



SERANGOON JUNIOR COLLEGE
General Certificate of Education Advanced Level
Higher 1

Candidate Name

Class

CHEMISTRY

JC2 Preliminary Examination

Paper 1 Multiple Choice

Additional Materials: Data Booklet
 Optical Mark Sheet (OMS)

8872/01

23 September 2016

50 minutes

READ THESE INSTRUCTIONS FIRST

On the separate multiple choice OMS given, write your name, subject title and class in the spaces provided.

Shade correctly your FIN/NRIC number.

There are **30** questions in 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 using a **soft pencil** on the separate OMS.

Each correct answer will score one mark.

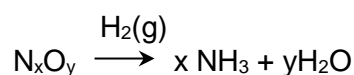
A mark will not be deducted for a wrong answer.

You are advised to fill in the OMS as you go along; no additional time will be given for the transfer of answers once the examination has ended.

Any rough working should be done in this question paper.

Answer all questions

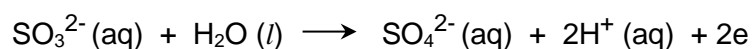
- 1 Which statement about one mole of a metal is always correct?
- A It contains the same number of atoms as 16g of oxygen atoms.
- B It contains the same number of atoms as $1/12$ mol of ^{12}C .
- C It has the same mass as 1 mol of hydrogen atoms.
- D It is liberated by 1 mol of electrons.
- 2 To identify an oxide of nitrogen, 0.10 mol of the oxide is mixed with an excess of hydrogen and passed over a catalyst at a suitable temperature.



The water produced weighs 7.20 g. The ammonia produced is neutralised by 200 cm³ of 1.0 mol dm⁻³ HCl.

What is the formula of the oxide of nitrogen?

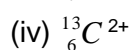
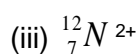
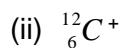
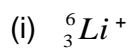
- A N₂O
- B NO
- C NO₂
- D N₂O₄
- 3 50 cm³ of a 0.10 mol dm⁻³ solution of a metallic salt was found to react exactly with 25.0 cm³ of 0.10 mol dm⁻³ aqueous sodium sulfite. In this reaction, the sulfite ion is oxidised as follows:



What is the new oxidation number of the metal in the salt if its original oxidation number was +3?

- A +1
- B +2
- C +4
- D +5

- 4 Under the same conditions, which of the following ions would be deflected in a mass spectrometer to the same extent as $^{12}_6\text{C}^{2+}$?



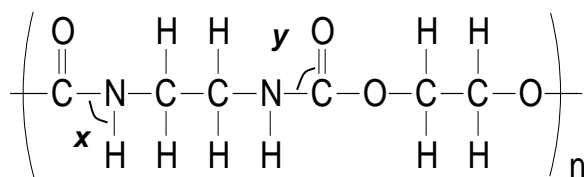
- A (i), (ii), (iii) and (iv)
 B (i) and (iii) only
 C (ii) only
 D None of the above.

- 5 Paramagnetism refers to the magnetic state of an atom with one or more unpaired electrons. The greater the number of unpaired electrons in an atom, the greater the paramagnetism.

Which atom has the greatest paramagnetism?

- A Oxygen
 B Chlorine
 C Scandium
 D Arsenic

- 6 Polyurethane is used in coatings, insulators and adhesives.



Polyurethane

What are the values of the bond angles marked **x** and **y** in polyurethane?

- | | x | y |
|---|----------|----------|
| A | 90 | 90 |
| B | 120 | 120 |
| C | 107 | 120 |
| D | 109.5 | 90 |

- 7 The Valence Shell Electron Pair Repulsion Theory (VSEPR) is used to predict the shapes of molecules.

Which shape is correctly predicted by VSEPR?

	number of regions of electron density	number of lone pairs	shape
A	3	1	Tetrahedral
B	3	1	Trigonal pyramidal
C	5	1	See-saw
D	5	1	Square pyramidal

- 8 Consider the following four compounds.

- 1) 1-chlorobutane
- 2) pentane
- 3) 2,2-dimethylpropane
- 4) butan-2-ol

What is the order of increasing boiling point of these compounds?

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

- 9 *Use of Data Booklet is relevant to this question.*

Propane, C_3H_8 , is the most common liquefied petroleum gas.

When propane was burnt under a vessel containing 200 g of water. The following data were collected.

Mass of propane tank before burning	1000.00 g
Mass of propane tank after burning	998.90 g
Initial temperature	25 °C
Final temperature	65 °C
Process efficiency	85%

Which value of the enthalpy change of combustion of propane is given by these result?

- A -1137 kJmol^{-1}
- B -1338 kJmol^{-1}
- C -1574 kJmol^{-1}
- D -1864 kJmol^{-1}
- 10 A $0.080 \text{ mol dm}^{-3}$ solution of an acid has a pH of 3.00.

25 cm^3 of this acid was completely reacted by 50 cm^3 of $0.040 \text{ mol dm}^{-3}$ of sodium hydroxide

Which is the acid?

- A HCl
- B H_2SO_4
- C $\text{C}_2\text{H}_2\text{O}_4$
- D $\text{C}_2\text{H}_4\text{O}_2$

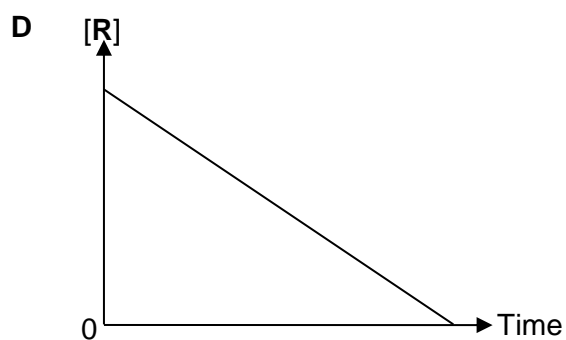
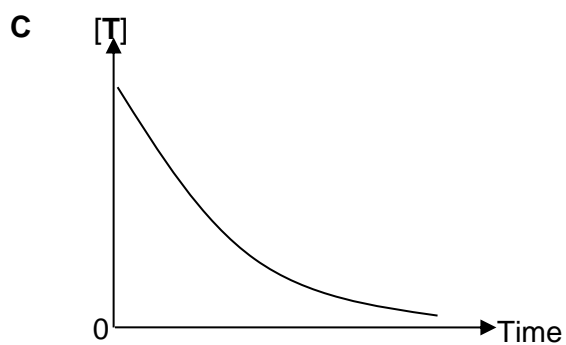
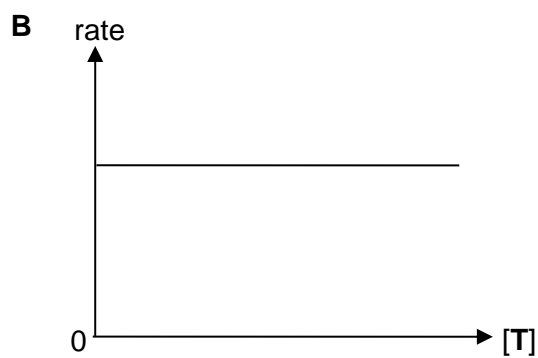
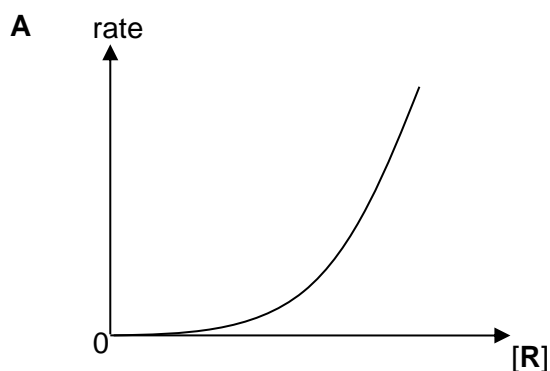
- 11 Which aqueous mixtures will maintain a fairly constant pH when small amount of acid is added?

A Sodium hydroxide + hydrochloric acid
B Ethanoic acid + ammonia
C Citric acid + potassium citrate
D Potassium chloride + sodium carbonate

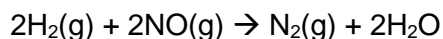
- 12 The rate equation for the reaction below is $\text{rate} = k[\text{R}][\text{T}]$



Which of the following graphs is correct for the above reaction, when **T** is in excess?



- 13** Hydrogen and nitrogen monoxide can react to form nitrogen and steam.

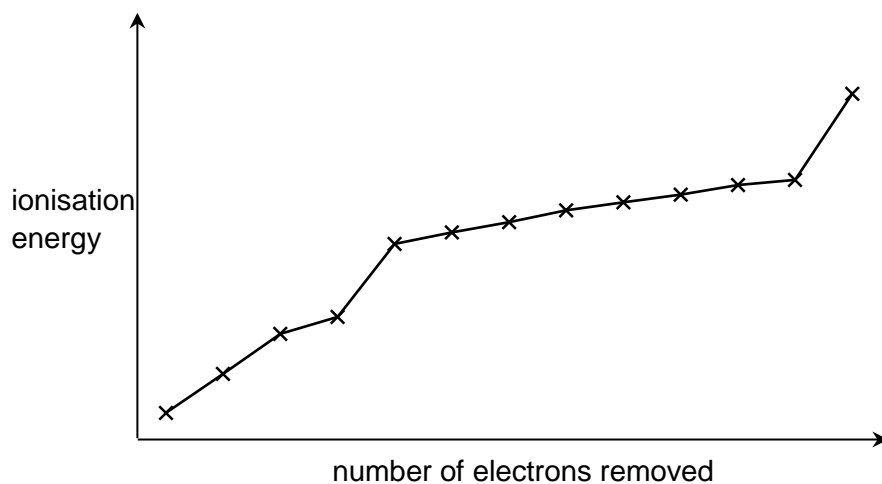


The rate of this reaction is first order with respect to hydrogen and second order with respect to nitrogen monoxide. When 1.5 mol of H_2 and 1.5 mol of NO were initially placed in a 5dm^3 flask, the initial rate is $3.0 \times 10^{-4} \text{ mol dm}^{-3} \text{ s}^{-1}$.

What will be the value of rate constant k ?

- A** 0.0000889
 - B** 0.000178
 - C** 0.0222
 - D** 0.0111
- 14** What can be deduced from the following equilibrium?
- $$2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{SO}_3(\text{g}) \quad \Delta H = -98 \text{ kJ mol}^{-1}$$
- A** Adding a catalyst increases the amount of $\text{SO}_3(\text{g})$.
 - B** Decreasing the pressure will cause the position of equilibrium to shift to the right.
 - C** Decreasing the temperature will cause the position of equilibrium to shift to the left.
 - D** The maximum theoretical mass of $\text{SO}_3(\text{g})$ that can be made from 64 g of $\text{SO}_2(\text{g})$ is 80 g
- 15** SiCl_4 is known to hydrolyse readily in water but CCl_4 is inert to water. Which statement best explains this observation?
- A** CCl_4 has a giant molecular structure, large amount of energy is required to overcome the strong covalent bond to allow solvation.
 - B** There are vacant orbitals to accommodate additional electrons in SiCl_4 but not in CCl_4 .
 - C** CCl_4 has weaker van der Waals' forces of attraction which cannot displace the stronger hydrogen bonding in water.
 - D** Si^{4+} has high charge density to polarise the large chlorine electron cloud.

16 The graph below shows the first thirteen ionisation energies for element J.

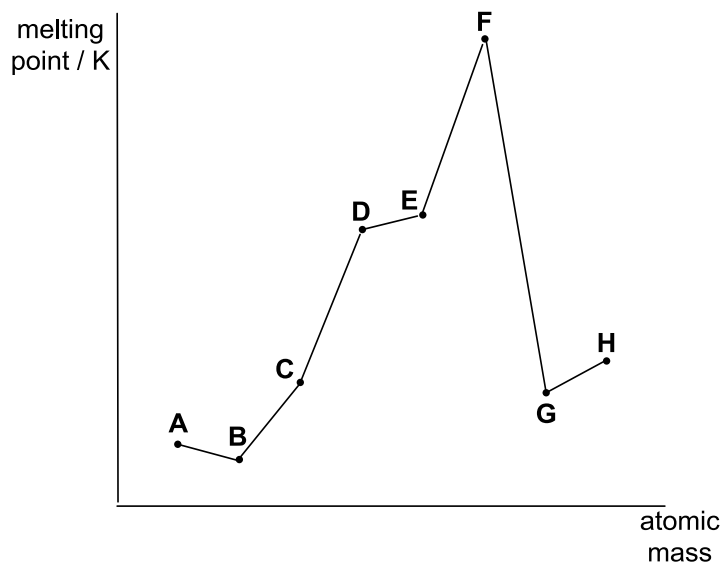


What can be deduced from the graph about element J?

- A It is a d-block element.
- B It has one electron in its outermost shell.
- C It has an electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^2$.
- D The large difference in the 4th ionisation energy and 5th ionisation energy is due to inter-electronic repulsion.

17 Use of the Data Booklet is relevant to this question.

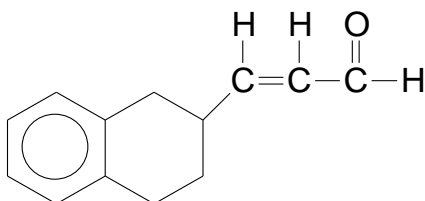
The graph below shows the variation in the melting points for eight consecutive elements in the Periodic Table, all with atomic number below 20.



What statement is correct?

- A Element **E** forms amphoteric oxide.
- B Element **B** exists as diatomic molecules.
- C Atomic radius of element **C** is smaller than element **D**.
- D Element **H** has a higher melting point than elements **A**, **B**, **C** and **G** due to intermolecular hydrogen bonding.

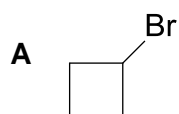
18 Identify the number of sp^2 and sp^3 carbon atoms in the given structure:



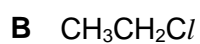
	sp^2	sp^3
A	8	5
B	9	4
C	2	5
D	3	4

- 19 In the reduction of $\text{CH}_2=\text{CHCH}_2\text{CH}=\text{CH}_2$ using nickel catalyst, the volume of hydrogen that reacts with 1 mole of the compound at standard temperature and pressure is
- A 22.4 dm³
 B 24.0 dm³
 C 44.8 dm³
 D 67.2 dm³
- 20 Which reagent could be used to distinguish between butan-2-ol and butanone?
- A bromine solution
 B alkaline aqueous iodine
 C acidified potassium manganate(VII)
 D sodium carbonate
- 21 Ten grams of each of the following compounds were heated for a prolonged period of time with $\text{NaOH}(\text{aq})$, before dilute $\text{HNO}_3(\text{aq})$ and $\text{AgNO}_3(\text{aq})$ were added.

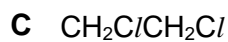
Which compound will produce the greatest mass of silver halides precipitate?



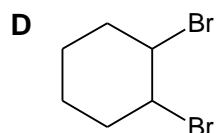
($M_r = 134.9$)



($M_r = 64.5$)

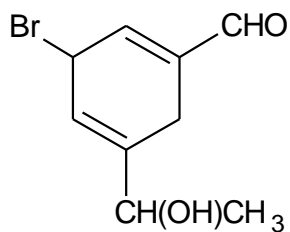


($M_r = 99.0$)

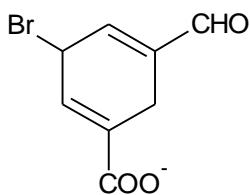


($M_r = 241.8$)

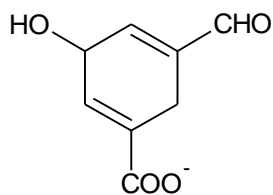
22 What are the organic products formed upon addition of NaOH(aq), I₂ (aq), heat?



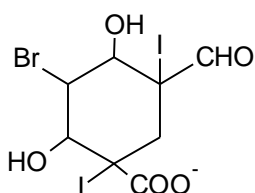
A



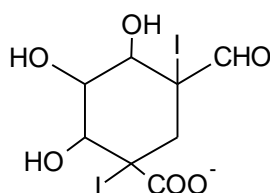
B



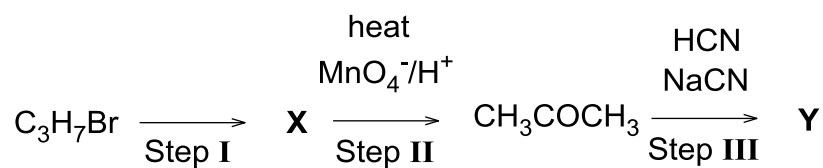
C



D



23 The reaction scheme below shows the formation of compound **Y**:



The reagent and condition required in **Step I** and the structure of **Y** are:

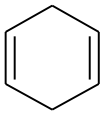
	Reagent and condition in Step I	Structure of Y
A	aqueous KOH, heat	(CH ₃) ₂ COHCN
B	alcoholic KOH, heat	(CH ₃) ₂ CHCN
C	alcoholic KOH, heat	(CH ₃) ₂ COHCN
D	aqueous KOH, heat	(CH ₃) ₂ CHCN

24 Which of the following shows the correct order of acidity.

	Strongest Acid		Weakest Acid	
A	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$	$\text{CH}_3\text{CH}_2\text{COOH}$	$\text{CH}_3\text{CH}(\text{Cl})\text{COOH}$	$\text{CH}_3\text{C}(\text{Cl})_2\text{COOH}$
B	$\text{CH}_3\text{C}(\text{Cl})_2\text{COOH}$	$\text{CH}_3\text{CH}(\text{Cl})\text{COOH}$	$\text{CH}_3\text{CH}_2\text{COOH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
C	$\text{CH}_3\text{CH}_2\text{COOH}$	$\text{CH}_3\text{CH}(\text{Cl})\text{COOH}$	$\text{CH}_3\text{C}(\text{Cl})_2\text{COOCH}_3$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
D	$\text{CH}_3\text{C}(\text{Cl})_2\text{COOCH}_3$	$\text{CH}_3\text{CH}(\text{Cl})\text{COOH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$	$\text{CH}_3\text{CH}_2\text{COOH}$

25 Deuterium, D, is an isotope of hydrogen, H

Which reaction will not yield a stable organic compound containing deuterium?

- A  $\xrightarrow{\text{KMnO}_4, \text{NaOD, cold}}$
- B $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{CD}_3\text{COOD, conc. D}_2\text{SO}_4}$
- C $\text{NH}_3 \xrightarrow{\text{CD}_3\text{Br}}$
- D $\text{CH}_3\text{CH}_2\text{CHO} \xrightarrow{\text{Cu}^{2+}, \text{NaOD, heat}}$

For **questions 26 – 30**, one or more of the numbered statements **1** to **3** may be correct. Decide whether each of the statements is or is not correct. The responses **A** to **D** should be selected on the basis of

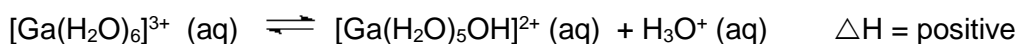
A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

No other combination of statements is to be used as correct response.

26 Why is a solution of aluminium chloride acidic?

- 1** Aluminium ions have a high charge density.
- 2** The H-O bonds are weaker in $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ than in H_2O .
- 3** Chloride ions react with water to form hydrochloric acid.

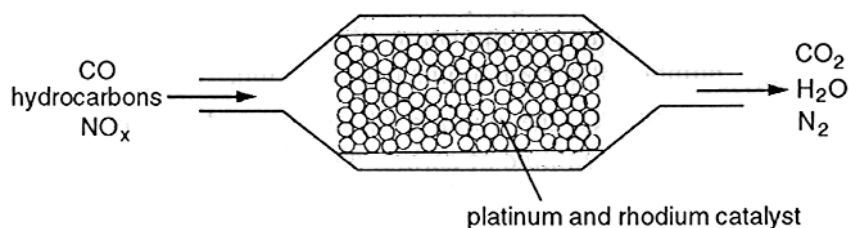
27 The gallium hydrate hydrolyses as shown below.



Which of the following statements about the equilibrium are **true**?

- 1** $[\text{Ga}(\text{H}_2\text{O})_6]^{3+}$ is more stable at low pH values.
- 2** Increasing the temperature will favour the formation of $[\text{Ga}(\text{H}_2\text{O})_5\text{OH}]^{2+}$
- 3** Increasing the concentration of $[\text{Ga}(\text{H}_2\text{O})_6]^{3+}$ will increase K_c as the forward reaction is favoured.

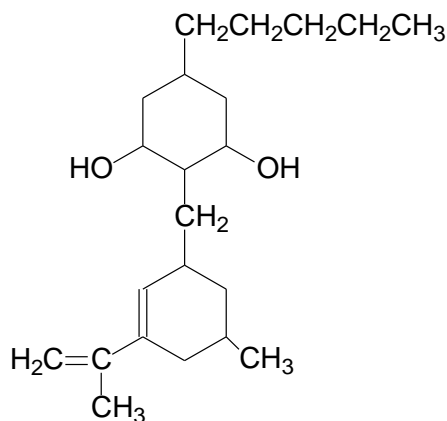
28 The diagram represents a section of a catalytic converter on the exhaust system of a car. Harmful gases are converted into carbon dioxide, nitrogen and water vapour.



Which processes take place in its catalytic converter?

- 1** Carbon monoxide and hydrocarbons react together.
- 2** Carbon monoxide and nitrogen oxide react together.
- 3** Platinum and rhodium catalyse redox reactions.

- 29 A psychoactive drug commonly found in cannabis is shown below.



What conclusion can be made about this drug?

- 1 Cis-trans isomerism is not present.
 - 2 It reacts with sodium metal to form 2 moles of hydrogen gas.
 - 3 It can undergo electrophilic substitution with chlorine under appropriate condition.
- 30 When ethanoic acid is esterified with methanol enriched with ^{18}O , the water produced is **not** enriched with ^{18}O . Which of the following conclusions can be drawn from this observation?
- 1 The oxygen in the water is derived from the ethanoic acid.
 - 2 The O–H bond in the methanol breaks during the reaction.
 - 3 The carbon–to–oxygen single bond of the $-\text{COOH}$ group in the acid breaks during the reaction.

END OF PAPER 1