ANDERSON JUNIOR COLLEGE

2015 JC 2 PRELIMINARY EXAMINATIONS

CHEMISTRY **8872/01**

Higher 1 **21 September 2015**

Paper 1 Multiple Choice **50 minutes**

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **thirty** 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 Multiple Choice 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.

Multiple Choice Answer Sheet

Write your name, PDG and NRIC / FIN number, **including** the reference letter.

Shade the NRIC / FIN number.

Exam Title: JC2 PRELIM

Exam Details: H1 Chemistry / Paper 1

This document consists of **12** printed pages.

Section A

For each question there are four possible answers, **A**, **B**, **C**, and **D**. Choose the **one** you consider to be correct.

1 The relative isotopic mass values and percentage abundances of the isotopes of a sample of neon are shown in the table.

relative isotopic mass	% abundance
20	90.92
21	0.26
22	8.82

Based on these figures, what is the relative atomic mass of neon to two decimal places?

A 20.16 **B** 20.17 **C** 20.18 **D** 20.20

2 Group I and Group II ionic hydrides react with water.

$$H^-(s) + H_2O(l) \longrightarrow OH^-(aq) + H_2(g)$$

In an experiment, 1 g samples of each of the following ionic hydrides are treated with an excess of water.

Which sample produces the greatest mass of hydrogen?

A LiH **B** NaH **C** CaH_2 **D** MgH_2

3 The equations for three reactions are given below.

$$Cl_2 + 2I^- \longrightarrow 2Cl^- + I_2$$
$$2Fe^{3+} + 2I^- \longrightarrow 2Fe^{2+} + I_2$$
$$Cl_2 + 2Fe^{2+} \longrightarrow 2Cl^- + 2Fe^{3+}$$

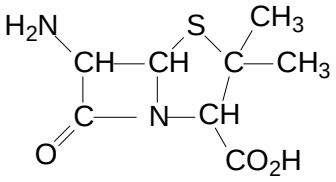
What is the correct order of strength of Cl^-, Fe^{2+} and I^- as reducing agents?

	weakest	⟶	*strongest*
A	Cl^-	Fe^{2+}	I^-
B	Cl^-	I^-	Fe^{2+}
C	Fe^{2+}	Cl^-	I^-
D	I^-	Cl^-	Fe^{2+}

4 In which pair do both atoms, in their ground states, have the same number of unpaired electron?

A B, Ca **B** F, Na **C** Ne, P **D** Be, Si

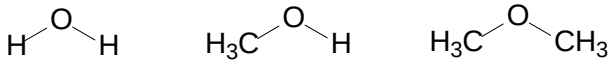
5 Penicillins are important antibacterial agents. The active penicillins are derivatives of the compound below.



How many lone pairs of electrons are present in this molecule?

A 2 **B** 4 **C** 8 **D** 10

6 Water, methanol and methoxymethane, CH_3OCH_3, have similarly shaped molecules.



What is the strongest intermolecular force in water, methanol and methoxymethane?

	H_2O	CH_3OH	CH_3OCH_3
A	hydrogen bonds	hydrogen bonds	hydrogen bonds
B	hydrogen bonds	hydrogen bonds	permanent dipoles
C	permanent dipoles	permanent dipoles	induced dipoles
D	hydrogen bonds	permanent dipoles	induced dipoles

7 Some car paints contain small flakes of silica, SiO_2.

In the structure of solid SiO_2

- each silicon atom is bonded to *x* oxygen atoms,
- each oxygen atom is bonded to *y* silicon atoms,
- each bond is a *z* type bond.

What is the correct combination of *x*, *y* and *z* in this statement?

	x	*y*	*z*
A	2	1	ionic
B	2	1	covalent
C	4	2	ionic
D	4	2	covalent

8 50.0 cm^3 of 2.0 mol dm^{-3} hydrochloric acid was added to 50.0 cm^3 of 2.0 mol dm^{-3} sodium hydroxide solution in a polystyrene beaker and the solution stirred. A temperature rise of 13.4 ^oC was recorded.

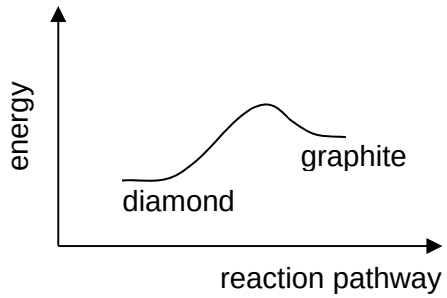
If the density and specific heat capacity of all solutions are assumed to be 1.00 g cm^{-3} and 4.18 J g^{-1} K^{-1} respectively, what is the standard enthalpy change of neutralisation of hydrochloric acid obtained from this experiment?

A –56 kJ mol^{-1} **B** –28 kJ mol^{-1} **C** +28 kJ mol^{-1} **D** +56 kJ mol^{-1}

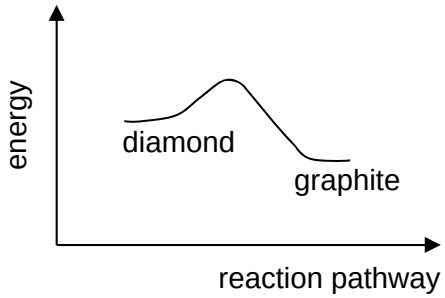
9 The conversion of diamond into graphite is an exothermic reaction. Diamond does not readily change into graphite.

Which reaction pathway correctly represents this conversion?

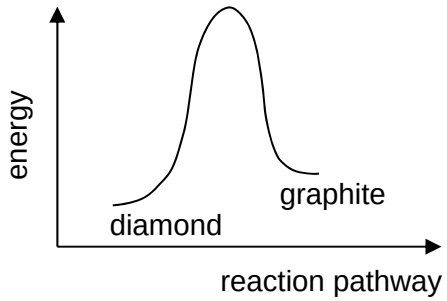
A



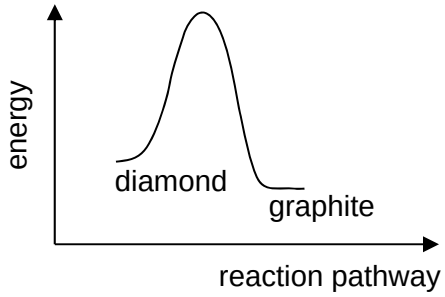
B



C



D



10 At body temperature of 37 ^{o}C, K_w has a value of 2.4 x 10^{-14}.

What is the concentration of OH^- if the pH of blood is 7.4 under these conditions?

A 7.00 x 10^{-7}

B 6.03 x 10^{-7}

C 2.51 x 10^{-7}

D 3.98 x 10^{-8}

11 In which of the following would the equilibrium concentration of hydrogen remain unchanged if the pressure was changed?

A $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

B $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$

C $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$

D $C_2H_6(g) \rightleftharpoons C_2H_4(g) + H_2(g)$

12 The table gives the concentrations and pH values of the aqueous solutions of two compounds **D** and **E**. Either compound could be an acid or a base.

	D	**E**
concentration / mol dm^{-3}	2.00	2.00
pH	6	9

Student **P** concluded that **D** is a strong acid.

Student **Q** concluded that the extent of dissociation is lower in **E**(aq) than in **D**(aq).

Which of the students are correct?

A both **P** and **Q**

B neither **P** nor **Q**

C **P** only

D **Q** only

13 The decomposition

$$2N_2O_5 \longrightarrow 4NO_2 + O_2$$

is first order with respect to N_2O_5.

In an experiment, 0.10 mol of pure N_2O_5 was put into an evacuated flask. It was found that there was 0.025 mol of N_2O_5 left 34 minutes later.

Which statement is true?

A It took 17 minutes for the amount of NO_2 to rise from 0 mol to 0.10 mol.

B There was 0.0625 mol of N_2O_5 left after 17 minutes.

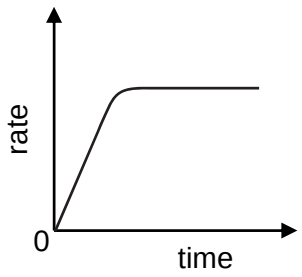
C There was 0.0125 mol of N_2O_5 left after 68 minutes.

D The amount of NO_2 in the flask went up by four times in the first 34 minutes.

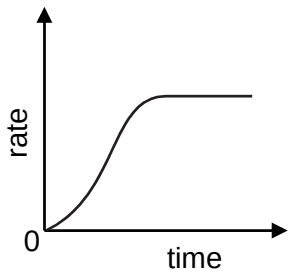
14 An autocatalytic reaction is a reaction in which one of the products catalyses the reaction.

Which curve will be obtained if the rate of reaction was plotted against time for an autocatalytic reaction?

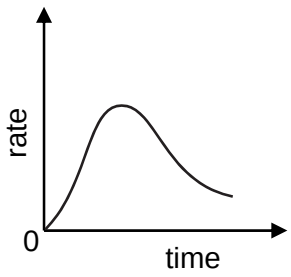
A



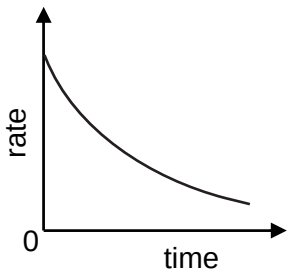
B



C



D



15 The information relates to element *W*.

- *W* is in Period 3 of the Periodic Table.
- *W* has a lower electrical conductivity than Mg.
- *W* forms only one chloride which can dissolve in water to give a strongly acidic solution.

What is the likely identity of *W*?

A Na **B** A*l* **C** Si **D** P

16 Consecutive elements **X**, **Y** and **Z** are in the third period of the Periodic Table. Element **Y** has the lowest first ionisation energy and the highest melting point of these three elements.

What could be the identities of **X**, **Y** and **Z**?

A magnesium, aluminium, silicon

B aluminium, silicon, phosphorus

C silicon, phosphorus, sulfur

D phosphorus, sulfur, chlorine

17 Which equation represents the reaction of sulfur dioxide with an excess of aqueous sodium hydroxide?

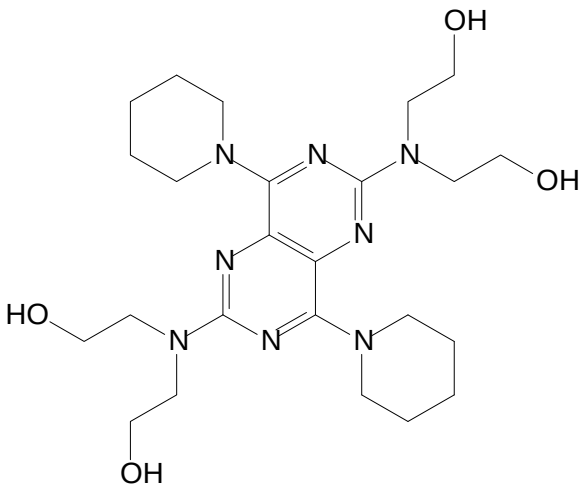
A $SO_2 + NaOH \longrightarrow NaHSO_3$

B $SO_2 + 2NaOH \longrightarrow Na_2SO_3 + H_2O$

C $SO_2 + 2NaOH \longrightarrow Na_2SO_4 + H_2$

D $2SO_2 + 2NaOH \longrightarrow Na_2S_2O_3 + H_2O + O_2$

18 Dipyridamole is a drug that is used to treat recovering stroke patients.



dipyridamole

What is the empirical formula of this drug?

A $C_6H_9N_2O$ **B** $C_6H_{10}N_2O$ **C** $C_{11}H_{20}N_4O_2$ **D** $C_{24}H_{40}N_8O_4$

19 Ozone depletion potential (ODP) is a measure of the effectiveness of chlorofluoroalkanes in destroying stratospheric ozone.

In which sequence are compounds listed in increasing order of their ODPs?

A	$CHCIF_2$	<	CH_3CCI_2F	<	CCI_2FCCIF_2
B	$CHCIF_2$	<	CCI_2FCCIF_2	<	CH_3CCI_2F
C	CCI_2FCCIF_2	<	$CHCIF_2$	<	CH_3CCI_2F
D	CH_3CCI_2F	<	CCI_2FCCIF_2	<	$CHCIF_2$

20 Aqueous silver nitrate was added at the same time to separate solutions of chloroethane and iodoethane. The first signs of a reaction were in the sample containing iodoethane.

Why was the reaction with iodoethane noticed first?

A The chloroethane also reacted with the aqueous silver nitrate but gave a soluble product.

B The chloroethane reacted more slowly because the carbon–chlorine bond is less polar than the carbon–iodine bond.

C The chloroethane reacted more slowly because the carbon–chlorine bond is longer than the carbon–iodine bond.

D The iodoethane reacted more quickly because the carbon–iodine bond is weaker than the carbon–chlorine bond.

21 Which type of formula will show butanone and butanal as different compounds?

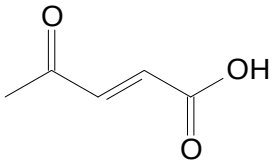
	empirical	molecular	structural	skeletal
A	*x*	*x*	*x*	√
B	*x*	*x*	√	√
C	*x*	√	√	√
D	√	√	√	√

key

√ = shows difference

x = shows no difference

22 4–oxopent–2–enoic acid has been found to inhibit the growth of *Trypanosoma cruzi*, a protozoan that causes the Chagas' disease.

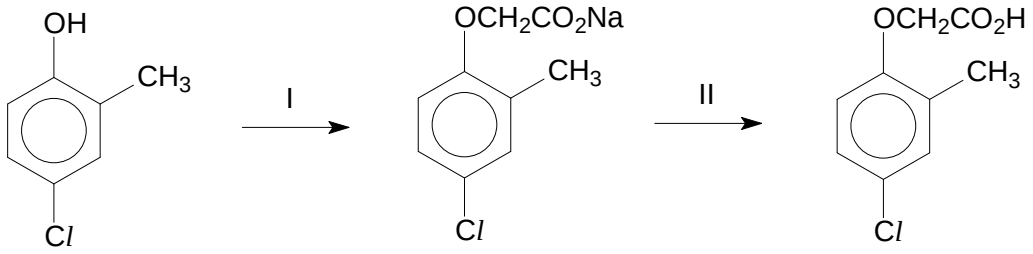


4-oxopent-2-enoic acid

If 4–oxopent–2–enoic acid is reacted with $NaBH_4$, what would be the M_r of the resultant product?

A 102 **B** 104 **C** 116 **D** 118

23 The reaction scheme below represents the manufacture of the selective weedkiller MCPA.



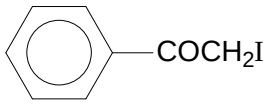
MCPA

Which type of reaction occurs in step I and in step II?

	step I	step II
A	addition	acid–base
B	addition	reduction
C	substitution	acid–base
D	substitution	reduction

24 Which compound will **not** give tri–iodomethane on warming with alkaline aqueous iodine?

A $CH_3COCHClCOCH_3$

B 

C $I_2CHCH(OH)CO_2H$

D $CI_3CO_2CH_3$

25 Compound **Z**, $C_4H_6O_2$, which is responsible for giving butter its characteristic flavor, gives the following experimental observations.

- On reduction, **Z** produces $C_4H_{10}O_2$.
- With hydrogen cyanide and aqueous sodium cyanide, **Z** produces $C_6H_8N_2O_2$.
- Fehling's solution, on warming with **Z**, retains its blue colour.

What is the likely identity of compound **Z**?

A $CH_2=CHCOCH_2OH$

B $CH_3COCH=CHOH$

C $CH_3COCOCH_3$

D CH_3COCH_2CHO

Section B

For each of the question in this section, one or more of the three numbered statements **1** to **3** may be correct.

Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct.)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

26 Two massive explosions rocked the Chinese city of Tianjin on 12th August, 2015.

Three reactions took place.

Water used by fire–fighters touched calcium carbide, producing acetylene gas.

Reaction 1 $CaC_2(s) + 2H_2O(l) \longrightarrow Ca(OH)_2(s) + C_2H_2(g)$

Flames ignited the acetylene gas, causing the first explosion.

Reaction 2 $C_2H_2(g) + \frac{5}{2}O_2(g) \longrightarrow 2CO_2(g) + H_2O(l)$

High temperatures caused nearby ammonium nitrate to detonate, causing the second explosion.

Reaction 3 $NH_4NO_3(s) \longrightarrow N_2(g) + 2H_2O(g) + \frac{1}{2}O_2(g)$

compound	$\Delta H_f^{\ominus}$ / kJ mol^{-1}
$CaC_2(s)$	–60
$Ca(OH)_2(s)$	–986
$C_2H_2(g)$	+228
$CO_2(g)$	–394
$H_2O(l)$	–286
$NH_4NO_3(s)$	–366

Using the standard enthalpy changes in the table, which statements are correct?

1 Reaction 1 gives off 80 kJ mol^{-1} more energy than Reaction 3 under standard conditions.

2 The enthalpy change for Reaction 3 is –206 kJ mol^{-1} under standard conditions.

3 Reaction 2 is the most exothermic reaction.

27 Concentrated sulfuric acid behaves as a strong acid when it reacts with water.

$H_2SO_4(l) + aq \longrightarrow H^+(aq) + HSO_4^-(aq)$

The HSO_4^- ion formed behaves as a weak acid.

$HSO_4^-(aq) \rightleftharpoons H^+(aq) + SO_4^{2-}(aq)$

Which statements are true for 1.0 mol dm^{-3} sulfuric acid?

1 $[H^+(aq)]$ is high

2 $[SO_4^{2-}(aq)]$ is high

3 $[HSO_4^-(aq)] = [SO_4^{2-}(aq)]$

28 The reaction of P and Q proceeds by the two–stage process shown.

$$P + Q \xrightarrow{\text{slow}} R$$

$$R + P \xrightarrow{\text{fast}} 2S$$

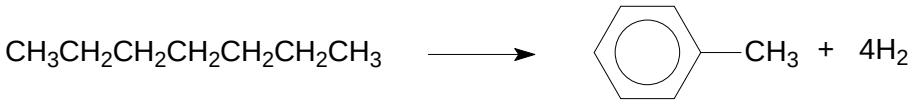
Which statements about this reaction are correct?

1 The initial rate of formation of *S* can be increased by adding *R*.

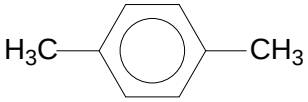
2 The relative molecular mass of *S* is higher than that of *P*.

3 The concentration of *R* will always exceed that of *S*.

29 In an industrial process, heptane vapour is passed over a heated catalyst to make methylbenzene.

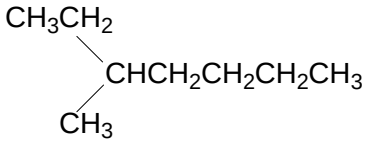


Under similar conditions, which of the C_8H_{18} isomers could give 1,4–dimethylbenzene?

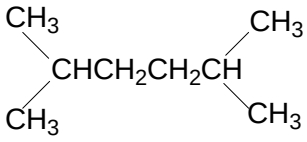


1,4-dimethylbenzene

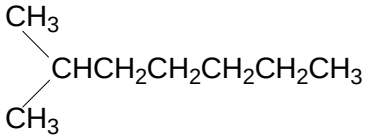
1



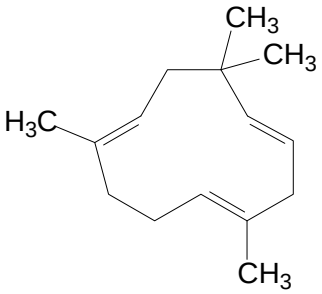
2



3



30 Humulene can be extracted from carnation flower.



humulene

Which products are obtained from the reaction of humulene with hot acidified concentrated $KMnO_4$?

1 $CH_3COCH_2CH_2CO_2H$

2 $CH_3COCH_2CO_2H$

3 $HO_2CCH_2C(CH_3)_2CO_2H$

H1 Chemistry 8872 **AJC 2015 JC2 PRELIM** **Paper 1 – 30 marks**

Question Number	*Key*	*Question Number*	*Key*
1	**C**	16	**D**
2	**A**	17	**B**
3	**A**	18	**B**
4	**B**	19	**A**
5	**D**	20	**D**
6	**B**	21	**B**
7	**D**	22	**C**
8	**A**	23	**C**
9	**D**	24	**D**
10	**B**	25	**C**
11	**C**	26	**C**
12	**B**	27	**D**
13	**A**	28	**B**
14	**C**	29	**B**
15	**C**	30	**A**

A	**6**
B	**9**
C	**8**
D	**7**