfur. When coal is burnt at power stations in an excess of oxygen, sulfur dioxide is formed according to the reaction shown below.

		$S + O_2 \rightarrow SO_2$
(a)	(i)	Explain why sulfur is considered to be oxidised in this reaction.
		[1]
	(ii)	Find the mass of sulfur burnt if 320 dm ³ of sulfur dioxide is formed at room temperature and pressure.
		[3]
	(iii)	Describe how the release of sulfur dioxide can indirectly cause damage to buildings made of limestone.
		[2]
(b)	Two	pollutants can be produced in the internal combustion engines of automobiles.
		e the pollutants and describe how they are produced in the engines of nobiles.
		[4]

(a)		ain, in terms of collision theory, how the temperature of reactants affect ed of reaction.	the
			.[2]
(b)	A stu	ident wants to investigate the rate of reaction involving particle size.	
		n that he has magnesium strips and magnesium powder with some hydrochlor describe how he can conduct a laboratory experiment to do his investigation.	ric
	Your react	description should include the measurement obtained to measure the rate of tion.	
			[5]
(c)	Magr	nesium can also react with copper(II) sulfate as shown below.	
		Mg + CuSO₄ → MgSO₄ + Cu	
	(i)	During this reaction, the temperature of the solution increases. Based on this observation, state what kind of reaction this is.	
			.[1]
	(ii)	Explain why this reaction is also considered a displacement reaction.	
			.[2]

-- End of section B ---- End of paper –

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The Periodic Table of Elements

	0	2 He	helium 4	10	Ne	neon 20	18	Ą	argon 40	36	찿	krypton	84	54	×e	xenon	131	98	R	radon	E				
	II/			6	ш	fluorine 19	17	ľ	chlorine 35.5	35	ğ	promine	80	23		iodine	127	85	Αt	astatine	ľ				
;	I/			∞	0	oxygen 16	16	S	sulfur 32	34	Se	elenium t	6/	52	_e	llurium	128	84	9 2	lonium (ſ,	116	_	morium	1
	>			_		nitrogen 14	_		S	⊢		35555	-			20.000	\dashv	_		noe	_			<u>live</u>	
	\ \					carbon ni 12			듑			_	_	,		10	_			_		14	F <i>l</i>	ovium	H
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			¥				5	_	alumi 2				_	1.1			_			10	14	2	_	icium	
										l		zinc				O				-			٥	8	
										-		copper	-				-	_			_	-		=	Î
Group										-		nickel	-	_			-				_	-			Ç
Ö										27	රි	cobalt	99	45	뫈	rhodium	103	11	ī	iridium	192	109	Μţ	meitnerium	H
		- I	hydrogen 1							26	Fe	iron	56	44	Z.	ruthenium	101	9/	SO	osmium	190	108	£	hassium	fi
				•						25	Mn	manganese	55	43	ر ک	technetium	ī	75	Re	rhenium	186	107	В	bohrium	I)
				umber	loc	mass				24	ర్	chromium	25	42	οM	molybdenum	96	74	×	tungsten	<u>\$</u>	106	Sg	seaborgium	L
			Key	proton (atomic) number	atomic symbol	name relative atomic mass						vanadium													Ê
				proton	atc	relativ				22	i=	tiťanium	48	40	ZŁ	zirconium	91	72	王	hafnium	178	104	¥	Rutherfordium	B
			4				•			21	လွ	scandium	45	ඉ	>-	yffrium	68	57 – 71	lanthanoids			89-103	actinoids		
	=		3	4	Be	beryllium 9	12	Mg	magnesium 24	20	Ç	calcium	40	38	ઌ૽	strontium	88	56	Ba	barium	_	_		radium	1
	_			-		lithium 7				_													Ļ	francium	Т

lanthanoids	22		59		61	62	83	64	65	99	29	68	69	20	
	La	Çe	<u>4</u>	PZ	Pm	Sm	Sm Eu	ලි	Tp	ò	운	щ	Tm	χ	
	lanthanum		praseodymium	_	promethium	samarium	europium	gadolinium	terbium	dysprosium	holmium	erbinm	thulium	yfferbiu	Ε
	139		141		î	150	152	157	159	163	165	167	169	173	
actinoids	88		91		93	94	95	96	26	98	66	100	101	102	I
	Ac		Ва		å	Pu	Am	Cm	益	ರ	Es	Fm	Md	ž	
	actinium		protactinium		neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobeliun	
	1		231	258WW	/.KiasuE	xamPa	per.com	1	1	3	J)	1	1	

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

56

Name Reg. No Class



4EX5NA

Sci (Chem) 5076 /5078

[65 marks]

SEMESTRAL ASSESSMENT One May 2018



Setter: Mr Timothy Chen Yanhui

Vetter: Mdm Jarina

Paper 1 (20m)

21	22	23	24	25	26	27	28	29	30
В	В	D	D	С	Α	В	Α	D	Α
31	32	33	34	35	36	37	38	39	40
Α	С	D	С	Α	С	Α	D	С	D

Paper 2 Section A (45m)

Qn	Part	Answer	Marks
1	(a)	Fractional distillation	1
	(b)	To condense the vapour entering the condenser as the distillate.	1
	(c)	50 °C.	1
		It is the boiling point of A which has the lowest boiling point of the 3	1
		substances	
2	(a)	(i) S	1
	, ,	(ii) Q	1
		(iii) U	1
		(iv) V and S	1
	(b)	It is fluorine.	1
		Both have 9 protons, however,	
		Fluorine has 10 neutrons while T has 11 neutrons.	11
3	(a)	(i) carbon monoxide	1
		(ii) $Fe_2Q_3 + 3CO \rightarrow 2Fe + 3CO_2$	1
		Fe ₂ O ₃ loses oxygen to carbon monoxide,	1
		/ / And is thus reduced to form iron /	1
		The oxidation state of Fe decreases from +3 in haematite	
	`	to 0 in iron.	
		(iii) Limestone and	1
		coke.	1
	(b)	Molten slag.	1
		It covers the molten iron, preventing it from oxidising with oxygen.	1
	(c)	(i) Alloys	1
		Since the sizes of particles in stainless steel are different,	1
		this disrupts the regular arrangement of iron, making it harder to slide when a force is applied. (ERC)	1
		which a force is applied. (LINO)	
4	(a)		1
	()	Universal indicator.	1
		There will be a colour change from purple to green.	-

	(b)	(i) (ii) (iii)	Mole of sulfuric acid = $0.02 * 0.2 = 0.004$ mol Mole of sodium hydroxide = $0.004 * 2 = 0.008$ mol Concentration of sodium hydroxide = $0.008 / 0.025$ = 0.32 mol/dm ³ Molar mass = conc (g/dm ³) / conc (mol/dm ³) = $12.8 / 0.32 = 40$ g/mol Molar mass of X = $40 - 16 - 1 = 23$ Therefore, X is sodium.	1 1 1 1
	(c)		onia gas. gas evolved will turn damp red litmus paper blue.	1 1
5	(a)	Ionic	bonding	1
	(b)	(i)	Li H OX H	1 mark each for correct transfer/ sharing of electrons for both 1 mark for no inner shell electrons for both
		(ii)	Since lithium hydride consist of strong electrostatic forces of attraction between positive and negative ions while ammonia consists of weak intermolecular forces between ammonia molecules.	1
			And because much more energy is required to overcome the forces of attraction in lithium hydride compared to ammonia, Therefore, lithium hydride has a much higher melting and boiling point, hence it exist as a solid while ammonia exist as a gas under room temperature. (ERC)	1

6	(a)	A: iron	1
		B: iron(II) nitrate	1
		C: hydrogen gas	1
		D: iron(II) hydroxide	1
		E: iron(III) hydroxide	1
		F: iron(III) chloride	1
	(b)	Test the gas evolved using a burning / lighted splint. It should extinguish	1
		with a pop sound	

Section B (20m)

Qn	Part		Answer	Remarks
7	(a)	(i)	Name 1 element from sodium to argon.	1
			Since sodium has an electronic configuration of 2.8.1, showing that	1
			it has 1 valence electron. Therefore, it is in Group I.	1
		(ii)	Across Period 3, the metallic character of the element decreases.	1
			Since the tendency of the elements to form positive ions by losing	1
			electrons decreases while	
			The tendency increases for elements to gain electrons, forming	_
			negative ions as the number of valence electrons increases,	1
			Therefore, elements show less metallic character across the period.	
	(b)		oft / can conduct electricity / low density.	1
		It can	react with water to form alkali and hydrogen gas. /	1
		It can	react with halogens to form halides.	
		OF: 6	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4
		Fr (\$	s) + 2H ₂ O (l) → 2FrOH (aq) + H ₂ (g) / + Cl ₂ (g) → 2FrCl ₂ (s)	1 mark for
	<	(3)	+ C12\(g)\ \(\forall \) 21 1C12\(\forall \)	balanced
	\	V,		chemical
		\ (equation
			10/050	1 mark
				for state
				symbols
			× ·	
8	(a)	(i)	Sulfur gains oxygen to form sulfur dioxide / the oxidation state of	1
		(!!)	sulfur increases from 0 to +2.	_
		(ii)	Mole of sulfur dioxide = 320 / 24 = 13.33 mol	1
			Mole ratio of SO ₂ : S = 1:1 = 13.33:13.33 Mass of sulfur burnt = 13.33 * 32 = 426.6 = 427g	1
		(iii)	sulfur dioxide can react with the water to form sulfurous acid.	1
		(''')	Sulfurous acid oxidises in the air to sulfuric acid which forms acid	1
			rain which can damage buildings made of limestone.	-
			ğ ğ	

-	(b)	Oxides of nitrogen	1
	` ´	Carbon monoxide	1
		Oxides of nitrogen are formed through the reaction of nitrogen and oxygen	1
		under high temperature in the engine.)
		Carbon monoxide is formed through the incomplete combustion of petrol /	1
		fuel in the engine.	
9	(a)	The smaller the particle size, the larger the surface area for reaction to	1
		occur.	
		This increases the frequency of collisions between reactant particles,	1
	(b)		1
			1
			1
		(eg. 30 seconds).	
		Record the values collected and plot a graph of volume of hydrogen gas	1
			4
	<		1
		powder to investigate the rate of eaction.	
	(c)	(i) Evothermic	1
	(0)		1
			1
			•
	(b)	resulting in a faster reaction. Add a fixed mass of magnesium strip to hydrochloric acid of fixed concentration. Collect the volume of hydrogen gas collected using a gas syringe and measure the volume of hydrogen gas collected at regular time intervals (eg. 30 seconds). Record the values collected and plot a graph of volume of hydrogen gas collected against time. Repeat the experiment using magnesium powder instead of magnesium ribbon. Compare the slopes of the graph obtained for both ribbon and powder to investigate the rate of reaction. (i) Exothermic (ii) Since magnesium is a more reactive metal than copper, Therefore it displaces copper from its sulfate to form magnesium sulfate and copper metal.	1 1 1 1 1

End of Answer Scheme

0

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Additional mat	terials: Multiple Choice Answer Sheet		1 hou
Paper 1 Multiple	5		11 May 2018
Science (Phy	rsics / Chemistry / Biology)		5076, 5078/01
CLASS		INDEX NUMBER	
CANDIDATE NAME			

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided. Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer all questions.

For each equation there are four possible answers A, B, C and D.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Data Sheet is printed on page 8.

A copy of the Periodic Table is printed on page 9.

The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use

40

Parent's Signature

This document consists of 9 printed pages, including the cover page.

Multiple Choice Questions (40 marks)

Answer all questions.

- 1 A student mixes 25 cm³ samples of acid solution with different volumes of alkali solution. At every 30 seconds, the student measures the change in temperature. Which piece of apparatus is **not** needed?
 - A gas syringe
 - **B** measuring cylinder
 - **C** thermometer
 - **D** stop watch
- 2 A separation technique is shown below.



Which pair of mixtures can best be separated by the above technique?

- A aqueous sodium chloride and aqueous copper(II) sulfate
- **B** dilute hydrochloric acid and aqueous potassium hydroxide
- C magnesium carbonate and dilute nitric acid
- D zinc oxide and aqueous calcium nitrate
- **3** The table shows the melting and boiling points of four substances.

Which of the following substances contains particles that are sliding past each other at room temperature (25 °C)?

	melting point / °C	boiling point / °C
Α	– 110	– 55
В	- 20	15
С	0	100
D	744	1214

4 Aqueous sodium hydroxide is added to aqueous salt Z and a white precipitate formed. The white precipitate dissolved when excess sodium hydroxide is added.

When this reaction was completed, aluminium foil is added to the solution. The gas given off turned damp red litmus blue.

What is aqueous salt Z?

- A calcium nitrate
- B lead(II) sulfate
- **C** zinc nitrate
- **D** zinc sulfate
- 5 The symbols for two ions are shown below.

²¹Na⁺

Which of the following statements is correct?

- **A** Both the ions contain the same number of electrons.
- **B** Both the ions contain the same number of protons.
- **C** The fluoride ion contains more electrons than the sodium ion.
- **D** The sodium ion contains more neutrons than the fluoride ion.
- 6 Statement 1: Non-metals share electrons to attain electronic configuration of a noble gas.

Statement 2: Non-metals share electrons to form covalent compounds.

Which of the following is true?

- A Both statements are correct, and statement 2 explains statement 1.
- **B** Both statements are correct, but statement 2 does not explain statement 1.
- C Statement 1 is correct but statement 2 is incorrect.
- **D** Statement 2 is correct but statement 1 is incorrect.
- 7 Which change occurs when magnesium bonds with chlorine?
 - A Chlorine loses seven electrons to form a noble gas configuration.
 - **B** Chlorine shares electrons with magnesium to form a molecule of magnesium chloride.
 - C Magnesium gains two electrons for form Mg²⁺ ions.
 - **D** Magnesium loses two electrons to form Mg²⁺ ions.

8 50 cm³ of nitrogen gas reacts with 50 cm³ of oxygen gas to produce nitrogen dioxide. The chemical equation for the reaction is given below:

$$N_2(g) + 2 O_2(g) \rightarrow 2 NO_2(g)$$

What are the volumes of the gases remaining at room temperature and pressure?

		volume of gases / cm ³	
	nitrogen	oxygen	nitrogen dioxide
Α	0	0	100
В	0	25	50
С	25	0	50
D	25	25	50

9 20 g of magnesium oxide, MgO, reacts completely with 500 cm³ of dilute nitric acid.

The chemical equation of the reaction is as follows:

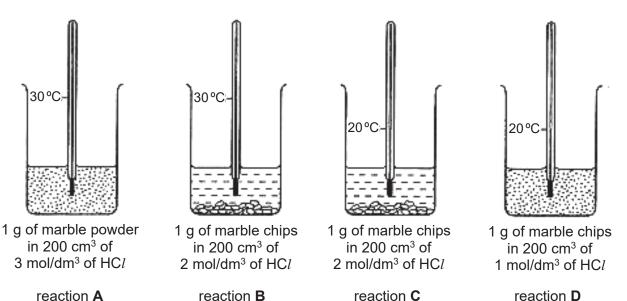
$$MgO(s) + 2 HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2O(l)$$

What is the concentration of the acid used? [relative atomic masses, A_r : O, 16; Mg, 24]

- **A** 0.002 mol/dm³
- **B** 0.008 mol/dm³
- C 2 mol/dm³
- **D** 8 mol/dm³
- **10** Which substance below will **not** react with aqueous potassium hydroxide but will react with dilute hydrochloric acid to form a salt and water?
 - A aluminium oxide
 - B carbon monoxide
 - C copper(II) oxide
 - D nitrogen dioxide
- 11 Which pair of reagents can be best used to prepare insoluble magnesium carbonate?

	reagent 1	reagent 2
Α	magnesium	ammonium carbonate
В	magnesium chloride	calcium carbonate
С	magnesium oxide	potassium carbonate
D	magnesium sulfate	sodium carbonate

12 Which of the following reactions will have the slowest rate of reaction?



- 13 What determines the Group of an element in the Periodic Table?
 - **A** The number of completely filled electron shells.
 - **B** The number of electrons in the valence shell.
 - **C** The number of electron shells containing electrons.
 - **D** The number of protons in the nucleus.
- **14** Caesium and potassium are both in Group I of the Periodic Table.

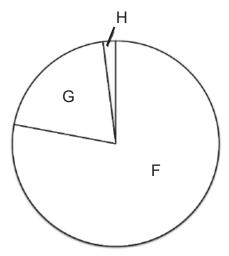
Which of the following statements about the elements is correct?

- **A** Caesium has a higher density than potassium.
- **B** Caesium reacts violently with water but potassium reacts explosively with water.
- **C** Potassium atoms are larger than caesium ions.
- **D** Potassium has a lower melting point than caesium.
- **15** Chlorine is in Group VII of the Periodic Table.

Which of the following statements is a property of chlorine?

- **A** It can displace bromine from aqueous sodium bromide.
- B It forms a basic oxide.
- **C** It has a darker colour than iodine.
- **D** It is a monoatomic element.

16 The pie-chart shows the composition of pure air.



Which of the following rows correctly identifies gases F, G and H?

	F	G	Н
A	nitrogen	carbon dioxide	oxygen
В	nitrogen	oxygen	argon
С	oxygen	nitrogen	carbon dioxide
D	water vapour	oxygen	hydrogen

- 17 Which of the following statement(s) is/are true for all metals?
 - 1 They conduct electricity.
 - 2 They form basic oxides.
 - 3 They have high melting points.
 - 4 They have high densities.
 - A 1 only
 - B 1 and 2 only
 - **C** 1, 3 and 4 only
 - **D** 1, 2, 3 and 4
- 18 Excess dilute nitric acid is added to brass.

Which of the following observations is correct?

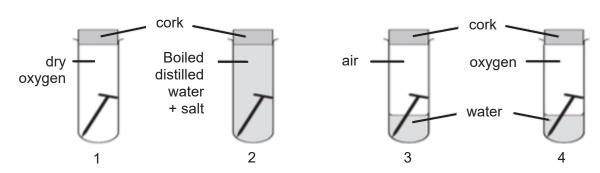
- A A blue solution is observed.
- **B** A colourless solution is observed.
- **C** A grey deposit is observed and a blue solution is formed.
- **D** A reddish-brown deposit is observed and a colourless solution is formed.

19 A metal X reacts as follows:

- X + dilute acid → salt + hydrogen gas
- $X + cold water \rightarrow no reaction$
- X + aqueous silver nitrate → silver metal + nitrate of X

By comparing X with calcium and silver, which of the following shows the correct order of reactivity of the metals, starting with the least reactive?

- A calcium, silver, X
- B calcium, X, silver
- **C** silver, X, calcium
- **D** X, calcium, silver
- 20 An experiment was set up as shown below to investigate the rate of rusting under different conditions.



Which of the following predicts the order of the test-tubes in which rust would first appear?

- **A** 1, 2, 3, 4
- **B** 1, 3, 2, 4
- **C** 4, 2, 3, 1
- **D** 4, 3, 2, 1

End of Paper

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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THE COLUMN TWO IS NOT THE OWNER.	0	2	완	helium 4	10	Ne	20	18	Ā	argon 40	36	궃	krypton	84	54	×e	xenon	131	86	쮼	radon	ı				
	IIN				6	u_	fluorine 19	17	70	chlorine 35.5	35	ä	bromine	8	53	ı	iodine	127	82	¥	astatine	i				
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				1	L			1			21	တ္တ	scandium	- 1					57 - 71	anthanoids			89 - 103	actinoids	<u>«</u>	
					4	Be	beryllium 9	12	Μg	magnesium 24	20	ő						-1	26		barium			Ra	radium	1
	-				က	=				sodium n		¥	potassium	ස	37	윤	rubidium	82	22	ర	caesium	133	87	ŭ.	francium	-

The Periodic Table of Elements

inthanoids	- 22	28	29	09	61	62	63	64	92	99	67	88	69	20	71
	g	ဗီ	ፚ	R	Pm	Sm	Ш	ဗ	a E	2	운	ய்	E	Υp	3
	lanthanum	cerium	praseodymium	neodymium	promethium	samarium	europium	gadolinium	terbium	dysprosium	holmium	erbinm	thulium	ytterbium	lutetium
	139	140	141	144	ı	150	152	157	159	163	165	167	169	173	175
inoids	88	80	91	92	93	94	92	96	97	86	66	100	101	102	103
	A _C	Ę	Ра	⊃	å	Pu	Am	S	ă	ັວ	Ж	E	ρW	8	
	actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium
	ı	232	231	238	1	ı	1	1	1	ı	ı	1	1	1	1

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CANDIDATE NAME			
CLASS		INDEX NUMBER	_
Science (Ch	emistry)	5076, 5078 / 0	3
Paper 3		7 May 201	8
No additional materials		1 hour and 15 minute	S

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces above.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B

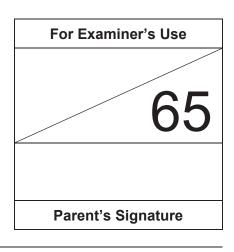
Answer any **two** questions.

Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 15.

A copy of the Periodic Table is printed on page 16.

The number of marks is given in the brackets [] at the end of each question or part question.



This document consists of **16** printed pages, including the cover page.

Section A [45 marks]

Answer all the questions in the spaces provided.

1 Name the substances needed for the following purposes.

purpose	name of substance
reducing the acidity in soil	
testing for presence of carbon dioxide gas	
testing for presence of chloride ions in water	

[3]

[Total: 3 marks]

2 The diagrams N, P, Q, R, S and T in Fig 2.1 represent the particles in different substances.

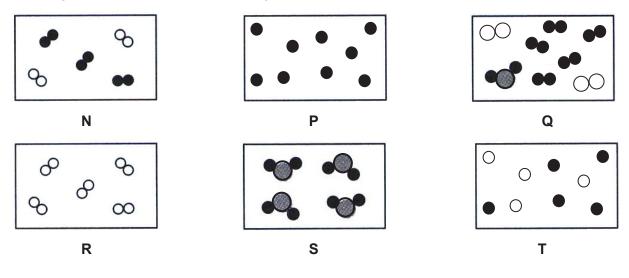


Fig 2.1

Use the diagrams N, P, Q, R, S and T to answer the questions below.

Which of the following above best represents liquid water?

[1
 r.

(b) Which of the following above best represents a mixture containing fluorine and chlorine gases?

[[1]
---	-----

(c) Which of the following above best represents air?

(a)

 [1]

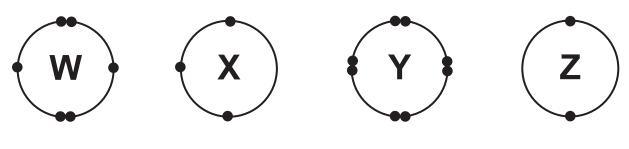
(d) Which of the following above best represents neon gas?



[Total: 4 marks]

[1]

The atomic structures of atoms **W**, **X**, **Y** and **Z** are shown below. The elements are found in Period 3 of the Periodic Table. The letters do not represent the elements and only the valence electrons of the elements are shown.



(a)	State and explain which group does atom Z belongs to in the Periodic Table.		
			 [2]
(b)	(i)	Write the chemical formula of the compound formed between atoms ${\bf W}$ and ${\bf X}$.	[~]
			 [1]
	(ii)	The compound formed between W and X has a melting point of 1100 °C. In term structure and bonding of the compound formed, explain why it has a high melting point of 1100 °C.	
			 [2]
(c)	Expl	lain why atom $oldsymbol{Y}$ is the least chemically reactive as compared to the other atoms.	
	•••••		
			 [1]

[Total: 6 marks]

(a)	(i)	Define the term, alloy.
	(ii)	Apart from its hardness and strength, state another advantage of using stainless start as an industrial material.
(b)		oon, also known as coke, is added to the Blast furnace reaction for the extraction of ir chemical equation for this reaction is given below.
		$2 \operatorname{Fe_2O_3}(s) + 3 \operatorname{C}(s) \rightarrow 4 \operatorname{Fe}(l) + 3 \operatorname{CO_2}(g)$
	[rela	tive atomic masses, A _r : C, 12; O, 16; Fe, 56]

(c)	Silicon dioxide, SiO ₂ , is an impurity produced in Blast furnace. Explain how silicon dioxide is removed from the Blast furnace.
	[2]
(d)	During the production of iron, sulfur dioxide gas is produced. Explain why sulfur dioxide gas produced pose an environmental threat to water bodies.
	[2]
	[Total: 9 marks]

Chlo	rine gas, a member of the halogens, is an element in Group VII of the Periodic Table.
(a)	State two physical properties of chlorine, other than existing as a gas at room temperature and pressure.
	[2]
(b)	Explain, using its electronic structure, why chlorine is found in Period 3 of the Periodic Table.
	[2]
(c)	Chlorine gas reacts vigorously with hot zinc metal to produce solid zinc chloride. Construct a balanced chemical equation, including state symbols, for the reaction.
	[2]
(d)	When chlorine gas is bubbled into aqueous potassium bromide, potassium chloride and bromine solution is obtained. Explain why this reaction occurs.
	[2]
	[Total: 8 marks]

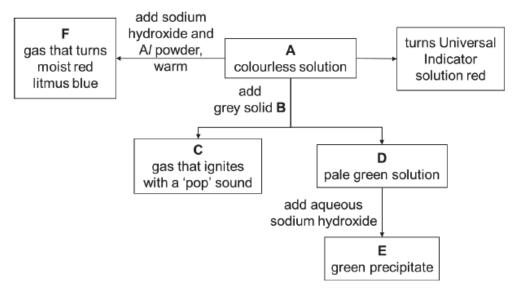
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6 (a) Metals A, B and C are placed in salt solutions as shown in the table.

metal	result of placing metal in solution of			
metai	salt of A	salt of B	salt of C	
Α		no reaction	C displaced	
В	A displaced		C displaced	
С	no reaction	no reaction		

Arrange the reactivity of the metals, starting with the least reactive metal.
[1]
Explain why carbon can be used to obtain zinc from zinc oxide but not to obtain sodium from sodium oxide.
[2]
Sodium metal is kept in oil to prevent it from corrosion. Explain how the oil prevents the sodium metal from corrosion, stating clearly the conditions that cause the corrosion of sodium.
[3]
[Total: 6 marks]

7 The figure below describes the reactions between colourless solution **A** and grey solid **B**.



(a) Identify A, B, C, D, E and F.

required.

Α	
В	
С	

D	 	
E	 	

(b) Construct a balanced ionic equation for the formation of precipitate E. State symbols are not

[2]

(c) Explain why grey solid **B** cannot be a metal carbonate.



[Total: 9 marks]

Section B [20 marks]

Answer any **two** questions in this section.

Write your answers in the spaces provided.

8		trogen, oxygen and argon gases can be extracted from compressed liquefied air (mixture of iscible liquids) at -200°C .			
	(a)	(i)	State the separation method used to obtain the gases separately at –200 °C.		
				[1]	
		(ii)	Describe the changes in movement of the air particles as it is compressed and coofrom room temperature to -200°C .	oled	
				 [1]	
	(b) Oxygen is a reactive non-metal.		gen is a reactive non-metal.		
		Desc	cribe, in terms of the number of electrons gained, lost or shared, what happens when		
		(i)	an oxygen atom combines with magnesium atom(s).		
				 [2]	
		(ii)	an oxygen atom combines with fluorine atom(s).		
				 [2]	

(c)	(i)	Draw a 'dot-and-cross' diagram for nitrogen gas.	
			[2]
	(ii)	Draw a 'dot-and-cross' diagram for oxygen gas.	
		ГТ	[2] otal: 10 marks]
			-

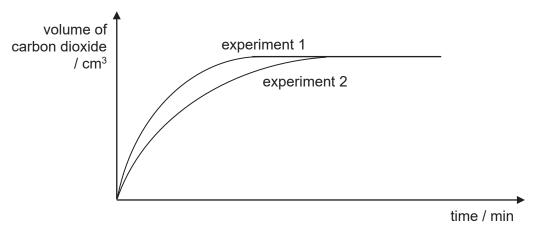
0	(0)	Ctata tura	physical	proportion	of oo	nnor	motal
9	(a)	State two	priysical	properties	OI CC	ppper	metai

Property 1:	
Property 2:	 [2]

- **(b)** Describe a way to prepare a pure sample of copper(II) sulfate crystals, from copper metal. Use the following information to help you
 - · copper does not react with dilute acids
 - copper burns in oxygen to form a black solid, which is copper(II) oxide
 - copper(II) oxide is insoluble in water
 - copper(II) sulfate is soluble in water

[4]

(c) 10 g of copper(II) carbonate lumps were reacted with excess 1.0 mol/dm³ hydrochloric acid and the carbon dioxide gas produced was collected. The experiment was repeated again but using excess 2.0 mol/dm³ hydrochloric acid. The graph of the data collected is plotted and shown below.



experiment 1: 10 g of copper(II) carbonate lumps with excess 2.0 mol/dm³ hydrochloric acid experiment 2: 10 g of copper(II) carbonate lumps with excess 1.0 mol/dm³ hydrochloric acid

 State why the production of carbon dioxide gas stopped after a period of t 	of time
--	---------

[1]

(11)	results in a faster rate of reaction.	acid
		 [2]

(iii) The experiment is repeated using 5 g of **powdered** copper(II) carbonate and excess 2.0 mol/dm³ hydrochloric acid. Add to **Fig. 9.1** the graph you would expect. The original graphs are already included. Label the new graph as **3**.

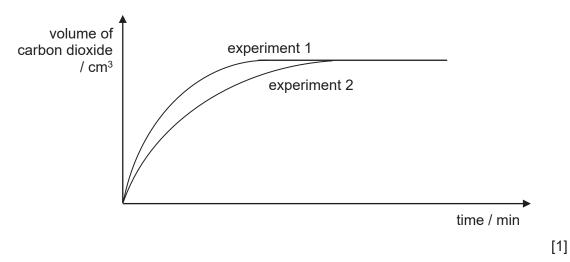
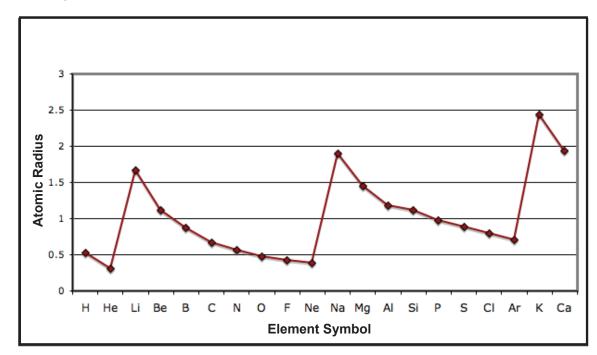


Fig. 9.1

[Total: 10 marks]

10 (a) The diagram below shows the atomic radius of the first 20 elements in the Periodic Table.



i)	Use the diagram above to describe the change in atomic radius across the Period and
	down the Group.

[2

(ii) Describe the change in the character of the elements across Period 3 and how it affects the respective oxides formed.

		[2

(b) Lithium, potassium and sodium are Group I elements.

State one physical property trend and one chemical property trend of these elements.

physical property trend

magnesium and silver in the reactivity series. Y answer the question.	ou may include a diagram if it helps you to
<u>Diagram</u>	
	[4]
	[Total: 10 marks]

Describe a laboratory investigation that can be used to justify the relative positions of iron,

(c)

End of Paper

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white			
copper(II) hydroxide	light blue			
iron(II) hydroxide	green			
iron(III) hydroxide	red-brown			
lead(II) hydroxide	white			
zinc hydroxide	white			

The Periodic Table of Elements

Mile at hard death	0	2	中	helium 4	9	e e	eou	റ്റ	18	4	ig c	98	7	,bton	34	45	ê	31	92	줃	nobi				-
			_	<u> </u>	-							+-		_		_			-			+			_
	₹				6	u_	fluorine	1	11	Ö	chlorine	35	Ä	bromine	8	53	Ι	iodine 127	85	Ą	astatine	1			
	N				8	0	oxygen	9	16	တ	sulfur 30	38	Se	selenium	79	52	ц Ц	tellurium 128	8	9	polonium	116	2 >	livermorium	
	>				7	z	nitrogen	4	15	۵.	phosphorus 34	38	As	arsenic	72	51	gs	antimony 122	83	ä	bismuth	203			
	2				9	O	carbon	12	14	Ö	silicon	32	Ge	germanium	73	20	S	# £	82	8	lead	117	ì	flerovium	
	=				5	۵	poron	1	13	Α	aluminium 27	34	ga	gallium	20	49	드	indium 115	81	1	thallium	†07			
												30	Zu	zinc	92	48	පි	cadmium 112	8	£	mercury	112	: : : :	copernicium	
												29	ō	copper	64	47	Ag	silver 108	79	Αu	gold	111	8	roentgenium	
dn												28	Z	nickel	29	46	Б	palladium 106	78	ŭ	platinum	110	SO	darmstadtium	
Group												27	ပိ	cobalt	29	45	돲	thodium 103	11	1	iridium	100	ž	meitnerium	
		-	I	hydrogen 1								26	æ	iron	29	44	2	ruthenium 101	76	SO	osmium	100	2 2 2	hassium	
					•							25	ğ	manganese	S	43	ည	technetium	75	æ	rhenium	107	<u></u> 듄	bohrium	
					umber	- - -		nass					ဝံ	Ę	52	42	Wo	molybdenum tech 96	74		tungsten			F	
				Key	proton (atomic) number	atomic symbol	name	relative atomic mass				23	>	vanadium	21	41	g	niobium 93	73	д	tantalum	105	8	 E	
					proton	ato	-	relativ				22	F	titanium	48	유	Ž	zirconium 91	72	Ī	hafnium	104	č	Rutherfordium	
												21	တ္တ	scandium	45	99	>	yttrium 89	57 - 71				actinoids		
	=				4	Be	beryllium	5	12	Ø	magnesium 24	20	Sa	calcinm	40	88	ഗ്	strontium 88	56	Ba	barium 127	1		radium	
	_				က	=	lithium 1		=		sodium 23	T	×	potassium	ස	37	윤	rubidium 85	55	ပိ	caesium 133	87	ı,	francium	

71	3	lutetium	175	103	ئ	lawrencium	ı
20	χ	ytterbium	173	102	8	nobelium	1
89	트	thulium	169	101	BM	mendelevium	ı
88	ய்	erbinm	167	100	E	fermium	1
67	운	holmium	165	66	Ш	einsteinium	ı
99	ò	dysprosium	163	86	ర	californium	ı
65	£	terbium	159	97	益	berkelium	1
64	ဗ	gadolinium	157	96	ညီ	curium	1
63	盁	europium	152	88	Am	americium	1
62	Sm	samarium	150	94	Pu	plutonium	ı
61	Pm	promethium	ı	93	g	neptunium	1
00	B	neodymium	144	85	_	uranium	238
29	ď.	praseodymium	141	91	Ъ	protactinium	231
28	Ö	cerinm	140	80	£	thorium	232
22	<u></u>	lanthanum	139	88	¥	actinium	
lanthanoids				actinoids			

The volume of one mole of any gas is $24\,\mathrm{dm}^3$ at room temperature and pressure (r.t.p.).

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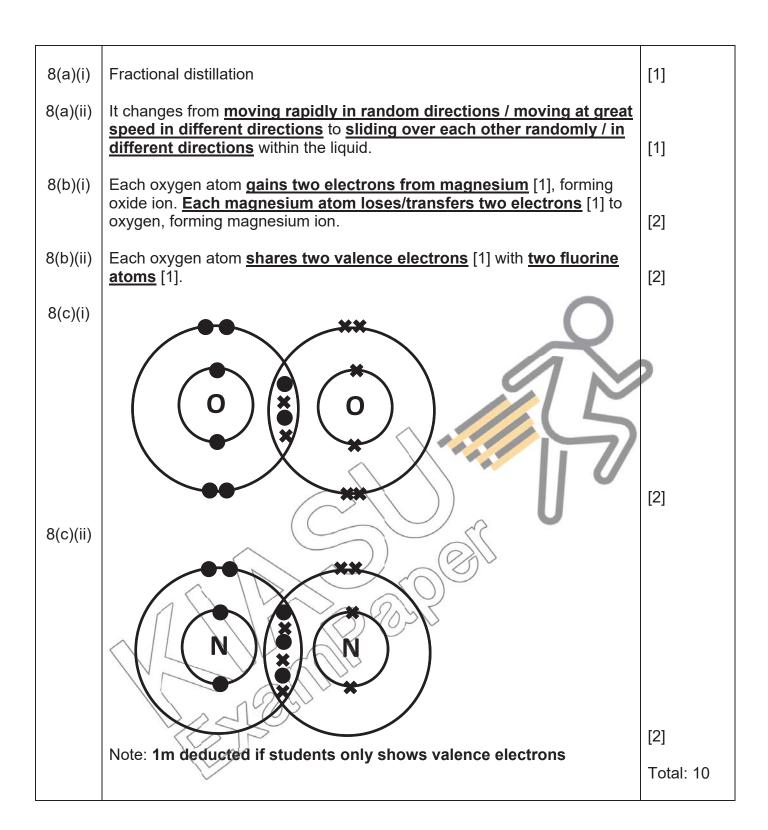
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Secondary 4 Express and 5 Normal Academic Science(Chemistry) Mid-Year Examination Mark Scheme

Qn no.			A	Answer Scher	ne			Marks Allocated		
1	Α	6	В	11	D	16	В	[1] each		
2	D	7	D	12	D	17	Α	20 m max		
3	С	8	С	13	В	18	D			
4	С	9	С	14	Α	19	C			
5	Α	10	С	15	Α	20	D	_		
1		purpose		_ m	ame of st	ubstance	5			
	reducing	the acidit	y in soil	calcium o lime / slake			AN AN			
	_	for prese on dioxide		limewa	ter / calci	ium hydro	oxide			
	_	for preser de ions in v		acidified lead(II) nitr	1 (>) \	itrate / aci ified silve				
		, 11	>//	1				[3]		
	1m each Reject: chemical formula of substances									
2(a)										
2(b)	N \	35	0)30					[1]		
2(c)	Q							[1]		
2(d)	Р							[1]		
								Total: 4		
3(a)	Z belongs t									
	it contains It has <u>two</u>			rons. OR Itermost elec	tron she	<u>II</u> . [1]		[2]		
3(b)(i)	X ₂ W ₃ (reje	ect: W ₃ X ₂)					[1]		
3(b)(ii)	The compound formed has a <u>giant lattice structure</u> [1]. Thus, large amount of energy is needed to <u>overcome strong electrostatic forces of attraction between the oppositely charged ions</u> [1].							[2]		
	Reject: "break strong electrostatic forces of attraction", "break ionic bonds", "giant ionic structure", "oppositely charged particles / molecules / atoms".									

3(c)	It has eight valence electrons / a completely filled valence shell /	
	does not need to take in, give out or share electrons with other elements.	[1]
		Total: 6
4(a)(i)	An alloy is a <u>mixture containing</u> at least <u>one metal with other elements</u> <u>/ substances</u> .	[1]
4(a)(ii)	It is more corrosion-resistant / does not rust easily.	[1]
4(b)	Mass, Fe ₂ O ₃ , present = 30% x 1000 = <u>300 kg</u> [1]	
	Mole, $Fe_2O_3 = (300 \times 1000) \div (2 \times 56 + 3 \times 16) = 1875 \text{ mol}$ [1]	
	Mole ratio: 2 Fe ₂ O ₃ : 3 C 1875 : 2812.5	
	Mass, C = 2812.5 x 12 = <u>33 750 q / 33.75 kg</u> [1]	[3]
	Note: 1. Allow ECF for wrong answer. 2. –1 if no/wrong units written for final answer.	
4(c)	Limestone [1] is used to remove silicon dioxide. It decomposes at high temperature in Blast furnace to produce basic calcium oxide [1], which reacts with silicon dioxide.	[2]
4(d)	Sulfur dioxide gas dissolves in rainwater, producing acid rain [1]. This causes the water bodies to be more acidic, killing marine/aquatic lives /	
	fishes [1].	[2]
		Total: 9
5(a)	Low melting point / low boiling point / light-green in colour / does not conduct electricity / exist as diatomic molecules [Any two]	[2]
5(b)	Chlorine has an electronic structure of <u>2.8.7</u> [1], hence it contains <u>3</u> <u>electrons shells</u> [1] filled with electrons. Therefore, it is in period 3.	[2]
5(c)	$\frac{Cl_2(g) + Zn(s) \rightarrow ZnCl_2(s)}{1m - correct balanced equation; 1m - correct state symbols}$	[2]
5(d)	<u>Chlorine is more reactive than bromine</u> [1]. Hence, it can <u>displace</u> <u>bromine</u> [1] to form potassium chloride and bromine.	[2]
		Total: 8

		<u> </u>
6(a)	C, A, B (only answer)	[1]
6(b)	Carbon is more reactive than zinc [1], but less reactive than sodium [1]. Hence it displaces zinc from zinc oxide but not sodium from sodium oxide.	[2]
6(c)	By keeping sodium in oil, the oil <u>creates a physical barrier</u> [1] that prevents the surface of sodium metal to come in <u>contact with oxygen gas</u>	
	[1] and water / water vapour [1], which causes corrosion.	[3]
		Total: 6
7(a)	A – nitric acid or HNO ₃ B – iron metal or Fe C – hydrogen gas or H ₂ D – iron(II) nitrate or Fe(NO ₃) ₂ E – iron(II) hydroxide or Fe(OH) ₂ F – ammonia or NH ₃	
	Im each, accept chemical formula	[6]
7(b)	Fe ²⁺ + 2 OH ⁻ → Fe(OH) ₂ 1m – correct equation, 1m – balanced equation	[2]
7(c)	A metal carbonate will <u>produce carbon dioxide gas</u> , instead of hydrogen gas. OR A metal carbonate <u>does not produce hydrogen gas</u> when reacted with acid.	[1]
		Total: 9



		1
9(a)	High density / High melting and boiling points / conducts electricity / conducts heat / malleable / ductile / shiny surface / Solid at room temperature / Pink/brown solid [Any two]	[2]
9(b)	Heat/Burn copper metal in air / in oxygen to produce copper(II) oxide. [1] To an excess amount of CuO, add a fixed volume of sulfuric acid and stir the mixture. [1] Filter to remove the excess CuO from the mixture. [1] Warm/Heat the filtrate to saturation and then allow it to cool for crystallization to occur. [1]	[4]
9(c)(i)	Copper(II) carbonate is used up.	[1]
9(c)(ii)	At a higher concentration, there are more reactant particles per unit volume [1]. Hence, the frequency of effective collisions between particles increases [1], leading to a faster rate of reaction.	[2]
9(c)(iii)	Graph showing half the volume of carbon dioxide gas and faster rate of reaction compared to Graph 1. Graph must be labelled.	[1]
		Total: 10
10(a)(i)	Atomic radius increases down the group [1] and decreases across the period [1].	[2]
10(a)(ii) 10(b)	The elements changes from metals to non-metals across the period / becomes less metallic across the period metallic to non-metallic character across the period [1] and the oxides changes from basic to acidic across the period [1]. Physical property trend: melting or boiling point decreases / density increases [1]	[2]
	Chemical property trend: chemical reactivity increases [1]	[2]

10(c) Reaction condition [1]: state the use of either water / steam / dilute acids

Data collection [1]: <u>counting the number of bubbles produced / measure volume of gas produced at regular intervals / measure lost in mass over regular intervals</u>

Comparison of data [1]:

The beaker / test-tube / boiling-tube with more bubbles produced will be magnesium, followed by iron. Silver will not have any bubbles produced as it is unreactive towards acid.

OR

Measure the gas collected at regular intervals and plot a graph of volume of gas produced over time / Measure the lost in mass at regular intervals and plot a graph of mass reading on scale balance against time. The graph with steepest gradient will be magnesium, followed by iron, followed by silver which shows a horizontal line due to its chemical unreactivity.

Justification of relative positions [1]:

Hence, magnesium is the most reactive, followed by iron, and silver is the least reactive. (or vice versa)

[4]

Total: 10



Pasir Ris Secondary School

Name	Class	Register Number
SECONDARY 4 EXPRESS MID-YEAR EXAMINATION 2018		
SCIENCE (CHEMISTRY)	5076 May 2018 1 hour	

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, glue or correction fluid.

Section A

There are **ten** questions in this section. Answer **all** questions.

For each question there are four possible answers, A, B, C and D.

Choose the one you consider correct and record your choice in the boxes provided on page 4.

Section B & C

Answer all questions in the spaces provided.

The number of marks is given in brackets [] at the end of each question or part question. A copy of the Periodic Table is printed on page 8.

Section	Marks
Α	/10
В	/20
С	/10
Total	/40

This document consists of 9 printed pages (inclusive of this page).

Setter: Mr Mohd Riffaii [Turn over

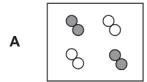
Section A: Multiple Choice Questions [20 marks]

21 A mixture contains an organic liquid **J**, and a dilute solution of potassium chloride. Liquid **J** boils at 21 °C and is immiscible in water.

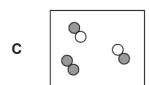
Which two methods of separation should be used in sequence to obtain samples of liquid **J** first before solid potassium chloride?

	method 1	method 2					
Α	use a separating funnel	evaporation					
В	evaporation	sublimation					
С	distillation	filtration					
D	filtration	evaporation					

22 Which diagram represents a mixture of diatomic elements?

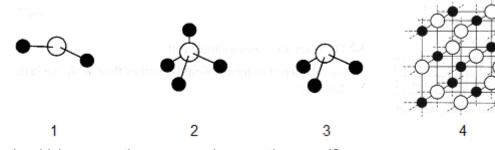


B 0 0



D 8

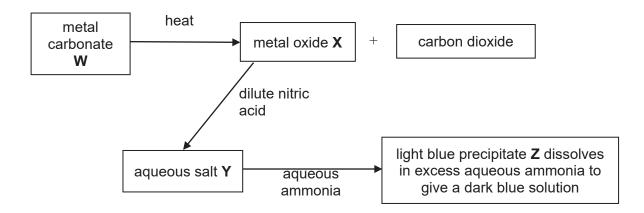
23 The diagrams represent four different compounds.



In which row are the compounds correctly named?

	1	2	3	4
Α	ammonia	sodium chloride	methane	water
В	methane	ammonia	sodium chloride	water
С	water	ammonia	methane	sodium chloride
D	water	methane	ammonia	sodium chloride

24 Study the following reaction scheme.



What is the identity of metal carbonate **W**?

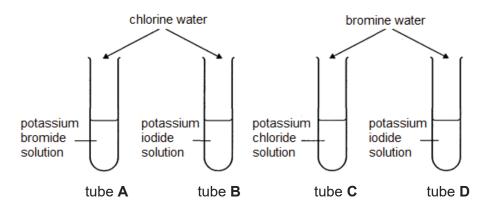
A copper(II) carbonate

B iron(II) carbonate

C iron(III) carbonate

D zinc carbonate

25 The diagrams show a series of experiments carried out using chlorine water and bromine water.



Which test tube, A, B, C or D shows no change in colour?

26 Which of the following processes is an endothermic reaction?

A combustion

B freezing

C photosynthesis

D respiration

27 Sulfur undergoes changes when it reacts with air and water.

The substances that sulfur form are represented in the following stages.

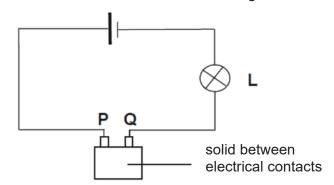
Stage 1	Stage 2	Stage 3	Stage 4
S	SO_2	SO ₃	H_2SO_4

Which of the following shows the correct change in oxidation states of sulfur in each stage of the process?

	S	SO ₂	SO ₃	H ₂ SO ₄
Α	0	+2	+6	+8
В	0	+4	+6	+6
С	+2	0	+6	+6
D	+6	+6	+2	0

- 28 Which statements about the pollutant carbon monoxide are correct?
 - 1 It is a colourless and odourless gas.
 - 2 It is formed by the complete combustion of natural gas.
 - 3 It reacts with the haemoglobin in the blood and reduce the transport of oxygen.
 - A 1 and 2 only
 - **B** 2 and 3 only
 - C 1 and 3 only
 - **D** 1, 2 and 3
- **29** The diagram shows a complete circuit.

Which solid, when placed between **P** and **Q**, would cause the light bulb **L** to light up?



- A copper
- **B** hydrogen fluoride
- C sodium chloride
- **D** sulphur

30 In the preparation of salts, which of the following would require the use of a burette and pipette?

A calcium sulfate

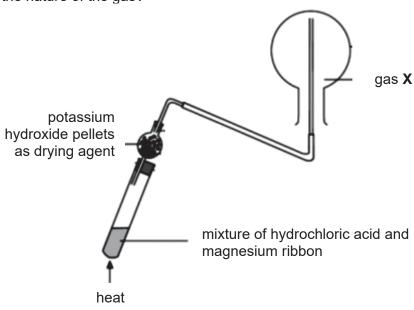
B sodium sulfate

C silver sulfate

D zinc sulfate

31 The diagram shows an upward delivery method for gas X.

What is the nature of the gas?

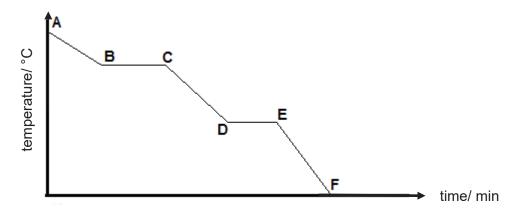


- **A** The gas is soluble in water and denser than air.
- **B** The gas is soluble in water and less dense than air.
- **C** The gas is insoluble in water and denser than air.
- **D** The gas is insoluble in water and less dense than air.

Which ionic equation represents the neutralisation of dilute sulfuric acid with aqueous sodium hydroxide?

- $A \quad H^+ + OH^- \rightarrow H_2O$
- **B** NaOH + $H^+ \rightarrow Na^+ + H_2O$
- **C** $H_2SO_4 + 2OH^- \rightarrow SO_4^{2-} + 2H_2O$
- $D SO_4^{2-} + 2Na^+ \rightarrow Na_2SO_4$

33 The diagram shows a cooling curve of steam.



Which of the following options correctly describes the changes that occur between points **C** to **D**?

	separation of particles	energy of particles	attractive forces between particles
Α	decreases	increases	decreases
В	decreases	decreases	increases
С	increases	increases	decreases
D	increases	decreases	increases

34 An element has an atomic number of 4.

Which statement about this element is correct?

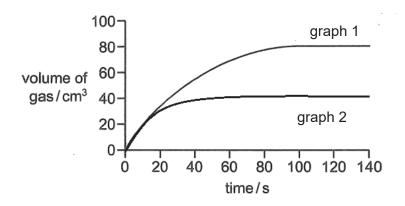
- **A** It forms ions by losing electrons.
- **B** It has four occupied electron shells in each of its atoms.
- **C** It is an unreactive gas at room temperature and pressure.
- **D** It is found in Group IV of the Periodic Table.
- 35 An element X forms an ion of X^{2+} .

Which group of the Periodic Table is this element found in?

- **A** Group I
- **B** Group II
- **C** Group V
- **D** Group VI

36 Some zinc carbonate was reacted with excess dilute nitric acid.

The graph shows the volume of carbon dioxide gas evolved at 20 second intervals until the reaction has finished. Graph 1 shows the results obtained from this reaction.



Which of the following could have been changed to produce graph 2?

- A The concentration of acid was doubled.
- **B** The concentration of acid was halved.
- **C** The mass of zinc carbonate was halved.
- **D** The particle size of the zinc carbonate was doubled.

37 The reaction between hydrochloric acid and calcium carbonate is shown.

$$2HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$$

What volume of 1.0 mol/dm³ hydrochloric acid is needed to react completely with 1.0 g of calcium carbonate ($M_r = 100$)?

A 10 cm³

B 20 cm³

C 100 cm³

D 200 cm³

38 Which of the following substances is **not** present in the reaction during the extraction of iron?

A calcium oxide

B calcium carbonate

C calcium hydroxide

D calcium metasilicate

39 Which oxide will neither react with acids nor alkalis?

A carbon dioxide B carbon monoxide

C magnesium oxide D zinc oxide

40 The results of three metal displacement experiments are tabulated as shown.

experiment	metal	metal nitrate solution					
охропшон	motar	JNO ₃	K NO ₃	LNO ₃			
1	J	-	no reaction	L displaced			
2	K	J displaced	-	L displaced			
3	L	no reaction	no reaction	-			

What is the order of reactivity of these metals?

	most reactive		least reactive
Α	J	K	L
В	K	L	J
С	K	J	L
D	L	J	K

End of Paper

The Periodic Table of Elements

	0	2	운	hellum 4	10	Se	neon	20	18	Ā	argon	40	36	눟	krypton	84	54	×	xenon	98	~	radon	1												
					6	ш	fluorine	19	17	õ	chlorine	35.5	35	亩	bromine	80	23	П	127	85	¥	astatine	ı												
	5				œ	0	oxygen	16	16	ဟ	sulfur	32	34	Se	selenium	79	25	_е	128	84	S.	polonium	ı	116	۲	livermorium	-								
	>				7	z	nitrogen	14	15	۵	phosphorus	31	33	As	arsenic	75	51	S	antimony	83	ā	bismuth	508												
	2										9	ပ	carbon	12	14	Ö	silicon	28	32	g	germanium	73	20	S	₽	82	윤	lead	202	114	F.	flerovium	'		
	≡				2	ш	poron	11	13	Α	aluminium	27	31	ga	gallium	70	49	드	indium 115	8	Ľ	thallium	204												
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Group												28	Z	nickel	59	46	Б	palladium	78	₫	platinum	195	110	S	darmstadtium	·									
Gro	-												27	ပိ	cobalt	59	45	듄	modium 103	77	ī	iridium	192	109	Ħ	meimerium									
		hydrogen	hydrogen 1									26	Pe			44	Ru	ruthenium 101	76	SO	osmium	190	108	£	hassium										
													•								25	M	manganese	55	43	ဥ	technetium	75	Re	rhenium	186	107		pohrium	
							umber	00		mass					24	ပ်	chromium	52	42	õ	molybdenum QR	74	>	tungsten	184	106	Sg	seaborgium							
				Key	proton (atomic) number	atomic symbo	name	relative atomic mass					23	>	vanadium	ú	4	Ź	doin	73	ř	tantalum	181	105	음	dubnium	ı								
					proton	atc		relativ					22	F	titanium	48	40	Zı	zirconium Q1	72	Ξ	hafnium	178	104	ፚ	Rutherfordium									
													21	တိ	scandium	45	39	>	yttrium	57 - 71				89 - 103	actinoids										
	=				4	Be	beryllium	5	12	Mg	magnesium	24	20	S	calcium	40	38	ഗ്	strontium	26	Ba	barium	137	88	Ra	radium	ı								
	_						lithium			Na	sodium	23	19	¥	potassium	39	37	윤	mbidium R5	22	S	caesium	133	87	Ŀ	francium	I								

71	3	Intetinm	175	103	۲	lawrencium	ı
20	χ	ytterbium	173	102	S	nobelium	ı
69	μ	thulium	169	101	Md	mendelevium	ı
68	ш	erbinm	167	100	Fm	fermium	ı
29	운	holmium	165	66	ES	einsteinium	,
99	ò	dysprosium	163	86	ర	californium	ı
92	<u>a</u>	terbinm	159	97	益	berkelium	ı
64	g	gadolinium	157	96	S	curium	ı
63	ш	europium	152	92	Am	americium	ı
62	Sm	samarium	150	94	P	plutonium	ı
61	Pm	promethium	1	93	å	neptunium	ı
09	PN	neodymium	144	92	⊃	uranium	238
29	Ā	praseodymium	141	91	Ра	protactinium	231
28	ဗီ	cerium	140	90	드	thorium	232
22	Га	lanthanum	139	88	Ac	actinium	ı
lanthanoids				actinoids			

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC MID YEAR EXAMINATION 2018

SCIENCE (PHYSICS, CHEMISTRY)

5076/03

Paper 3 Chemistry

Monday 0800 – 0915

07 May 2018 1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

Write in dark blue or black pen.

Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

You may use lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 15. A copy of the Periodic Table is printed on page 16.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use
Section A

Total

This document consists of 16 printed pages, including the cover page.

Setter: Mr Mohd Riffaii [Turn over

Section A

Answer all the questions in the spaces provided.

Use **three** words from the box below to describe each substance in Table 1.1. 1 The words can be used once, more than once, or not at all.

For Examiner's Use

solid	liquid	gas	atom	molecule
	element	compound	mixture	ions

Table 1.1

substance	diagram	description words
A	+ - + - + - + - + - + - + - + - + - + -	1 2 3
В		1 2 3
С		1 2 3

[3]

(b)	(i)	Explain why substance A will conduct electricity when dissolved in water.	Ī
			[1]
			ı

(ii) Suggest another way of making substance **A** conduct electricity.

[1]

2 Spots of different coloured dyes were placed along a pencil line on a sheet of chromatography paper. The paper was then placed in a solvent.

For Examiner's Use

Fig. 2.1 shows the chromatogram obtained.

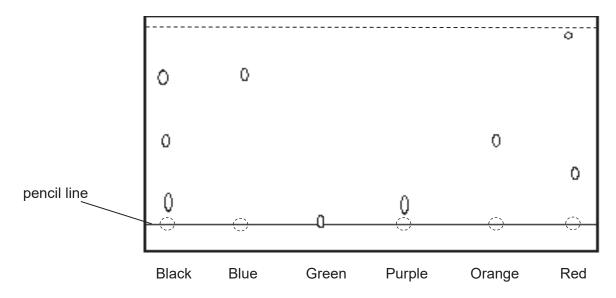


Fig. 2.1

(a)	Which physical property allows chromatography to separate components of the dyes?	Ì
		[1]
(b)	Based on Fig. 2.1, what can be deduced about the components of the black dye?	
		[1]
(c)	Suggest why the start line was drawn in pencil line and not in ink for this experiment?	
		[1]

3	Hydr	ogen br	omide has a melting point of –87 °C and a boiling point of –67 °C.	For Exan Use
	(a)		a 'dot and cross' diagram to show the arrangement of electrons in a molecule of gen bromide. Show only the outer shell electrons.	Use
				[2]
	(b)	Hydrog	gen bromide dissolves in water to form an acidic solution which is colourless.	
		(i)	Give the formula of the ion which causes the acidity.	
				[1]
		(ii)	Describe what is seen when chlorine gas is bubbled through the solution.	
				[1]
		(iii)	Construct an ionic equation, including state symbols, for the reaction you have described in (ii).	
				[2]
				i

		n the blast furnace.	Exa Use
		f zinc blende is roasted in air (oxygen) to form zinc oxide which is then reduced with pnoxide in the blast furnace, similar to the extraction of iron from haematite.	
The	extrac	ction of zinc can be represented by the equation as shown.	
		$ZnO + CO \rightarrow Zn + CO_2$	
(a)	Stat	e which substance is reduced and give a reason for your answer.	
	subs	stance reduced	
	reas	on	[2]
(b)		produced by the blast furnace is often alloyed to increase its hardness and strength. ss is an alloy of zinc and copper.	
	(i)	Draw the structure of brass in the box provided in Fig. 4.1.	
		Fig. 4.1	[1]
	(ii)	With reference to your drawing in Fig. 4.1, explain why brass is harder and stronger compared to pure zinc.	
			[2]

5 The reaction between copper(II) oxide and hydrogen can be represented by the equation as shown.

For Examiner's Use

$$CuO(s) + H_2(g) \rightarrow H_2O(g) + Cu(s)$$

In this reaction, 0.40 g of solid copper(II) oxide was used.

(a) (i) Calculate the number of moles of copper(II) oxide used in the reaction.

[1]

(ii) Hence, determine the number of moles of hydrogen gas is required for all the copper(II) oxide to be used up in the reaction.

[1]

- (b) It is also known that 165 cm³ of hydrogen gas was used in the reaction.
 - (i) Using your answer from (a), determine the limiting reagent. Explain your answer clearly by showing all relevant calculations.

[3]

(ii) Hence or otherwise, calculate the mass of water vapour produced at the end of the reaction.

[2]

]	
								Ī		Ī	Ī		-	
V									X					
									Υ					
w											Z			
													_	
					l	Fig. 6.	1							
	h of the foll		statem	ents, c	decide	wheth	er the	statem	ent is	true o	r false	and s	tate a	
reason	for your de	cision.												
(a) W	<i>I</i> is more m	etallic t	han Z .											
(a) W	<i>I</i> is more m	etallic t	han Z .											
(a) W	<i>I</i> is more ma	etallic t	han Z .											-
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(a) W 	<i>I</i> is more me	etallic t	han Z .											
	is more me													
														-
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(b) V (c) V	is less read	r meltir	an W .	it than	w .									-

Examiner's Use

[2]

7 Study the flowchart in Fig. 7.1 and answer the following questions.

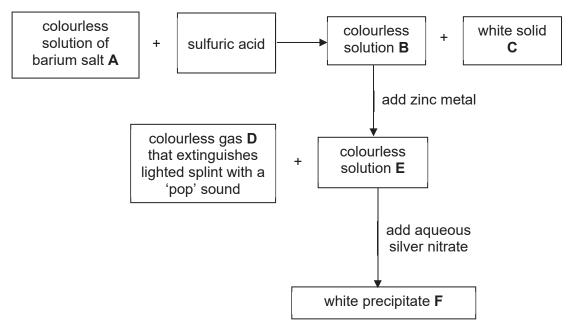


Fig. 7.1

(a)	lder	ntify substances A to F .	
	Α		
	В		
	С		
	D		
	E		
	F		[6]
(b)	Wri	te a balanced chemical equation for any one of the reactions described in Fig. 7.1.	

8 (a) A chemical company makes salts for use in industries. Table 8.1 shows some names and formulae of salts with the names of the acids and other compounds used to make them.

Examiner's Use

[3]

Complete the table by writing the missing information.

Table 8.1

name of salt	formula of salt	name of acid used to make salt	name of the other compound used to make salt
sodium sulfate	Na ₂ SO ₄		
potassium phosphate	K ₃ PO ₄	phosphoric acid	
silver chloride	AgC <i>l</i>		
calcium phosphate		phosphoric acid	calcium hydroxide

(b) Fig. 8.2 shows a rusted car. However, not all the parts have rusted. The areas that have not rusted are either painted or have plastic coatings.



Fig. 8.2

	Explain how the paint and plastic coating can slow down rusting.	
		[2]
(c)	Harmful gases released into the atmosphere can form acid rain which speeds up rusting.	
(-)	Name one such gas which causes acid rain and state its source.	
		[2]

Section B

For Examiner's Use

Answer any two questions in this section.

Write your answers in the spaces provided.

9 Read the information about chlorine.

Chlorine ranks among the top ten chemicals produced today. Chlorine is produced by passing an electric current through a concentrated solution of sodium chloride or through molten sodium chloride. This process is one of the most important commercial processes in industry. Chlorine, in one form or another, is added to most swimming pools, spas, and public water supplies because it kills bacteria that cause disease. Many people also use chlorine to bleach their clothes. Large paper and pulp mills use chlorine to bleach their products.

Two naturally occurring isotopes of chlorine exist, chlorine-35 and chlorine-37. Chlorine exists commonly both in the Earth's crust and in seawater as sodium chloride. Smaller amounts of potassium chloride and magnesium chloride also occur in seawater.

Chlorine is very reactive. The reaction between chlorine and other elements can often be vigorous. For example, chlorine reacts explosively with hydrogen to form hydrogen chloride.

(a)	The information contains examples of a mixture. Identify two mixtures in the information.	
		[1]
(b)	The chemical symbols of the two chlorine isotopes are shown below.	
	$^{37}_{17}$ C l $^{35}_{17}$ C l	
	Compare and contrast the structures of the nuclei in chlorine isotopes.	

[2]

(c) Magnesium burns in chlorine gas to produce magnesium chloride.

For Examiner's

(i) Complete Table 9.1 which gives information about the two ions in magnesium chloride.

Table 9.1

name of ion	number of protons	number of neutrons	number of electrons	electronic structure
magnesium ion	12			2,8
chloride ion	17	18		

[2]

(ii) Draw a 'dot' and cross diagram to show the arrangement of electrons in magnesium chloride. Show only outer shell electrons.

[2]

- (d) Chlorine can react with hydrogen to form hydrogen chloride. Hydrogen chloride is a gas at room temperature.
 - (i) In terms of electrons, describe the bonding in hydrogen chloride.

[1]

(ii) At room temperature, magnesium chloride is a solid while hydrogen chloride is a gas.

Use your knowledge of the bonding in magnesium chloride and hydrogen chloride to explain the difference in physical state.

10	(a)	Hydro	ochloric acid is used for rust removal while sodium hydroxide is used in detergents.	For Examiner's Use
		(i)	State the colour of Universal Indicator in dilute hydrochloric acid and in aqueous sodium hydroxide.	
				[2]
		(ii)	Explain briefly, in terms of ions in solution, the reason for the difference in acidity and alkalinity of hydrochloric acid and sodium hydroxide solutions.	
				[2]
		(iii)	The reaction between hydrochloric acid and magnesium metal produces a soluble salt, magnesium chloride. Describe the steps to obtain a pure sample of magnesium chloride from the reaction.	
				[4]
	(b)	of hy	experiment, 20.0 cm³ of 1.50 mol/dm³ sodium hydroxide exactly neutralised 25.0 cm³ drochloric acid. Using the chemical equation provided for the reaction, calculate the entration of the hydrochloric acid used.	
			NaOH + HC $l \rightarrow$ NaC l + H ₂ O	

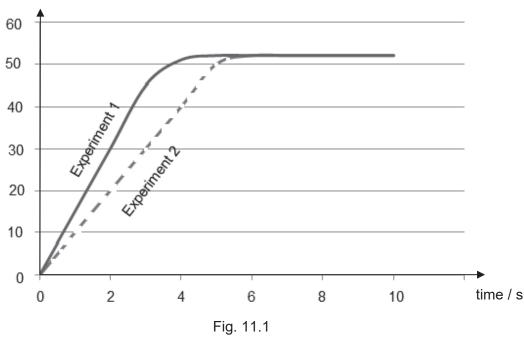
[2]

11	(a)	Fig. 11.1 shows the speed of reaction between calcium carbonate and hydrochloric acid
		in two different experiments.

For Examiner's Us

Experiment 1 was performed using 10 g of powdered calcium carbonate. Experiment 2 was performed using 10 g calcium carbonate in lumps.

volume of carbon dioxide released / cm³



(i)	Based on the graphs, compare the speed of reaction for the two experiments.	
		ı

(ii) Use your knowledge of reacting particles to explain why the particle size of calcium carbonate affects the speed of reaction.

(iii) Write a balanced chemical equation, including state symbols, for the reaction between calcium carbonate and hydrochloric acid.

[2]

[1]

(b)		h on Fig. 11.1 the speed of reaction for 5 g of powdered calcium carbonate . this 'Experiment 3'.	[1]
(c)	The to	emperature of the mixtures increased during the reaction in both experiments 1 and	
	(i)	Suggest whether the reactions are exothermic or endothermic.	[1]
	(ii)	Explain in terms of bond breaking and bond forming for your answer in c (i).	ניז
			[2]
	(iii)	Suggest a method that can be used to accurately determine that all the acid has been used up during the reaction.	
			[1]

End of Paper

DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

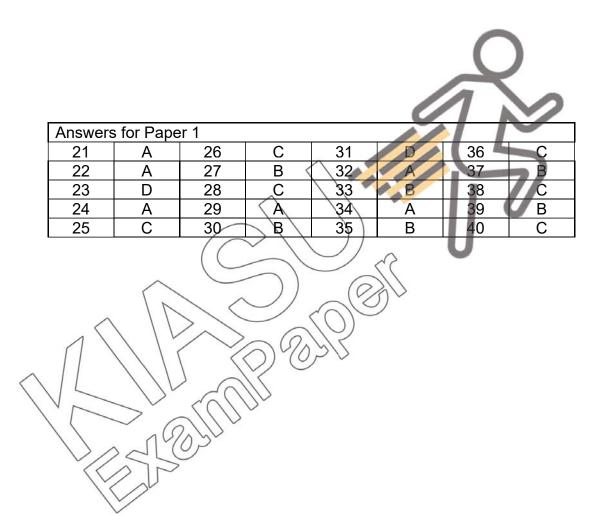
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The Periodic Table of Elements

																_					Т							\neg
	0	2	운	helium.	4	10	Š	neon	20	18	Ā	argon	40	36	눟	kryptor	84	24	×	xenon	98	を	radon	1				
	II					0	ட	fluorine	19	17	õ	chlorine	35.5	35	亩	bromine	80	53	П	odine 127	85	¥	astatine	ı				
	I					ø	0	oxygen	16	16	ഗ	sulfur	32	34	Se	selenium	79	52	Тe	tellurium	84	S.	polonium	1	116	^	livermorium	ı
	>					7	z	nitrogen	14	15	۵	phosphorus	31	33	As	arsenic	75	51	g	antimony	83	窗	bismuth	509				
	2					9	ပ	carbon	12	14	ij	silicon	28	32	ge	germanium	73	20	S	₽ 5	82	8	lead	207	114	Ε/	flerovium	ı
	≡					5	ш	poron	1	13	Αl	aluminium	27	31	ga	gallium	70	49	디	indium 115	2 5	17	thallium	204				
					,									30	Zu	zinc	65	48	8	cadmium 112	80	문	mercury	201	112	ວົ	copernicium	ı
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dno														28	Ż	nickel	29	46	В	palladium	282	盂	platinum	195	110	S	darmstadtium	ı
Group														27	ပိ	cobalt	59	45	문	mpodium 403	22	=	iridium	192	109	¥	meitnerium	ı
		-	I	hydrogen	-									56	Ъ	iron	26	44	Ru	ruthenium	76	SO	osmium	190	108	£	hassium	ı
						'								52	Mn	manganese	22	43	ပ	technetium	75	æ	rhenium	186	107			ı
						umber	Ю		nass					24	ပ်	chromium	52	42	ω	molybdenum	74	>	tungsten	184	106	Sg	seaborgium	ı
				,	Rey	proton (atomic) number	atomic symbol	name	relative atomic mass					23	>	vanadium	51	41	g	miopinm	73	Ta	tantalum	181			E	ı
						proton	ato		relativ					22	F	titanium	48	40	Z	zirconium 04	72	Έ	hafnium	178	104	¥	Rutherfordium	1
					,														>	yttrium	57 – 71	lanthanoids			89 - 103	actinoids		
	=					4	Be	beryllium	6	12	Mg	nagnesium	24	20	Ca	calcium	40	38	ഗ്	strontium	26	Ва	parium	137	88	Вa	radium	1
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20	χ	ytterbium	173	102	õ	nobelium	ı
69	μ	thulium	169	101	Md	mendelevium	1
89	ш	erbinm	167	100	Fm	fermium	ı
29	운	holmium	165	66	ES	einsteinium	1
99	ò	dysprosium	163	86	రే	californium	ı
65	2	terbium	159	6	益	berkelium	1
64	В	gadolinium	157	96	S	curium	ı
63	ш	europium	152	92	Am	americium	1
62	Sm	samarium	150	94	Pn	plutonium	ı
61	Pm	promethium	1	93	ď	neptunium	1
09	ğ	neodymium	144	92	⊃	uranium	238
29	Ā	praseodymium	141	91	Ра	protactinium	231
28	ဗီ	cerium	140	90	드	thorium	232
22	Га	lanthanum	139	89	Ac	actinium	1
lanthanoids				actinoids			

The volume of one mole of any gas is 24 \mbox{dm}^3 at room temperature and pressure (r.t.p.).





Pasir Ris Secondary School

SECONDARY 4 EXPRESS MID-YEAR EXAMINATION 2018

SCIENCE (CHEMISTRY)

5076

Paper 1: Friday 0800 – 0900 Paper 3: Monday 0800 - 0915 04 May 2018

07 May 2018

20 + 65 marks



This document consists of 14 printed pages (inclusive of this page).

Setter: Mr Mohd Riffaii [Turn over

Section A: Structured Questions [45 marks]

1	(a)		description words			[3]			
		1 sol	•	Stude	nts incorrectly state				
		2 ion	S	mixtu	re due to the different				
		3 cor	npound		harges.				
		1 liqu			nts incorrectly state solid				
		2 ele 3 ato		due to the connecting atoms or					
		3 ato	III	molecule					
				Stude	nts incorrectly state				
		1 gas			re due to the different				
			npound lecule	colou	ed shapes failing to				
		0 1110	iodaio		ciate the line or as				
				atom	5.				
		Any	order		4 16 2				
					1 mark for every 3 correct answers				
	(b)	(i)	Presence of mobile ions to	act as	Missing key terms of mobile ions act as	[1]			
	, ,	charge carriers to enable			charge carriers. Students state free				
			conduction of electricity		electrons which is reserved for metals.				
		(ii)	Heating A till it melts / A is	in	Students state electrolysis and	[1]			
			molten state.	·l	electroplating it as a method.				
			[Total: 5	marks					
2	(a)	Differe	ent solubilities of compone						
		solver	nt	`	word response. Failing to state solubility of				
					the dyes.				
	(b)	Conta	ins blue, purple and orange	//	Most who got wrong failed to indicate blue	[1]			
	(5)	Ooma	ino bido, purpio dila ordrigo	1	as well as they felt it wasn't perfectly in line.	[,,]			
))					
	(c)		ite/Carbon in the pencil is in			[1]			
			solvent and would not aff	fect the					
		results	S. \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(90)	not used. Some used 'lead' as a term to				
	\wedge		[Total: 3	Marks	explain about the carbon from pencil.				
3	(a)	1	Liotalio	ividino					
	()		V XIII		Most could not recall how to draw the				
			LIMA Dr X		bromine electrons properly. Left blank.				
		V	DI *		Legend stated only as hydrogen/bromine	[2]			
			XXX.						
			XX						

	/l ₌ \				
	(b)	/i\	H ⁺	Students wrote equations of HPr or H-	[4]
		(i) (ii)	Colourless solutions starts to turn	Students wrote equations of HBr or H ⁻ . Students described the displacement	[1] [1]
		(11)	reddish - brown	reaction itself rather than colour	ניו
				observations. Some stated yellow instead	
				of reddish brown.	
		(iii)	$Cl_2(g) + 2Br(aq) \rightarrow$	Very poorly done. 98% could not do this	[2]
			$2Cl^{-}$ (aq) + Br_{2} (aq)	question and could not balance equation.	
			[1] – correct chemical	Need to revisit this topic.	
			formula/ions		
			[1] – correct state symbols		
			(2 nd mark is only awarded if the		
			1 st mark is given)		
				[Total: 6 marks]	
4	(a)	Substa	ance reduced: ZnO has been	substance reduced: most incorrectly state	
	` ′	reduce	ed [1]	as just Zn.	
		Reaso	on: ZnO has lost an oxygen atom to	Reason: students are able to explain the	[2]
			n / oxidation number of Zn has	loss of oxygen to identify the substance	
		decrea	ased from +2 in ZnO to 0 in Zn. [1]	reduced. However, their phrasing is wrong	
				using oxygen has been reduced from zinc	
				oxide.	
	(b)	(i)			
	(b)	(i)		most students who made mistakes drew	
				orderly arranged atoms or did not	
		1		differentiate the size of the atoms	
	^			enough.	[4]
				the size of the atoms enough. Labelling	[1]
		1		might help.	
	6	//			
		(ii)	The different sized atoms disrupts	Most fail to get the full marks by either	
		(ii)	the orderly arrangement [1]	omitting different size disrupts orderly	
			of pure metal. This makes it	arrangement.	[2]
			harder for the layers to slide over	aa.igomona	[-]
			one another [1] thereby making it		
			harder.		
				[Total: 5 marks]	
5	(a)	(i) N	Mr of CuO = 64 + 16 = 80		
			No. of moles of CuO		
		1	= 0.40		
			80		[1]
		=	= 0.0050 moles		

		ı			T
		(ii)	Mole ratio, CuO:H ₂ is 1:1, hence 0.0050 moles of H ₂ is required	Students fail to state why the value is same as a(i).	[1]
	(b)	(i)	No. of moles of hydrogen gas used $= \frac{165}{24000}$ $= 0.006875 \text{moles} \qquad [1]$ Mole ratio, CuO:H ₂ is 1:1 $0.005 \text{mole of CuO requires only}$ $0.005 \text{ moles of H}_2. \text{ However,}$ $0.006875 \text{moles of H}_2 \text{ is used.}$ $\underline{\text{Hence H}_2 \text{ is in excess.}} \qquad [1]$ CuO is the limiting reagent. [1]	Quite a large number of students had not done this part as they forgot to change cm3 to dm3. They also had forgotten the formula. Lastly, they incorrectly associate CuO and H2 mole directly by looking which is more rather than by looking at amount of H2 available vs needed.	[3]
		(ii)	Mr of water vapour = 2 + 16 = 18 Mole ratio of CuO:H ₂ O is 1:1. Hence 0.005mols of water vapour is formed. [1] Mass of water vapour = 0.005 x 18 =	Quite a fair number of students erroneously used the amount of hydrogen used in a(i). to calculate the number of moles. 1m was given for method mark.	[2]
	\wedge		0.09g [1]	[Total: 7 marks]	
6	(a)	cha fron	e; In the same Périod, <u>metallic</u> racter of elements decreases helf to right of PD so W is more allie than Z.	Most students were able to do this question. However the explanation needs improvement as they only say the Z is a halogen rather than showing less character of a metal.	[1]
	(b)	eler	e; On moving down Group I ments, the reactivity increases so less reactive than W.	Most students could do this well.	[1]
	(c)	Fal ele ele	se; On moving down Group I ments, the melting point of the ment decreases so V should have igher melting point than W.	Quite a fair number of students had forgotten trends of Grp 1	[1]
	(d)	the ator	se, On moving down any group, number of electron shells in the ms of the element increases so X uld have less electron shells than	Almost all students were able to answer this question well.	[1]

		(No mark for reason incorrect.)	f 'true/false'	is			
		incorrect.)				[Total: 4 marks]	
7	(a)	A: barium chloride			A students	s could not identify the acid.	
		B: hydrochloric acid C: barium sulfate D: hydrogen gas E: zinc chloride F: silver chloride			HCI. Most poption. C most lef D all stude E some stu	s could not identify the acid as placed Barium sulfate in this it this blank ents could identify this udents were able to identify this able to work backwards.	[6]
					F as above		
	(b)	2AgNO ₃ (aq) + ZnC l_2 (Zn(NO ₃) ₂ (aq) BaC l_2 (aq)+ H ₂ SO ₄ (ac) 2HC l (aq) 2HC l (aq) + Zn (s) \rightarrow Z	ຐ) → BaSO₄	(s) +	could not wri	te a balanced equation. Some nonsensical response as the not go through.	[2]
				1	1	[Total: 8 marks]	
8	(a)	name of salt	formula of salt	to m	e of acid used ake salt		
		sodium sulfate potassium phosphate	Na ₂ SO ₄		uric acid	sodium oxide/hydroxide/carbona te potassium oxide/	
		silver chloride	AgCl		ochloric	hydroxide/carbonate silver nitrate	
		calcium phosphate	Few recalled the charge for phosphori c acid	acid		calcium hydroxide	[3]
	(b)	The paint and plastic co	ating acts as	· a ı	Most students a	could identify why the paint can	
	(b)	barrier [1] to	auny acts as	b n	e used to pre number did n	event rusting but quite a large not state how it acts as a more from the reactants.	[2]

	(c)	from direct	ent / minimize oxyg coming into contact dy [1] gen dioxide – moto r dioxide – fac nic eruptions	r vehicles		tly stated the gases SO2 but r incorrect response. [Total: 7 ma	
	Sect		- Free Response C	Questions [20			For Examiner's Use
9	(a)	Solut	ion of sodium chlor ater	ride and	•	I swimming pool, tap but the nly inferred not mentioned.	[1]
	(b)	They neutro	have same numbe have different ons, <u>C<i>l</i>-35 has 18</u> has 20 neutrons.	number o	f number in p	nts correctly stated the the sa roton but did not elaborate on the number of neutron throu to show how they knew sidifferent.	the [1] ugh
	(c)	(i)			Table 8.1		
		(ii) <	name of ion magnesium ion chloride ion	number of protons	number of neutrons	number of electronic structure 10 lons mean that there is a difference between proton and electron. Mg loses 2 electrons 18 Chlorine gains one electron	[2]
			charges [1], election of the charges [1] and the charges [1] are t	w the proper ch	narges and wro	ngly indicated the outermost s	[2]

	(1)	(:)			I
	(d)	(i)	Hydrogen and chlorine share a pair of electrons between them.	Most wrongly stated by just stating it has covalent bonds without describing further.	[1]
		(ii)	Magnesium chloride is a solid at room temperature as <u>a large</u> <u>amount of energy</u> is required to overcome the <u>strong electrostatic</u> forces of attraction <u>between oppositely charged ions</u> .	Most students failed to state everything to get full marks. Many confused between structure and bonding. Structure describes how the particles are packed and its movement and arrangement.	[1]
			Hydrogen chloride is a gas at room temperature as only a <u>small</u> <u>amount of energy</u> is required to overcome the <u>weak intermolecular</u> forces of attraction <u>between molecules.</u>	[Total : 10 marks]	[1]
10	(a)	(i)	Universal indicator in hydrochloric acid is red while it is purple in sodium hydroxide. Reject orange/yellow for hydrochloric acid and blue for sodium hydroxide	Orange and blue are synonymous for weak acid and alkalis	[2]
		(ii)	There are more H ⁺ ions than OH- ions in acid. [1] There are more OH- than H ⁺ ions in alkaline solutions. [1]	Acids have both types of ions only that there are more of one type than the other. The converse is true.	[2]
			Add magnesium/sarbonate/oxide in excess to acid [1] Filter the mixture to obtain magnesium as residue and keep the filtrate [1] Heat the filtrate to saturate the solution and allow it to cool to allow crystals to form [1] Dry the crystals between sheets of filter paper [1]	By drawing out the reaction, students can visualise better and not omit the steps.	[4]
	(b)	[1]	f moles of NaOH = 0.02x1.5 = 0.03 entration of HCl = 0.03 / 0.0250 [1] = 1.20 mol/dm ³		[2]
				[Total: 10 marks]	
11	(a)	(i)	Experiment 1 has a faster rate of reaction than experiment 2. / Experiment 1 took a faster time to complete than experiment 2.	Steeper gradient indicates a faster rate of reaction.	[1]
		(ii)	Powdered calcium carbonate has a larger surface area to volume	Most omitted to state which particle was the smaller one and assumed the reader to	[2]
	<u> </u>		a larger carrace area to volume	smaller one and assumed the reader to	[-]

			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
		ratio / larger total surface area exposed to collisions. [1] Results in higher frequency of effective collisions [1], thus greater speed of reaction.	know. Many used higher probability instead of frequency.	
	(iii)	CaCO ₃ (s) + 2HC l (aq) \rightarrow CaC l ₂ (aq) + CO ₂ (g) + H ₂ O(l)	Most could not recall reactions between acid and carbonates and the product obtained.	[2]
(b)	Volume of carbon dioxide released (cm²) ω A ω	Time (sec)	Sizeable number of students failed to label the correct term. Students failed to appreciate the half volume compared to first graph. Students did not follow the reaction speed of the first graph.	[1]
(c)	(i)	Exothermic reactions.	Heat increase is exothermic reaction	[1]
	(ii)	Greater energy is given off when bonds of products are formed [1] then energy taken in from surrounding in breaking bonds [1] of reactants. Hence there is a net increase in temperature.	Students failed to appreciate how bonds of existing compunds need to be broken in order to form new bonds. Breaking of bonds require energy which is taken in (endo) from surroundings. Forming of bonds require the energy to be given out to surroundings (exo). Since final is exo it means that more energy is given off than taken in.	[2]
	(iii)	Using a pH meter.	accurately = use instrument to measure	[1]
			[Total: 10 marks]	

End of Paper



Setter

Mr. Joel Lee

West Spring Secondary School MID-YEAR EXAMINATION 2018

Ψ					5076/5078
Science (Chemist	ry)				5076/5076
SECONDARY 4/5	XPRESS / NORI	MAL (A	CADE	EMIC)	
Name		()	Date	10 May 2018
Class				Duration:	1 hr 45 mir
Additional Materials: F	eriodic Table				
READ THESE INSTRU	CTIONS FIRST				
Write your index number, co You may use a HB pencil fo Write in dark blue or black p Do not use staples, paper o The use of an approved sci You may lose marks if you	or any diagrams, gra pen. lips, highlighters, glu entific calculator is e	phs, table ue or corre xpected, v	s or ro	ough working. fluid. appropriate.	
use appropriate units. Section A (20 Marks)					
Answer all questions. Write your answers in the s	paces provided on p	age 6.			
Section B (45 Marks) Answer all questions. Write your answers in the s Show all relevant workings		ne questic	n pap	er.	
Section C (20 Marks) Answer both questions. Write your answers in the s Show all relevant workings	•				
The number of marks is giv	en in [] at the end of	f		FOR EXAM	IINER'S USE
each question or part quest	ion.			Section A	/20
				Section B	/45
				Section C	/20
				Total	/85

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This document consists of 16 printed pages including this cover page.

[Turn over

Section A

Answer all questions in the spaces provided on page 6.

1 The approximate pH values of four aqueous substances are shown.
Which substance could be used to neutralise excess acid in the stomach?

	substance	рН
Α	baking soda	9
В	salt	7
С	orange juice	4
D	vinegar	3

- Which two substances react without giving off a gas?
 - A citric acid and calcium carbonate
 - **B** hydrochloric acid and magnesium.
 - **C** nitric acid and aqueous ammonia.
 - **D** sodium hydroxide and ammonium sulfate.
- Which ionic equation represents the reaction between aqueous potassium hydroxide and dilute sulfuric acid?
 - A H^+ (aq) + OH^- (aq) $\rightarrow H_2O$ (I)
 - **B** H_2SO_4 (aq) + $2K^+$ (aq) $\rightarrow K_2SO_4$ (aq) + H_2 (g)
 - **C** $2K^+$ (aq) + SO_4^{2-} (aq) $\rightarrow K_2SO_4$ (aq)
 - **D** KOH (aq) + H⁺ (aq) \rightarrow K⁺ (aq) + H₂O (I)
- **4** A student proposed a few methods to safely prepare a sample of sodium chloride in the laboratory:
 - 1 sodium hydroxide and hydrochloric acid
 - 2 sodium metal and hydrochloric acid
 - 3 sodium nitrate and hydrochloric acid

Which of the above method(s) may be used?

- A 1 only
- B 2 only
- C 1 and 2 only
- D 12 and 3
- **5** Which of the following contains the greatest number of atoms?
 - A 0.5 mol of helium
 - **B** 30 dm³ of krypton
 - **C** 40 g of calcium
 - **D** 100 g of gold

6 What is the mass of sodium hydroxide present in 500 cm³ of 1.0 mol/dm³ sodium hydroxide solution?

A 0.5 g

B 20 g

C 40 g

D 2 kg

7 In a reaction, 10 cm³ of butene (C₄H₈) was burnt in 80 cm³ of oxygen. The equation for the reaction is shown:

$$C_4H_8(g) + 6O_2(g) \rightarrow 4CO_2(g) + 4H_2O(I)$$

At the end of the reaction, what is the total volume of gas remaining? (all volumes are measured at r.t.p.)

A 40 cm³

B 60 cm³

C 80 cm³

D 100 cm³

8 Which air pollutant below is **not** correctly matched to its source?

	pollutant	source
Α	carbon monoxide	incomplete combustion of petrol in car engines
В	nitrogen oxides	lightning activity
С	sulfur dioxide	decomposition of organic matter
D	unburned hydrocarbons	incomplete combustion of petrol in car engines

9 The data below gives the concentration of various air pollutants, in parts per billion, in four different cities.

In which city are limestone buildings under the greatest threat from pollution?

	carbon monoxide	oxides of nitrogen	sulfur dioxide
Α	5	45	11
В	17	11	23
С	25	8	32
D	108	5	23

10 Which statement about the elements of the Periodic Table is correct?

A Group 0 elements are unreactive metals.

B Group II elements tend to form positive ions.

C Group VII elements exist as single atoms.

D The elements become more metallic from the left of the Periodic Table to the right.

- 11 Fluorine, F, is an element in Group VII of the Periodic Table. Which of the following statements about fluorine is **false**?
 - A Fluorine exists as diatomic molecules.
 - **B** Fluorine forms ions with a -1 charge.
 - **C** Fluorine has a higher melting point than chlorine.
 - **D** Fluorine is a non-metal.
- 12 The reaction between iron(III) ions and iodide ions is represented by the following ionic equation:

$$2Fe^{3+}$$
 (aq) + $2I^{-}$ (aq) $\rightarrow 2Fe^{2+}$ (aq) + I_2 (s)

Which statement about the reaction is correct?

- **A** Fe²⁺ ions are oxidised by loss of electrons.
- **B** Fe³⁺ ions are reduced by gain of electrons.
- **C** Fe³⁺ ions are reduced by loss of electrons.
- **D** I ions are oxidised by gain of electrons.
- 13 Aqueous solution **X** is known to contain a powerful oxidising agent.

To two separate samples of solution \mathbf{X} , a solution of potassium iodide was added to one, while a solution of acidified potassium manganate(VII) was added to the other.

Which of the following correctly describes the colour of solution X in the respective samples?

	after addition of aqueous potassium iodide	after addition of aqueous acidified potassium manganate(VII)
Α	brown	colourless
В	brown	purple
С	colourless	colourless
D	colourless	purple

The ionic equations below represent the reactions between four metals zinc, iron, **X** and **Y** and the aqueous ions of one of the other listed metals.

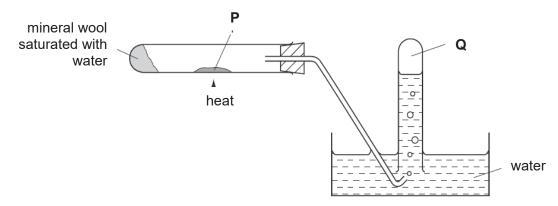
$$Zn + X^{2+} \rightarrow Zn^{2+} + X$$

 $Zn + Fe^{2+} \rightarrow Zn^{2+} + Fe$
 $X + Fe^{2+} \rightarrow \text{no reaction}$
 $Y + Zn^{2+} \rightarrow Y^{2+} + Zn$

What is the correct order of reactivity of the metals?

	most reactive		—	least reactive
Α	X	Fe	Zn	Υ
В	Y	Fe	X	Zn
С	Y	Zn	Fe	X
D	Zn	Υ	X	Fe

- 15 Which of the following explains why recycling ensures that metals will be available in the future?
 - A Dumping of metals in landfill sites is unsightly.
 - **B** Recycling avoids the environmental damage of opening new mines.
 - **C** Recycling costs less than obtaining metals from their ores.
 - **D** There are only limited amounts of metals in the Earth's surface.
- 16 In the experiment shown below, steam is passed over heated solid P, which reacts to give gas Q:



Which of the following could be **P** and **Q**?

	Р	Q
Α	copper	hydrogen
В	potassium	oxygen
С	silver	oxygen
D	zinc	hydrogen

Aqueous sodium hydroxide and aqueous ammonia were added separately to two different aqueous solutions each containing the same metallic ion. In both cases, a white precipitate was formed which dissolved when excess sodium hydroxide or ammonia was added.

What is the ion?

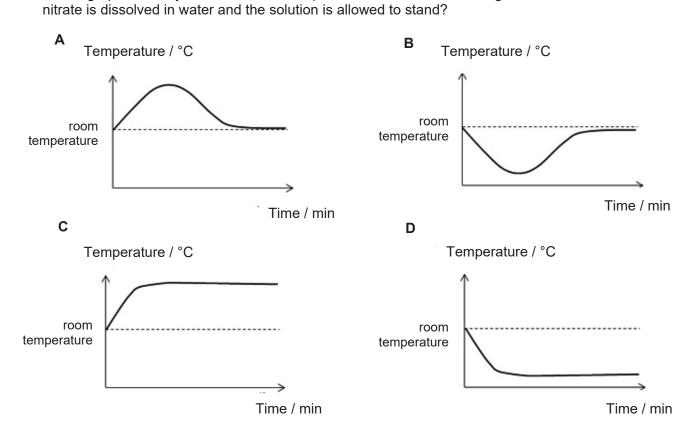
- **A** Al³⁺
- **B** Ca²⁺
- C K⁺
- \mathbf{D} Zn²⁺
- An aqueous solution of compound **Z** reacts with aqueous sodium hydroxide to form a green precipitate. A piece of aluminium foil is added to the mixture and heated; a gas that turns damp red litmus paper to blue is given off.

What is **Z**?

- A ammonium nitrate
- B copper(II) nitrate
- **C** iron(II) chloride
- **D** iron(II) nitrate

- 19 Which of the following processes is exothermic?
 - A Burning of petrol in car engines
 - **B** Evaporation of a water puddle
 - **C** Melting tar for the paving of roads
 - **D** Sublimation of dry ice
- The dissolving of ammonium nitrate in water is an endothermic process.

 Which graph correctly shows how the temperature of the mixture changes over time when ammonium



Answers

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Section B

Answer **all** the questions in the spaces provided.

1 The physical and chemical properties of five unknown oxides are summarised in Table 1.1.

Table 1.1

unknown oxide	state at r.t.p	solubility in water	pH of aqueous solution	reacts with dilute hydrochloric acid?	reacts with dilute sodium hydroxide?
Α	solid	soluble	14	yes	no
В	solid	insoluble	-	yes	yes
С	gas	soluble	7	no	no
D	solid	insoluble	-	yes	no
E	gas	soluble	2	no	yes

(a)	Which oxide(s) is/are:	
	(i) non-metallic?	
		[2]
	(ii) able to form an alkali?	
		[1]
	(iii) amphoteric?	
		[1]
(b)	Give an example for your answer in (a)(iii).	
		[1]
(c)	Suggest the identity of oxide A .	
		[1]

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2 Phosphorus is an element that does not react with water, but will react readily in air, forming an oxide.

Fig. 2.1 below shows a piece of phosphorus fastened to a copper wire and left for a few days in the set up. The water slowly rises up the tube.

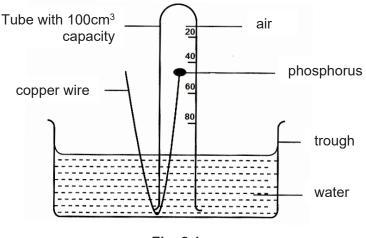


Fig. 2.1

(a)	State the gas in air that phosphorus has reacted with.	
		_

1	h١	At which mark will the	water level	annrovimately	ha aftar a	fow days?
١	v	At which mark will the	water lever	approximatery	De ailei a	lew days:

11	1
 1 1 1	1

(c) State two gases that are left in the tube after a few days.

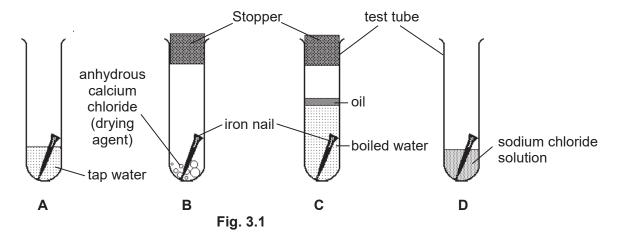
When a mixture of aluminium powder and zinc oxide is heated, the mixture burns vigorously with a bright flame, and may even explode. The reaction is illustrated by the equation below.

$$2AI + ZnO \rightarrow AI_2O_3 + 3Zn$$

(a)	is the reaction endothermic or exothermic? Explain your answer.
	[2]

(b) State whether zinc oxide is oxidised or reduced. Explain your answer in terms of electron transfer.

A common reaction iron undergoes is rusting. Fig. 3.1 below shows an experiment where some iron nails have been exposed to different conditions in four test tubes **A**, **B**, **C** and **D**.



(a)	In which test tube(s) will the iron nail not rust? Explain your answer.			
	[3]			
(b)	In which test tube will the iron nail rust the fastest?			
	[1]			

5 The electronic configurations of lithium, sodium and potassium are shown in Table 5.1.

Table 5.1

element	symbol	proton number	electronic configuration
lithium Li		3	2,1
sodium	Na	11	2,8,1
potassium	K	19	2,8,8,1

(a)	Explain why these three elements are in the same group of the Periodic Table.	
		[1]
(b)	For one of the metals in Table 5.1, name the products of its reaction with water.	
		[2]
(c)	Name one other element that is in the same group as the elements in Table 5.1.	
		[1]
(d)	Describe how the reactivity of the element in (c) would differ from the elements in Table 5.1.	
		[1]

6	An unknown metal ${\bf M}$ forms the nitrate ${\bf M}{\rm NO}_3$. The compound is stable, but decomposes upon strong heating.		
	Whe	en a 17.0 g sample of MNO ₃ was heated, it decomposed completely according to the equation:	
		$2MNO_3(s) \rightarrow 2MNO_2(s) + O_2(g)$	
	At th	ne end of the reaction, 2400 cm³ oxygen was collected.	
	(a)	Is the above decomposition reaction exothermic or endothermic one? Explain your answer.	
		[2]	
	(b)	Calculate the number of moles of MNO₃ that decomposed.	
	(c)	Calculate the molar mass of $\mathbf{M} \mathrm{NO}_3$, and hence determine the identity of \mathbf{M} .	
	(d)	Identity of M :	

7 Group VII and Group 0 are found at the right side of the Periodic Ta			of the Periodic Table.
	(a)	What are the names given to elements in Gr	oup VII and Group 0?
			[1]
	(b)	Explain why the elements in Group 0 are unr	reactive.
			[1]
	(c)	A student is given four substances below.	
		aqueous bromine	aqueous chlorine
		aqueous potassium bromide	aqueous potassium chloride
	Describe how she could use two of the substances to perform an experiment chlorine is more reactive than bromine. Include the observations you would expec and construct a balanced chemical equation of the reaction.		

8 Fig. 8.1 describes some of the reactions of two unknown substances **A** and **B**.

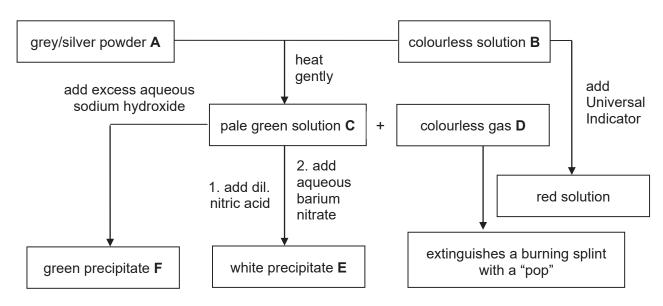


Fig. 8.1

(a)	Identify unknown substances A – F .	
	A :	
	B:	
	C:	
	D:	
	E:	
	F:	[6]
(b)	Write a balanced chemical equation for any one of the reactions in Fig. 8.1.	
		[2]

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Section C

Answer all the questions in the spaces provided.

9 Iron is extracted from iron ore in the blast furnace, as shown in Fig. 9.1 below.

(i)

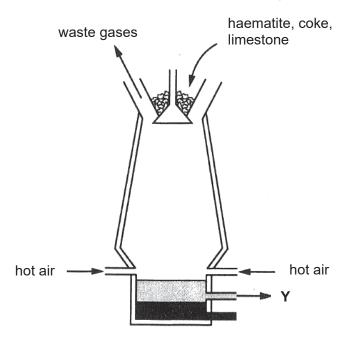


Fig. 9.1

(a) In the furnace, the coke is converted to carbon monoxide. A redox reaction then takes place between iron(III) oxide in haematite and carbon monoxide to produce iron and carbon dioxide.

	monoxide.	
		[1]
/ii\	Explain why the reaction in (i) is a redox reaction	

Write a balanced chemical equation for the reaction between iron(III) oxide and carbon

.....

.....[2]

(iii) Identify the reducing agent in reaction (a)(i).

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(D)	on from the blast furnace is frequently mixed with other elements to form alloys. The example of this alloy, and explain why it is preferred to pure iron.	
(c)	Identify substance \mathbf{Y} , and explain how it is formed. Include the relevant chemical equation(your answer.	s) in
		Γ Δ1

10 Magnesium nitrate is commonly used as a dehydrating agent; it is also present in some fertilisers.

A student prepared a sample of magnesium nitrate by adding magnesium oxide to 200 cm³ of nitric acid of an unknown concentration. The equation is shown below:

$$2HNO_3$$
 (aq) + MgO (s) \rightarrow Mg(NO₃)₂ (aq) + H₂O (l)

In this particular reaction, 7.4 g of magnesium nitrate was collected at the end of the reaction.

(a) Given that the nitric acid reacted completely, calculate the moles of nitric acid that reacted and hence its concentration in mol/dm³.

Outline an experimental procedure to describe how pure crystals of zinc nitrate may be prepare using a similar method as above. State clearly the reagents that you use.	d
[6	3]
Explain why sodium nitrate cannot be prepared with the method in (b).	
[1]

[3]

End of Paper

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West Spring Secondary School Science Department – Mid-Year Exam [2018] **Marking Scheme**

Name of Setter(s): <u>Joel Lee</u>

Title of Assessment: Secondary 4 Express / 5 Normal (Academic)
Subject: Science (Chemistry) 5076/5078

Duration: 1hr 45mins

	Section A [20 marks]								
1	2	3	4	5	6	7	8	9	10
Α	С	Α	Α	В	В	В	С	Α	В
11	12	13	14	15	16	17	18	19	20
С	В	В	С	D	D	D	D	Α	В

	Section B [45 marks]				
Q/No	Answer	Comments/ Suggestions to Markers	Marks		
1(a)(i)	Oxides C and E	CAO	2		
1(a)(ii)	Oxide A	CAO	1		
1(a)(iii)	Oxide B	CAO	1		
1(b)	lead(II)/aluminium/zinc oxide	CAO	1		
1(c)	Any Group I oxide (sodium oxide, potassium oxide etc.)		1		
2(a)	Oxygen	CAO	1		
2(b)	It will be at approximately the 80cm ³ mark.	CAO	1		
2(c)	Any 2: Nitrogen / Argon / Carbon dioxide / Water vapour	CAO	2		
_					
	The reaction is exothermic.	CAO	1		
3(a)	It gives burns vigorously/may explode, signifying that a lot of heat is given out to the surroundings.	OWTTE	1		
	Zinc oxide is <u>reduced</u> .		1		
3(b)	Zn gains 2 electrons from Zn ²⁺ in ZnO to Zn.	CAO	1		
	(Students need to specify no. of electrons to get the mark.)		'		
	The nail will not rust in tubes B and C .	CAO	1		
4(a)	There is <u>no moisture/water in tube B</u> , and	OWTTE	1		
	There is no oxygen in tube C.	OWTTE	1		

4(b)	Tube D .	CAO	1
5(a)	They have the <u>same number of valence electrons</u> .	CAO	1
5(b)	Lithium/sodium/potassium hydroxide and hydrogen gas.	CAO	2
5(c)	Rubidium/caesium/francium	CAO	1
5(d)	It is more reactive.	CAO	1
	The weartier is and the wais because heat needs to be		
6(a)	The reaction is <u>endothermic</u> , because <u>heat needs to be</u> <u>supplied/heat is taken in</u> for the reaction to start	OWTTE	2
	Moles of oxygen = 2400 / 24000		1
6(b)	= 0.10 mol.	CAO	
	Moles of $MNO_3 = 0.10 \times 2$ = 0.20 mol.	1	1
	Molar mass of one mol. of $MNO_3 = 17.0 / 0.2$		
	= 85 g/mol		1
6(c)	$A_{\rm r}$ of M = 85 - [14 + (3x16)]	CAO	
	= 23	(ecf allowed)	1
	Therefore M is sodium.	Ш	1
6(d)	Insert a glowing splint into a test tube containing the gas.	CAO	1
	If it <u>relights</u> , the gas is oxygen.		1
7(a)	Halogens (Group VII) and noble gases (Group 0)	CAO	1
7(b)	They have a fully filled valence shell, which confers stability.	CAO	1
	Mix aqueous chlorine and aqueous potassium bromide.		1
7(c)	The mixture of solutions will turn from colourless to brown as bromine is displaced.	CAO	1
	2 KBr + Cl ₂ → 2 KCl + Br ₂		1
8(a)	A: iron B: sulfuric acid C: iron(II) sulfate D: hydrogen E: barium sulfate F: iron(II) hydroxide	1m each	6
	$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$	CAO	
8(b)	FeSO ₄ + 2NaOH → Na ₂ SO ₄ + Fe(OH) ₂	1m for correct formula, 1m for	2
,	$FeSO_4 + Ba(NO_3)_2 \rightarrow Fe(NO_3)_2 + BaSO_4$	balanced	
	(Any one)	equation.	

Section C [20 marks]					
9(a)(i)	$Fe_2O_3 + 3 CO \rightarrow 2 Fe + 3CO_2$		1		
9(a)(ii)	It is a redox reaction as Fe_2O_3 is reduced to Fe, and CO is oxidised to CO_2 . Fe_2O_3 loses oxygen while CO gains oxygen.	1m for stating oxidised and reduced species 1m for	2		
9/2\/iii\	CO is the reducing agent	explanation CAO	1		
9(a)(iii)	CO is the reducing agent.	CAO	1		
9(b)	(Stainless) steel is one iron-based alloy. It is preferred as it is stronger / more corrosion resistant than pure iron.	CAO	1		
	Y is slag.	CAO	1		
	The <u>limestone added to the furnace decomposes to form calcium</u> <u>oxide</u> and carbon dioxide.	OWTTE	1		
9(c)	The <u>calcium oxide reacts with acidic impurities / silicon dioxide</u> in the haematite to form slag.		1		
	(1m can be given for the role of limestone in removing acidic impurities, without mention of its decomposition)				
	CaO + SiO₂ → CaSiO₃	CAO	1		
40()	Moles of Mg(NO ₃) ₂ = $7.4 / 148$ = 0.050 mol. Moles of HNO ₃ = 0.050 x 2		1		
10(a)	= 0.10 mol. Conc. of HNO ₃ = 0.10 / (200/1000)	CAO	1		
	= 0.50 mol/dm ³		1		
	The reagents used are <u>nitric acid and zinc metal/carbonate/oxide</u> .		1		
	Add excess zinc metal/carbonate/oxide to nitric acid.		1		
	2. After the reaction is complete, <u>filter</u> to obtain zinc nitrate solution as the filtrate.		1		
10(b)	3. <u>Heat</u> the solution <u>to obtain a saturated solution</u> .	OWTTE	1		
	4. <u>Cool</u> the saturated solution <u>to crystallise zinc nitrate</u> .		1		
	 Filter to obtain crystals of zinc nitrate, <u>wash</u> with cold distilled water <u>and dry</u>. 		1		
10(c)	Sodium carbonate, the starting material, is soluble in water.	OWTTE	1		

Name:	Register Number:	Class:





BEDOK GREEN SECONDARY SCHOOL

4E

Preliminary Examination 2018

SCIENCE (CHEMISTRY/BIOLOGY)

5078/01

Paper 1 Multiple Choice

21 August 2018

1 hour

Additional Material: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, register number and class on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this Question Booklet.

A copy of the Data Sheet is printed on page 16.

A copy of the Periodic Table is given on page 17.

The use of an approved scientific calculator is expected, where appropriate.

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[Turn Over

1 Which apparatus is most suitable to measure 21.20 cm ³ of hydrochloric a	cid?
---	------

- A pipette
- **B** burette
- **C** measuring cylinder
- **D** electronic top pan balance
- 2 Which method is suitable for obtaining pure ethanol from wine?
 - A filtration
 - **B** distillation
 - **C** crystallisation
 - **D** fractional distillation
- 3 An unknown white substance was found on a murdered victim's body. A crime scene investigator conducted a series of tests on the substance.

First, he dissolved the substance in water to form a colourless solution. Next, to a portion of the solution, he added aqueous sodium hydroxide dropwise. A white precipitate was formed. The precipitate did not dissolve when excess sodium hydroxide was added.

What is the white substance likely to be?

- A zinc nitrate
- B zinc sulfate
- C calcium nitrate
- D calcium sulfate

- **4** Which group of particles has eight electrons in their valence shells?
 - **A** Li⁺, Na⁺, C*l*⁻, S
 - **B** Li⁺, Na⁺, Cl⁻, Ne
 - **C** H⁺, Mg²⁺, F⁻, He
 - **D** S²⁻, Na⁺, O²⁻, Ar
- **5** An element has the electronic configuration, 2.8.4. What is the identity of the element?
 - **A** sulfur
 - B silicon
 - **C** carbon
 - **D** nitrogen
- 6 Two elements react to form a compound with the chemical formula X₂Y.

This compound is able to conduct electricity when dissolved in water.

Which of the following pairs is most likely to be elements **X** and **Y**?

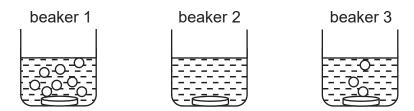
	X	Y
Α	sodium	sulfur
В	magnesium	chlorine
С	oxygen	carbon
D	nitrogen	oxygen

7 Using the equation shown below, find the volume of oxygen needed to completely react with 36 dm³ of CH₄ at room temperature and pressure.

$$CH_4 (g) + 2O_2 (g) \longrightarrow CO_2 (g) + 2H_2O (g)$$

- **A** 24 dm³
- **B** 36 dm³
- **C** 48 dm³
- **D** 72 dm^3

- In a village, before using a cast iron wok, lemon juice is used to clean the surface of the wok. This is because
 - A the lemon juice is acidic and will react with iron surface to produce iron(II) salt.
 - **B** the lemon juice is acidic and will react with iron surface to produce iron(III) salt.
 - **C** the lemon juice is acidic and will remove the iron(III) oxide that is found on the surface.
 - **D** the lemon juice is acidic and will add on to the iron(III) oxide that is found on the surface.
- **9** Aluminium oxide can react with both acid and alkali to form a salt. What type of oxide is it?
 - A basic
 - **B** acidic
 - C neutral
 - **D** amphoteric
- 10 What result is obtained when liquid bromine is added to aqueous potassium chloride?
 - **A** A brown vapour forms.
 - **B** A silvery solid is formed.
 - **C** A green gas is produced.
 - **D** There is no visible reaction.
- 11 Element **Z** has the electronic configuration of 2.8.8.1. A scientist dropped a piece of element **Z** in cold water. What would his observation be?
 - A Element **Z** sinks to the bottom of the container and no bubbles was seen.
 - **B** Element **Z** floats on the surface of the water and some bubbles were seen.
 - **C** Element **Z** sinks to the bottom of the container and effervescence was seen.
 - **D** Element **Z** darts around the surface of the water, effervescence and sparks were seen.



The diagrams above show the results obtained when three different metallic discs of the same shape and size were dropped into dilute hydrochloric acid separately.

Which metal is likely to have been placed in each beaker?

	beaker 1	beaker 2	beaker 3
Α	magnesium	copper	calcium
В	calcium	copper	magnesium
С	copper	magnesium	calcium
D	calcium	magnesium	copper

13 Nickel is between iron and lead in the reactivity series.

Which statement(s) can be deduced from its position in the reactivity series?

- I Nickel forms effervescence with cold water.
- II Nickel is obtained by heating nickel ore with carbon monoxide.
- III Nickel reacts with dilute hydrochloric acid to produce hydrogen gas.
- A I only
- B I and III
- C II and III
- D I, II and III
- 14 Carbon monoxide, sulfur dioxide and oxides of nitrogen are all common pollutants of air.

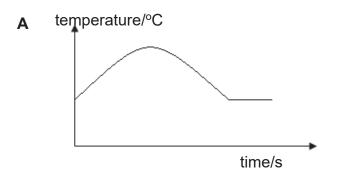
 Which pollutant is shown with its correct source and its adverse effect on the environment?

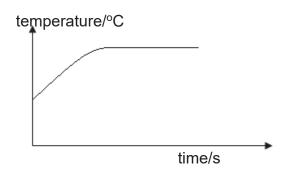
	pollutant	source	effect on the environment
Α	carbon monoxide	combustion of fossil fuels	acid rain
В	carbon monoxide	lightning	global warming
С	oxides of nitrogen	lightning	acid rain
D	sulfur dioxide	volcanoes	global warming

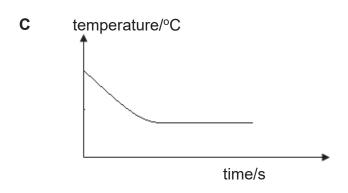
15 Ammonium chloride was added to distilled water. Which graph correctly shows the change in temperature?

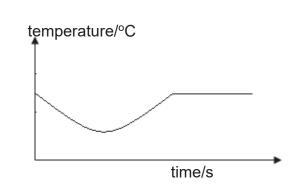
В

D







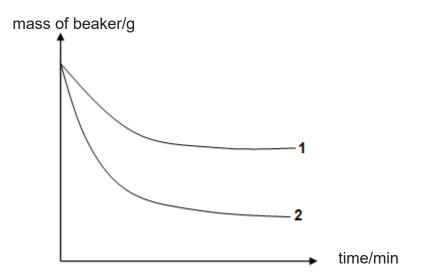


Acidified potassium manganate(VII) can be used to detect the presence of ethanol vapour in the breath of a person who has consumed alcohol.

If ethanol is present, a colour change is observed. What is the colour change observed?

- A colourless to brown
- **B** purple to colourless
- **C** colourless to purple
- **D** brown to colourless

17 Excess magnesium was added to a beaker of dilute hydrochloric acid on an electronic mass balance. A graph of the mass of the beaker and contents was plotted against time (curve 1).



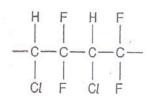
What change in the experiment could give curve 2?

- I The same volume of a more concentrated solution of hydrochloric acid.
- II The same mass of magnesium but in smaller pieces.
- **III** A lower temperature.
- A I only
- B II only
- C I and II only
- **D** II and III only
- A compound with molecular formula C₂H₄O₂ dissolves readily in water to form an aqueous solution. When this aqueous solution reacts with magnesium and limestone respectively, bubbles of colourless gas are observed. What is the structural formula of this compound?

19 The diagram shows the structure of a monomer.

Which polymer can be made from this monomer?

Α



F

C

D

What is the structure of the product formed when ethene gas is passed through aqueous bromine?

Α

В

C

D

Name:	Register Number:	Class:

4E 5N

BEDOK GREEN SECONDARY SCHOOL



Preliminary Examination 2018

4E 5N

5076/03

5078/03

Paper 3 Theory 15 August 2018

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

SCIENCE (CHEMISTRY)

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all the work you hand in.

You may use an HB pencil for any diagrams, graphs, tables or rough working.

Write in dark blue or black pen.

Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 12.

A copy of the Periodic Table is printed on page 13.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A [45 marks]	
Section B [20 marks]	
Total [65 marks]	

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[Turn Over

Section A

Answer **all** the questions in the spaces provided.

1 Fig. 1.1 shows the particles in six substances.

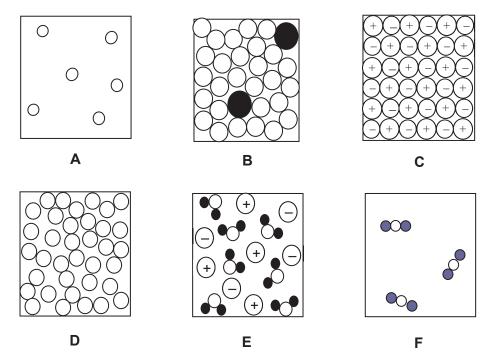


Fig 1.1

(a) Which diagram best represents

	(i)	carbon dioxide,		
	(ii)	molten copper,		
	(iii)	solid sodium chloride,		
	(iv)	helium,		
	(v)	brass.	[5	5]
(b)	Whic	n of the above substances, A – F , represents an eleme	nt?	
			[1]

2 Table 2.1 gives some information on the component gases of clean air in the atmosphere.

Table 2.1

gas	melting point / °C	boiling point / °C	
nitrogen	-210	-196	
oxygen	-218	-183	
argon	-189	-186	
other noble gases			
carbon dioxide	sublimes at –78 °C		
water vapour	0	100	

Separating air into its component gases is an important process in the industries. Air is first cooled to liquid at -200 °C before it is gradually warmed up and separated into its component gases, as illustrated in Fig. 2.1.

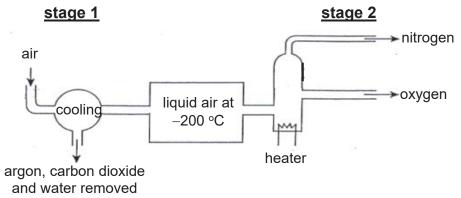


Fig. 2.1

Describe the arrangement and movement of the particles in the liquid all.	
[2
) Explain why argon, carbon dioxide and water can be removed when air is compressed and cooled to –200 °C in stage 1 .	∋d
[1]
Name the method used to separate the components of liquid air in stage 2.	
[1]

	(d)	Whi	ich component will be collected last in stage 2 ? Explain your answer.
			[2]
	(e)	Whi	ich component will have the largest volume collected in stage 2?
			[1]
3	(a)		James Jeans, who was a great populariser of science, once described an atom of oon as being like six bees buzzing around a space the size of a football stadium.
		(i)	Suggest what were represented by the six bees in this description.
			[1]
		(ii)	What is missing from Jeans' description when applied to an atom of carbon?
			[1]
	(b)	Car	bon has two isotopes which have the symbols $^{12}_{6}\mathrm{C}$ and $^{13}_{6}\mathrm{C}$.
		(i)	State, in terms of atomic structure, the difference between the two isotopes of carbon.
			[1]
		(ii)	Draw a diagram to show the arrangement of electrons in an atom of the $^{12}_{\ 6}\text{C}$ isotope.

[1]

4 Chromatography is often used to solve crimes involving forgery.

In an investigation of a case which involves a bank cheque issued with a forged signature, the sample of ink from the forged signature was tested together with inks from the pens of five suspects **V**, **W**, **X**, **Y** and **Z**. Fig. 4.1 shows the chromatogram that was obtained with the use of an organic solvent.

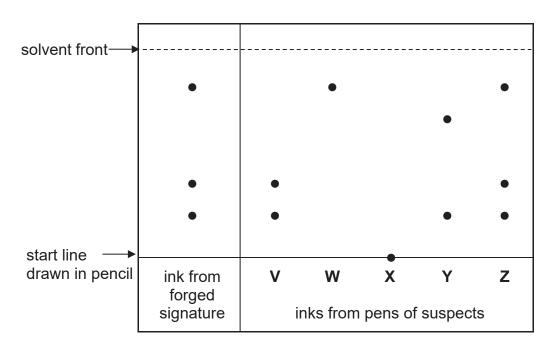
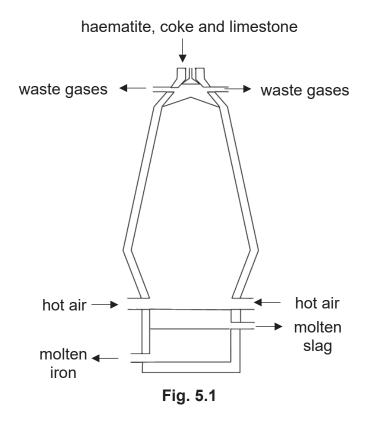


Fig. 4.1

(a)	which suspect is most likely to have lorged the signature in the bank cheque?
	[1]
(b)	Suggest why the ink from the pen of suspect ${\bf W}$ gives only one spot on the chromatogram.
	[1]
(c)	Explain why the start line is drawn in pencil but not in pen.
	[2]
(d)	Suggest a reason why water would probably not be a suitable solvent to use for this chromatography.
	[1]

5 Haematite, a common ore used for the extraction of iron, contains the compound, iron(III) oxide. Iron is produced in the blast furnace by heating a mixture of iron(III) oxide, coke and limestone with air. Fig. 5.1 gives the outline of a blast furnace in which iron is extracted from its ore.



(a)	Des	cribe how carbon dioxide is produced under high heat in the blast furnace.
		[2]
(b)	The	chemical equation for the production of iron in the blast furnace is shown.
		Fe_2O_3 (s) + 3CO (g) \rightarrow 2Fe (l) + 3CO ₂ (g)
	(i)	State the oxidation state of iron in iron(III) oxide.
		[1]
	(ii)	Explain, in terms of oxidation states, whether iron(III) oxide is oxidised or reduced.
		[2]

6	(a)	A 500 cm³ aqueous sample contains 37.6 g of copper(II) nitrate. Calculate the concentration of the copper(II) nitrate solution in mol/dm³.
		[Relative atomic masses: A _r , Cu, 64; N, 14; O, 16]
		concentration =mol/dm³ [2]
	(b)	When a piece of zinc is added to the copper(II) nitrate solution, a reddish brown solid
		is formed. Explain the observation.
		rol
		[2]
7	Fig.	7.1 describes some of the properties and reactions of solution Z .
		x add y add Y
		white dilute nitric acid green aqueous solution aqueous solution green solution green insoluble in excess
		silver nitrate hydroxide hydroxide
		Fig. 7.1
	(a)	Give the identities of X , Y and Z .
		X
		Υ
		Z
		[3]
	(b)	Write a balanced chemical equation for any one of the reactions in Fig. 7.1.
		[2]

[Turn Over

8 (a) Complete Table 8.1 by filling in the **five** blanks.

Table 8.1

name of substance	chemical formula	solubility in water
sodium carbonate		soluble
calcium nitrate	Ca(NO ₃) ₂	soluble
	K ₂ SO ₄	soluble
barium chloride		soluble
lead(II) chloride	PbCl ₂	
iron(III) carbonate		insoluble

			[5]
(b)	(i)	Give the names of the two reagents in Table 8.1 that can be used to prepare white precipitate of calcium carbonate.	а
		1	
		2	[1]
	(ii)	Describe the process of how you could prepare a pure dry sample of calcicarbonate from the two reagents you have given in (b)(i) .	um
			[3]

Section B

Answer any **two** questions in this section.

Write your answers in the spaces provided.

9		orine is an element found in Group VII. It would react vigorously with potassium, from up I, to form potassium fluoride. It would also react with hydrogen gas to form hydrogen ride.
	(a)	Write a balanced chemical equation for the reaction of fluorine and potassium.
	(b)	Draw and label the electronic structures of potassium fluoride and hydrogen fluoride.
		[Proton (atomic) numbers: H, 1 ;F, 9; K, 19]
		potassium fluoride
		hydrogen fluoride
		[4]
	(c)	Use these structures to explain why, at room temperature and pressure, potassium fluoride is a solid and hydrogen fluoride is a gas.
		[1/]

10	Alco	ohols	form a homologous series.	
	(a)	(i)	Give two general properties of a home	ologous series.
				[2]
		(ii)	Write the general formula of the homo	ologous series of alcohols.
				[1]
	(b)	X is	an alcohol with two carbon atoms in its	molecule.
		(i)	Complete Table 10.1 by naming and o	drawing the full structural formula of X .
			Tab	le 10.1
			name of X	structural formula of X
				[2]
		(ii)	Give the chemical formula of the orgreacts with atmospheric oxygen.	ganic substance that is formed when X
				[1]
		(iii)	A solution of X can be made by ferr process is completed in the laboratory	nentation of glucose. Describe how this
		(!\		[3]
		(IV)	X is commonly used in Brazil as a fucan be used for this purpose.	el for vehicles. Suggest a reason why X
				[1]

11

Wh	en hydrochloric acid reacts with strips of magnesium, a gas is given off.	
(a)	Draw a diagram to show how you would investigate the speed of the reaction between hydrochloric acid and magnesium in an experiment. Describe how you would find the speed of the reaction based on the data collected in this experiment	u
	[4	1]
(b)	State and explain one way of increasing the speed of this reaction. Use you knowledge of reacting particles in your explanations.	ır
(b)		ır
(b)	knowledge of reacting particles in your explanations.	ır
(b)	knowledge of reacting particles in your explanations.	
(b)	knowledge of reacting particles in your explanations.	
(c)	knowledge of reacting particles in your explanations.	
	knowledge of reacting particles in your explanations.	
	knowledge of reacting particles in your explanations. [3] Give the name of the gas given off in this reaction.	
(c)	knowledge of reacting particles in your explanations. [3] Give the name of the gas given off in this reaction. [1]	
(c)	Knowledge of reacting particles in your explanations. Give the name of the gas given off in this reaction. [3] G is the next member in the same group that magnesium belongs to.	
(c)	Knowledge of reacting particles in your explanations. [3] Give the name of the gas given off in this reaction. [4] [6] [7] [6] is the next member in the same group that magnesium belongs to. [7] [8] [9]	

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

BEDOK GREEN SECONDARY SCHOOL SCIENCE DEPARTMENT MARKING SCHEME

YEAR (2018)

SUBJECT: Science Chemistry 5076/5078 Paper 1

SETTER: Ms Nadiah

LEVEL: 4E5N

EXAM: Prelim

PAPER 1 (20 marks)

	1	В	1/1 (D //
	2	D	12	B
	3	C	13	9/
	4	D	14	
	5	₿ \	15	D
	6	A	16	BUND
	7	<i>p</i> ///	17	
(8	C//V	18	Α
	9	V	19\\\\	В
	10	9	20	С
	1 1	10//	1 44	

BEDOK GREEN SECONDARY SCHOOL SCIENCE DEPARTMENT MARKING SCHEME YEAR (2018)

SUBJECT: Science Chemistry 5076/5078 Paper 3

SETTER: Tang Hui Boon EXAM: Prelim

LEVEL: 4E5N

PAPER 3

Section A: 45 marks

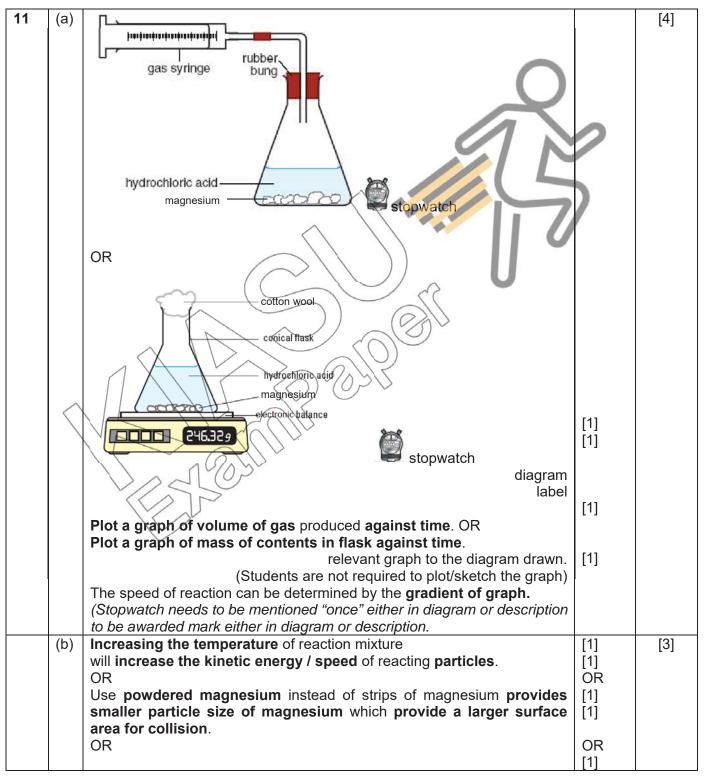
Qn. No.		Scoring Points	Marks	Max. Marks
1	(a)	(i) F	[1]	[5]
-	(a)	(ii) D	[1]	[ی]
		(iii) C	ii	
		(iv) A	[1]	
		(v) B	[1]	
	(b)	A and/or D	[1]	[1]
	()			1.1
2	(a)	Particles are closely packed but not orderly arranged.	[1]	[2]
		Particles move freely and slide past each other throughout the liquid.	וֹן וֹן	
	(b)	At -200°C, argon, carbon dioxide and water will be removed as solids.	[1]	[1]
	(c)	Fractional distillation	[1]	[1]
	(d)	Oxygen gas	[1]	[2]
	` ,	It has the highest boiling point.	[1]	
	(e)	Nitrogen gas	[1]	[1]
3	(a)	(i) electrons	[1]	[1]
		(ii) protons or neutrons or nucleus	[1]	[1]
	(b)\	(i) They have different number of neutrons. ¹² ₆ C has 6 neutrons	[1]	[1]
		whereas 13 has 7 neutrons.		
		(ii)		
			[1]	[1]
				<u> </u>
4	(a)	Suspect Z	[1]	[1]
	(b)	The ink from the pen of W is probably made from a pure substance .	[1]	[1]
	(c)	Unlike ink from a pen, pencil line will not dissolve in the solvent and	[1]	[2]
		will not interfere with the separation of the ink.	[1]	
		OR		
		Ink from a pen is a mixture and it will dissolve in the solvent and		
		will get separated in the solvent which will interfere with the separation of the ink.		
	(d)	The ink used for signing bank cheque would probably be insoluble in	[1]	[1]
		water.		

5	(a) Carbon dioxide is formed when coke is burnt in hot air and when limestone is decomposed at high temperature . (will not accept CO reducing Fe ₂ O ₃ equation given in part (b). CO ₂ is produced mainly by oxidation under this reaction.)			
	(b)	(i) +3	[1]	[1]
	(c)	(ii) The oxidation state of iron has decreased and thus, it is reduced. Iron's oxidation state has decreased from +3 in iron(III) oxide to 0 in iron.	[1] [1]	[2]
	(0)	37.6	[4]	[0]
6	(a)	Number of moles of Cu(NO ₃) ₂ = $\frac{37.6}{188}$ = 0.2 Concentration in mol / dm ³ = $\frac{0.2}{0.5}$ = 0.4 mol / dm³	[1] [1]	[2]
	(b)	Zinc is more reactive than copper. Zinc displaces copper in copper(II) nitrate to form copper metal which is the reddish brown solid.	[1] [1]	[2]
7	(a)	X: silver chloride / AgCl Y: iron(II) hydroxide / Fe(OH) ₂ Z: iron(II) chloride / FeCl ₃	[1] [1] [1]	[3]
	(b)	FeC l_2 + 2AgNO ₃ \rightarrow Fe(NO ₃) ₂ + 2AgC l OR FeC l_2 + 2NaOH \rightarrow Fe(OH) ₂ + 2NaC l correct formulae of reagents and products balanced equation	[1]	[2]
		Dalanced Equation	נין	
8	(a)	name of substance chemical formula solubility in water sodium carbonate Na ₂ CO ₃ soluble	[1]	[5]
		calcium nitrate Ca(NO ₃) ₂ soluble		
		potassium sulfate K ₂ SO ₄ soluble	[1]	
		barium chloride BaCl ₂ soluble	[1]	
		lead(II) chloriĝe PbCl ₂ insoluble	[1]	
		iron(III) carbonate Fe₂(CO₃)₃ insoluble	[1]	
	(b)	sodium carbonate calcium nitrate	both [1]	[1]
	(c)	Mix sodium carbonate and calcium nitrate solution (or reagents	[1]	[3]
		stated in 8(b)(i) together. Filter the mixture and collect the residue. Wash the residue with distilled water and dry between pieces of filter paper.	[1] [1]	

Section B: 30 marks

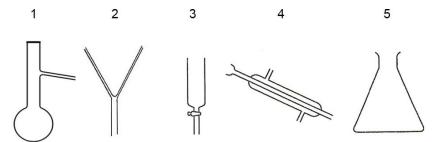
Qn. No.			Scoring	g Points	Marks	Max. Marks
9	(a)	2K +	·F ₂ → 2KF c	orrect formulae of reagents and product balanced equation	[1]	[2]
	(b)		K F	5		[4]
			F	correct transfer of electron and charge correct number of electrons	[1] [1]	
(\wedge			correct number of shared electrons	[1]	
	(c)	Pota		rect number of electrons in the molecule pound with strong electrostatic forces	[1] [1]	[4]
	, ,	of a		[.,]		
			it requires a large amount has a high melting and boili	of energy to overcome the attraction no point	[1]	
		Hyd	rogen fluoride is a covalent	compound with weak intermolecular	[1]	
			1 -	f energy to overcome the attraction, ling point.	[1]	
10	(a)	(i)	Member of the same homolo	gous series have similar chemical	[1]	[2]
10	(4)	(1)	properties and			[4]
			number of carbon atoms incr	nal groups or general formula because	[1]	
		(ii)	C _n H _{2n+1} OH	na not structure.)	[1]	[1]
	(b)	(i)	name of X	structural formula of X		[2]
			ethanol	H H H-C-C-O-H H H		
				correct name	[1] [1]	
		(ii)	CH₃COOH	correct structural formula	[1]	[1]
		(iii)	Yeast is added to a solution	of glucose in a conical flask and placed	[1]	[3]
			in a water bath. Temperature of the mixture 37°C .	in the water bath needs to be kept at	[1]	

	The conical flask is connected through a delivery tube to a test tube with limewater to prevent oxygen in air from entering the conical flask. *please emphasize to students that a brief mention of the 3 conditions with no proper description of experiment will be penalised one mark in the exams because the question asked for description of process.	[1]	
(iv)	X can be burnt exothermically to produce heat to power the vehicles.	[1]	[1]



	Use a higher concentration of hydrochloric acid provides more H* ions per unit volume for collision with magnesium particles. either of the above answers [1] Higher frequency of effective collision between H* ions and magnesium particles increases the speed of reaction. Note: Students need to mention the reacting particles, magnesium and acid particles (H* ions) at least once in the answers. (c) hydrogen [1] [1] (d) (i) Ca [1] [1] (ii) They have the same number of valence electrons OR [1] [1]			
		W	of the above answers [1] ween H* ions and ction. cles, magnesium and [1] [1] [1] [1]	
		Higher frequency of effective collision between H* ions a magnesium particles increases the speed of reaction.	and [1]	
		Note: Students need to mention the reacting particles, magnesium a	and	
		acid particles (H+ ions) at least once in the answers.		
((c)	hydrogen	[1]	[1] [1] [1] [1]
((d)	(i) Ca	[1]	[1]
		(ii) They have the same number of valence electrons OR	[1]	[1]
		They both have two valence electrons.		

21 The diagram shows some laboratory apparatus.



Which apparatus are needed to produce and collect pure water from seawater?

A 2 and 5

B 3 and 5

C 1, 2 and 4

- **D** 1, 4 and 5
- Which substance, **A** to **D** undergoes changes in physical states from room temperature to 0°C?

	Melting point/°C	Boiling point / °C
Α	-2	65
В	-23	4
С	50	250
D	-187	-165

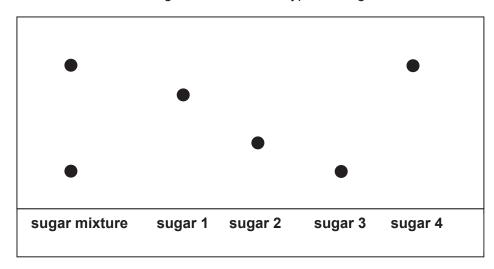
- 23 Which statements are true about compounds?
 - 1 They can be made from another compound.
 - 2 They can be made from metals alone.
 - 3 They can be made from non-metals alone.
 - 4 They can be made from a metal and a non-metal.
 - **A** 1, 2 and 3

B 1, 2 and 4

C 1, 3 and 4

D 2, 3 and 4

24 A sugar mixture was compared with four different simple sugars using chromatography. The results are shown in diagram below. What types of sugars does the mixture contain?



A sugar 1 and 2

B sugar 1 and 4

C sugar 2 and 3

- **D** sugar 3 and 4
- 25 Which compound contains three atoms?
 - **A** H₂O

B HC/

C CaSO₄

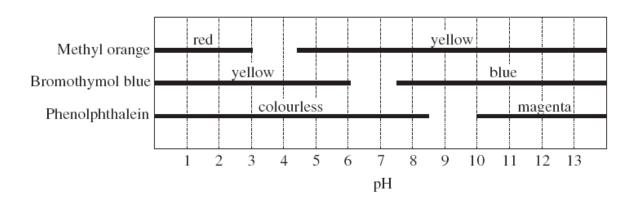
- **D** NO
- 26 Which of the following compounds has the highest percentage of nitrogen by mass?
 - ${\color{red}\boldsymbol{A}} \qquad NH_4NO_3$

B (NH₄)₂CO₃

 \mathbf{C} CO(NH₂)₂

- D NH₄C/
- 27 A student dissolved 14.9g of potassium chloride, KCl, in 100 cm³ of water. What is the concentration of the resulting potassium chloride solution in mol/dm³?
 - **A** 0.002 mol/dm³
 - **B** 0.01 mol/dm³
 - **C** 0.15 mol/dm³
 - **D** 2.0 mol/dm³

28 The graph below shows the colour ranges of the acid-base indicators methyl orange, bromothymol and phenolphthalein.



A solution, when placed in the three indicators separately, is yellow in methyl orange, yellow in bromothymol and colourless in phenolphthalein. What is the pH range of the solution?

A 2.5 to 3.5

B 4.5 to 5.5

C 7.5 to 8.5

- **D** 9.5 to 10.5
- Which of the following elements burns in air to produce a substance which can react with both hydrochloric acid and sodium hydroxide?
 - A lead

B hydrogen

C iron

- **D** phosphorous
- **30** Which of the following reagents **cannot** be used to differentiate sodium hydroxide solution from sodium chloride solution?
 - A Aqueous iron(III) nitrate
 - B Aqueous copper(II) nitrate
 - C Aqueous lithium nitrate
 - **D** Aqueous ammonium nitrate

31 Separate samples of hydrogen peroxide are added to aqueous potassium iodide and to acidified potassium manganate(VII). It is known that hydrogen peroxide is both an oxidising agent and a reducing agent.

What colour changes are seen?

	aqueous potassium iodide	acidified potassium manganate(VII)
Α	colourless to brown	purple to colourless
В	brown to colourless	purple to colourless
С	colourless to brown	orange to green
D	brown to colourless	orange to green

32 X, **Y** and **Z** are elements in the same period of the Periodic Table.

X forms an acidic oxide, **Y** forms a basic oxide and **Z** forms an amphoteric oxide.

If **X**, **Y** and **Z** are placed in increasing order of atomic number (lowest atomic number first), which order is correct?

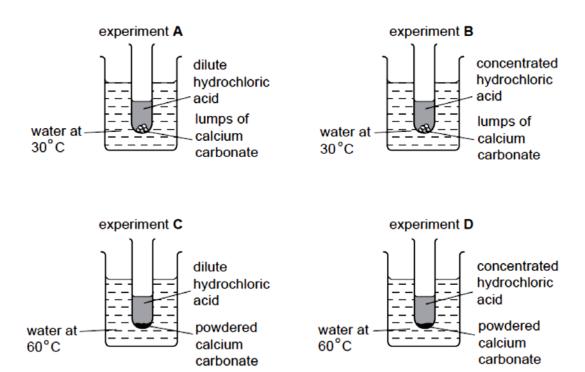
A X, Y, Z

B Y, Z, X

C Y, **X**, **Z**

- D X, Z, Y
- 33 Rubidium is in the same group as sodium in the Periodic Table. What is a likely property of rubidium?
 - **A** It reacts with water to form hydrogen gas.
 - **B** It cannot be cut by knife.
 - **C** It reacts with chlorine gas to form a salt with the formula $RbCI_2$.
 - **D** It does not conduct electricity in the molten state.

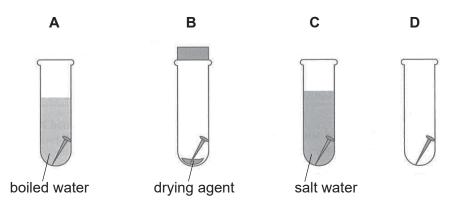
34 Which of the following experiment will have the fastest speed of reaction?



35 The element chromium produces hydrogen from dilute hydrochloric acid but it does not react with cold water. When a piece of chromium is placed in lead(II) nitrate solution, solid of lead appear.

What is the order of **decreasing** reactivity of the metals lead, calcium and chromium?

- A calcium, chromium, lead B calcium, lead, chromium
- C chromium, calcium, lead D lead, chromium, calcium
- **36** In which tube is the iron nail **not** likely to rust?



Which of the following shows the correct percentage composition of oxygen, nitrogen and carbon dioxide found in dry unpolluted air?

	Oxygen	Nitrogen	Carbon dioxide
Α	78	21	1
В	1	78	21
С	21	78	1
D	78	21	78

38 Which of the following shows the correct use of the different fractions of petroleum?

	Fraction	Uses
Α	Petrol	used for making chemical feedstock
В	Bitumen	used for lubricating machine parts
С	Kerosene	used as fuel for aircraft
D	naphtha	used to pave road

- **39** Which of the following hydrocarbon undergoes substitution reaction?
 - **A** C₂H₄

B C₂H₆

 \mathbf{C} C_2H_5COOH

- D C_2H_5OH
- **40** Which of the following is the same for both ethanol and ethanoic acid?
 - A empirical formula
 - **B** functional group
 - c number of carbon
 - D homologous series

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

	0	4 lim 4	20 ge 40	9 4r 10 mg	36	pton 7	6 54 (e	31	36 ?n	uop I		
									_	_		\dashv
	II/		floring 19									
	>		8 O 8 4								116 L	livermorium —
	^		N nitrogen 14	15 Phosphorus 31	33	arsenic 75	Sb	anumony 122	83 Bi	bismuth 209		
	Λ		6 C Carbon 12	Si silicon 28	32	germanium 73	50 Sn	119	82 Pb	lead 207	114 F <i>I</i>	flerovium —
	=		boron 11	13 All aluminium 27	31	gallium 70	49 In	115	81 T <i>I</i>	thallium 204		
					30	Zinc 85	84 S	112	8 F	mercury 201	112 Ch	copernicium —
					53	copper 64	Ag Ag	108 108	79 Au	gold 197	111 Rg	oentgenium -
dno					28 Ni	nickel 59	46 Pd	106	8 H	platinum 195	110 Ds	darmstadtium —
Group							45 Rh					
		1 H hydrogen			26	. io 56	44 Ru	101	76 Os	osmium 190	108 동	hassium -
					25 Mn	manganese 55	43 Tc	recunetium -	75 Re	rhenium 186	107 Bh	bohrium —
			umber ool nass		24	chromium 52	42 Mo	monybaenum 96	74 W	tungsten 184	106 Sg	seaborgium -
		Key	proton (atomic) number atomic symbol name relative atomic mass		23	v vanadium 51		93 83	73 Ta	Ε	50 음	dubnium -
			proton ato relativ		22	titanium 48	40 Zr	Sirconium 91	72 Hf	hafnium 178	104 Rf	Rutherfordium —
		1			21	scandium 45		_	57 – 71 lanthanoids		89 – 103 actinoids	_
	=		Be beryllium 9	12 Mg magnesium 24	20	calcium 40	38 Sr	88	56 Ba	barium 137	88 Ra	radium -
	_		3 Li lithium 7	Na sodium 23	19	potassium 39	37 Rb	manalum 85	35 S	caesium 133	87 Fr	francium —

lanthanoids	25	28	59	8	61	62	63	64	92	99	29	68	69	70	71
	Га	Ce	ď	B	Pm	Sm	Ш	В	Q L	2	운	ய்	E	Υp	3
	lanthanum	-	praseodymium	neodymium	promethium	samarium	europium	gadolinium	terbium	dysprosium	holmium	erbium	thulium	ytterbium	lutetium
	139	140	141	144	ĵ	150	152	157	159	163	165	167	169	173	175
actinoids	88	90	91	82	93	94	92	96	26	86	66	100	101	102	103
	Ac	드	Pa	\supset	d N	P	Am	ő	益	ರ	Ë	F	Md	2	ے
	actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium
	1	232	231	238	į	1	į	1	1	1	1	1	1	1	1

The volume of one mole of any gas is $24\,\mbox{dm}^3$ at room temperature and pressure (r.t.p.).

4E/5NA

CANDIDATE NAME				
CLASS		REGIS NUMBI		
SCIENCE Paper 3 Chemistry	(CHEMISTRY)		5	5076/03 & 5078/03 31 July 2018
Candidates answer or No additional material			1 h	nour 15 minutes
READ THESE INSTR	UCTIONS FIRST			
You may use an 2B p Write in dark blue or b	ster number and class on all vencil for any diagrams, graphs black pen. aper clips, glue or correction fl	s, tables or rough work	ing.	
	ed scientific calculator is expe f you do not show your workin			
Section A (45 marks Answer all questions. Write your answers in		estion paper.		
Section B (20 marks Answer any two ques Write your answers in		lestion paper.		
A copy of Data Sheet A copy of the Periodic	is printed on page 15. Table is printed on page 16.			
	n, fasten all your work securel in given in brackets [] at the e		r part question.	
			For Exam	iner's Use
			Section A	
			Section B	
				

Setter: Ms Cynthia Chong

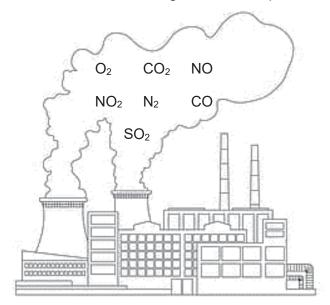
Section C

Total

Section A

Answer all questions in the spaces provided.

A1 The diagram below shows the formulae of some gases found in polluted air.



Choose formulae from the diagram to answer the following questions (a) to (d). Each may be use once, more than once or not at all.

(a)	Give the formula of a gas that is produced by incomplete combustion of fuels. State harmful health effect of this gas.	the
		[2]
(b)	Give the formulae of two gases that are produced by reactions in catalytic converters and	s. [1]
(c)	Give the formulae of two gases that are involved in both respiration and photosynthe	sis. [1]
(d)	Give the formulae of two gases that produce acid rain. and	[1]
	[Total: 5 ma	II KS]

A2	Sulfur	and sulfur	compounds	are common	in	the	environme
A Z	Ouliui	and Junui	Compounds			uic	

(b)

(ii)

- (a) A sample of sulfur from a volcano contained two different types of sulfur isotopes: sulfur-32 and sulfur-34.
 - (i) Complete the table below to show the atomic structure of each isotope of sulfur.

lastone		Number of	
Isotope	Proton	Neutron	Electron
Sulfur-32			
Sulfur-34			

[2]

(ii)	The relative atomic mass of sulfur is 32.2. Explain why does the relative atomic mass of sulfur is not a whole number.
	[2]
	f the gases produced during volcanic eruptions is hydrogen sulfide. H ₂ S. Hydrogen is a poisonous, colourless gas which smells of rotten eggs.
(i)	Draw a dot-and-cross diagram to represent the bonding in a hydrogen sulfide molecule. Show outer electrons only.
	[2]

Explain, in terms of bonding and structure, why hydrogen sulfide gas does not conduct

[Total: 8 marks]

A3 The table below shows some salts and products that contain them.

(a)

(i)

Salt	product
Silver chloride	Photographic film
Potassium nitrate	fertiliser
Zinc sulfate	Health supplement

Explain your reasoning.	
Salt:	
Reason:	[2]

Which salt in the table can be made by **precipitation**?

(ii)	Which salt in the table can be made by titration ? Suggest two reagents needed to make this salt.
Salt:	

Reagent 1:	Reagent 2:	[2]

(b) Other substances are used to make a range of useful products. Put a tick $(\sqrt{})$ in one box in each row to show a correct use of each substance.

		U	se	
Substance	to make car battery	to make road surface	to reduce acidity in soil	to fill filament bulb
Calcium silicate				
Calcium hydroxide				
Argon				
Sulfuric acid				

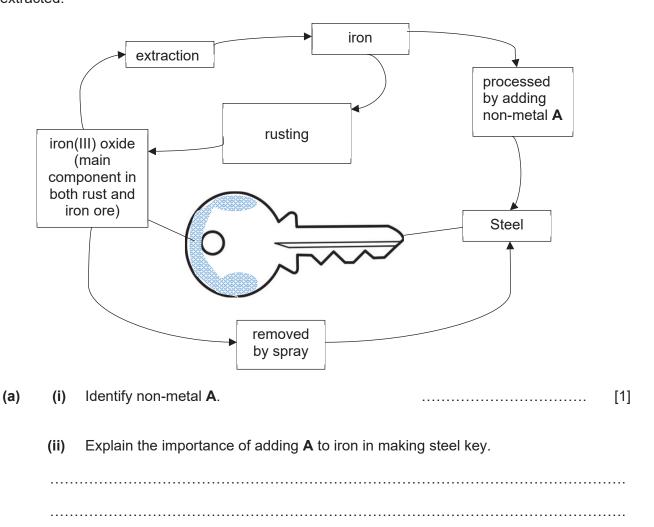
[2]

[Total: 6 marks]

	What is the physical	property tha	t allows t	the variou	us fra	actions in	crude oil	I to be s	eparated?
									[1]
(b)	To meet the world's to produce lighter fra		•				diesel u	ndergoe	es cracking
	C ₁₂ l	H ₂₆	→ (C ₆ H ₁₄	+	C ₂ H ₄	produc	et P	
	Give the chemical na	ame and forr	nula of th	ne produc	ct P.				
	Chemical name:								
	Chemical formula:								[2]
								[Tota	al: 3 marks]
(a)	Complete the equati	on for the rea	action by	filling in	miss	ing state	symbols		ime time.
	()								
(b)	(i) The table show		rmation :	about oxi	datic	on state c	hanges c	luring th	
(b)	• •		n state at		datic	on state con state a			
(b)	Complete the	Oxidation	n state at		datio	on state a			reduced?
(b)	Complete the	Oxidation	n state at start		datio	on state a		dised or	reduced?
(b)	Complete the Element Oxygen	Oxidation	n state at start		datio	on state a		dised or	reduced?
(b)	Complete the Element Oxygen Aluminium	Oxidation the s	n state af start 2	t Oxi	datio	on state a e end -2	t Oxio	dised or uncha	reduced?

(c)	Is Thermit reaction an endothermic or exothermic reaction? Explain your answer.
	[2]
(d)	Predict if the melting point of aluminium oxide is high or low. Explain your answer in terms of structure and bonding.
	[2]
	[Total: 8 marks]

A6 Common keys are made from steel. One problem with using steel is that the iron in steel will rust. The diagram shows the cycle of changes that happens when iron in a steel key rust and then extracted.



[2]
A shop sells a spray-on rust treatment. The spray contains particles of zinc. Explain how zinc prevents rust from forming.
[2]
Write a balanced chemical equation for the extraction of iron in the blast furnace. [1]
Though the extraction of iron from blast furnace is a relatively cheap process, steels are still widely recycled.
Explain the importance of recycling of metals such as iron.
[1]
[Total: 7 marks]
Propane burns completely in oxygen to form carbon dioxide and water. The equation for the reaction is
$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
(i) Calculate the number of moles in 44 g of propane.

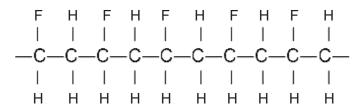
A7

[1]

(ii) Hence, calculate the volume of carbon dioxide that is produced from 44 g of propane at room temperature and pressure.

e made into polymer but propane cannot.
uish between propene and propane.
[2
of polymer to the environment.
[1

(c) The figure below shows the structure formula of part of an addition polymer.



Deduce and draw the structural formula of the **monomer** from which this polymer is made.

[Total: 8 marks]

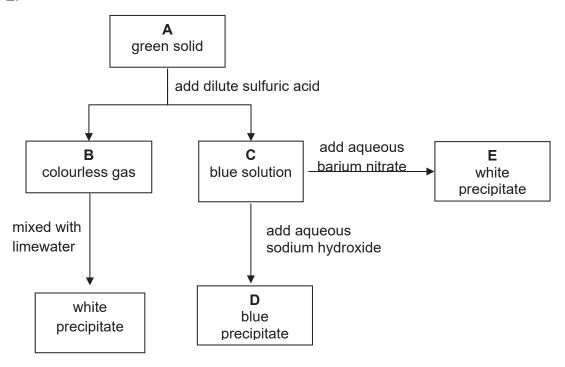
Section B

Answer any **two** questions in this section. Write your answers in the spaces provided.

B8	(a)	Explain why sulfuric acid can act as an acid and why potassium hydroxide can act as an alkali. Give examples of chemical reaction that sulfuric acid and potassium hydroxide undergo.
		[4]
	(b)	Write the ionic equation that describes the reaction of an acid with an alkali

.....[1]

(c) The diagram below shows some of the properties and reactions of the substances A, B, C, D and E.



Identify these substances.

(i)	green solid A ,	
(ii)	colourless gas B ,	
(iii)	blue solution C ,	
(iv)	hlue precipitate D	Γ Δ1

(d) The formation of white precipitate **E** shows the presence of sulfate ions. Why does this **not** prove that sulfate ions are present in solid **A**?

......[1]

[Total: 10 marks]

В9	(a)	The speed of a chemical reaction can be changed by • increasing the temperature of the reaction, • decreasing the concentrations of reacting solutions.
		(i) State the effect that each of these has on the speed of a reaction.
		(ii) Use your knowledge of reacting particles to explain your answer to (a)(i).
		[5]

- **(b)** A student carried out an experiment to investigate how the speed of reaction between magnesium and hydrochloric acid will change with time.
 - (i) Draw a labelled diagram to show the experiment setup that the student use.
 - (ii) Describe how the student will carry out the experiment, clearly stating the physical quantity he will measure.
 - (iii) Describe how the speed of this reaction would change with time.

[5]

[Total: 10 marks]

B10	(a)	What is the common name given to elements in Group VII?
		[1]
	(b)	Give the electronic structures of fluorine and chlorine and use these to explain why the are placed in Group VII.
		[2]
	(c)	Chlorine was discovered by Carl William Scheele in 1774 at Sweden. The origin of the name came from the Greek word "chloros" meaning "pale green".
		In 1886, a new element was discovered. Based on its electronic structure, colour and it reaction with zinc chloride, this new element was placed above chlorine in Group VII of the Periodic Table and given the name fluorine.
		(i) Predict the colour of fluorine.
		[1]
		(ii) Suggest how the colour of fluorine could help explain its position in the Periodi Table.
		(iii) Describe what would be observed when fluorine is bubbled into a solution of potassium bromide. Explain your observation.
		[2]

(d)

the r	naked human eye.
(i)	Consider the properties of other elements in the same group as this element, predict one physical and one chemical property of the element with atomic number 85.
	[2]
(ii)	Give the chemical formula of the compound formed between magnesium and the element with atomic number 85.
	[1]
	[Total: 10 marks]

The element with an atomic number of 85 is so unstable that it has never been seen by

End of Paper

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

5076/03/BDS4E5N/Prelim/18

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The Periodic Table of Elements

T,	_	Де Те	lium 4	0	e	noe O	8	٦٢	gon 10	36	<u>ا</u>	pton 34	54	<u>е</u>	31 31	36	Sh.	uop I				
			hel				-		_	_					Accessor.							$\frac{1}{2}$
57	>			6	ш	fluorine 19	17	Ö	chlorine 35.5	32	ğ	bromine 80	53	Н	iodine 127	85	Αt	astatine -				
5	\ 			8	0	oxygen 16	16	တ	sulfur 32	34	Se	selenium 79	52	_е Ц	tellurium 128	84	P	polonium —	116	_	ivermorium -	
>	>			2	Z	nitrogen 14	15	ட	hosphorus 31	33	As	arsenic 75	51	g	antimony 122	83	m	bismuth 209				
2	>			9	O	carbon 12	14	: <u>S</u>	silicon p 28	32	Ge	ermanium 73	20	က်	119	82	<u>م</u>	lead 207	114	Ħ.	Herovium -	
Ξ	=			2	ш	boron 11	13	Αľ	luminium 27	31	Ğ	gallium g	49	Ц	indium 115	81	11	thallium 204				
			14				<u> </u>		w	30	Zu	zinc 65	48	8	admium 112	80	윈	nercury 201	112	ან [:]	hernicium -	
										_		copper 64	⊢		100	┝			⊢	_	<u> </u>	4
۵										\vdash		nickel 59	H			⊢			-	_	_	-
Group										_		cobalt 59	_			⊢			⊢		5	4
		Ţ.	nydrogen 1							L		iron 56	_			L			⊢		=	1
	3			3						22	Mn	manganese 55	43	ပ H	schnetium r	75	Re	rhenium 186	107	윰:	E I	
			õ	nber	_	388				24	ර්	thromium m 52	42	Мо	molybdenum tec 96	74	>	tungsten 184	106	Sg	seaborgium -	
			Key	stomic) nur	nic symbo	name relative atomic mass				23	>	anadium o	_		niobium me 93				\vdash		mnuano	
				proton (a	aton	relative				22	iΞ	titanium v		Zr	irconium 91	72	Ï	hafnium 178	104	峜	- Autherfordium	
			9				T			21	တွ	scandium 45	39	>	yttrium 2 89	57 – 71	anthanoids		89 – 103		ř <u> </u>	
=	=		2	4	Be	beryllium 9	12	Mg	magnesium 24	Т		calcium 40	Т		strontium 88	H	-	barium 137			radium	
-	_						$\overline{}$		sodium m 23	19	エ	potassium 39	37			⊢			⊢		rrancium -	

7.1	ŋ	lutetium	175	103	۲	lawrencium	1
0/	Хþ	ytterbium	173	102	2	nobelium	1
69	E	thulium	169	101	PΜ	mendelevium	1
68	ш	erbium	167	100	H	fermium	1
29	웃	holmium	165	66	В	einsteinium	ı
99	à	dysprosium	163	86	び	californium	1
65	Д	terbium	159	26	鮝	berkelium	
64	рg	gadolinium	157	96	S	curium	ĵ
63	E	europium	152	92	Am	americium	i
62	Sm	samarium	150	94	Pu	plutonium	a
61	P	promethium	Ī	93	ď	neptunium	1
09	PN	neodymium	144	35	\supset	uranium	238
29	ሷ	praseodymium	141	91	Ба	protactinium	231
28	Ö	cerium	140	06	T	thorium	232
25	Б	lanthanum	139	89	Ac	actinium	1
lanthanoids				actinoids			

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

2018 Bedok South Secondary School Secondary 4 Science(Chemistry) PRELIM Marking Scheme

Paper 1: 30 Marks

21	22	23	24	25	26	27	28	29	30
D	В	С	D	Α	С	D	В	Α	С
31	32	33	34	35	36	37	38	39	40
Α	В	Α	D	Α	В	С	С	В	С

Answe	er		
A1	(a)	CO Prevents blood from absorbing oxygen which causes headaches,	1
		giddiness or may lead to death.	1
	(b)	N ₂ and CO ₂ (both must be correct)	1
	(c)	CO ₂ and O ₂ (both must be correct)	1
	(d)	NO ₂ and SO ₂ (both must be correct)	1
		[Total: 5 marks]	
A2	(ai)	Number of	
		Isotope Protein Neutron Electron	
		Sulfur-\$2 16 32-76 = 16 16	1
	1	Sunur-34 16 34 16 = 18 16	1
	(aii)	Each sulfur isotope has different relative abundance/ percentage/	1
	1	When the <u>average</u> of the masses of the 2 sulfur isotope is taken, there is decimal. (any phrase to the effect)	1
	(bi)	Correct valence electron for sulfur and hydrogen	1
		Correct number of shared electrons (2 single bond)	1
	(bii)	[structure] hydrogen sulfide is a simple covalent molecule/compound	1
		[charge carrier] there are no free moving electrons/charge carrier to conduct electricity. [bonding]	1
		[Total: 8 marks]	

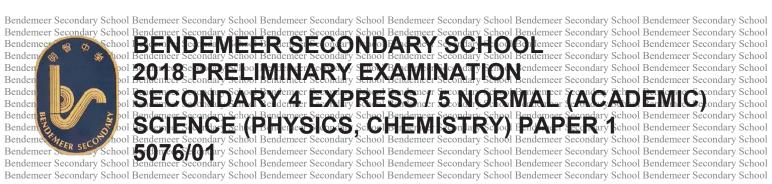
A3	(ai)	Salt: Silver chlo	ride					1
(salt pre)		Reason: It is an	insoluble sa	lt.				1
	(aii)	Salt: Potassium	nitrate (SPA	– titration (r	neustralisa	ation))		1
		Reagent 1: pota	ssium hydro	oxide Reag		ric acid (both o	correct)	1
	(b)				Use			
		Substance	to make car battery	to make road surface	to reduce	-	nt	2
		Calcium silicate (SLAG)		V				
		Calcium hydroxide(slaked lime)			V			
		Argon				~~		
		Sulfuric acid	V					
		All correct – 2 m	arks 3/2 cor	rect – 1 ma	rk 1 con			
						Li otal: (marks]	
A4	(a)	Difference in boi	ling point			11 4		1
	(b)	Name: <u>Butene</u> formula: <u>C₄H₈</u>		\setminus))		U		1
					-{?	[Total: 3	3 marks]	
A5	(a)	2 Al (s) + Fe ₂ O correct)	$(\underline{\mathbf{s}}) \rightarrow 2 \overline{\mathbf{p}} \mathbf{e}$	<u>1</u>) + Al ₂	35	(all must be	}	1
^	(bi)	Element	Oxidation start at the start	1 1 1	on state e end	Oxidised or reduced?		
	1	Oxyge h	- AFT		2	unchanged		
,	1	Atuminium	+3		3	Oxidised		1 1
		Aluminium is avi	-		ļ.			
	(bii) <	Aluminium is oxi reduction occur			-		ction.	1
	(c)	Exothermic reac	•		•			1
		Temperature muthe effect)	ıst be high fo	r iron to be	in liquid s	tate. (any phra	sing to	1
	(d)	[P1] Aluminium	·					3 pt – 2 M
		[P2] Aluminium (_		ructure,	2 pt –
		[P3] large amou electrostatic for ions. (bonding)					ed	1M
						[Total: 8	3 marks]	
A6	(ai)	carbon						1

	(aii)	[P1] Carbon will disrupt the orderly arrangement of iron, (ALLOY)	3 pt –
		[P2] making it more <u>difficult</u> for the iron atoms to slide past each other,	2 M 2 pt –
		[P3] thus <u>increasing the strength</u> of iron. (any phrasing to the effect)	1M
	(b)	[P1] zinc is more reactive than iron / zinc has higher tendency to lose	1
		its electrons,	
		[P2] zinc will preferentially <u>corrode</u> <u>in place of iron</u> .	1
	(c)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	1
	(d)	The earth's mineral ores are limited and are non-renewable. Recycling helps to conserve the limited resources in our earth and make them last longer.	1
		With a decrease of mining for ores, land will be free for other uses eg, agriculture.	
		Recycling means saves the environment from pollution as unsightly scrap metals is removed from the environment.	
		[any one, reject any answer about saving cost]	_
_		[Total: 7 marks]	
A7	(ai)	Number of moles of propane: 44/44 = 1 mole	1
	(aii)	Number of moles of CO_2 : 3 moles Volume of CO_2 : 3 x 24 = 72 dm ³ (must include correct units, no ecf)	1
	(bi)	Propene is <u>unsaturated/ contains C=C double bond</u> , thus it is able to undergo <u>addition reaction</u> . OR Propane is saturated, contains all single covalent bond, thus unable to undergo addition reaction. (any phrasing with similar meaning)	1
	(bii)	[test] Add (aqueous) bromine solution to propane and propene.	1
		[result] reddish brown colour of promine will become colourless in propene but remains unchanged in propane.	1
	(biii)	Polymer is non-biodegradable and thus will [effect] remain in the environment for a long time, thus causing land pollution/ constantly in need to find land to bury them.	1
<	1	Polymer, when burnt, will release toxic gases to the environment thus, causing air pollution. [any one]	
	(c)	F	1
		monomer (alkene)	
		[Total: 8 marks]	
B8	(a)	[P1] An acid is a substance which <u>produces hydrogen ions</u> when it is <u>dissolved</u> in water .	1
		[P2] Example: Sulfuric acid reacts with reactive metal to produce salt and hydrogen gas/ sulfuric acid reacts with carbonates to produce salt,	Any

water and carbon dioxide gas. Sulfuric acid react with base/alkali to produce salt and water. [P3] An alkali is a substance which produces hydroxide ions when it is dissolved in water. [P4] Example: sodium hydroxide reacts with ammonium salt to form salt, water and ammonia gas. (full credit if formulae/ chemical equation given) (b) H⁺ (aq) + OH⁺ (aq) → H₂O (I) (c) Green solid A: copper(II) carbonate colourless gas B: carbon dioxide blue solution C: Copper(II) sulfate blue precipitate D: copper(II) hydroxide (d) Sulfuric acid was added to the green solid, thus the sulfate ion might have come from sulfuric acid instead. [Total: 10 marks] 39 (a) [Etemp] when temperature is increases, speed of chemical reaction decreases. [Rtemp] when temperature increases, particles gains kinetic energy and many factor. Forgus and factors of the product will increase and the product of the product of the particles gains kinetic energy and many factor. Forgus and product of the product will increase and product of the pro
dissolved in water. [P4] Example: sodium hydroxide reacts with ammonium salt to form salt, water and ammonia gas. (full credit if formulae/ chemical equation given) (b) H⁺ (aq) + OH⁺ (aq) → H₂O (I) (c) Green solid A: copper(II) carbonate colourless gas B: carbon dioxide 1 blue solution C: Copper(II) sulfate 1 blue precipitate D: copper(II) hydroxide 1 1 blue precipitate D: copper(II) hydroxide 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
water and ammonia gas. (full credit if formulae/ chemical equation given) (b) H⁺ (aq) + OH⁻ (aq) → H₂O (I) 1 (c) Green solid A: copper(II) carbonate colourless gas B: carbon dioxide 1 1 5 5 5 5 5 5 6 5 6 6 7 6 7 7 7 8 9 7 9 7 9 7 9 7 9 7 9 9 7 9 9 7 9 7
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(d) Sulfuric acid was added to the green solid, thus the sulfate ion might have come from sulfuric acid instead. [Total: 10 marks] [Etemp] when temperature is increases, speed of chemical reaction increases. [Econc] when concentration decreases, speed of chemical reaction decreases. [Rtemp] when temperature increases, particles gains kinetic energy and
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[Etemp] when temperature is increases, speed of chemical reaction increases. [Econc] when concentration decreases, speed of chemical reaction decreases. [Rtemp] when temperature increases, particles gains kinetic energy and
increases. [Econc] when concentration decreases, speed of chemical reaction decreases. [Rtemp] when temperature increases, particles gains kinetic energy and
decreases Rtemp] when temperature increases, particles gains kinetic energy and
move faster. Frequency of effective collision will increases.
[Rconc] when concentration decreases, number of particles per unit
volume decrease. Frequency of effective collision will decreases.
[collision theory – 1 mark]
(b) Measurement of volume of Measurement of decrease in mass hydrogen gas
[1] Cotton Wool Appar atus
gas syringe [1] Hydrochloric Acid Set up 1M
Magnesium Ribbon Og Electric Scale [1]
Student will record the volume of hydrogen gas [1] produced at regular interval. [1] Student will record the decrease in mass of reaction mixture [1] at regular interval [1].
Speed of reaction will decrease with time.

		[Total: 10 marks]	
B10	(a)	halogen	1
	(b)	[electronic configuration] E.C of Fluorine: 2.7, E.C of chlorine is 2.8.7 (state both to get 1 mark)	1
		Since they both have <u>7 valence electron</u> , thus they are placed in group VII.	1
	(ci)	Yellow	1
	(cii)	It is <u>lighter</u> in colour than chlorine, thus Fluorine is placed <u>above</u> <u>chlorine</u> in group VII.	1
	(ciii)	[observation] colourless solution turns reddish brown.	1
	1	[explanation] fluorine is more reactive than bromine, thus it will displace bromine from potassium bromide and produce bromine.	1
	(di)	[physical] cannot conduct electricity/ black colour/ solid at room temperature [any one] (to NOT write "high/low" melting point)	1
		[chemical] gain 1 electron to form anion/ least reactive in group VII/ reacts with metal to form ionic compound/ reacts with non-metal to form covalent compounds. [any one]	1
	(dii)	MgAt ₂	1
		[Total: 10 marks]	

	Register No.	Class
Name		



DATE : 29th August 2018

DURATION: 1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, class and register number on the work you hand in.

Do not use paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A**, **B**, **C** and **D**.

Choose the one you consider correct and record your choice in 2B pencil on the OTAS sheet.

Read the instructions on the OTAS sheet very carefully.

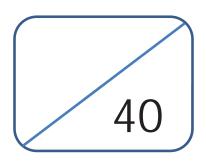
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done on the question paper.

A copy of the Data Sheet is printed on page 20.

A copy of the Periodic Table is printed on page 21.

The use of an approved scientific calculator is expected, where appropriate.

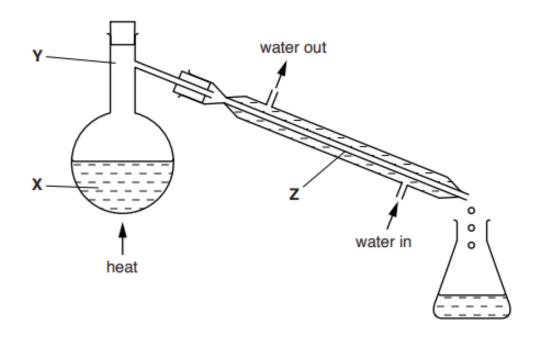


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21 The diagram shows the apparatus used to distil seawater.

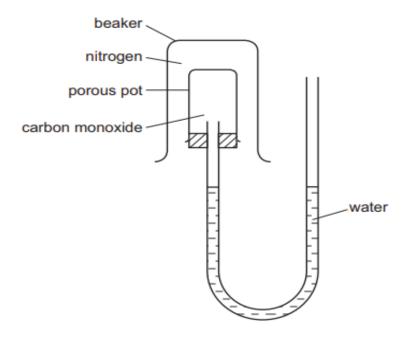


While water is being collected, at which point(s) is the temperature 100°C?

- A X
- B Y
- **C** X and Z
- **D** X,Y and Z

[Turn over

22 Gases can diffuse through porous pots. The diagram shows a beaker full of nitrogen inverted over a porous pot containing carbon monoxide.



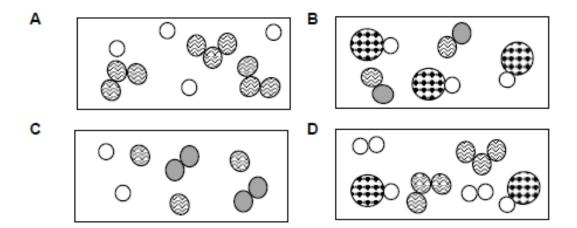
The water level does not move.

Which statement explains this?

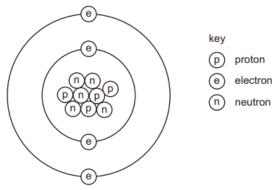
- A Both gases have two atoms in a molecule.
- **B** Neither gas is soluble in water.
- C Nitrogen is almost inert.
- **D** The two gases have equal molecular masses.
- 23 Which statement(s) best explain(s) that air is a mixture, not a compound?
 - I Air does not have a fixed composition.
 - II It is a colourless and odourless gas.
 - III It is made up of more than two elements.
 - IV The gases making up air can be separated by fractional distillation.
 - A I only B II only C I and IV D III and IV

[Turn over

24 Which diagram correctly represents a mixture of element(s) and compound(s)?



25 The diagram shows the atomic structure of an element X.



What is X?

- **A** aluminium
- **B** beryllium
- **C** boron
- **D** fluorine
- What happens when a bond is formed between a green gaseous element and a soft metallic element?
 - A The gaseous atoms gain an electron.
 - **B** The gaseous atoms lose an electron.
 - **C** The metal atoms gain an electron.
 - **D** The two elements share a pair of electrons.

[Turn over

- 27 Which salt can be prepared by an acid-alkali titration method?
 - A aluminium carbonate
 - B ammonium chloride
 - **C** calcium nitrate
 - **D** iron(II) sulfate
- The oxide of element X dissolves in water to form a solution which when tested with Universal Indicator paper gives a pH of 14. The oxide does not react with potassium hydroxide. Where is X mostly likely to be found in the Periodic Table?
 - A Group I
 - **B** Group VI
 - **C** Group VII
 - **D** Group 0
- 25 cm³ of 0.1 mol / dm³ hydrochloric acid exactly neutralise 20 cm³ of aqueous sodium hydroxide. The equation for this reaction is:

What is the concentration of the sodium hydroxide solution?

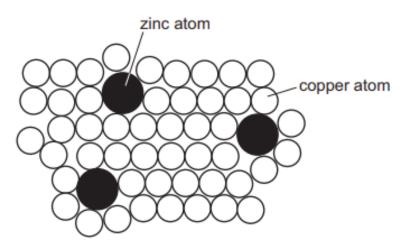
- **A** 0.080 mol / dm³
- **B** 0.125 mol / dm³
- **C** 0.800 mol / dm³
- **D** 1.250 mol / dm³

- **30** W, X and Y are metals, one of which is copper and one of which is iron.
 - W has a coloured oxide which can be reduced by carbon.
 - X has a black oxide and is also found in nature as a pure metal.
 - Y has an oxide which cannot be reduced by carbon.

Which metal is the most reactive and what is the possible identity of W?

	most reactive metal	possible identity of W
Α	Х	Cu
В	X	Fe
С	Υ	Cu
D	Υ	Fe

31 The diagram shows the structure of brass.



Why is brass harder than pure copper?

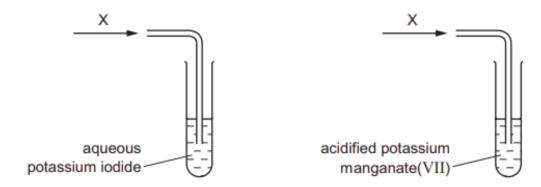
- **A** The zinc atoms form strong covalent bonds with copper atoms.
- **B** The zinc atoms have more electrons than the copper atoms.
- **C** The zinc atoms prevent the 'sea of electrons' from moving freely in the solid.
- **D** The zinc atoms prevent the layers of copper atoms from sliding over each other.

[Turn over

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32	The	e following statements are about elements in the Periodic Table.
	I II III IV	
	Wh	nich statements are correct for the noble gases?
	A	I, II and III B I, II and IV C I, III and IV D II, III and IV
33	sol	e labels on two bottles fell off. One bottle was known to contain sodium chloride ution and the other bottle contained sodium nitrate solution.
	Wh	nich test would most likely identify the solutions?
	Α	addition of aqueous ammonia
	В	addition of aqueous silver nitrate
	С	addition of blue litmus paper
	D	addition of dilute sulfuric acid
34	Wh	nich reagent when reacted with ammonium sulfate, liberates ammonia?
	Α	acidified potassium dichromate(VI)
	В	aqueous bromine
	С	dilute hydrochloric acid
	D	limewater

35 Gaseous compound X is an oxidising agent. X is bubbled through separate solutions of aqueous potassium iodide and acidified potassium manganate(VII).

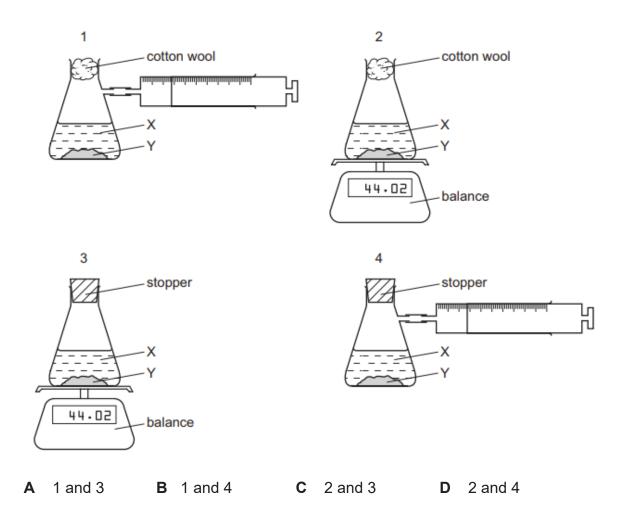


Which row shows the colour changes when X is bubbled through these two solutions?

	aqueous potassium iodide	acidified potassium manganate(VII)
Α	brown to colourless	no change
В	brown to colourless	purple to colourless
С	colourless to brown	no change
D	colourless to brown	purple to colourless

36 A liquid X reacts with solid Y to form a gas.

Which two diagrams show suitable methods for investigating the rate (speed) of the reaction?



37 A thermometer is placed in water and the temperature is measured to be $43.0\,^{\circ}$ C. An endothermic change takes place as a solid is dissolved in the water. The temperature changes by $4.5\,^{\circ}$ C.

What is the thermometer reading now?

A 38 °C

B 38.5 °C

C 47 °C

D 47.5 °C

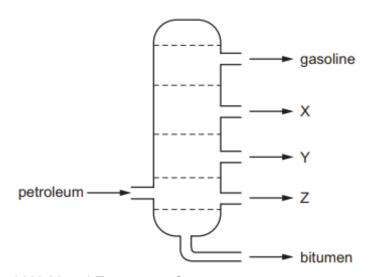
38 A new planet has been discovered and its atmosphere has been analysed.

The table shows the composition of its atmosphere.

gas	percentage by volume / %
carbon dioxide	4
nitrogen	72
oxygen	24

Which gases present in the atmosphere of the new planet are in a higher percentage than they are in the Earth's atmosphere?

- A carbon dioxide and nitrogen
- **B** carbon dioxide and oxygen
- **C** carbon dioxide, nitrogen and oxygen
- **D** nitrogen and oxygen
- **39** The diagram shows the separation of petroleum into fractions.



What could X, Y and Z represent?

	X	Y	Z
Α	diesel oil	lubricating fraction	paraffin
В	lubricating fraction	diesel oil	paraffin
С	paraffin	lubricating fraction	diesel oil
D	paraffin	diesel oil	lubricating fraction

[Turn over

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40 The diagram shows a molecule of an organic compound W.

Which statement is not correct?

- **A** A solution of W in water has a pH greater than 7.
- **B** A solution of W in water reacts with sodium hydroxide solution.
- **C** When copper(II) carbonate is added to a solution of W, a gas is produced.
- **D** When magnesium is added to a solution of W, a gas is produced.

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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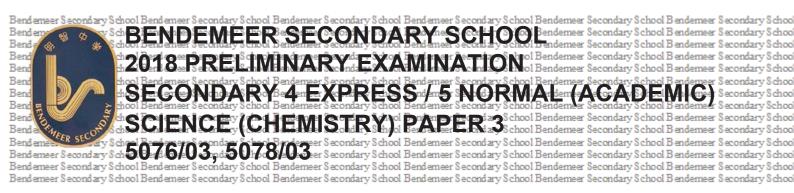
The Periodic Table of Elements

,c	2-7			-					A)		150	70			_				125	3	01		15					
	0	2	He	helium 4	10	Ne	neon	20	18	A	argon	40	36	文	kryptor	84	54	×	xenon	131	98	R	radon	1				
	IIA				6	ш	fluorine	19	17	C	chlorine	35.5	35	മ്	bromine	80	53	Ι	iodine	127	85	At	astatine	1				
	M				8	0	oxygen	16	16	ഗ	sulfur	32	34	Se	selenium	79	52	Те	tellurium	128	84	Ь	polonium		116	۲۸	livermorium	Ē
74-	>				7	Z	nitrogen	14	15	<u>a</u>	phosphorus	31	33	As	arsenic	75	51	Sp	antimony	122	83	Bi	bismuth	209				
93	Ν				9	O	carbon	12	14	S	silicon	28	32	Ge	germanium	73	20	S	tin	119	82	В	lead	207	114	FI	flerovium	()
60	=				5	8	boron	1	13	AI	aluminium	27	31	Ga	gallium	70	49	I	mnipui	115	81	11	thallium	204				
33	35 3										377		30	Zu	zinc	65	48	8	cadmium	112	80	H	mercury	201	112	Cu	copernicium	t
53												34													111		=	\neg
dn		•										200	28	Z	nickel	59	46	Pd	palladium	106	78	亡	platinum	195	110	Ds	larmstadtium	ß
Group	16	•										4.0	27	ပိ	cobalt	59	45	돈	rhodium	103	11	1	indium	192	109	Mt	meitnerium c	
52	35	-	I	hydrogen 1								7	26	Fe	iron	99	44	R	ruthenium	101	9/	S	osmium	190	108	Hs	hassium	Ĕ
					1								25	Mn	manganese	55	43	ည	technetium	100	75	Re	rhenium	186	107	Bh	pohrium	Ę
\$**	*	•			Imber	Г		nass					24	ပ်	chromium	52		Mo	molybdenum	96	74	>	tungsten	184	106	Sg	seaborgium	É
25	- 65			Key	proton (atomic) number	mic symb	name	relative atomic mass	6)				23	>	vanadium	51	41	2			73	Та	tantalum	181	105		dubnium	ľ
	*				proton	ato		relativ	87			3	22	F	titanium	48	40	Zr	zirconium	91	72	Ξ	hafnium	178	104	¥	Rutherfordium	į
部	0								2.1				21	လွ	scandium	45	39	>	yttrium	88	57 - 71	lanthanoids			89-103	actinoids		
55	=				4	Be	benyllium	6	12	Mg	magnesium	24	20	Ca	calcium	40	38	ഗ്	strontium			Ba	barium	137		Ra	radium	Ě
8					3		lithium	7	11	755				¥	potassium	39	37	&	rubidium	85	55	S	caesium	133	87	ù.	francium	Ļ

lanthanoids	22	28	26	09	61		63	64	65	99	29	89	69	70	7.1
	La	S	ď	N	Pm		Ш	В	T	Dy	운	ய்	Tm	Yb	7
	lanthanum	cerium	praseodymium	neodymium	promethium	01	europium	gadolinium	terbium	dysprosium	holmium	erbium	thulium	ytterbium	Intetium
	139	140	141	144	1		152	157	159	163	165	167	169	173	175
actinoids	88	06	91	92	93		95	96	26	86	66	100	101	102	103
	Ac	드	Pa	>	S N	Pu	Am	S	益	₽	Es	Fm	Md	2	۲
	actinium	thorium	protactinium	uranium	neptunium	_	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium
	Ĩ	232	231	238	ì	I	Ţ	Ţ	Î	Î	į	Ĩ	ı	ī	I

The volume of one mole of any gas is $24\,\mathrm{dm}^3$ at room temperature and pressure (r.t.p.).

	Register No.	Class
Name		



DATE : 20th August 2018 DURATION : 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on the work you hand in. You may use a 2B pencil for any diagrams, graphs, tables or rough working. Write in dark blue or black pen. Do not use paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate. You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

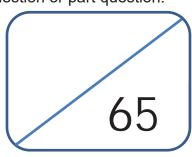
Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 14.

A copy of the Periodic Table is printed on page 15.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.



This document consists of **15** printed pages.

Section A

Answer **all** the questions in the spaces provided.

1 The structures of some substances containing chlorine are shown in Fig. 1.1.

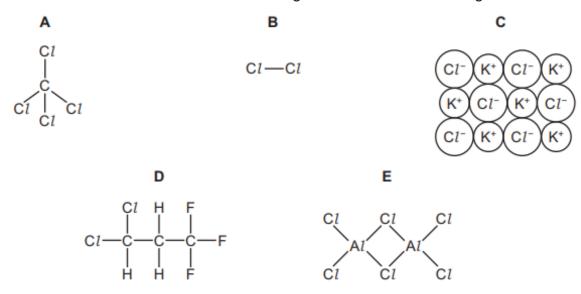


Fig. 1.1

Answer the following questions about these substances. Each of these letters A to E can be used once, more than once or not at all.

(a)	Which substance conducts electricity in molten or aqueous state only?	
		[1]
(b)	Which substance is a diatomic molecule?	
		[1]
(c)	Which substance is an element?	
	Explain your answer.	
		[2]
d)	Which substance is the product of substitution of methane?	
		[1]

2 Table 2.1 gives the composition of three particles.

Table 2.1

particle	number of protons	number of electrons	number of neutrons
А	15	15	16
В	15	18	16
С	15	15	17

(a)	Wha	it is the evidence in Table 2.1 for each of the following?	
	(i)	Particle A is an atom.	
			[1]
	(ii)	A, B and C are all particles of the same element.	
			[1]
	(iii)	Particles A and C are isotopes of the same element.	
(b)		What is the electronic structure of partials C2	[2]
(b)	(i) 	What is the electronic structure of particle C?	[1]
	(ii)	Is element C a metal or a non-metal? Give a reason for your choice.	
			[1]

3	Coal-burning power stations generate a large amount of heat from the combustion of coal
	to convert steam which in turn drives turbine generators to produce electricity. Flue gas that
	is produced contains sulfur dioxide and oxides of nitrogen. These two gases cause acid
	rain.

	oxides of nitrogen p	roduced.	gen monoxide is the main c causes acid rain even thoug	·
	oxide.			
(b)	and results in leach a farmer has been a	ing of nutrients advised to trea	as it often causes the soil to s. In order to alleviate the eff at the soil to reduce the acidit ome calcium compounds.	ects of acid rain,
			Table 3.1	
		calcium hydroxide	calcium oxide	calcium carbonate
	solubility in water (g per 100 ml of water)	0.173	immediately reacts with water on contact to form an alkaline solution	6.17 x 10 ⁻⁴

(c) Another source of oxides of nitrogen is from car engines.

Explain how the oxides of nitrogen are formed in car engines.

..... [2]

[2]

	(d) Besides acid rain, name two other harmful effects of oxides of nitrogen and sulfur dioxide.		
			[2]
4	Solu	ble salts can be made by using a base and an acid.	
	(a)	Complete this method of preparing dry crystals of the soluble salt cobalt(II) chloride from the insoluble base cobalt(II) carbonate.	
		step 1 Add an excess of cobalt(II) carbonate to hot dilute hydrochloric acid.	
		step 2	
		step 3	
		step 4	
		step 5	[0]
			[3]
	(b)	5.95 g of solid cobalt(II) carbonate is added to 40 cm ³ of hydrochloric acid, concentration 2.0 mol / dm ³ .	
		(i) Write a balanced chemical equation, including state symbols, for the above reaction.	
			[2]
		(ii) Show that the cobalt(II) carbonate is added in excess.	

5 The reactivity of different metal oxides was compared by heating them with metals in a crucible. This is shown in Fig. 5.1.

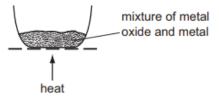


Fig. 5.1

The results are shown in Table 5.2.

Table 5.2

mixture	observations
iron(III) oxide + metal X	reacts
lead(II) oxide + iron	reacts
magnesium oxide + metal X	no reaction

(a)	Use the results in Table 5.2 to suggest the order of reactivity of the metals iron, lead, magnesium and X, starting with the most reactive metal.	
		[1]
(b)	Predict whether iron will react with zinc oxide.	
	Explain your answer.	
		[1]
(c)	Write down two observations when lead(II) oxide reacts with iron.	
		[2]
(d)	In the mixture, iron(III) oxide reacts with metal X.	
	Which element is reduced in the reaction? Use ideas about oxidation state to explain your answer.	
		[2]

6 Fig. 6.1 shows how the ions present in solution A are separated.

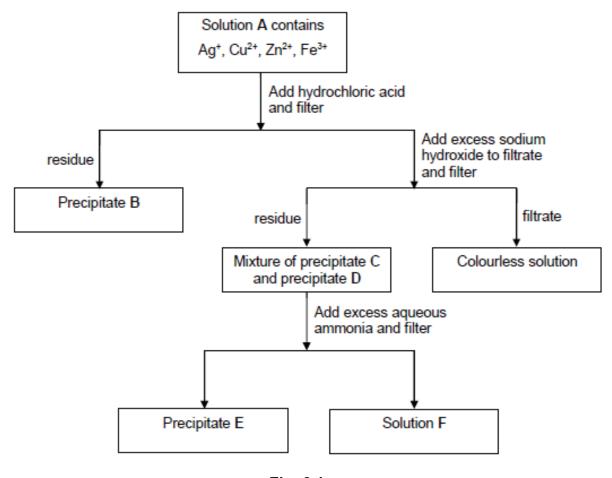


Fig. 6.1

(a)	(i)	It is known that solution A contains one anion. Suggest the identity of this anion. Give a reason for your answer.	
			[2]
	(ii)	Describe a test to confirm the anion named in (a)(i).	
			[1]
(b)	Sug	gest the identity of substances B and C.	
	В.		
	C .		[2]

(c)	Describe the movement and arrangement of particles in precipitate E which has been dried.		
	[2]		
_	7.1 shows a molecule of cyclohexane, C_6H_{12} , which is a cycloalkane and a saturated ocarbon. Cycloalkanes react in a similar way to alkanes.		
	H-C-C-H		

7

Fig. 7.1

(a)	(i)	Define the term saturated.	
			[1]
	(ii)	Define the term hydrocarbon.	
			[1]
(b)	Con	struct the equation for the complete combustion of cyclohexane.	
			[1]
(c)		ohexane reacts with chlorine in the presence of ultraviolet light. This is a stitution reaction. Write the molecular formulae of two products of this tion.	
			[2]

Section B

Answer **any two** questions in this section. Write your answer in the spaces provided.

- 8 Metals undergo different chemical reactions to produce different products.
 - (a) The rate of reaction between a metal and an acid is investigated.

A piece of zinc foil is added to 50 cm³ of hydrochloric acid, of concentration 2.0 mol / dm³. The acid is in excess. The hydrogen evolved is collected in the gas syringe and its volume measured every minute. The results are plotted and labelled as graph 1. This is shown in Fig. 8.1.

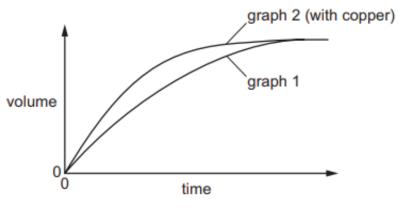


Fig. 8.1

The experiment is repeated to show that the reaction between zinc metal and hydrochloric acid is catalysed by copper. A small volume of aqueous copper(II) chloride is added to the acid before the zinc is added. The results of this experiment are plotted on the same grid and labelled as graph 2 in Fig. 8.1.

(a)	(i)	Explain why the reaction mixture in the second experiment contains copper metal. Include an equation in your explanation.	
			[2]

	(ii)	If the first experiment is repeated using ethanoic acid, CH ₃ COOH, instead of hydrochloric acid, explain how and why the graph would be different from graph 1. Indicate the speed of this reaction on Fig. 8.1 and label it as graph 3.	
			[3]
(b)		en lithium reacts with water, it moves about on the surface of the water. bles are seen and the lithium disappears slowly.	
		dict how the reaction of potassium with water compares with the reaction of um with water.	
	In y	our answer, include	
	• the	y three differences in observations, e names of the products formed when lithium and potassium react with ater.	
			[5]

In the laboratory, scientists are always doing research and conducting experiments to make

9

(a)		such useful product is phosphine, PH ₃ , which is used as a fumigant. It has mell of garlic and is effective in pest control.	
	(i)	Predict two physical properties of phosphine at room conditions.	
		Explain your answer.	
	•••••		
	•••••		
	•••••		
	(ii)	Draw the electronic structure of phosphine. Show outer electrons only.	
(b)		ntists also make margarine from vegetable oils. List the conditions and ain how vegetable oils are used to make margarine for use in foods.	
(b)			

- 10 Thermal decomposition of compounds breaks them down into smaller substances when sufficient heat is applied.
 - (a) Air bags are used to protect passengers in a car during an accident. When the crash sensor detects an impact, it causes a mixture of chemicals to be heated to a high temperature. Reactions take place which produce nitrogen gas. The nitrogen fills the air bag. This is shown in Fig. 10.1.

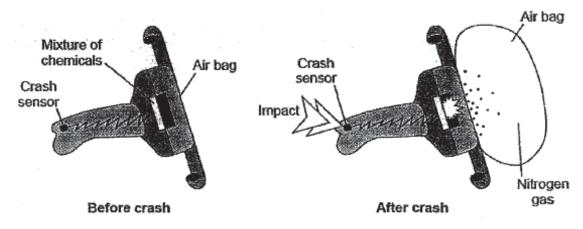


Fig. 10.1

The mixture of chemicals contains solid sodium azide, NaN₃ which decomposes to form sodium and nitrogen as follows.

.....
$$NaN_3$$
 (......) \rightarrow Na (......) + N_2 (......)

- (i) Balance the chemical equation and complete the state symbols in the chemical equation above.
- (ii) Draw the electronic structure of nitrogen gas. Show outer electrons only.

[2]

[2]

(iii) An air bag consists of 130 g of sodium azide. When the sodium azide decomposed, 60 dm³ of nitrogen was obtained at room temperature and pressure.

Show, using calculations, if the thermal decomposition of sodium azide has been efficient in producing nitrogen to fill up the air bag.

[3]

(b) A student used the apparatus in Fig. 10.2 to investigate what happens when liquid paraffin is heated to a high temperature.

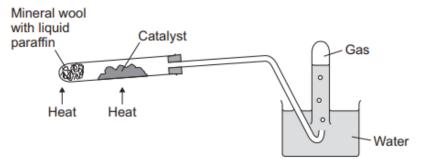


Fig. 10.2

Liquid paraffin contains alkanes. The most abundant alkane has a chemical formula of $C_{20}H_{42}$.

Name the reaction shown in Fig. 10.2. Describe, with the aid of a chemical equation, what happens to the alkane molecules in the reaction.

[3]

END OF PAPER

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

825	34	95	04	20	Ö	Group		83						100
- 24				8				8 0	=	<u>N</u>	>	Ν	IIA	0
	I			~ I										2 He
Key				nydrogen 1				,						nelium 4
proton (atomic) number		number							5	9	7	8	6	10
atomic symbo	_	loqu							Ω	O	z	0	ட	Ne
name									poron	carbon	nitrogen	oxygen	fluorine	neon
relative atomic mass	0	mass							=	12	14	16	19	20
		E							13	14	15	16	17	18
									AI	S	Д	ഗ	C	A
									aluminium	silicon	phosphorus	sulfur	chlorine	argon
38						33			27	28	31	32	35.5	40
		24	25	26	27		29	30	31	32	33	34	32	36
> =		ပ်	M	Fe	ပိ		D O	Zu	Ga	ලී	As	Se	亩	文
val	3-307171	23.570	manganese		cobalt		copper	zinc	gallium	germanium	arsenic	selenium	bromine	krypton
48 51	- 1	52	55	26	59	_	64	65	70	73	75	79	80	84
40 41			43	44	45		47	48	49	20	51	52	53	54
2		Mo	ည	Ru	윤		Ag	ਲ	I	S	Sb	Ц Ц	Н	×e
		molybdenum	technetium	ruthenium	mnipou	- States	silver	cadmium	indium	tin	antimony	tellurium	iodine	xenon
93		96	1 T	101	103	4	108	112	115	119	122	128	127	131
73		74	75	92	11	-	62	80	81	82	83	84	85	98
		>	Re	SO	ı		Au	H	11	9 B	ä	Ъ	Ą	R
hafnium tantalum		tungsten	rhenium	osmium	iridium	= 0.0	plog	mercury	thallium	lead	bismuth	polonium	astatine	radon
_		184	186	190	192	- 1	197	201	204	207	209	1	1	1
104 105		106	107	108	109	110	111	112		114		116		
		Sg	Bh	Hs	Mt	_	Rg	5 S		FI		^		
Rutherfordium dubnium		seaborgium	pohrium	hassium	meitnerium	ep	roentgenium	copernicium		flerovium		livermorium		
0		ĺ	ľ	Ü			ľ	1		į		ı		

lanthanoids	22	28	29	09	61	62	63	64	65	99	29	89	69	70	7.1
	La	8	ď	PN	Pm	Sm	Ш	B	Tb	ò	운	ய்	ᄪ	χp	Lu
	lanthanum	cerium	praseodymium	neodymium	promethium	samarium	europium	gadolinium	terbium	dysprosium	holmium	erbium	thulium	ytterbium	Intetium
	139	140	141	144	İ	150	152	157	159	163	165	167	169	173	175
actinoids	89	90	91	92	93	94	95	96	26	86	66	100	101	102	103
	Ac	드	Ра	>	o N	Pu	Am	Cm	益	ŭ	Es	Fm	Md	S	۲
	actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium
	Ĩ	232	231	238	l	Ţ	ī	ţ	I.	Ĺ	1	Ĩ	ĺ	1	ı

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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Prelim Exam 2018 4E/5N Sc(Chem) Marking Scheme

Section A [1 mark each; 20 marks total]

1	2	3	4	5	6	7	8	9	10
В	D	С	D	В	Α	В	Α	В	D
11	12	13	14	15	16	17	18	19	20
J	Α	В	D	C	D	B	В	D	Α

Section B [45 marks total]

1 (a) C (b) B	[1] [1]
	[1]
() D [4]	
(c) B [1]	
It has only one type of atom. [1]	[2]
(d) A	[1]
2 (a) (i) It has the same number of protons and electrons; 15 each.	[1]
(ii) All have the same number of protons (15) / same proton numb	per /
same atomic number	
	[1]
(iii) same number of protons (15) / same proton number / same at	omic
number [4];	
Different number of neutrons / different nucleon number / different	mace
number [1]	111033
numberth	[2]
(b) (i) 2.8.5 2,8,5 [1]	
(ii) non-metal because it accepts electrons / needs 3 electrons to	
complete valence electron shell / because it is in Group V or 5 elec	ctrons
in valence shell [1]	
Note: need both non-metal and reason for one mark	[2]

	1				
3	(a)	NO will be oxidised by oxygen in air to form nitrogen dioxide. [1]			
		Nitrogen dioxide will then dissolve in rainwater to form nitric acid which caused acid rain. [1]	[0]		
			[2]		
	(b)	Calcium carbonate is very much less soluble than calcium hydroxide and calcium oxide. [1]			
		Thus, CaCO ₃ reacts slowly with acid / effective only in reducing acidity of soil / surface in contact / cannot penetrate soil to neutralize acid deeper down. [1]			
		acception de minim [11]	[2]		
	(c)	The high temperatures of the car engines causes[1]			
		nitrogen in the air to react with oxygen in the air producing oxides of nitrogen. [1]	[2]		
	(d)	➢ irritates the eyes and lungs and cause breathing difficulties [1]			
		high levels lead to inflammation of the lungs (bronchitis) [1]	[2]		
4	(a)	Step 2 Filter to remove excess cobalt(II) carbonate; [1]			
		Step 3 Heat the filtrate till saturation; [1]			
		Step 4 Cool to allow crystals to form, [0.5]			
		Step 5 Rinse crystals with a little distilled water to remove impurities and			
		dry between sheets of filter paper; [0.5]	[3]		
	(b)	(i) CoCQ ₃ (s) + 2HCl (aq) - CoCh (aq) + CO ₂ (g) + H ₂ O (l)			
		State symbols [1]; balanced chemical equation [1]			
		(ii) no of moles of HCl = cv = 2 * (40/1000) = 0.08 mol [1]			
		Mole ratio CoCO₃ : HCI			
		Fm egn 1 : 2			
		Fm data 0.04 : 0.08 [1]			
		Mass of CoCO ₃ = mol * molar mass = 0.04 * (59+12+48) = 0.04 * 119 = 4.76 g [1]			
		4.76 g of CoCO₃ needed but 5.95 g was used. Hence, CoCO₃ was in excess.			
		was iii excess.	[3]		
			1		

5	(a)	$magnesium \rightarrow X \rightarrow iron \rightarrow lead / \qquad \qquad Mg > X > Fe > Pb$	[1]
	(b)	no / it will not react and zinc is more reactive / iron is less reactive; [1] ignore: zinc is reactive / iron is unreactive	[1]
	(c)	A greenish ppt/solid [1] and a grey/silver solid are formed. [1]	[2]
	(d)	Iron is reduced.[1]	
		The oxidation state of iron decreases from +3 in iron(III) oxide to 0 in iron. [1]	[2]
6	(a)	(i) Nitrate [1] All nitrates are soluble. [1] or Sulfate [1] All Ag ⁺ , Cu ²⁺ , Zn ²⁺ and Fe ³⁺ sulfates are soluble. [1]	[2]
		(ii) Add sodium hydroxide, aluminium foil and warm. [0.5] Gas produced turns moist red litmus paper blue. [0.5] or Add barium nitrate / barium chloride. [0.5] A white precipitate is seen. [0.5]	[1]
	(b)	B: silver chloride / AgCl [1] C: copper(II) hydroxide / Cu(OH) ₂ / iron(II) hydroxide / Fe(OH) ₂ [1]	[2]
	(c)	The particles are in solid state. They vibrate at their fixed positions. [1]	
		They are closely packed in a orderly manner. [1]	[2]
7	(a)	(i) Contains only carbon-carbon single bonds	[1]
	(b)	(ii) Contains only carbon and hydrogen atoms	[1]
	(b)	$C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$	[1]
	(c)	HCI (1) C ₆ H ₁₁ CI (1)	[2]

Section C (20 marks)

Sect	ion C	(20 marks)	
8	(a)	(i) zinc displaces copper / zinc more reactive than copper; [1]	
		$Zn + CuCl_2 \rightarrow ZnCl_2 + Cu / Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}; [1]$	
		(ii) less steep (line) or lower gradient / (because of) decreased rate; [1]	
		ethanoic is a weak(er) acid / only partially ionised / dissociated / lower	
		concentration of hydrogen ions; [1];	
		graph 3 is below graph 1 and ends at the same volume as graph 1 [1]	[6]
			[5]
	(b)	3 marks from any 3 differences in observations e.g.	
		more bubbles with K;	
		• it /K moves faster (on water surface);	
		 Li does not catch fire/K catches fire/K bursts into flame; 	
		• it /K fizzes more than Li;	
	<	•it /K disappears rapidly;	
		• K explodes lithium does not explode;	
		K melts / ball with k/ lithium does not melt/ does not go into ball [3]	
		Products: lithium hydroxide [0.5]	
		potassium hydroxide; [0.5]	
		hydrogen/H ₂ [1]	[5]

9	(a)	(i)	Phosphine is a liquid / gas at room condition [1] It is made up of 2 non-metals [1] which will form a covalent compound	
			which is a liquid / gas at room conditions. [1] /	
			Phosphine has low melting and boiling points [1] It is a simple covalent molecule [1] with weak intermolecular forces of	
			attraction. Hence little energy is needed to overcome them. [1] /	
			Phosphine does not conduct electricity in any state [1] It has no mobile ions [1]or mobile electrons to carry the current to conduct electricity. [1]	
			Any 2 points with explanations maximum [5]	[5]
		(ii)	H	
	\langle		[1] for P, [1] for H	[2]
	(b)	in t	ct with hydrogen or hydrogenation [1] the presence of a nickel catalyst at 60 °C (allow 50-200 °C) [1] cause vegetable oils are unsaturated or have carbon-carbon double	
		boı	nds (vegetable oils are hardened) to make them solid at room nperature or to make them useful as spreads/spreadable [1]	[3]

10	(a)	(i) 2, 2, 3 [1] (s), (s), (g) [1]	[2]
		(iii) N N In pairs of bonds, [1] for 2 unshared electrons per N atom	[2]
		(iii) Mole of NaN ₃ = mass / molar mass	[4]
		It was not efficient as only 60 dm³ of N₂ was produced. [0.5]	[3]
	(b)	Cracking [1]	
		Big alkane \rightarrow smaller alkanes + smaller alkene (+ hydrogen) $C_{20}H_{42} \rightarrow C_{12}H_{26} + C_8H_{16}$ (any appropriate balanced equation) [1]	
		It undergoes cracking to produce small(er) molecules / alkanes hydrocarbons and alkenes or a named alkene [1]	[3]

Prelim Exam 2018 4E/5N Sc(Chem) Marking Scheme

Section B [45 marks total]

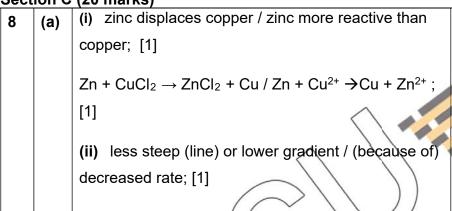
		[+5 marks total]		
				Marker's Comments
1	(a)	С	[1]	
	(b)	В	[1]	
	(c)	B [1]		
		It has only one type of atom. [1]	[2]	
	(d)	A \\	[1]	
2	(a)	(i) It has the same number of protons and		
		electrons; 15 each.	[1]	U
		(ii) All have the same number of protons (15)	11	
		same proton number / same atomic number		
		(iii) same number of protons (15) / same proton		
		number / same atomic number [t];		
		Different number of neutrons / different nucleon		
		number / different mass number [1]		
		vialities / different ridge frames [1]	[2]	
	(b)	(i) 2.8.5 / 2.8,5 [1]		
		(ii) non-metal because it accepts electrons / needs		
		3 electrons to complete valence electron shell /		
		because it is in Group V or 5 electrons in valence		
		shell [1]		
		Note: need both non-metal and reason for one mark	[2]	

3	(a)	NO will be oxidised by oxygen in air to form nitrogen dioxide. [1]		
		Nitrogen dioxide will then dissolve in rainwater to		
		form nitric acid which caused acid rain. [1]	[2]	
	(b)	Calcium carbonate is very much less soluble than	[2]	
	(b)	calcium hydroxide and calcium oxide. [1]		
		Thus, CaCO₃ reacts slowly with acid / effective only		
		in reducing acidity of soil / surface in contact / cannot		
		penetrate soil to neutralize acid deeper down. [1]	[2]	
	(c)	The high temperatures of the car engines causes[1]		
		nitrogen in the air to react with oxygen in the air		
		producing oxides of nitrogen. [1]	[2]	
	(d)	 irritates the eyes and lungs and cause breathing difficulties [1] 		
		> high levels lead to inflammation of the lungs		
	1	(bronchitis) [17]	[2]	
4	(a)	Step 2 Filter to remove excess cobalt(II) carbonate;		
	V	Step-3 Heat the filtrate till saturation; [1]		
		(0.\\)		
		Step 4 Cool to allow crystals to form; [0.5]		
		Step 5 Rinse crystals with a little distilled water to remove impurities and dry between sheets of filter		
		paper; [0.5]	[3]	

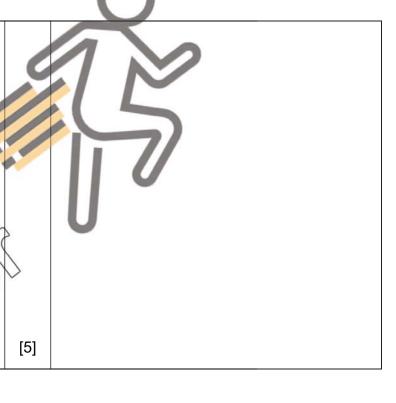
	(b)	(i) CoCO ₃ (s) + 2HCl (aq) → CoCl ₂ (aq) + CO ₂ (g) + H ₂ O (l) State symbols [1]; balanced chemical equation [2]
		(ii) no of moles of HCl = cv = 2 * (40/1000) = 0.08 mol [1] Mole ratio CoCO ₃ : HCl Fm eqn 1 : 2 Fm data 0.04 : 0.08 [1] Mass of CoCO ₃ = mol * molar mass = 0.04 * (59+12+48) = 0.04 * 149 = 4.76 g
		4.76 g of CoCO ₃ needed/but 5.95 g was used. Hence, CoCO ₃ was in excess. [3]
5	(a)	magnesium $\rightarrow X \rightarrow \text{iron} \rightarrow \text{lead} X > $ Fe > Pb [1]
	(b)\	no / it will not react and zinc is more reactive / iron is less reactive; [1] ignore: zinc is reactive / iron is unreactive [1]
	(c)	A greenish ppt/solid [1] and a grey/silver solid are formed. [1] [2]
	(d)	Iron is reduced.[1] The oxidation state of iron decreases from +3 in iron(III) oxide to 0 in iron. [1] [2]

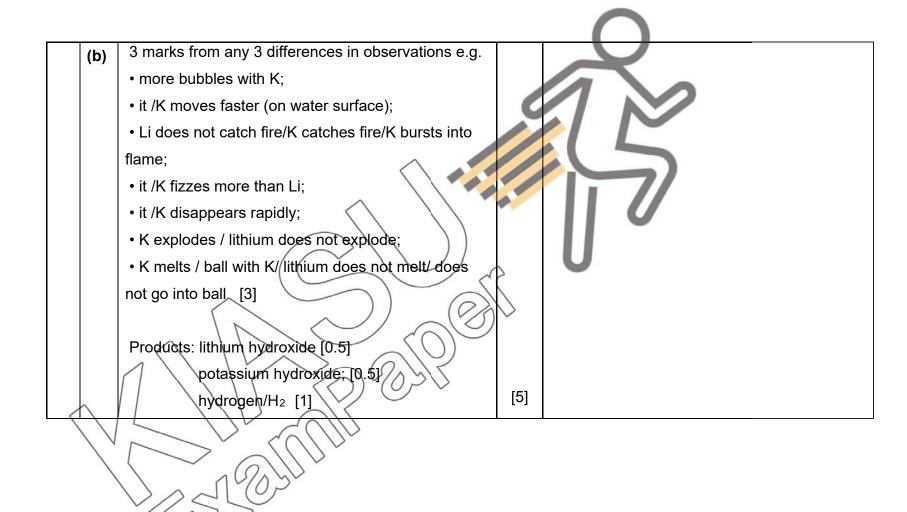
6	(a)	(i) Nitrate [1]			
		All nitrates are soluble. [1] or			
		Sulfate [1]			
		All Ag ⁺ , Cu ²⁺ , Zn ²⁺ and Fe ³⁺ sulfates are soluble.			
		[1]	[2]		
		(ii) Add sodium hydroxide, aluminium foil and warm.			
		[0.5]			
		Gas produced turns moist red litmus paper blue.	(
		[0.5] or		7/	
		Add barium nitrata / barium ablarida [0.5]	ш		
į		Add barium nitrate / barium chloride. [0.5]	[1]		
		A white precipitate is seen. [0.5]	111		
	(b)	B: silver chloride / AgCl [1]			
		C: copper(II) hydroxide / Cu(OH) ₂ / iron(N) hydroxide / Fe(OH) ₂ [1]	[2]		
			[2]		
1	(c)	The particles are in solid state.			
		They vibrate at their fixed positions. [1]			
		They are closely packed in a orderly manner. [1]	[2]		
7	(a)	(i) Contains only carbon-carbon single bonds	[1]		
		(ii) Contains only carbon and hydrogen atoms	[1]		
	(b)	$C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$	[1]		
<	(c)	HOI (4)	[2]		
	\\	C6H11Cl (1)			

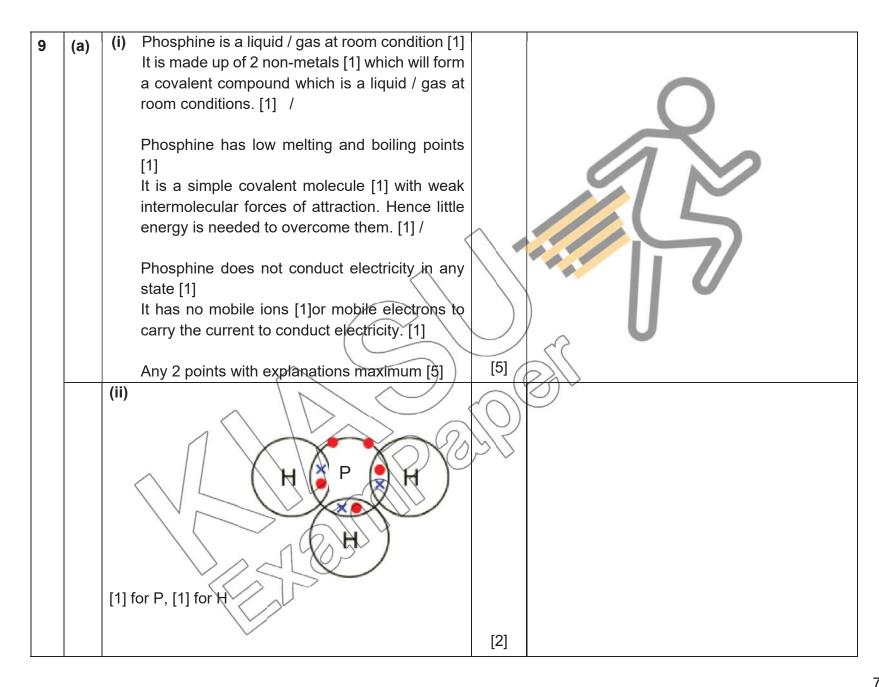
Section C (20 marks)



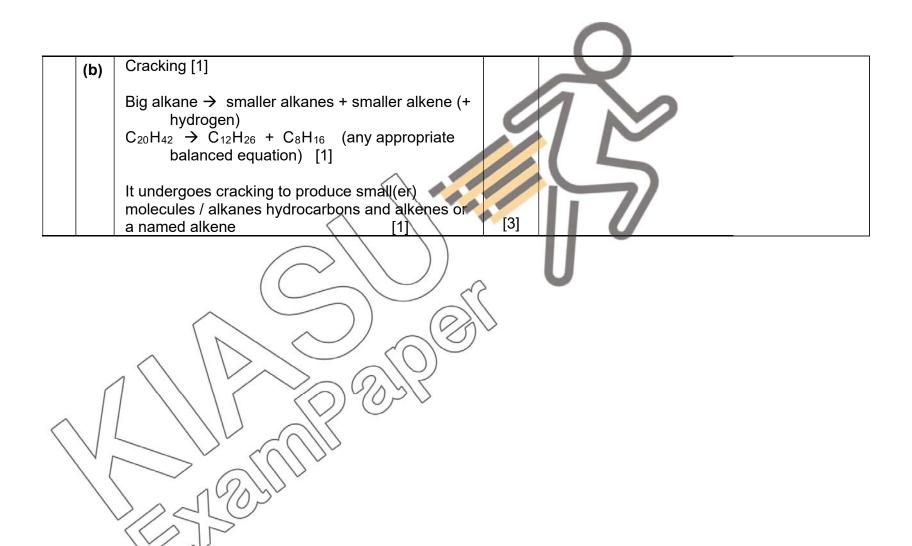
ethanoic is a weak(er) acid / only partially ionised / dissociated / lower concentration of hydrogen ions; [1]; graph 3 is below graph 1 and ends at the same volume as graph 1 [1].







_			
	(b)	react with hydrogen or hydrogenation [1]	
	` ′	in the presence of a nickel catalyst at 60 °C (allow	
		50-200 °C) [1]	
		because vegetable oils are unsaturated or have	
		_	
		carbon-carbon double bonds (vegetable oils are	
		hardened) to make them solid at room temperature	[3]
		or to make them useful as spreads/spreadable [1]	i a
10	(a)	(i) 2, 2, 3 [1]	
	()	(s), (s), (g) [1]	[0]
			[2]
		(ii)	
		$N_{\circ}(\frac{1}{2})$ $N_{\circ}(\frac{1}{2})$	
	1		
		[1] for 3 pairs of bonds, [1] for 2 unshared electrons	
_		per Natom	[2]
	IL	(iii) Mole of MaN ₃ = mass / molar mass	
//		= 130 / (23 + (14*3)) = 2 [1]	
/	/	Mote ratio NaN ₃ : N ₂	
	/)	Fmegn 2:3	
		Fm data 2 : 3 [0.5]	
		Vol of N_2 = mol x 24	
		$= 3 * 24 = 72 \text{ dm}^3$ [1]	
		It was not efficient as only 60 dm ³ of N ₂	
		was produced. [0.5]	[3]
		[m. [e.e.]	1 - 1





Bukit Batok Secondary School PRELIMINARY EXAMINATIONS 2018 SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

SCIENCE (PHYSICS / CHEMISTRY)

Paper 1 Multiple Choice

5076 / 01 24 August 2018 0745 – 0845 1 hour

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

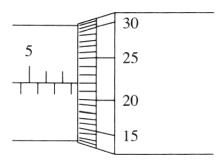
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

Electronic calculators may be used.

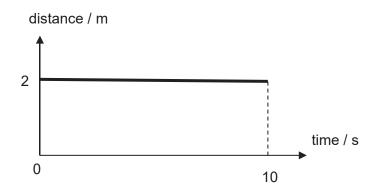
A copy of the Data Sheet is printed on page 15.

A copy of the Periodic Table is given at the end of the paper.

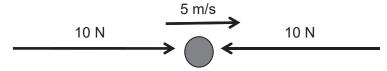
1 What is the reading shown by the micrometer screw gauge?



- **A** 5.272 mm
- **B** 5.72 mm
- **C** 7.22 mm
- **D** 7.72 mm
- 2 Which of the following best describes the distance-time graph below?



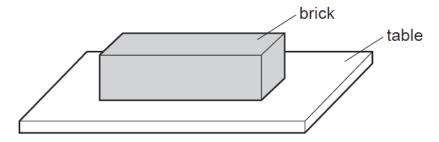
- A An object at rest.
- **B** An object moving with a constant speed of 2.0 m/s.
- C An object moving with a constant velocity of 2.0 m/s.
- **D** An object moving with a constant acceleration of 2.0 m/s².
- 3 Which of the following consist of only vector quantities?
 - A mass, distance, time
 - B friction, velocity, electromotive force
 - **C** tension, speed, energy
 - D weight, displacement, electrostatic force
- **4** A particle moving at constant speed of 5 m/s is being acted on by two 10 N forces as shown.



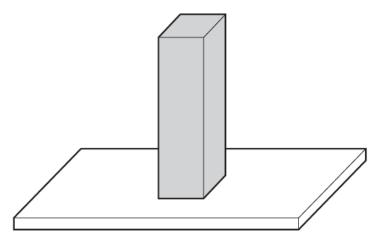
The particle will

- A continue to move at 5 m/s in a straight line.
- **B** increase its speed gradually.
- **C** slow down gradually and stop.
- **D** stop immediately.

5 A brick with flat, rectangular sides rests on a table.



The brick is now turned so that it rests on the table on its smallest face.

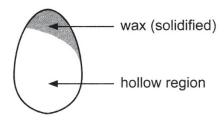


How has this affected the force and the pressure exerted by the brick on the table?

	force	pressure
Α	increased	increased
В	increased	unchanged
С	unchanged	increased
D	unchanged	unchanged

- **6** When solid A of mass 15 g is immersed in a displacement can filled with water, it displaced the same volume of water as solid B of mass 10 g. Which of the following best describes the densities of solid A and solid B?
 - A Solid A and solid B have the same density.
 - **B** Density of solid A is 0.667 times the density of solid B.
 - **C** Density of solid A is 1.5 times the density of solid B.
 - **D** Density of solid A is 5 times the density of solid B.

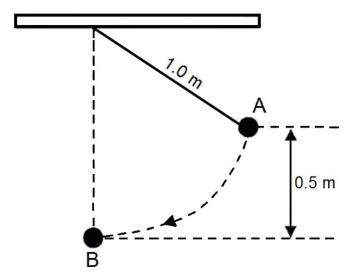
7 An empty egg shell has molten wax solidified inside it as shown in the figure below.



In which position is the egg shell most stable when placed on a flat, horizontal surface?

Α	В	С	D

8 A pendulum with length of 1.0 m is displaced to position A and released as shown.



Ignoring air resistance, what is the speed of the pendulum bob as it passes its lowest point B?

- **A** 1.5 m/s
- **B** 2.3 m/s
- **C** 3.2 m/s
- **D** 4.1 m/s
- **9** A cube of ice is heated to water, then to steam. Which of the following is true?
 - A The molecules expand as ice changes to steam.
 - **B** The molecules move slower as ice changes to steam.
 - C The molecules move further apart as the ice changes to steam.
 - **D** The molecules move closer to one another as ice changes to steam.

- **10** A beaker of water is heated at the bottom to form a convection current in the water. An explanation on how convection occurs contains four statements.
 - 1 Density of expanded water decreases.
 - 2 Warm water that is less dense rises and cold water moves in to replace it.
 - 3 Water at the bottom gains heat and becomes warmer.
 - 4 Water expands.

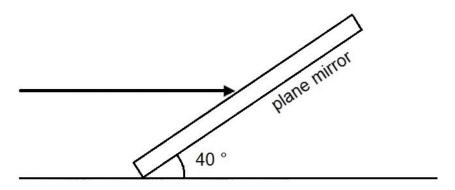
What is the correct order of these four statements?

- $A \quad 3 \rightarrow 1 \rightarrow 2 \rightarrow 4$
- $\mathbf{B} \quad 3 \rightarrow 2 \rightarrow 4 \rightarrow 1$
- C $3 \rightarrow 4 \rightarrow 1 \rightarrow 2$
- **D** $3 \rightarrow 4 \rightarrow 2 \rightarrow 1$
- **11** The diagram shows an electric flask. Which of the following statement is true?



- **A** The plastic lid is a good conductor of heat.
- **B** The plastic lid increases heat loss through convection.
- **C** The white colour exterior reduces rate of heat loss by radiation.
- **D** The transparent water level marking increases heat loss by radiation.

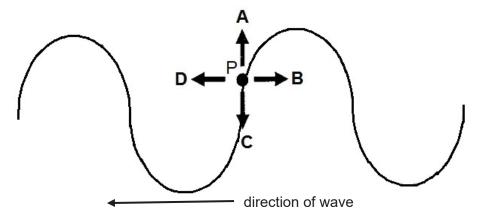
12 A light ray is parallel to the floor and strikes a plane mirror as shown.



What is the angle of incidence?

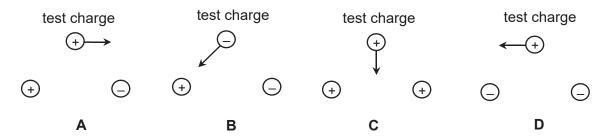
- **A** 40°
- **B** 50°
- **C** 90°
- **D** 140°

13 A rope is set to oscillate up-and-down to create a transverse wave that moves to the left. At the particular instant below, what is the direction of movement of point P?

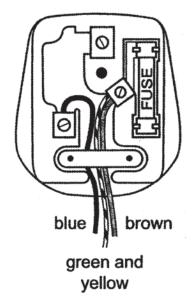


- 14 What is the speed of X-rays in a vacuum?
 - **A** 380 m/s
 - **B** $3.0 \times 10^8 \text{ m/s}$
 - C Slightly less than 3.0 x 10⁸ m/s
 - **D** Slightly more than 3.0 x 10⁸ m/s
- **15** Which of the following is **not** an application of gamma rays?
 - A checking welds
 - **B** intruder alarm
 - **C** sterilizing equipment
 - **D** treatment of cancer

16 Which of the following diagrams correctly shows the direction of the resultant electrostatic force acting on a small test charge?



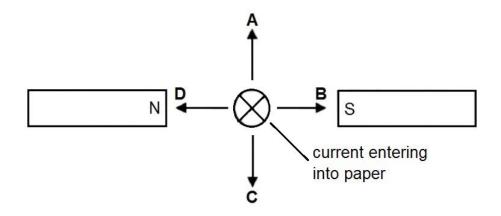
17 The plug of the vacuum cleaner is wrongly wired as shown.



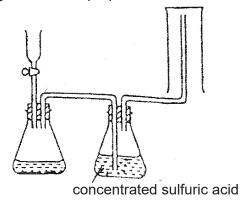
What is the effect of using the plug wired this way?

- A The fuse in the plug blows.
- B The metal case becomes live.
- **C** The vacuum cleaner catches fire.
- **D** The vacuum cleaner does not work.
- 18 Which material is used to make the needle of a plotting compass?
 - **A** aluminium
 - **B** brass
 - **C** iron
 - **D** steel

- 19 One kilowatt-hour of electricity costs \$0.20.
 - How much does it cost to switch on a heater marked "120 V, 3 A" for 90 minutes.
 - **A** \$0.11
 - **B** \$2.70
 - **C** \$64.80
 - **D** \$108.00
- **20** The figure below shows a current-carrying conductor between two magnets. Which of the arrows indicates the direction of the force acting on the conductor?



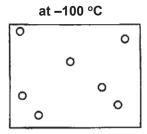
- 21 Which of the following is a compound?
 - A fluorine
 - **B** lithium
 - C petroleum
 - **D** sugar
- 22 Which of the following gases can be prepared and collected using the apparatus shown?



- A ammonia
- **B** carbon dioxide
- C hydrogen
- **D** oxygen

23 The diagrams show the arrangement of molecules in a substance at a pressure of 1 atm and at two different temperatures.

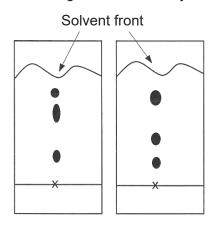
at –150 °C



Which substance could the diagrams represent?

Substance	Melting point / °C	Boiling point / °C
Α	-183	-89
В	-182	-162
С	-169	-104
D	-114	-85

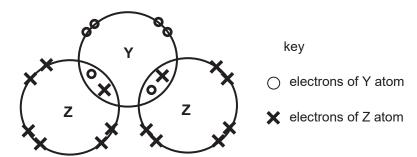
24 Two students carried out chromatography experiments to examine the dyes in a black ink. They used the same ink. The chromatograms obtained by the students are shown below.



Why were the chromatograms different?

- **A** One student used the wrong solvent.
- **B** One student did not use enough solvent.
- C The two students used different solvents.
- **D** The solvent moved up the paper at different speeds.

25 The diagram shows the arrangement of electrons in the outer shells of the atoms in the compound YZ₂.



Which pair of elements could be Y and Z?

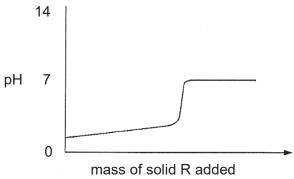
	Υ	Z
Α	calcium	fluorine
В	carbon	sulfur
С	oxygen	hydrogen
D	sulfur	chlorine

- **26** Which ion has the same number of protons as the hydroxide ion?
 - **A** O²⁻
 - B F-
 - C Na⁺
 - **D** Mg²⁺
- **27** Rubidium is in Group I of the Periodic Table. Which of the following are properties of rubidium chloride?

	formula	melting point	solubility in water
Α	RbC/	70°C	insoluble
В	RbC/	700°C	soluble
С	RbCI ₂	70°C	soluble
D	$RbC\mathit{I}_2$	700°C	insoluble

- 28 Which of the following is unlikely to react with aqueous sodium hydroxide?
 - A carbon dioxide
 - B aluminium oxide
 - **C** zinc oxide
 - D copper (II) oxide

29 Solid R is gradually added to aqueous solution S. The changes in pH are shown in the graph below.



What are R and S?

	R	S
Α	insoluble metal oxide	hydrochloric acid
В	insoluble non-metal oxide	sodium hydroxide
С	soluble metal oxide	hydrochloric acid
D	soluble non-metal oxide	sodium hydroxide

30 Test on a sample of polluted water from a factory gives the following results.

Reagent	Result
Hydrochloric acid and aqueous barium chloride	White precipitate
Aqueous ammonia	White precipitate soluble in excess

Which compound is present in the water?

- A lead (II) chloride
- B lead (II) sulfate
- C zinc chloride
- **D** zinc sulfate
- **31** Magnesium reacts with hydrochloric acid.

$$Mg_{(s)} + 2HCI_{(aq)} \rightarrow MgCI_{2(aq)} + H_{2(g)}$$

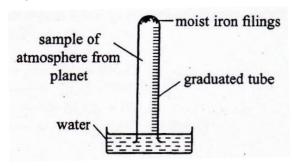
Which volume of hydrogen at room temperature and pressure is produced if 6g of magnesium reacts with an excess of the acid?

- \mathbf{A} 1 dm³
- **B** 6 dm³
- **C** 12 dm³
- \mathbf{D} 24 dm³

- 32 Which statement about the production of iron from haematite is correct?
 - A Coke is used to oxidize the slag.
 - **B** Limestone is used to remove basic impurities.
 - **C** Molten iron floats on slag at the furnace base.
 - **D** The haematite is reduced by carbon monoxide.
- **33** The atmosphere of a newly discovered planet contains the following gases.

carbon dioxide	20%
nitrogen	40%
oxygen	30%
noble gases	10%

The apparatus below was set up with a 100 cm³ sample of the atmosphere of the planet in the graduated tube. The volume of the sample was measured at intervals until no further change in volume took place.

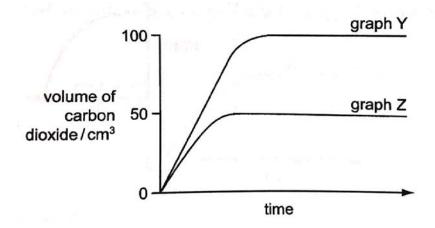


What volume of the sample would remain?

- **A** 30 cm³
- **B** 40 cm³
- **C** 60 cm³
- **D** 70 cm³
- **34** Which process is endothermic?
 - **A** The formation of a hydrogen-chlorine bond.
 - **B** The formation of rust.
 - **C** The formation of water from ice.
 - **D** The formation of water molecule from oxygen and hydrogen atoms.

- **35** Which of the following statement described the conversion of a sodium atom, Na, to a sodium ion, Na⁺?
 - A The change is reduction; there is a gain of electron.
 - **B** The change is reduction; there is a loss of electron.
 - **C** The change is oxidation; there is a gain of electron.
 - **D** The change is oxidation; there is a loss of electron.
- **36** Some crystals of magnesium carbonate were added to an excess of sulfuric acid at room temperature. The volume of carbon dioxide gas produced was measured over a period of time. The results are shown in graph Y.

The experiment was repeated and graph Z was obtained.



Which change was used to obtain the results shown in graph Z?

- A Acid of the same volume and half the original concentration was used.
- **B** Half the mass of magnesium carbonate was used.
- **C** Larger crystals of magnesium carbonate was used.
- **D** Using a lower temperature.
- **37** The table below shows the boiling point ranges of fractions collected from the distillation of a sample of crude oil.

Which fraction contained the smallest molecules?

Fraction	Boiling point range / °C
Α	20 – 50
В	50 – 100
С	100 – 150
D	150 - 250

38 'Meta-fuel', C₈H₁₆O₄, is a fuel used in camping stoves. What is the equation for its complete combustion?

A
$$C_8H_{16}O_4 + 2O_2 \longrightarrow 8C + 8H_2O$$

B $C_8H_{16}O_4 + 5O_2 \longrightarrow 8CO + 8H_2O$
C $C_8H_{16}O_4 + 10O_2 \longrightarrow 8CO_2 + 8H_2O$
D $C_8H_{16}O_4 + 8O_2 \longrightarrow 4CO_2 + 4CO + 8H_2O$

- 39 Which of these reactions does not produce carbon dioxide?
 - A combustion of methane
 - B fermentation of sugar
 - C oxidation of ethanol to ethanoic acid
 - D reaction of ethanoic acid with calcium carbonate
- 40 A compound, Z, has the molecular structure as shown. How can Z be described?

- A an alkane and an acid
- B an alkene and an acid
- C an alkane and an alcohol
- **D** an alkene and an alcohol

- End of Paper 1 -

DATA SHEET

Colours of some common metal hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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DATA SHEET The Periodic Table of Elements

	0	2	He	Helium	4	10	Ne	Neon	20	18	Ā	Argon	40	36	ż	Krypton	84	54	Xe	Xenon	131	98	Ru	Radon	ı					
						6	ш	Fluorine	19	17	C	Chlorine	35.5	35	Ŗ	Bromine	80	53	_	lodine	127	85	Αt	Astatine	ı					
	>					®	0	Oxygen	16	16	ഗ	Sulfur	32	34	Se	Selenium	79	52	Тe	Tellurium	128	84	Ро	Polonium	ı	116	_	Livermorium	-	
	>				-	7	Z	Nitrogen	4	15	۵	Phosphorus	31	33	As	Arsenic	75	51	Sb	Antimony	122	83	Ö	Bismuth	209					
	≥					9	ပ	Carbon	12	14	S	Silicon	28	32	Ge	Germanium	73	20	Sn	Tin	119	82	Pb	Lead	207	114	F/	Flerovium	1	
	=				-	2	m	Boron	7	13	₹	Aluminium	27	31	Ga	Gallium	70	49	므	Indium	115	81	1	Thallium	204				ı	
					L									30	Zn	Zinc	65	48	ပ	Cadmium	112	80	Hd	Mercury	201	112	S	Copernicium	-	
														29	Cn	Copper	64	47	Ag	Silver	108	62	Αn	Gold	197	111	Rg	Roentgenium	1	
an	<u> </u>													28	Z	Nickel	59	46	Pd	Palladium	106	78	Ŧ	Platinum	195	110	Ds	Darmstadtium	ı	
Group														27	ပိ	Cobalt	29	45	몺	Rhodium	103	2.2	<u>-</u>	Iridium	192	109	Mt	Meitnerium	ı	
		1	I	Hydrogen	_									26	Ьe	Iron	26	44	Ru	Ruthenium	101	92	SO	Osmium	190	108	Hs	Hassium	1	
					_									25	M	Manganese	55	43	ဍ	Technetium		22	Re	Rhenium	186	107	Bh	Bohrium	I	
						Jec	_		S					24	ပ်	Chromium	52	42	Mo	Molybdenum	96	74	>	Tungsten	184	106	Sg	Seaborgium	ı	
				Kev		atomic) nun	atomic) nun	atomic symbol	name	relative atomic mass					23	>	Vanadium	51	41	Q N	Niobium	93	73	Та	Tantalum	181	105	Ob	Dubnium	1
						proton (a	atom		relative					22	F	Titanium	48	40	Zr	Zirconium	91	72	¥	Hafnium	178	104	ጟ	Rutherfordium	ı	
					L									21	လွ	Scandium	45	39	>	Yttrium	89	57 – 71	lanthanoids			89 – 103	actinoids			
	=					4	Be	Beryllium	o	12	M	Magnesium	24	20	Ca	Calcium	40	38	ഗ്	Strontium	88	99	Ba	Barium	137	88	Ra	Radium	-	
	_					3	=	Lithium	7	11	Na	Sodium	23	19	¥	Potassium	39	37	R _b	Rubidium	85	22	S	Caesium	133	87	ቷ	Francium	-	

	22	58	59	09	19	62	63	64	65	99	29	89	69	20	71
lanthanoids	La	Se	P	PZ	Pm	Sm	Вu	В	Д	D	유	ш	T	Υb	Γn
	Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium
	139	140	141	144	147	150	152	157	159	162	165	167	169	173	175
	88	06	91	92	93	94	92	96	26	86	66	100	101	102	103
actinoids	Ac	۲	Ра	_	Q N	Pu	Am	CB	B	ర	Es	Fm	Md	%	בֿ
	Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium
	ı	232	231	238	ı	ı	ı	ı	I	ı	I	ı	ı	ı	ı
The volume of one male of any are in 24 dm3 at mom tom	200	000	in 01 Am3	4002	tomorot	a + 1/ 01/100010 bao 01/1+0100	0210002	(" + ")		•				*	

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

Name:	Class register no	Class:
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Bukit Batok Secondary School PRELIMINARY EXAMINATIONS 2018 SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

SCIENCE (PHYSICS / CHEMISTRY)

Paper 2 Physics

5076/02 17 August 2018 0745 – 0900 1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided at the top of this page.

Write in dark blue or black pen

You may use a pencil for any diagrams, graphs or rough working

Do not use staples, paper clips, highlighters, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer all questions in the spaces provided.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer any two questions.

Write your answers in the spaces provided on the Question Paper.

At the end of the examination, fasten all your work securely together.

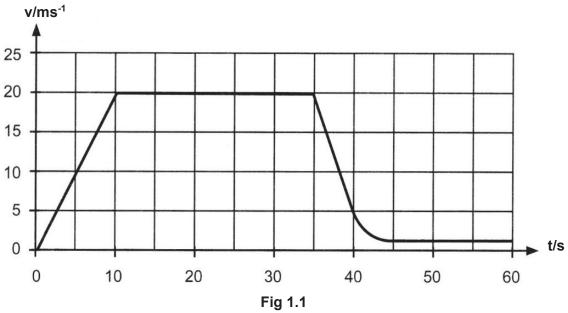
The number of marks is given in brackets [] at the end of each question or part question.

For Exam	iner's Use
Section A	
Section B	
Total	

This document consists of 17 printed pages (including cover page).

SECTION A [45 MARKS] Answer all the questions in the spaces provided.

1 Fig.1.1 below shows the velocity-time graph of a 900 kg car travelling on a straight horizontal road for the first sixty seconds of its journey.



- (a) Calculate, for the first 10 seconds,
 - (i) the acceleration of the car,

(ii) the resultant force acting on the car.

(b) State how the braking force relates to the forward driving force,(i) from t = 35 s to t = 45 s and
(ii) between $t = 45 \text{ s}$ to $t = 60 \text{ s}$.
[2]
(c) Determine the total distance travelled by the car during the first 30 s of its journey.
total distance = m [2]

2 Fig. 2.1 shows a stone supported by two strings that hang from a rod. The tensions in the two strings are 1.3 N and 2.0 N.

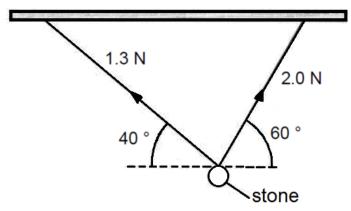


Fig. 2.1 (not drawn to scale)

In the space below, draw a labelled diagram to show the resultant force of the two tensions. Determine the size of the resultant force and the angle between the resultant force and the horizontal.

scale = 1 cm to	Ν
resultant force =	N
angle =[5]

Fig 3.1 shows a barrier found in most carparks. The barrier is in equilibrium. The weight of the pole is 450 N and the centre of gravity of the pole is 1.30 m away from the pivot.

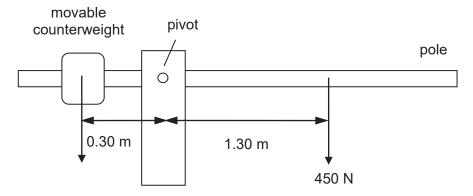


Fig. 3.1

- (a) The centre of gravity of the movable counterweight is 0.30 m away from the pivot.
 - (i) Calculate the weight of the counterweight.

(ii) Hence, calculate the mass of the counterweight.

(b) Calculate the amount of force acting on the pivot.

(c) Describe and explain how the gate can be opened.

4 Fig. 4.1 shows a toy car of mass 1.00 kg on a smooth track. The toy car which is given a slight push starts to move with an initial speed of 2.00 m/s down a smooth track.

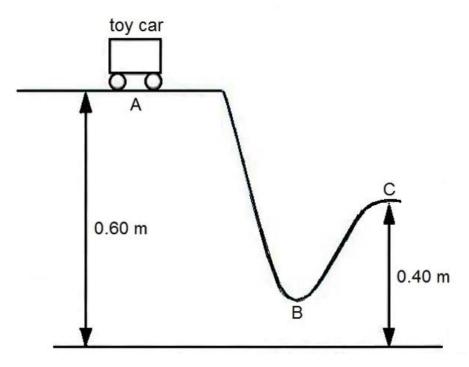


Fig 4.1

(a)	State the Principle of Conservation of Energy.
	[2]
(b)	State and explain at which point on the track would the speed of the toy car be at its maximum.
	[2

(c)	(i)	Calculate the gravitational potential energy of the toy car at point C .
		gravitational potential energy = J [1]
	(ii)	Hence, determine the speed of the toy car at C .
		speed = m/s [2]
		oposa

5 (a) Fig. 5.1 shows how the temperature of an unknown solid substance varies when heated over a Bunsen flame.

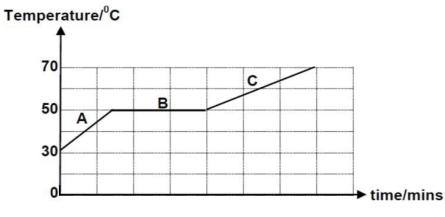
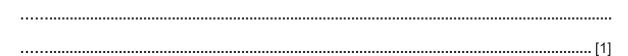


Fig. 5.1

	(i) Name the process taking place during stage B .	[1]
	(ii) Describe the movement of the particles at stage C.	
	(iii) Describe the arrangement of the particles at stage A .	[1]
		[1]
(b)	Explain why a pot of water boils faster with a covered lid.	

6 Fig. 6.1 shows a rectangular glass block, **PQRS**, with a refractive index of 1.50. A light ray is incident on the side **PS** of the glass block as shown.

(a) What is meant by the phrase refractive index of 1.50?



(b) A ray of light is incident on the side PS at 75° and is refracted into the glass block at 40°.

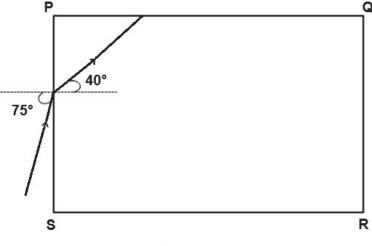


Fig. 5.1

(i) Show that the refractive index of the glass block is 1.50.

[1]

(ii) Calculate the critical angle of the glass block.

(iii) Complete the path of the light ray until it emerges into the air again. Label all the angles clearly.

[2]

7 (a) A beam of light is travelling parallel to the axis of a thin lens, as shown in Fig. 7.1. Point **F** is the focal point of the lens.

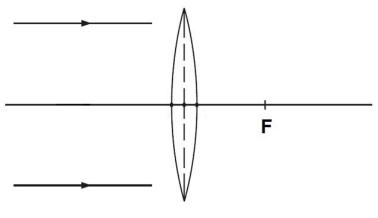


Fig. 7.1

On Fig. 7.1, complete the paths of the two rays after passing through the lens.

[2]

(b) In this part of the question, you are required to draw an accurate ray diagram using the grid on Fig. 7.2 for the lens in part (a).

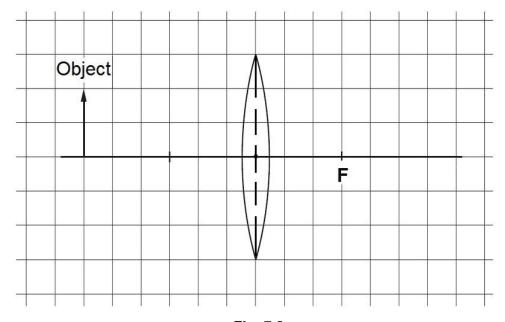


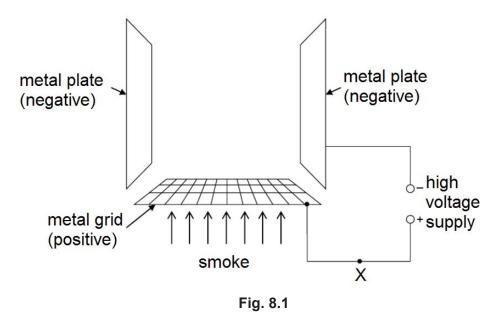
Fig. 7.2

(i) On the diagram, draw two rays from the top of the object through the lens to locate the position of the image. Label the image "I" beside it. [2]

(ii) From your diagram, state one similarity about the image and the object.

•••••	 	
		[4]

Fig. 8.1 shows an arrangement that is used to remove dust particles from the smoke in a factory chimney.



When smoke passes through the metal grid, this results in the dust particles having a net positive charge.

(a) Explain what happened to the dust particles as they pass through the metal grid.

	[2]
/b\	
(D)	If 6.0 C of charges flow past point X in 1.0 minute, calculate the current flowing through X .

current = A [1]

SECTION B [20 MARKS]

Answer ANY TWO questions from this section.

9 Fig. 9.1 shows a metal cylinder which contains 0.000 46 m³ of oil. The total mass of the cylinder and the oil is 1.2 kg. The mass of the cylinder is 0.800 kg and the space above the oil is air. The gravitational field strength is 10 N/kg.

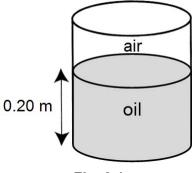


Fig. 9.1

(a)	State two	differences	between	the mass	and the	weight of	a substance.
-----	------------------	-------------	---------	----------	---------	-----------	--------------

Difference 1:	
Difference 2:	
	[2]

(b) Calculate the weight of the oil.

(c) Calculate the density of the oil in SI unit.

(d)	Cal	culate the pressure exerted by the oil on the base of the cylinder in SI unit.
		pressure =[2]
(e)	the	te and explain how the values of each of the following quantities would change when cylinder and the oil is brought to the Moon, where the gravitational field strength is uced.
	(i)	density of oil.
		[1]
	(ii)	pressure exerted by the oil on the base of the cylinder.
		[2]

10 (a) A boy holds the loose end of a long rope which is fixed to a pole.

He moves it up and down at a rate of 20 complete oscillations in every 50 seconds.

Fig. 10.1 shows a section of the wave moving along the rope.

vertical displacement / cm

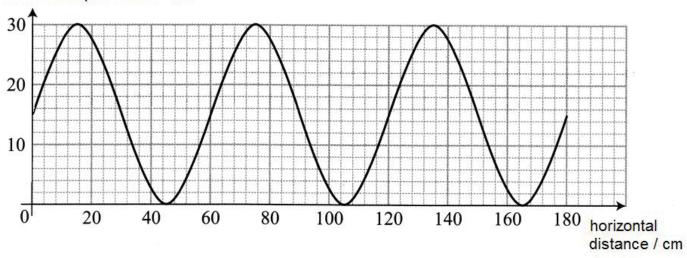


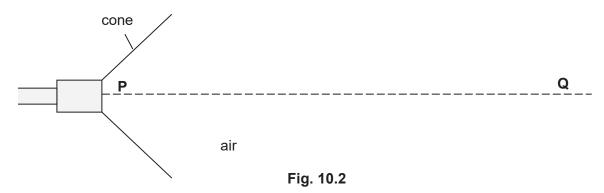
Fig. 10.1

(i) State the value of the amplitude of the wave.

(ii) Calculate the frequency of the wave.

(iii) Calculate the speed of the wave.

(b) Fig. 10.2 shows the cone of a loudspeaker that is producing sound waves in air. At any given moment, a series of compressions and rarefactions exist along the line **PQ**.



The sound wave experience a rarefaction at P.

(i)	On Fig 10.2, draw the wave lines to represent two wavelengths of compressions and	1
	rarefactions between P and Q .	
	Use the letter ${\bf C}$ to mark ${\bf two}$ compressions and the letter ${\bf R}$ to mark ${\bf two}$ rarefactions	
	along PQ .	[2]

(ii)	With reference to the sound wave travelling along PQ in Fig. 10.2, explain what is meant by a <i>longitudinal</i> wave.	
		. [1]

(iii) To the right of **Q**, there is a large vertical wall 50 m in front of the loudspeaker. The speed of sound in air is 340 m/s.

Calculate the time taken for the echo to return to **P**.

time taken =[2]

11 (a) Fig. 11.1 below shows an electrical circuit with a lamp and two resistors

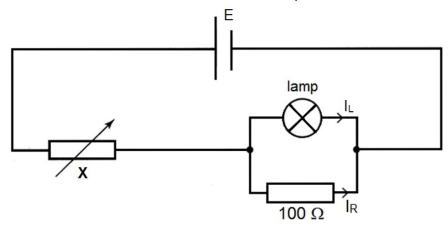


Fig. 11.1

(i) Name the component X.

.....[1]

Fig. 11.2 shows the graph of current against potential difference for the lamp **alone**. The potential difference across the lamp is 4.0 V.

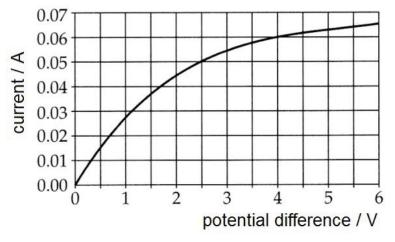


Fig. 11.2

Determine

(ii) the current in the lamp, I_L.

$$I_L = \dots [1]$$

(iii) the current in the 100 Ω resistor, I_R.

$$I_R =$$
 [2]

(iv) the current in component X.

Apply past knowledge to new situations

16

(b) Fig. 11.3 shows a type of electromagnetic lock in a door.

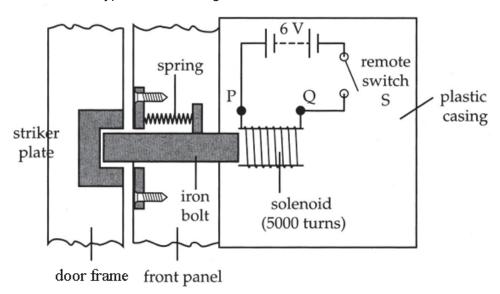


Fig. 11.3

When switch S is closed, the iron bolt moves to the right and out of the striker plate, allowing the door to be opened.

(i)	Explain why the iron bolt moves to the right and into the solenoid when the switch is closed.
	[3]
(ii)	After using the electric lock for a year, the 6 V battery goes "flat" and its e.m.f. drops to 4 V.
	Why the electromagnetic lock does not work now?
	[2]

**** END OF PAPER 2 ****

[1 for working]

2018 Preliminary Examination Marking Scheme [Sec. 4 Express / 5 Normal (Academic) 5076 Science Physics Paper 2]

SECTION A [45 MARKS]

1 (a) (i) acceleration,
$$a = \frac{v - u}{t} = \frac{20 - 0}{10}$$

 $= 2.0 \text{ m/s}^2$ [1 for ans]

(ii) resultant force,
$$F_R = ma = (900)(2.0)$$
 [1 for working]
= 1 800 N [1 for ans]

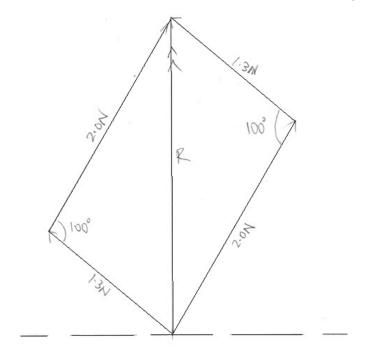
- (b) (i) From t = 35 s to t = 45 s, the <u>braking force is greater than the forward driving force</u>. [1]
 - (ii) Between t = 45 s to t = 60 s, the braking force is equal to the forward driving force.

(c) Total distance =
$$\frac{1}{2}(10)(20) + (20)(20)$$

= 100 + 400 [1 for working]
= $\frac{500 \text{ m}}{}$ [1 for ans]

[Maximum = 2 for correct length of arrows]
 [To deduct 1 mark for lack of arrows or wrong arrow]
 [To deduct 1 mark for lack of angles or wrong angle between arrows]

Suitable scale = $\frac{1 \text{ cm to } 0.2 \text{ N}}{1 \text{ resultant force}}$ [1] resultant force = $\frac{2.56 \pm 0.02 \text{ N}}{1 \text{ nge}}$ [1 for value within range] angle of resultant with horizontal = $\frac{90^{\circ} \pm 1^{\circ}}{1 \text{ nge}}$ [1 for angle within range]



3 (a) Using Principle of Moments,

(i) W x 0.30 m = 450 N x 1.30 m [1 for working]
W =
$$\frac{450 \times 1,30}{0.30}$$

= 1950 N [1 for ans]

(ii) Using W = mg

$$m = \frac{W}{g}$$

$$= \frac{1950}{10}$$

$$= \underline{195 \text{ kg}}$$
 [1 for working & ans]

- (b) Force on pivot = 1950 N + 450 N = <u>2400 N</u> [1 for working & ans]
- (c) The gate can be opened by shifting the counterweight further away from the pivot.

 (OR shift to the left).

so the <u>counterclockwise moment</u> produced by the force of the counterweight is <u>larger</u> than the <u>clockwise moment</u> produced by the weight of the pole. [1]

4 (a) Energy cannot be created or destroyed.

It can only be converted from one form to another; [1] the total energy of an isolated system is constant. [1]

(b) At <u>point B</u>. [1]

At this point the **change in height of the toy car is the greatest** and the largest amount of GPE would have been converted to KE and thus the car would be at the greatest speed.

[1]

(c) (i) GPE at point C = mgh
=
$$(1.00)(10)(0.40) = 4.0 \text{ J}$$
 [1 for working & ans]

(ii) Total energy at point **A** = KE at point **A** + GPE at point **A**
=
$$\frac{1}{2}$$
 mv² + mgh
= $\frac{1}{2}$ (1.00) (2.00)² + (1.00)(10)(0.60)
= 2.0 + 6.0 = **8.0 J** [1 for working & ans]

Total energy at point **A** = GPE at point **C** + KE at point **C**

$$8.0 = \text{mgh} + \frac{1}{2} \text{mv}^2$$

 $8.0 = (1.00)(10)(0.40) + \frac{1}{2} \text{mv}^2$
 $8.0 - 4.0 = \frac{1}{2} (1.00) \text{v}^2$
 $\text{v} = (\sqrt{8.0})$
 $= 2.83 \text{ m/s}$ [1 for ans & unit]

[allow ecf from (c)(i)]

- 5 (a) (i) melting [1]
 - (ii) During stage **C**, the molecules are <u>sliding past one another</u>. [1]
 - (iii) The molecules at stage **A** are **closely packed together**. [1]
 - (b) With a covered lid, it reduces heat loss to the surroundings by:
 - o prevents convection current from forming.
 - o reducing evaporation from the water surface,
 - reducing conduction through the layer of trapped air between the water and the lid.
 [any TWO answers, 1 mark each, max = 2]
- 6 (a) "refractive index of 1.50" shows that
 the <u>ratio</u> of the <u>sine of the incident angle</u> to the <u>sine of the refracted angle is 1.50</u> OR
 Ratio of the <u>speed of light in vacuum</u> to the <u>speed on light in the medium is 1.50</u>. [1]
 - **(b) (i)** Refractive index, $n = \frac{\sin i}{\sin r} = \frac{\sin 75^{\circ}}{\sin 40^{\circ}}$

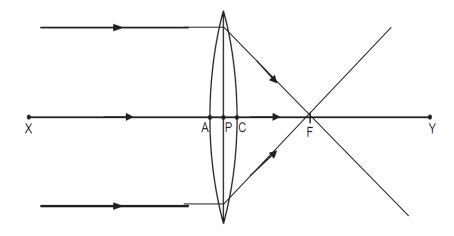
(ii)
$$n = \frac{1}{\sin c}$$

$$1.50 = \frac{1}{\sin c}$$
 [1 for working]

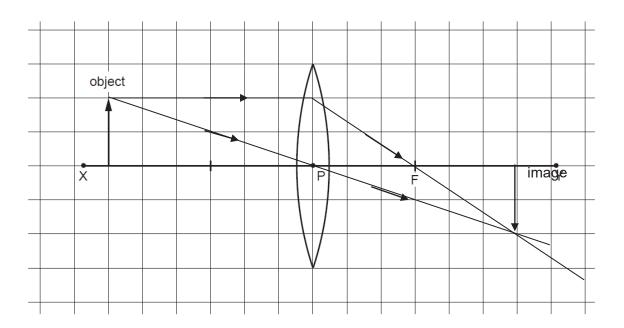
$$c = \sin^{-1}\left(\frac{1}{1.50}\right)$$

$$= 41.8^{\circ}$$
 [1 for ans]

- (b) (iii) [1 for Total Internally Reflected ray, angle 50°, at side PQ] [1 for emergent ray at side QR, angle = 75°]
- 7 (a) [1 mark for each ray converging onto F on the right after passing through the lens]
 [max = 2 marks]



(b) (i) [1 mark for each ray, max = 2 marks]



- (ii) The <u>object distance is the same as the image distance</u>. OR

 The <u>size of the image is the same as the size of the object</u>. [1]
- 8 (a) When the dust particles come into contact with the grid, they lose electrons to the grid [1]. Thus the particles will have less negative charges than positive charges and end up with a net positive charge and this cause it to be attracted to the metal plate. [1]

(b) Using I = Q / t =
$$6.0 / (1 \times 60) = 0.10 \text{ A}$$

[1 for working & ans]

SECTION B [2 X 10 = 20 MARKS]

9 (a) [Any TWO answers. 1 mark each. Maximum = 2]

Mass	Weight
A measure of the amount of matter in	The force of gravitational attraction on
an object.	an object.
SI unit: kilogram (kg)	SI unit: newton (N)
Measured with a beam balance.	Measured with a spring balance.
Mass remains unchanged when it is	Weight changes when it is moved to
moved to another place with different	another place with different gravitational
gravitational attraction.	attraction.

(b) Using W = mg
=
$$(1.2 - 0.800)(10)$$

= **4.0 N**

[1 for working, ans & unit]

(c) Using density =
$$\frac{m}{V} = \frac{0.400}{0.00046}$$

[1 for working]

 $= 870 \text{ kg/m}^3$

[1 for ans & unit]

(d) Using P =
$$\frac{F}{A} = \frac{4.0}{\left(\frac{0.00046}{0.20}\right)}$$

[1 for working]

= <u>1740 Pa</u>

[1 for ans & unit]

- (e) (i) Density <u>does not change</u>. Since <u>Density = Mass / Volume</u>, both the <u>mass and volume of the liquid does not change</u>. [1]
 - (ii) Pressure will be reduced.

[1]

According to P = F/A, weight W (= F) of the liquid is smaller on Moon with base area remains constant. [1]

[1]

(ii) frequency, f = no of oscillations / time

= 20 / 50

[1 for working]

= <u>0.40 Hz</u>

[1 for ans & unit]

(iii) Using $v = f \lambda$

 $v = 0.40 \times 60$

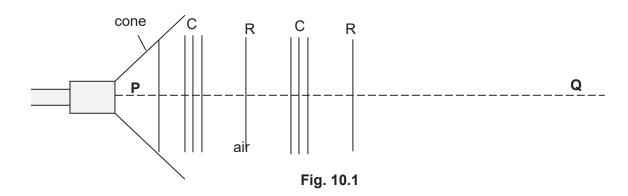
[1 for working]

= 24 cm /s or 0.24 m/s

[1 for ans & unit]

[allow ecf from (a)(ii) for value of frequency]

(b) (i) lines = 1 mark
Labelling of C and R = 1 mark



(ii) The sound wave <u>travels in the direction</u> (along PQ)<u>parallel to the direction of the vibration</u> of the air molecules. (along PQ). [1]

(iv) Time =
$$\frac{2 \times \text{distance}}{\text{speed}} = \left(\frac{2 \times 50}{340}\right)$$
 [1 for working]

= <u>0.29 s (accept 0.294 s)</u> [1 for ans & unit]

11 (a) (i) Rheostat or variable resistor [1]

(ii) (From the graph) current
$$I_L = 0.060 A$$
 [1 for ans & unit]

(iii) Using V = IR $\text{current I}_{R} = \frac{V}{R} = \frac{4.0}{100}$ [1 for working] = 0.040 A [1 for ans & unit]

(iv) current
$$I_X = 0.06 + 0.04$$

= 0.10 A [1 for ans & unit]

(b) (i) When the switch is closed, the solenoid becomes an electromagnet. [1]
 The iron bolt is then attracted to the solenoid due to magnetic induction. [1]
 This strong attractive force will overcome the force of the spring and cause the lock to be unlocked. [1]

(ii) At 4 V, there is <u>little current flowing through the solenoid</u>. [1]
 Therefore <u>the magnetic field strength of the solenoid is too weak to attract the iron bolt</u>. [1]

Name: Class: Index No Class:



BUKIT BATOK SECONDARY SCHOOL

GCE O LEVEL PRELIMINARY EXAMINATION

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

SCIENCE
Paper 3 Chemistry

5076/03 15 August 2018 1030 – 1145 h

1 hour 15 minutes

Candidates answer on the Question Paper. No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided at the top of this page.

Write in dark blue or black pen

You may use a pencil for any diagrams, graphs or rough working

Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer all questions in the spaces provided.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer any two questions.

Write your answers in the spaces provided on the question paper.

Electronic calculators may be used.

A copy of the Data Sheet is printed on page 18.

A copy of the Periodic Table is given at the end of the paper.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use					
Section A					
Section B					
Total					

Section A [45 marks]

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

- **1** Fig. 1.1 shows the composition of unpolluted, dry air.
 - (a) Write in the missing name of the gas which occupies 78% of air.

[1]

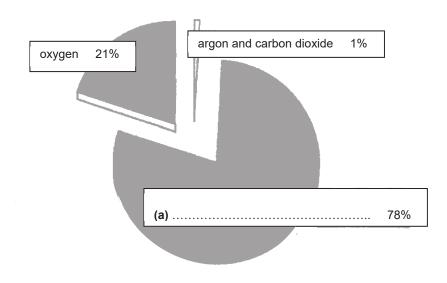


Fig. 1.1

(b)	Name two gases that pollute the atmosphere and name the chemical source of
	each.

Gas 1	 	 	 	 	 	
Source	 	 	 	 	 	
Gas 2	 	 	 	 	 	
Source	 	 	 	 	 	
	 	 	 	 	 	 [4]

2 A student collected some water from a polluted river. The water contains some soluble solids and insoluble clay.

(a) State a method that can separate the clay from the rest of the water.

(b) The student then boiled the river water to obtain the soluble solids. Fig. 2.1 shows how she heated the water.

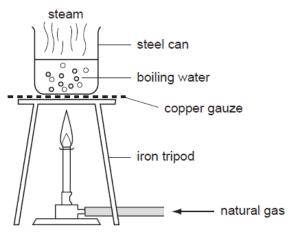


Fig. 2.1

The student wrote in her practical sheet that "the boiled river water is pure because the universal indicator remains green when it is added to the boiled river water."

	Do you agree with her statement? Explain.	
		[1]
(c)	On cooling, steam will condense. Describe what happens to the spacing and movement of the particles of steam during condensation.	
	changes to spacing	
		• • • •
	changes to movement	
		[2]

	A li	st of	chemica	als from a science lab	oratory is show	n below:	
				ammonium nitrate, anhydrous sodium			
	(a)			st of chemicals provid aking a cold pack in a		=	icals that can be
							[1]
	(b)	Exp	olain you	r answer in (a) and s	tate the type of	energy change.	
							[2]
	Λ -	- 14:		de esta UNO de esta		£ 400 m/slm 3	
1	A s	oluti	on of nit	ric acid, HNO₃, has a	concentration o	if 126 g/dm ³ .	
	(a)	(i)		ate the relative molec re atomic masses, <i>A</i> r			
			-			-	
				rela	tive molecular m	nass =	[1]
		(ii)	Calcula	ate the concentration	of the solution ir	n mol/dm³.	
					concentra	tion =	[1]

Cold packs are used to reduce swelling, inflammation and pain by removing the heat.

(b)	Ма	gnes	ium carbonate reacts with this solution of nitric acid as follows: MgCO₃ + 2HNO₃ → Mg(NO₃)₂ + H₂O + CO₂
		(i)	What mass of magnesium carbonate react with 500 cm³ of nitric acid?
			Mass of magnesium carbonate =[2]
		(ii)	Find the volume of carbon dioxide gas produced in this reaction.
			Volume of carbon dioxide =[1]
	(c)		other nitric acid solution is made by diluting 1.0 mol to make 2.0 dm ³ of solution. at is the concentration of this solution in mol/dm ³ ?
			concentration[1]

5 Fig. 5.1 shows the properties of some elements in Group VII.

Properties	X	Y	lodine
melting point / °C	- 7.2	- 101.0	114.0
boiling point / °C	58.8	- 35.0	184.0
reaction with aqueous potassium iodide	colourless solution turns brown	colourless solution turns brown	
reaction with cold aqueous sodium hydroxide	reacts quickly and less vigorously to form a colourless solution	reacts rapidly and vigorously to form a colourless solution	reacts slowly to form a colourless solution

Fig. 5.1

(a)	Sta	te the physical state and colour of Y at room temperature and pressure.
		[1]
(b)	Usi	ng evidence from Figure 5.1, explain and deduce the identity of X .
		[3]
(c)	lod	ine reacts with cold aqueous sodium hydroxide according to the equation: 2NaOH + I_2 \rightarrow Na I + NaO I + H_2 O
	(i)	Explain why both element X and Y undergoes similar reaction with cold aqueous sodium hydroxide.
		[1]
	(ii)	Hence, construct a chemical equation for the reaction between element X and cold aqueous sodium hydroxide.
		[1]

6 Equal masses of lumps of lead (II) carbonate were reacted with three different acids of the same concentration in three separate experiments I, II and III. The acids were in excess and all other conditions were kept the same.

Experiment	Reagents			
I	Lead (II) carbonate	Nitric acid		
II	Lead (II) carbonate	Sulfuric acid		
III	Lead (II) carbonate	Ethanoic acid		

The mass of the lead (II) carbonate was measured and calculated at regular time intervals and the results for experiments I and II are shown in Figure 6.1.

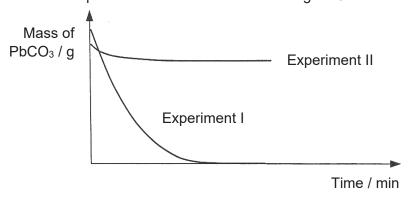


Fig. 6.1

(a)		ng Fig. 6.1, determine if lead (II) carbonate react completely with sulfuric acid. plain your answer.
		[1]
(b)	(i)	In experiments I and III, would ethanoic acid react faster than nitric acid? Explain your answer in terms of hydrogen ions in the acids.
		[2]
	(ii)	Lead (II) ethanoate is a white, crystalline substance with a sweetish taste and is

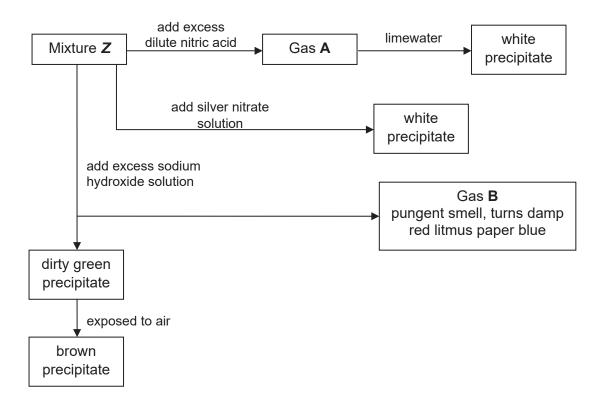
soluble in water.

[1]

Sketch on the same axes above, the result for experiment III.

	(C)	lead (II) carbonate.	
7	Dro	nano and propono are both organic compounds	
7	Pro	pane and propene are both organic compounds.	
	(a)	Compare how they react, if at all, with (i) oxygen, (ii) hydrogen.	
			[5]
	(b)	Write a chemical equation for any one of these reactions.	
			[1]

A mixture **Z** was made by dissolving two salts, **X** and **Y**, in water. A series of reactions was carried out on mixture **Z** as shown below.



(a) Identify the **four** ions that are present in mixture **Z**. Justify your answers.

lons	Formula	Reasons
1		
2		
3		
4		

[4]

(D)	of mixture Z .
	[1]
(c)	No reaction was observed when ammonia solution was added to aqueous solution of salt $\emph{\textbf{Y}}$.
	Give the names of salts X and Y .
	X :
	Y:[2]

- End of Section A -

Section B [20 marks]

Answer any two questions.

Write your answers in the spaces provided on the question paper.

9 Fig. 9.1 shows the structures of calcium chloride and chlorine gas.

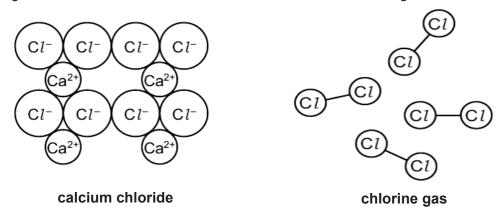


Fig. 9.1

(a)	Chlorine exists as two isotopes, 35 C l and 37 C l .
	Describe the similarities and differences between these two isotopes.
	[3]
(b)	Calcium reacts with chlorine atoms to form calcium chloride.
()	Fig. 9.2 shows the physical properties of calcium chloride and chlorine.

	conductivity	boiling point/ °C
calcium chloride	conducts in molten state but not in solid state	1935
chlorine gas	does not conduct electricity	-34

Fig. 9.2

(i) Predict and explain the electrical conductivity of strontium chloride.	
[2	2]

(11)	chloride. Your answer should include: electronic structures of atoms force of attraction in the compound
	[3]
(iii)	Give a reason why chlorine gas has such a low boiling point.
	[2]
	[Total : 10 marks]

10 (a) Duralumin is an alloy made up mainly of aluminium and copper atoms.

Fig. 10.1 shows how the strength of duralumin changes with the different percentage of copper added.

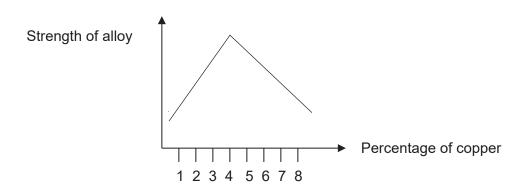


Fig. 10.1

(i)	Using the information from Figure 10.1, estimate the percentage of copper that will produce the strongest duralumin mixture.
	[1]
(ii)	Explain, with the aid of a well-labelled diagram of duralumin, why it is stronger than pure aluminium.

(b) Fig. 10.2 shows the results of an experiment in which four metals are placed in solutions of other metal nitrates.

Solution		Metals added			
Metal nitrate	Colour	Calcium	Chromium	Cobalt	Copper
Calcium nitrate	Colourless	No reaction	No reaction	No reaction	No reaction
Chromium (III) nitrate	Green	Colourless solution and grey solid	No reaction	No reaction	No reaction
Cobalt (II) nitrate	Pink	Colourless solution and grey solid	Green solution and grey solid	No reaction	No reaction
Copper(II) nitrate	blue	Colourless solution and reddish- brown solid		Pink solution and reddish- brown solid	No reaction

Fig. 10.2

i) <i>i</i>	Arrange the four metals in order of their reactivity starting with the most reactive.
	[1]
ii) F	Predict two observations when chromium is added to copper(II) nitrate solution.
	[2]

(c) One possible chemical reaction between metal Y and the solution of salt X is as follows:

$$Y + X(NO_3)_2 \rightarrow X + Y(NO_3)_2$$

(i) Complete the table below with the missing information.

formula	oxidation state of Y
Y	
Y (NO ₃) ₂	

[2]

(ii)	Using the	data above,	explain whe	ther Y is an o	oxidizing or a	reducing agent.	
							[2]
							[4]

[Total : 10 marks]

11 Poly(methyl methacrylate) is formed by addition polymerisation. Its structure is shown below.

(a) (i) Draw the structure of the monomer of poly(methyl methacrylate).

(ii) Explain why and how the monomer drawn in (a)(i) can undergo addition polymerisation to form poly(methyl methacrylate).

- **(b)** Ethanol can be obtained from glucose through the process of fermentation. One of the conditions of this process is having an anaerobic environment. Otherwise, substance **X** will be produced instead.
 - (i) Write the chemical equation for fermentation of glucose. [1]
 - (ii) Draw the structural formula of substance X.

[1]

[1]

(iii)	Describe a laboratory experiment to differentiate ethanol and substance X .
	[3]
(iv)	A student carries out fermentation in a laboratory. To speed up the process, he heats up the mixture to 100 °C. Explain why he will not obtain ethanol.
	[1]
(v)	State one use of ethanol.
	[1]
	[Total : 10 marks]

- End of Paper -

DATA SHEET

Colours of some common metal hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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DATA SHEET The Periodic Table of Elements

	0	2	He	Helium 4	10	Ne	Neon	20	18	Ā	Argon	40	36	ž	Krypton	84	54	Xe	Xenon	131	98	R	Radon	ı				
	IIA				6	ш	Fluorine	19	17	7	Chlorine	35.5	35	Ā	Bromine	SO.	53	_	lodine	127	85	Αt	Astatine	ı				
	IN				80	0	Oxygen	16	16	တ	Sulfur	32	34	Se	Selenium	6/	52	Те	Tellurium	128	84	Ро	Polonium	ı	116	^	Livermorium	ı
	^				7	Z	Nitrogen	14	15	_	Phosphorus	31	33	As	Arsenic	(2)	51	Sb	Antimony	122	83	Ö	Bismuth	500				
	N				9	ပ	Carbon	12	14	S	Silicon	28	32	Ge	Germanium	7.3	20	Sn	Тi	119	82	Pb	Lead	207	114	J.	Flerovium	ı
	=				2	Ω	Boron	11	13	₹	Aluminium	27	31	Ga	Gallium	/ 0	49	므	Indium	115	81	È	Thallium	204				ı
													30	Zu	Zinc	co	48	ဝ	Cadmium	112	80	Hg	Mercuny	201	112	c	Copernicium	ı
													29	D C	Copper	94	47	Ag	Silver	108	62	Αn	Gold	197	111	Rg	Roentgenium	1
dn													28	Z	Nickel	29	46	Pd	Palladium	106	78	చ	Platinum	195	110	Ds	Damstadtium	-
Group													27	ပိ	Cobalt	58	45	묎	Rhodium	103	77	<u>-</u>	Iridium	192	109	Mt	Meitnerium	I
		1	I	Hydrogen 1									26	Ь	no L	90	44	Ru	Ruthenium	101	9/	Os	Osmium	190	108	Hs	Hassium	-
					•								25	M	Manganese	22	43	ဍ	Technetium		22	Re	Rhenium	186	107	Bh	Bohrium	-
					Jer								24	ပ်	Chromium	25	42	Mo	Molybdenum	96	74	>	Tungsten	184	106	Sg	Seaborgium	-
				Key	proton (atomic) number		atomic symbol						23	>	Vanadium	2.1	41	qN	Niobium	93	73	Та	Tantalum	181	105	Op	Dubnium	ı
					proton (a	1	atom						22	F	Titanium	48	40	Zr	Zirconium	91	72	Ŧ	Hafnium	178	104	ጟ	Rutherfordium	-
				L									21	လွ	Scandium	45	39	>	Yttrium	89	57 – 71	lanthanoids			89 – 103	actinoids		
	=				4	Be	Beryllium	6	12	Mg	Magnesium	24	20	Ça	Calcium	40	38	ഗ്	Strontium	88	99	Ва	Barium	137	88	Ra	Radium	1
	_				က	=	Lithium	7	11	Na	Sodium	23	19	¥	Potassium	39	37	Rb	Rubidium	85	22	S	Caesium	133	87	ŗ	Francium	ı

71	r	Lutetium	175	103	۲	Lawrencium	ı
70	Υp	Ytterbium	173	102	Š	Nobelium	ı
69	T	Thulium	169	101	Md	Mendelevium	I
89	ш	Erbium	167	100	Fm	Fermium	I
29	우	Holmium	165	66	Es	Einsteinium	ı
99	D	Dysprosium	162	86	Ç	Californium	ı
99	Д	Terbium	159	26	쑮	Berkelium	ı
64	Вd	Gadolinium	157	96	CH	Curium	ı
69	En	Europium	152	<u> </u>	Am	Americium	1
62	Sm	Samarium	150	94	Pu	Plutonium	-
19	Pm	Promethium	147	66	dN	Neptunium	I
09	N	Neodymium	144	76		Uranium	238
29	P	Praseodymium	141	91	Ра	Protactinium	231
28	Ce	Cerium	140	06	ц	Thorium	232
22	La	Lanthanum	139	88	Ac	Actinium	ı
	lanthanoids				actinoids		

The volume of one mole of any gas is $24\ dm^3$ at room temperature and pressure (r.t.p.).

Bukit Batok Secondary School Sec 4 Express, 5 Normal (Academic) Science (Chemistry)

PRELIMINARY EXAMINATIONS 2018 ANSWERS

Paper 1: Multiple Choice Questions (20 marks)

21 D Sugar = C ₆ H ₁₂ O ₆ where carbon, hydrogen and oxygen atoms are bonded together Conc sulfuric acid H ₂ SO ₄ dries acidic gases (so they don't react). Upward delivery is used to collect gases which are less dense that the SO ₄ will react with conc H ₂ SO ₄ though it can be collected via upw CO ₂ , H ₂ and O ₂ will not react with conc H ₂ SO ₄ thus can be dried	
Upward delivery is used to collect gases which are less dense that the Collect gases which are less dense that NH ₃ will react with conc H ₂ SO ₄ though it can be collected via upw CO ₂ , H ₂ and O ₂ will not react with conc H ₂ SO ₄ thus can be dried	
Only H ₂ is less dense than air to be collected via upward delivery	& collected.
23 C Melting point of substance is to be <-150°C and boiling point <-10	00°C.
24 C Different substances have different solubility in different solvents.	
25 D Y – from Group VI because it has 6 valence electrons Z – from Group VII because it gas 7 valence electrons	7
B Hydroxide ion = OH There are 8 protons in oxygen and 1 proton in hydrogen atoms = F- ion has 9 protons (each fluorine atom has 9 protons, it takes in form a fluoride ion, proton number is not affected thus remains the	1 electron to
27 B Rubidium chloride is made up of Rb and Ct ions thus RbCl. Group I metals have low melting point and are soluble in water.	
28 D Acidic oxide (CO ₂) and amphoteric oxides (Al ₂ O ₃ and ZnO) can rewhich is a base.	react with NaOH
R is a solid which can react with solution S in a neutralisation react Thus R = insoluble metal oxide (le a solid) and S = acid (solution)	
BaCl ₂ gives white precipitate = SO ₄ ² present White precipitate soluble in excess aq NH ₃ = Zn ²⁺ ion present	
No of moles of Mg $=$ mass $=$ molar mass $=$ 6g \div 24 $=$ 0.250 mol 1 mol Mg produces 1 mol H ₂ Volume of H ₂ $=$ no of moles x molar volume = 0.250 mol x 24 dm ³ $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$	
D Fe ₂ O ₃ + 3CO → 2Fe + 3CO ₂ Answer is NOT (B) because <u>LIME</u> is used to remove acidic impur limestone. <u>LIME</u> is produced of heat limestone. CaCO ₃ → CaO + CO ₂ CaO + SiO ₂ → CaSiO ₃	rities, not
33 D 30% of O ₂ will be used up, 70% of air left.	
(A) formation of bond = exothermic (B) rusting = exothermic (C) melting (ice absorb heat) = endothermic (D) H ₂ combust in O ₂ to form H ₂ O = exothermic	_
D Na atom (2.8.1) loses 1 electron to form Na ⁺ ion (2.8). Loss of electrons = oxidation	
36 B ½ volume of CO ₂ produced , thus ½ mass of limiting reactant (Mg	gCO ₃) used.

1

37	Α	Smallest molecules = lowest boiling point range
38	С	Complete combustion produce carbon dioxide and water.
39	С	Oxidation of ethanol to ethanoic acid produces water.
40	В	It has C=C and carboxyl group (COOH).

Paper 3 Section A: Short Answer Questions (45 marks)

sliding past one another in random motion.

Ammonium nitrate and water

3a.

1a. Nitrogen 1m

1b. Gas: Sulfur dioxide (sulfur trioxide)

Source: Burning of coal in power stations / factories

Gas: Carbon monoxide

Source: Incomplete combustion of carbon-containing fuels in vehicles

Gas: Oxides of nitrogen

Source: Produce when oxygen and nitrogen react at high temperature

gas 1m when fuel is burned/combusted in vehicle engine ource 1m

2a. filtration

2b. No. no mark The purity of the liquid is determined by the fixed boiling point.

The universal indicator remains green can only prove that the liquid has

a neutral pH (pH 7).

The universal indicator can only prove whether the solution is acidic or alkaline, but cannot show whether the water is pure. either 1m

2c. Changes to spacing The spacing decreases, from moving far apart to closely packed. 1m

Changes to movement The movement slows down, from moving randomly at high speeds to

3b. Endothermic. 1m

When ammonium salts react with water, the reaction take in / absorb energy from surrounding, causing surrounding temperature to drop / decrease. 1m

4ai. $M_{\rm r}$ of HNO₃ = 1 + 14 + 3(16) = 63 1m

4aii. Concentration of HNO₃ = concentration in g/mol ÷ molar mass = 126 g/mol ÷ 63 = 2.00 mol/dm³ 1m

2

1m

1m

4bi. No of moles of HNO₃ = concentration x volume $= 2.00 \text{ mol/dm}^3 \text{ x } (500/1000) \text{ dm}^3$ = 1.00 mol1m 2 mol of HNO₃ reacts with 1 mol of MgCO₃ 1.00 mol of HNO₃ reacts with 0.500 mol of MgCO₃ Mass of $MgCO_3$ = no of moles x molar mass 1m ecf if 1st 1m = 0.500 mol x [24 + 12 + 3(16)]= 42 gwrong overall -1 if any answer not in 3sf 4bii. 2 mol of HNO₃ produces 1 mol of CO₂ 1.00 mol of HNO₃ produces 0.500 mol of CO₂ Volume of CO₂ = no of moles x molar volume $= 0.500 \text{ mol } \times 24 \text{ dm}^3$ = <u>12 dm³</u> 1m 4c. Concentration = no of moles ÷ volume $= 1.0 \text{ mol} \div 2 \text{ dm}^3$ = <u>0.500 mol/dm³</u> 1_m 5a. Pale yellow / yellowish-green gas 1m 5b. X could be bromine since it is a liquid. 1m It is more reactive than iodine since it is able to displace iodine. 1m But it is less reactive than Y since it reacts less vigorous sodium hydroxide. 1m 5ci. All of them have seven valence electrons. 1m 5cii. 2NaOH + X₂ → NaX + NaOX + H₂O (or use Br for X) 1m 6a. No. Lead (II) sulfate produced is an insoluble salt / there is mass of lead 1m (II) sulfate left. 6bi. No. Ethanoic acid is weak acid but nitric acid is a strong acid. 1m It has / produces lesser H+ ions per unit volume compared to nitric acid. 1m (Frequency of collisions is lesser thus reaction is slower) 6bii. Mass Experiment II PbCQ2 Experiment III Experiment I 1m Τ

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3

- 6c. (1) Add excess lead (II) carbonate to nitric acid. 1m (2) Filter to remove excess lead (II) carbonate. Obtain the filtrate, lead (II) nitrate. (not necessary) 1m (3) Heat lead (II) nitrate solution till saturation. Leave to cool for crystals to form. 1m (4) Filter out the crystals. Pat dry between filter papers 1m 7a. Both propane and propene reacts with excess oxygen to produce carbon dioxide and water. 1m Both undergoes incomplete combustion to produce carbon monoxide and water. 1m Propane does not react with hydrogen. 1m Propene reacts with hydrogen at (200 °C with nickel catalyst) to produce propane. 7b. $2C_3H_6 + 9O_2 \rightarrow 6CO_2 + 6H_2O$ $2C_3H_8 + 10O_2 \rightarrow 6CO_2 + 8H_2O$ $2C_3H_6 + 6O_2 \rightarrow 6CO + 6H_2O$ $2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$ $C_3H_6 + H_2 \rightarrow C_3H_8$ either egn 1m 8a. Formula Reasons lons green precipitate formed after adding Fe²⁺ sodium hydroxide which turned brown 1 over time ammonia gas produced when sedium NH_{4}^{+} 2 hydroxide is added carbon dioxide produced after adding CO_3^2 each formula nitric acid + reason 1m white precipitate formed after adding silver hitrate
- 8b. Dirty green precipitate formed which is insoluble in excess aqueous

ammonia. Turns brown on standing / when exposed to air

1m bonus 1m

total 4m

8c. X = iron (II) chloride 1m Y = ammonium carbonate 1m

Explanation:

Possible answers are

- (a) iron (II) chloride and ammonium carbonate
- (b) iron (II) carbonate and ammonium chloride

However, iron (II) carbonate is an insoluble salt (both X and Y dissolve). Also, no reaction when aq NH₃ added to Y so Y is an ammonium salt.

Paper 3 Section B: 3 Questions choose 2 (20 marks)

9a.	Both have 17 protons.	1m
	They have different number of neutron / atomic mass.	1m
	35 C l has 18 neutrons/ mass number of 35. 37 C l has 20 neutrons/mass number of 37.	1m
9bi.	Strontium chloride conducts in molten state but not in solid state. The ions $(Sr^{2+}$ and $Cl^-)$ are mobile in molten state. But they cannot move (and are fixed in positions) when in solid state.	no marks 1m 1m
9bii.	Calcium atom has an electronic configuration of 2.8.8.2. Chlorine has an electronic configuration of 2.8.7.	1m
	Each calcium atom transfers two valence electrons to 2 chlorine atoms.	1m
	Ca ²⁺ and Cl ⁻ ions are formed which are attracted by electrostatic forces of attraction.	1m
9biii.	Weak intermolecular force between chlorine molecules required little amount of energy to overcome.	1m 1m
10ai.	4%	1m
10aii.	copper atoms	
	aluminium atoms	
		1m
	Copper atoms is bigger than aluminium atoms thus they disrupt the orderly arrangement of aluminium atoms and prevent them from sliding.	1m
10bi.	Calcium > chromium > cobalt > copper	1m
10bii.	Blue solution turns green. Brown solids formed.	1m 1m
10ci.	Y: 0 Y(NO ₃) ₂ : +2	1m 1m
10cii.	It is a reducing agent.	no marks
	Y is oxidised as the oxidation state of Y increases from 0 in Y to +2 in $Y(NO_3)_2$.	1m
	Y reduces $X(NO_3)_2$ by decreasing the oxidation state of X from +2 to 0 in X.	1m

1m

At high temperature and pressure (and in the presence of a catalyst), 11aii. the carbon-carbon double bonds of the monomer break / the

1m

Each monomer forms single bonds and joins with two other monomers form the polymer, poly(methyl methacrylate).

1m

11bi. $C_6H_{12}O_6 \rightarrow 2 C_2H_5OH + 2CO_2$

11bii.

1m

Add potassium manganate(VII) to both substances. 11biii. If it turns from purple to colourless, it is substance is ethanol. 1m 1m

If it remains purple, it is substance X.

monomer has C=C bonds which break.

1m

Also accept -

Use of blue litmus paper

X turns blue litmus paper red

Blue litmus paper remains blue if its ethanol.

Add suitable metal / metal carbonate If susbstance X, effervescence seen.

H₂ produced with caused lighted splint to extinguish with pop sound (if

use metal)

CO2 produced which formed white precipitate in limewater (if use metal carbonate)

1m

When the mixture is heated, the yeast denatures and stops the reaction. 11biv.

Solvent in paints and varnishes 11bv.

Manufacture of perfumes, detergent, deodorants etc.

Found in alcoholic drinks like beer, wines and spirits

Used in preparation of ethanoic acid

(Any one)

1m

Bukit Batok Secondary School Sec 4 Express, 5 Normal (Academic) Science (Chemistry)

PRELIMINARY EXAMINATIONS 2018 ANSWERS

Paper 3 Section A: Short Answer Questions (45 marks)

1a.	Nitrogen	1m
1b.	Gas : Sulfur dioxide (sulfur trioxide) Source : Burning of coal in power stations / factories	
	Gas : Carbon monoxide Source : Incomplete combustion of carbon-containing fuels in vehicles	\bigcirc
	Gas : Oxides of nitrogen Source : Produce when oxygen and nitrogen react at high temperature when fuel is burned/combusted in vehicle engines	gas 1m source 1m
2a.	filtration	1m
2b.	No. The purity of the liquid is determined by the fixed boiling point. OR The universal indicator remains green can only prove that the liquid has a neutral pH (pH 7). OR	no mark
_	The universal indicator can only prove whether the solution is acidic or alkaline, but cannot show whether the water is pure.	either 1m
2c.	Changes to spacing The spacing decreases, from moving far apart to closely packed. Changes to movement The property laws down from the space to be specified as a specified with the space to the space	1m
	The movement slows down, from moving randomly at high speeds to sliding past one another in random motion.	1m
3a.	Ammonium nitrate and water	1m
3b.	Endothermic. When ammonium salts react with water, the reaction take in / absorb energy from surrounding, causing surrounding temperature to drop /	1m
	decrease.	1m
4ai.	$M_{\rm r}$ of HNO ₃ = 1 + 14 + 3(16) = 63	1m
4aii.	Concentration of HNO ₃ = concentration in g/mol ÷ molar mass = 126 g/mol ÷ 63 = <u>2.00 mol/dm</u> ³	1m
4bi.	No of moles of HNO₃ = concentration x volume	
	= 2.00 mol/dm ³ x (500/1000) dm ³ = 1.00 mol	1m

2 mol of HNO₃ reacts with 1 mol of MgCO₃ 1.00 mol of HNO₃ reacts with 0.500 mol of MgCO₃

Mass of MgCO₃ = no of moles x molar mass = 0.500 mol x [24 + 12 + 3(16)]= 42 g

1m ecf if 1st 1m wrong

overall -1 if any answer not in 3sf

4bii. 2 mol of HNO₃ produces 1 mol of CO₂ 1.00 mol of HNO₃ produces 0.500 mol of CO₂

Volume of CO_2 = no of moles x molar volume = 0.500 mol x 24 dm³ = 12 dm³

1m

4c. Concentration = no of moles \div volume = 1.0 mol \div 2 dm³ = 0.500 mol/dm³

1m

5a. Pale yellow / yellowish-green gas

ım

5b. X could be bromine since it is a liquid.

1m 1m

It is more reactive than iodine since it is able to displace iodine.

But it is less reactive than Y since it reacts less vigorously with sodium hydroxide.

1m

5ci. All of them have seven valence electrons

1m

5cii. 2NaOH + X₂ → NaX + NaOX + H₂O (or use Br for X)

1m

6a. No. Lead (II) sulfate produced is an insoluble salt there is mass of lead (II) sulfate left.

1m

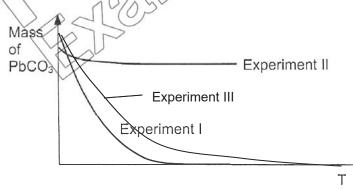
6bi. No. Ethanoic acid is weak acid but nitric acid is a strong acid.

1m

It has / produces lesser H+ ions per unit volume compared to nitric acid. (Frequency of collisions is lesser thus reaction is slower)

1m

6bii.



1m

6c. (1) Add excess lead (II) carbonate to nitric acid.

(2) Filter to remove excess lead (II) carbonate.

Obtain the filtrate, lead (II) nitrate. (not necessary)

1m 1m

(3) Heat lead (II) nitrate solution till saturation. Leave to cool for crystals to form.

1m

(4) Filter out the crystals.

Pat dry between filter papers

1m

7a. Both propane and propene reacts with excess oxygen to produce carbon dioxide and water.

1m

Both undergoes incomplete combustion to produce carbon monoxide and water.

1m

Propane does not react with hydrogen.

1m

Propene reacts with hydrogen at (200 °C with nickel catalyst) to produce propane.

1m have () 1m

7b. $2C_3H_6 + 9O_2 \rightarrow 6CO_2 + 6H_2O$ $2C_3H_8 + 10O_2 \rightarrow 6CO_2 + 8H_2O$ $2C_3H_6 + 6O_2 \rightarrow 6CO + 6H_2O$ $2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$ $C_3H_6 + H_2 \rightarrow C_3H_8$

either egn 1m

8a.

	lons	Formula	Reasons
			green precipitate formed after adding
	1	Fe ²⁺	sodium hydroxide which turned brown
			over time
	2	NH_4^+	ammonia gas produced when sodium
	2		hydroxide is added
	3	CO_3^{2-}	carbon dioxide produced after adding
	3	ιo_3	nitric acid
	1	Cl-	white precipitate formed after adding
	4	Cl	silver/nitrate

each formula + reason 1m total 4m

Dirty green precipitate formed which is insoluble in excess aqueous 8b. ammonia.

Turns brown on standing / when exposed to all

1m bonus 1m

X = iron (N) chloride 8c.

Y = ammonium carbonate

1m 1m

Explanation:

Possible answers are

- (a) iron (II) chloride and ammonium carbonate
- (b) iron (II) carbonate and ammonium chloride

However, iron (III) carbonate is an insoluble salt (both X and Y dissolve). Also, no reaction when aq NH₃ added to Y so Y is an ammonium salt.

Paper 3 Section B : 3 Questions choose 2 (20 marks)

9a.	Both have 17 protons.	1m
	They have different number of neutron / atomic mass.	1m
	35 C l has 18 neutrons/ mass number of 35. 37 C l has 20 neutrons/mass number of 37.	1m
9bi.	Strontium chloride conducts in molten state but not in solid state. The ions $(Sr^{2+}$ and $Cl^{-})$ are mobile in molten state. But they cannot move (and are fixed in positions) when in solid state.	no marks 1m 1m
9bii.	Calcium atom has an electronic configuration of 2.8.8.2. Chlorine has an electronic configuration of 2.8.7.	1 m
	Each calcium atom transfers two valence electrons to 2 chlorine atoms.	1m
	Ca ²⁺ and Cl ⁻ ions are formed which are attracted by electrostatic forces of attraction.	m
9biii.	Weak intermolecular force between chlorine molecules required little amount of energy to overcome.	1m 1m
10ai.	4%	1m
10aii.	copper atoms aluminium atoms	
		1m
	Copper atoms is bigger than aluminium atoms thus they disrupt the orderly arrangement of aluminium atoms and prevent them from sliding.	1m
10bi	Caldium > chromium > cobalt > copper	1m
10bii.	Blue solution turns green. Brown solids formed	1m 1m
10ci.	Y: Y(NO ₃) ₂ : +2	1m 1m
10cii.	It is a reducing agent.	no marks
	Y is oxidised as the oxidation state of Y increases from 0 in Y to +2 in $Y(NO_3)_2$.	1m
	Y reduces $X(NO_3)_2$ by decreasing the oxidation state of X from +2 to 0 in X.	1m

11ai.

1m

11aii. At **high temperature and pressure** (and in the presence of a catalyst), the **carbon-carbon double bonds** of the monomer **break** / the monomer has C=C bonds which break.

1m

Each monomer forms single bonds and joins with two other monomers form the polymer, poly(methyl methacrylate).

1m

11bi. $C_6H_{12}O_6 \rightarrow 2 C_2H_5OH + 2CO_2$

1m

11bii.

1m

11biii. Add potassium manganate(VII) to both substances. If it turns from purple to colourless, it is substance is ethanol.

1m 1m

If it remains purple, it is substance X.

1m

Also accept -

Use of blue litmus paper

X turns blue litmus paper red

Blue litmus paper remains blue if its ethanol.

Add suitable metal / metal carbonate

If susbstance X, effervescence seen.

H₂ produced with caused lighted splint to extinguish with pop sound (if use metal)

 CO_2 produced which formed white precipitate in limewater (if use metal carbonate)

11biv. When the mixture is heated, the yeast denatures and stops the reaction.

1m

11bv. Solvent in paints and varnishes

Manufacture of perfumes, detergent, deodorants etc.

Found in alcoholic drinks like beer, wines and spirits

Used in preparation of ethanoic acid

(Any one)

1m



Geylang Methodist School (Secondary) Preliminary Examination 2018

5076/01

SCIENCE (PHYSICS/CHEMISTRY)

Paper 1 Multiple Choice

Sec 4 Express Sec 5 Normal (A)

Additional materials: Optical Answer Sheet 1 hour

Setter: 24 August 2018

Mr Iskander

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class on the Optical Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Read the instructions on the Optical Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Gravitational field strength is assumed to be 10 N/kg unless otherwise specified.

A copy of the Periodic Table is printed on page .

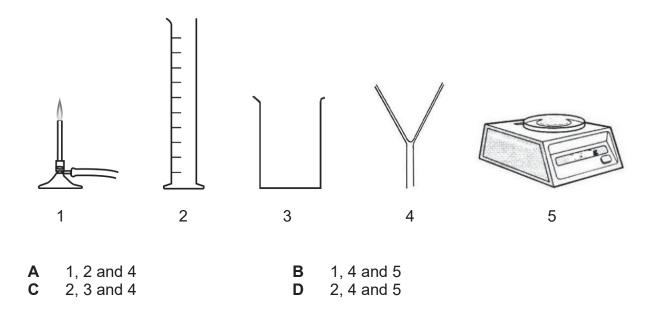
This document consists of printed pages.

[Turn over

Silver chloride is made by adding 20.0 cm³ of aqueous silver nitrate to 20.0 cm³ of dilute hydrochloric acid.

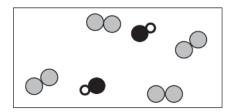
2

Which pieces of apparatus are needed to obtain solid silver chloride from aqueous silver nitrate and dilute hydrochloric acid?



2 The diagram below shows the arrangement of gases in a balloon.

Which pair of gases could be in the balloon?



- A argon and hydrogen chloride
- B argon and nitrogen
- **C** hydrogen and nitrogen
- **D** hydrogen chloride and nitrogen

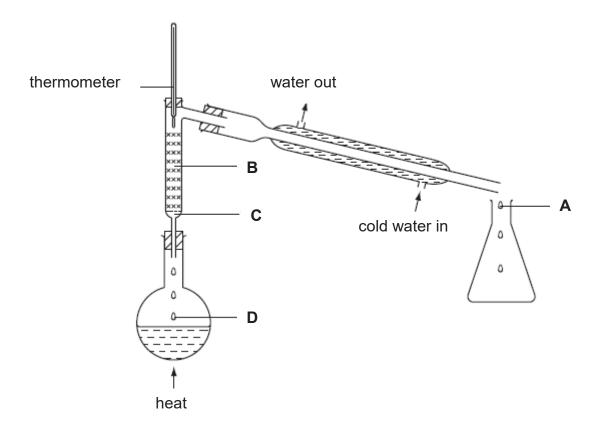
3 Salt can be separated from sand by using the processes shown.

What is the correct order for the processes?

	first			last
Α	filter	dissolve	evaporate	crystallise
В	dissolve	evaporate	crystallise	filter
С	dissolve	evaporate	filter	crystallise
D	dissolve	filter	evaporate	crystallise

4 A mixture containing equal volumes of two liquids that mix completely but do not react together is placed in the apparatus shown and heated until the thermometer first shows a steady reading.

At which position will there be the highest proportion of the liquid with the lower boiling point?



- **5** Which of the following changes will result in the particles moving at a higher speed?
 - $\mathbf{A} \qquad \mathsf{I}_2\left(\mathsf{g}\right) \to \mathsf{I}_2\left(\mathsf{s}\right)$
 - $\mathbf{B} \quad \mathsf{CO}_2(\mathsf{s}) \to \mathsf{CO}_2(\mathsf{g})$
 - $\mathbf{C} \quad \mathsf{H}_2\mathsf{O} \ (I) \to \ \mathsf{H}_2\mathsf{O} \ (\mathsf{s})$
 - $\textbf{D} \qquad N_2\left(g\right) \rightarrow N_2\left(\textit{I}\right)$

6 An imaginary element Gemsium(Gm) contains 111 protons and 141 neutrons.

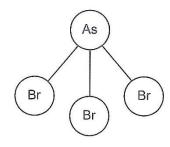
Which one of the following represents an atom of Gemsium?

- **A** $^{141}_{30}$ Gm
- **B** 141 Gm
- **C** 111 Gm
- **D** 252 Gm
- 7 The nucleon number and proton number of an atom of P and atom of Q are shown.

	Р	Q
nucleon number	85	80
proton number	37	35

Which statement about P and Q is correct?

- A An atom of P has fewer electrons than an atom of Q.
- **B** An atom of P has more neutrons than an atom of Q.
- **C** P is above Q in the same group of the Periodic Table.
- **D** P is in the same period in the Periodic Table as Q.
- 8 A molecule of arsenic bromide, AsBr₃, has the structure shown.



Which properties could be correct for arsenic bromide?

	melting point/°C	electrical conductivity at room temperature
Α	31	does not conduct
В	39	conducts
С	650	conducts
D	755	does not conduct

9 A student thinks that element Q is a metal because it has a high melting point and a high boiling point.

What other properties could element Q have if it is a metal?

- 1 Q conducts electricity when solid.
- 2 Q forms an acidic oxide, QO₂.
- 3 Q is malleable.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3

10 In the Periodic Table, caesium, lithium and sodium are in the same group.

Which statement about caesium is likely to be correct?

- A It forms a nitrate, Cs(NO₃)₂.
- **B** It forms an insoluble hydroxide.
- **C** It has a density greater than potassium.
- **D** It reacts slowly with water at room temperature.
- **11** Astatine is at the bottom of Group VII in the Periodic Table.

Which of the following is a property of astatine?

- A It forms a basic oxide.
- **B** It is a good conductor of electricity.
- C It forms a covalent compound of formula NaAt.
- **D** It is displaced by chlorine from aqueous potassium astatide.
- When two aqueous solutions are mixed in a test-tube, a reaction occurs and the test-tube feels hot.

Which statement is correct?

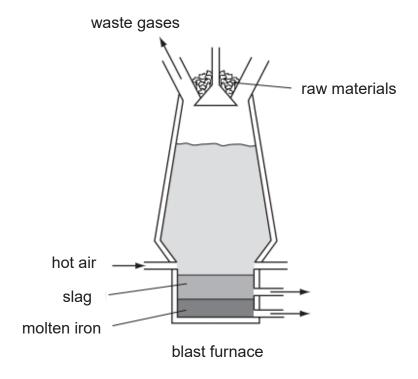
- A An exothermic reaction takes place as the reacting chemicals gain energy.
- **B** An exothermic reaction takes place as the reacting chemicals lose energy.
- **C** An endothermic reaction takes place as the reacting chemicals gain energy.
- **D** An endothermic reaction takes place as the reacting chemicals lose energy.
- **13** 2.0 g of magnesium are completely burnt in pure oxygen.

$$2Mg + O_2 \rightarrow 2MgO$$

Which volume of oxygen is used in this reaction at room temperature and pressure?

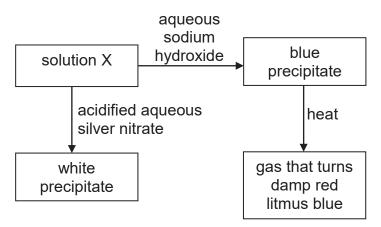
A 0.5 dm³ **B** 1.0 dm³ **C** 1.5 dm³ **D** 2.0 dm³

14 Iron is produced in a blast furnace as shown in the diagram below.



Which statement about this process is correct?

- A Carbon is oxidised to carbon dioxide.
- **B** Carbon monoxide is produced by the thermal decomposition of calcium carbonate.
- **C** Haematite is reduced by calcium carbonate.
- **D** Impurities are removed by the hot air blast.
- **15** The diagram below shows some of the reactions of solution X.

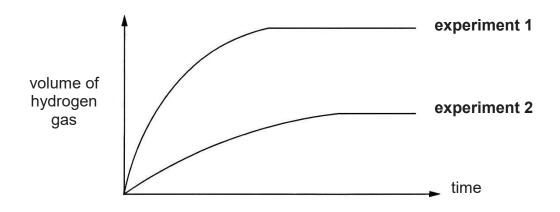


Which of the following the substance(s) is/are present in solution X?

- A copper(II) nitrate only
- **B** ammonium chloride only
- **C** zinc nitrate and copper(II) nitrate
- **D** ammonium chloride and copper(II) chloride

16 Zinc powder was added to excess dilute sulfuric acid at room temperature. The volume of hydrogen gas produced was measured over a period of time.

The graph labelled **experiment 1** shown below was obtained.



Which change was made to obtain the results shown in **experiment 2**?

- A Half the mass of zinc granules was used.
- **B** Half the concentration of dilute sulfuric acid was used.
- **C** Larger zinc strip of the same mass was used.
- **D** Dilute sulfuric acid at lower temperature was used.
- 17 Crude oil is fractionally distilled into useful fractions.

Which option matches the fraction to its use?

	fraction	use
Α	bitumen	feedstock for the petrochemical industry
В	diesel oil	fuel for aircraft engines
С	petrol	fuel for engines in buses, lorries and trains
D	petroleum gas	fuel for cooking and heating

18 Many countries have taken measures to ensure that the amount of sulfur in unleaded petrol and diesel fuels are kept low.

Which of the following could be the reason for such measures?

- A To cut down the amount of fuel used in vehicles.
- **B** To reduce the acidity of the rain.
- **C** To reduce incomplete combustion.
- **D** To prevent the pH of soil from increasing.

19 Which reaction describes the following equation?

$$C_{15}H_{32} \rightarrow C_{10}H_{22} + C_{3}H_{6} + C_{2}H_{4}$$

A additionB crackingC oxidationD substitution

The table shows the observations made when an organic compound X reacts with aqueous bromine and acidified potassium manganate (VII).

reagent	observation
aqueous bromine	no change
acidified potassium manganate(VII)	purple solution turns colourless

What is compound X?

A ethaneB ethanoic acidC methanolD propene

End of paper

DATA SHEET The Periodic Table Of Elements

Ar Ar argon 20 36 84 84 Xe Xenon Xenon 20 36 Xe Xenon	Rn radon -
9 Figurine 19 35.5 Signature 19 80 Br 19 10 dine 19 10 didne	
8 O O oxygen 16 S S sulfur 32 S S Selenium 79 T 9 T 6 T 6 T 6 T 6 T 6 T 6 T 6 T 6 T	128 84 Po polonium - 116 Lv livermorium
N nitrogen 14 15 P phosphorus 31 33 As arsenic 75 51 Sb antimony	
6 C C carbon 14 Si silicon 28 32 Ge germanium 73 73 Sn tin tin	82 Pb lead 207 114 F I
boron 13 Al aluminium 27 31 Ga gallium 70 49 In indium indium	115 81 T I thallium 204
30 Zn zinc 65 48 Cd cadmium	Hg mercury 201 112 Cn copernicium
	108 79 Au gold 197 1111 Rg roentgenium
Group Grou	78 Pt platinum 195 110 Ds
27 Co cobatt 59 A5 Rh rhodium	103 77 Ir iridium 192 109 Mt meitherium
	76 Os osmium 190 108 Hs hassium
MIn manganese 55 55 43 TC Tc	75 Re rhenium 186 107 Bh bohrium
number nbol mass 24	96 74 W tungsten rh 184 106 Sg seaborgium bc
Key (atomic) mic syn name ve atomic V V V A1 N N N N N N N N N	93 73 73 Ta tantalum 181 105 Db dubnium -
	91 72 Hf hafnium 178 104 Rutherfordium
Sc scandium 45 39 × yttrium 21	89 57 – 71 lanthanoids 89 – 103 actinoids
A Be beryllium 9 9 9 12 Mg magnesium 24 20 Ca 20 Ca 20 Ca 38 Sr Strontium 5 Sr	88 56 Ba barium 137 137 88 Ra radium –

_							
71	Γn	lutetium	175	103		lawrencium	ı
	Хþ	\rightarrow				_	I
69	Tm	thulium	169	101	M	mendelevium	I
89	Щ	erbium	167	100	Fm	fermium	I
29	웃	holmium	165	66	ЕS	einsteinium	I
99	Δ	dysprosium	162	86	Č	californium	ı
65	Тb	terbium	159	26	BK	berkelium	ı
64	Вd	gadolinium	157	96	C	curium	ı
63	En	europium	152	96	Am	americium	I
62	Sm	0,		94	Pu	plutonium	I
61	Pm	m promethium	I	93	a N	ne	I
09		eodymiu	144	92	\supset	uranium	238
59	Pr	praseodymium	141	91	Pa	protactinium	ı
58	Ö	cerium	140	06	Ļ	thorium	I
22	Гa	lanthanum	139	89	Ac	actinium	I
	lanthanoids)			actinoids		

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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Geylang Methodist School (Secondary) End of Year Examination 2018

Candidate Name	
Class	Index Number
SCIENCE	5076/03, 5078/03
Paper 3 Chemistry	Sec 4 Express Sec 5 Normal (A)
Additional Materials : Writing Paper	1 hour 15 minutes
Setter Miss Na Sio Yina	17 August 2018

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen. You may use a pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer all questions.

Write your answers in the spaces provided on the question paper.

A copy of the Periodic Table is printed on page 14.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use						
Section A	/45					
Section B						
	/10					
	/10					
Total	/65					

This document consists of 13 printed pages and 1 blank page.

[Turn over

Section A

Answer all the questions in this section.

Write your answers in the spaces provided on the question paper.

1 The diagram shows part of the Periodic Table. Only some of the elements are shown.

			Н								
							С	Ζ		F	
							Si	Р	S	CI	
	Ti		Fe		Cu	Zn		As		Br	

(a) Answer each of the following questions using only those elements shown in the diagram. Each element may be used once, more than once or not at all.

Give one element which

X in the Periodic Table above.

(b)

(i)	oxidises in the presence of water and air to form rust,	
(ii)	forms an ion of Y ⁻ which has only three completely filled shells electrons,	
(iii)	forms an oxide which is amphoteric,	
(iv)	is a colourless diatomic gas,	
(v)	is found as an impurity in fossil fuels and burns in air to product an air pollutant that causes acid rain.	ce
		 [5]

Element **X** is a noble gas with two electron shells. Label this element as

[1]

2 Fig. 2.1 shows some reactions of copper(II) nitrate, Cu(NO₃)₂.

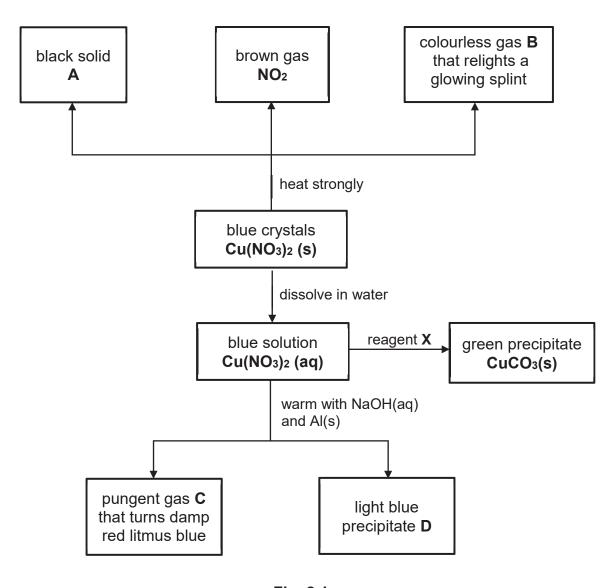


Fig. 2.1

(a) Identify the substances A - D.

Α	
В	
С	
D	

[4]

.....

[2]

Titanium, Ti, is a metal used in the aerospace industry. It exists naturally as titanium-iron oxide, FeTiO₃, in a mineral called ilmenite. To extract titanium, the compound is first converted to titanium tetrachloride, TiCl₄, which is being heated to 2000°C with magnesium in an atmosphere of a noble gas, argon.

The extraction of titanium from its chloride is represented by the following equation.

$$TiCl_4 + 2Mg \rightarrow 2MgCl_2 + Ti$$

(a) What is the mass of magnesium chloride formed when 12 kg of titanium is extracted? [Relative atomic masses: Ar: Ti, 48; Mg, 24; Cl, 35.5]

mass of magnesium chloride = kg [2]

(b) Calculate the smallest mass of titanium-iron oxide, FeTiO₃, needed to produce 12 kg of titanium. [Relative atomic masses: A_r: Ti, 48; Fe, 56; O, 16]

mass of titanium-iron oxide =kg [2]

4 Fig. 4.1 shows the materials used to make ballpoint pen.

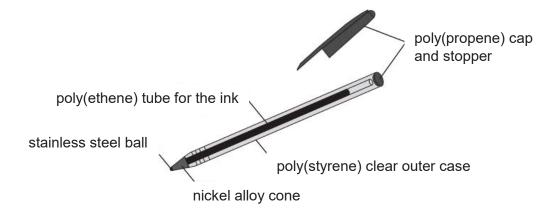


Fig. 4.1

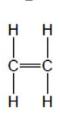
(a)	steel are used as materials in the pen, instead of pure metals.	1 45
		 [2]
(b)	Give one advantage and one disadvantage of recycling the mater from this ballpoint pen.	rials
		 [2]

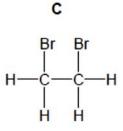
Write a chemical equation for the reaction. State symbols are not required.

[1]

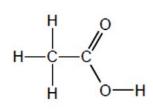
6 The structures of five organic compounds are shown below.

(ii)





D



E

(a) Answer each of the following questions using the letters that represent each compound.

(i) Which two compounds are in the same homologous series?

Which compound is formed when ethanol reacts with atmospheric oxygen?

(iii) Which compound reacts with steam to form ethanol?

[3]

- A solution of ethanol can be made by fermentation of glucose. (b)
 - (i) Draw the structural formula of ethanol.

[1]

State two conditions required for the fermentation of glucose. (ii)

[2]

(iii) Calculate the relative molecular mass of ethanol and the percentage by mass of carbon in each molecule of ethanol. [Relative atomic masses: A_r: H, 1; C, 12; O, 16]

[2]

7 Cinnamic acid is found in plants called balsams.

The structure of cinnamic acid is shown below.

- (a) Cinnamic acid is an unsaturated compound.
 - (i) What is meant by the term *unsaturated*?

[1]

(ii) Describe a chemical test to show that cinnamic acid is unsaturated.

chemical test

result with cinnamic acid

.....

[2]

(b) Balsam flowers contain a mixture of pigments.

A student uses chromatography to separate the pigments in balsam flowers. He puts the pigment mixture on a sheet of chromatography paper as well as five spots of pure pigments **A**, **B**, **C**, **D** and **E**.

The results are shown as a chromatogram in Fig. 7.1.

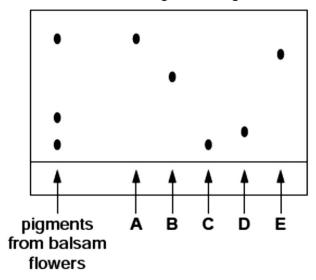


Fig. 7.1

(i) Which of the pigments are present in balsam flowers?

(ii) Draw the apparatus that could be used to produce this chromatogram.

Section B

Answer any **two** questions in this section.

Write your answers in the writing papers provided.

- Fluorine is the lightest halogen and exists as a highly reactive pale yellow diatomic gas at room temperature and pressure. Fluorine is found in nature in the form of calcium fluoride crystals, called fluorite.
 - (a) The following equation describes the reaction between fluorine gas and water.

$$2F_2(g) + 2H_2O(I) \rightarrow O_2(g) + 4HF(aq)$$

Given that 48 cm³ of fluorine gas reacts with excess water, calculate the **volume** and **mass** of oxygen gas produced at room temperature and pressure. [2]

(b) Draw and label the electronic structures of fluorine gas and calcium fluoride.

[Proton numbers: F, 9; Ca, 20]

- (c) Use these structures to explain why, at room temperature and pressure, calcium fluoride is a solid and fluorine is a gas. [4]
- 9 (a) The reaction of metal **X** with water places it between calcium and iron in this order of reactivity. Explain why **X** would displace copper if added to a solution of copper(II) sulfate. [2]
 - (b) Aluminium does not react with cold water. Does this give a true indication of the reactivity of this element? Explain your answer. [2]
 - (c) Iron is produced in the blast furnace by heating a mixture of iron(III) oxide, coke and limestone with air.

Describe the reactions involved in this extraction.

Include an equation of a redox reaction.

[6]

- **10** Dilute hydrochloric acid reacts with calcium carbonate to produce carbon dioxide.
 - (a) (i) With the aid of a diagram, design and describe an experiment in a laboratory to show how the rate of reaction between these two substances depends on the particle size of calcium carbonate.

[4]

- (ii) Describe the measures you would take to ensure that your experiment is fair. [2]
- (iii) State and explain how the rate of reaction between two substances is affected by the particle size of one substance. Use your knowledge of reacting particles in your explanation. [2]
- (b) Increasing the concentration of acid can change the speed of a reaction. State and explain how it affects the speed of the reaction. Use your knowledge of reacting particles in your explanation. [2]

End of Paper

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Geylang Methodist School (Secondary) Preliminary Examination 2018 Secondary 4E5N Science (Chemistry) Answer Scheme

Paper 1

1	2	3	4	5	6	7	8	9	10
С	D	D	Α	В	D	В	Α	С	С
11	12	13	14	15	16	17	18	19	20
D	В	В	Α	D	Α	D	В	В	С

Paper 3 Section A

Qu	estio	n	Marking Point	Marks
1	(a)	(i)	Fe	1
		(ii)	CI	1
		(iii)	Zn	1
		(iv)	H or N	1
		(v)	S	1
	(b)		Position of X : Group 0, 2 nd element (Ne)	1
			Total:	6
2	(a)		A - copper(II) oxide B - oxygen gas C - ammonia gas D - copper(II) hydroxide	4 (1M each)
	(b)	(i)	Any soluble carbonate e.g. sodium carbonate / potassium carbonate	1
		(ii) <	Cu(NO₃)₂ (aq) + Na₂CO₃ (aq) → CuCO₃ (s) + 2 NaNO₃ (aq) Balanced chemical equation – 1 State symbols – 1	2
		(iii)	Mix the solutions together and stir.	1
			Filter the mixture to obtain copper(II) carbonate as the residue.	1
			Wash the residue with distilled water.	1
	(c)		Add hydrochloric acid to copper(II) carbonate.	1
			Effervescence observed, gas produced forms white precipitate when passed into limewater.	1
			Total:	12

			2 GMS(S)/Sci(Chem)/P3/Prelim/2018	
Qu	estio	n	Marking Point	Marks
3	(a)		No. of moles of titanium = 12 000 / 48 = $\underline{250}$ moles No. of moles of MgCl ₂ = 250 x 2 = 500 moles	1
			Mass of MgCl ₂ = 500 x (24 + 35.5 x 2) = 47500 g = 47.5 kg	1
	(b)		% mass of Ti in FeTiO ₃ = 48 / (56+48+16x3) x 100% = 31.57894 %	1
			Mass of FeTiO₃ to produce 12kg of Ti = 12/31.57894 x 100 = <u>38</u> kg	1
			Total:	4
4	(a)		Alloys are <u>harder</u> than pure metals.	1
			The different sized atoms disrupt the orderly arrangement of	1
			atoms, Hence making it <u>difficult</u> for the metal atoms to <u>slide over</u> one another.	2
	(b)		Advantage: Conserves finite resources of crude oil/metal ores. Reduces use of landfill. Less problems caused from disposal. Materials used are non-biodegradable. Less expensive than producing from raw materials.	Any 1
			Disadvantage: • Difficulty / high cost to separate the materials. • Not all materials can be recycled.	Any 1
		1	Total:	4
5	(a)	(j)	They all have 2 valence electrons.	1
		(ii)	They all have complete/full valence shell.	1
	(b)	(i)	 Chlorine has lower boiling/melting point than astatine/Z. OR Chlorine is a gas at room temperature but astatine/Z is a solid at room temperature. Chlorine is greenish yellow in colour but astatine/Z is black in colour. Chlorine is more reactive than astatine/Z. 	Any 2
	(b)	(ii)	$Cl_2 + 2 NaZ \rightarrow Z_2 + 2 NaCl$	2
			Total:	6
6	(a)	(i)	A and D	1
		(ii)	E	1
		(iii)	В	1
		<u> </u>	1	

Que	estio	n	Marking Point	Marks
	(b)	(i)	H H H-C-C-O-H H H	1
		(ii)	37°C, absence of oxygen, presence of yeast	Any 2
		(iii)	Mr of ethanol = $2x12 + 6 + 16 = 46$ (no units)	1
			%mass of carbon = 24/46 x 100% = <u>52.2%</u> (3sf)	1
			Total:	8
				0
7	(a)	(i)	Compound consists of at least one C=C bond	1
		(ii)	Add compound to aqueous bromine/ bromine solution/ bromine water.	1
			Reddish brown aqueous bromine decolourises.	1
	(b)	(i)	A and C (both must be correct)	1
		(ii)	chromategraphy paper solvent * * * * * * * * * * * * * * * * * * *	2
			Total:	6

Section B

Qu	estio	n	Marking Point	Marks
8	(a)		Volume of oxygen = $48/2 = 24 \text{ cm}^3$	1
			No. of moles of oxygen = 0.024 / 24 = 0.001 Mass of oxygen = 0.001 x 32 = <u>0.032</u> g.	1
	(b)		Fluorine gas Correct sharing – 1 Correct number of valence electrons – 1 Calcium fluoride Correct calcium ion – 1 Correct fluoride ion – 1	4
	(c)		Fluorine is a covalent molecule. It has weak intermolecular forces of attraction	1
		1	which requires small amount of energy to overcome/ has low boiling point hence it is a gas at r.t.p.	1
			Calcium fluoride is an ionic compound. It has strong electrostatic forces of attraction between the ions	1
			which requires <u>large amount of energy</u> to overcome/ Has <u>high melting point</u> hence is a solid at room temperature.	1
			Total:	10

5 GMS(S)/Sci(Chem)/P3/Prelim/2018/4E/5NA

Qu	estio	n	Marking Point	Marks
9	(a)		X is more reactive than iron, which is more reactive than copper.	1
			Hence X is more reactive than copper.	\mathbf{O}^1
	(b)		No. Aluminium reacts with oxygen to form a layer of aluminium oxide	1
			which is <u>unreactive</u> and hence <u>prevents the aluminium metal</u> <u>from reacting with water.</u>	1
	(c)		Coke burns in air to form carbon dioxide	1
			Carbon dioxide reacts with more coke to form carbon monoxide.	1
			Carbon monoxide reacts with iron(III) oxide to form iron and carbon dioxide.	1
		1	Limestone decomposes to form calcium oxide and carbon dioxide.	1
	$\langle \rangle$		Calcium oxide reacts with sand (silicon dioxide) to form calcium silicate/molten slag.	1
			Equation of Redox reaction • $C + O_2 \rightarrow CO_2$ • $CO_2 + C \rightarrow 2 CO$ • $Fe_2O_3 + 3 CO \rightarrow 2 Fe + 3 CO_2$	Any 1
			Total:	10

Qu	estio	n	Marking Point	Marks
10	(a)	(i)	Weigh 2.0 g of calcium carbonate lumps and place in a conical flask. Add 50cm³ of 1mol/dm³ dilute hydrochloric acid into the flask. Record the time taken for effervescence to stop / time taken to collect 10 cm³ of gas Repeat experiment with powdered calcium carbonate and compare the time taken for both experiments. Marking points (1M each): Appropriate diagram with suitable labels Use of appropriate mass of calcium carbonate and volume of acid Use of appropriate size of calcium carbonate (lumps vs powdered or large lumps vs small lumps) in two experiments. Observation or change that is measured to compare the rate of reaction (time taken for effervescence to stop / time taken to collect fixed volume of gas)	4
		(ii)	 Concentration of dilute hydrochloric acid used is the same. Mass of calcium carbonate used is the same. Temperature of both experiments is the same. Reject. Equal volume of dilute hydrochloric acid Shake the acid to ensure reaction is complete Repeat experiment and obtain average of results. 	Any 2
		(iii)	The <u>smaller the particle size</u> , the larger the total surface area for particles to collide,	1
			resulting in increased number of effective collisions and hence higher speed of reaction. (opposite is true)	1
	(b)		The higher the concentration of acid, the higher the speed of reaction	1
			The more concentrated the acid, the more <u>acid particles per</u> <u>unit volume</u> , resulting in increased number of effective collisions	1
			Total:	10