

Class                      Reg Number

Candidate Name \_\_\_\_\_

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MERIDIAN JUNIOR COLLEGE  
**JC 2 Preliminary Examination**  
Higher 1

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**Chemistry**

**8872/01**

**26 September 2014**

**Paper 1 Multiple Choice**

**50 minutes**

Additional Materials: OMR Sheet and *Data Booklet*

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**READ THESE INSTRUCTIONS FIRST**

Write your name, class and register number in the spaces provided at the top of this page.

There are **thirty** questions in this section. Answer **all** questions. For each question, there are four possible answers labelled **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the OMR answer sheet.

**Read very carefully the instructions on the use of OMR answer sheet.**

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

**Use of OMR Answer Sheet**

Ensure you have written your name, class register number and class on the OMR Answer Sheet.

Use a **2B** pencil to shade your answers on the OMR sheet; erase any mistakes cleanly. Multiple shaded answers to a question will not be accepted.

For shading of class register number on the **OMR sheet**, please follow the given examples:

If your register number is **1**, then shade **01** in the index number column.

If your register number is **21**, then shade **21** in the index number column.

**Answer all questions in this section.**

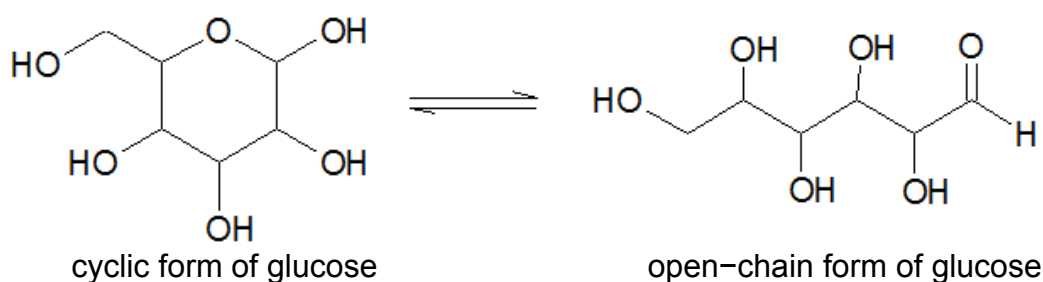
For each question there are four possible answers, **A**, **B**, **C**, and **D**. Choose the **one** you consider to be correct.

- 1 A 0.70 g impure sample of ammonium hydrogen sulfate,  $\text{NH}_4\text{HSO}_4$ , is titrated with  $0.200 \text{ mol dm}^{-3}$  sodium hydroxide.  $24.80 \text{ cm}^3$  of aqueous sodium hydroxide is required for complete reaction. ( $M_r$  of  $\text{NH}_4\text{HSO}_4 = 115$ )

What is the percentage purity of the sample?

- A** 40.7%                      **B** 61.1%                      **C** 81.5%                      **D** 98.3%

- 2 Glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , can exist in either the open-chain form or the cyclic form.



Which of the following statement is correct?

- A** The forward reaction is hydrolysis.  
**B** The reverse reaction is condensation.  
**C** The percentage by mass of carbon in glucose is 40%.  
**D** The percentage by mass of carbon is higher than the percentage by mass of oxygen in glucose.

- 3 What is the change in oxidation number of carbon when methanol is oxidised to methanoic acid?

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

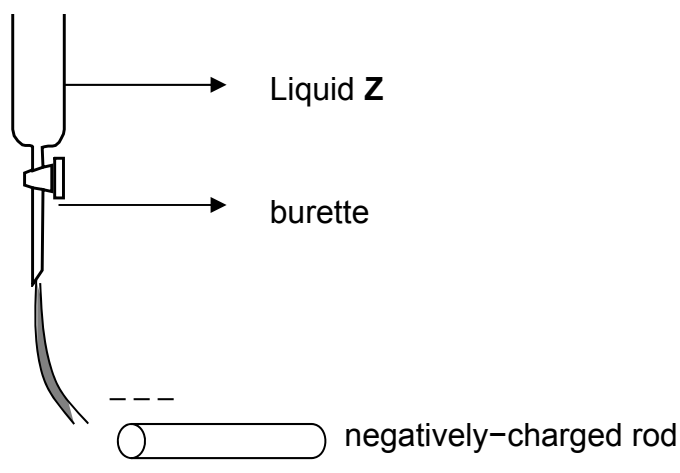
- 4 Which of the particles would, on losing an electron, have a half-filled set of p orbitals?

- A**  $\text{N}^+$                       **B**  $\text{O}^-$                       **C**  $\text{P}^-$                       **D**  $\text{Cl}^{2+}$

- 5 Hydrazine,  $\text{N}_2\text{H}_4$  is used as a rocket fuel. In an appropriate solvent such as tetrahydrofuran, hydrazine reacts with  $\text{BF}_3$  to form the most stable addition product.

Which of the following statements is **not** true?

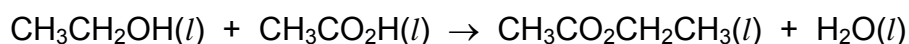
- A The bond angle in the addition product is  $109.5^\circ$ .  
 B One mole of hydrazine reacts with two moles of  $\text{BF}_3$ .  
 C The shape of hydrazine is trigonal planar with respect to each nitrogen atom.  
 D The addition product can represent liquid Z which is deflected as shown in the diagram below when a negatively charged rod is brought in close vicinity.



- 6 You are provided with the following data.

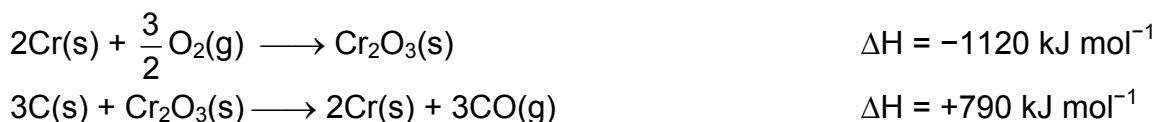
enthalpy change of formation of ethanol	= $-277 \text{ kJ mol}^{-1}$
enthalpy change of formation of ethanoic acid	= $-484 \text{ kJ mol}^{-1}$
enthalpy change of formation of ethyl ethanoate	= $-480 \text{ kJ mol}^{-1}$
enthalpy change of formation of water	= $-286 \text{ kJ mol}^{-1}$

What is the enthalpy change of the following reaction, in  $\text{kJ mol}^{-1}$ ?

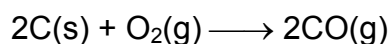


- A +5                      B -5                      C +1527                      D -1527

- 7 The following information is given.



What is the standard enthalpy change of the following reaction, in  $\text{kJ mol}^{-1}$ ?

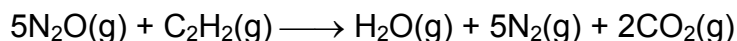


- A -110                      B -220                      C -637                      D -1273

- 8 Use of the Data Booklet is relevant to this question.

Dinitrogen oxide burns in ethyne in gaseous phase to produce water vapour, nitrogen and carbon dioxide gases.

Assume that the nitrogen–nitrogen bond energy and nitrogen–oxygen bond energy in dinitrogen oxide is  $418 \text{ kJ mol}^{-1}$  and  $686 \text{ kJ mol}^{-1}$  respectively. What is the enthalpy change of the following reaction, in  $\text{kJ mol}^{-1}$ ?

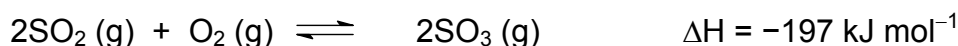


- A** -1670                      **B** -1210                      **C** +1210                      **D** +1670

- 9 Which statement is true about a reaction for which the equilibrium constant is independent of temperature?

- A** The enthalpy change of reaction is zero.  
**B** The concentrations of reactants and products are equal.  
**C** There are equal numbers of moles of reactants and products.  
**D** The rate constants for both the forward and reverse reactions are independent of temperature.

- 10 The following reaction is one of the steps involved in the manufacture of sulfuric acid.



The operating conditions are:

Temperature	450 – 550 °C
Pressure	10 atm
Catalyst	V <sub>2</sub> O <sub>5</sub> catalyst

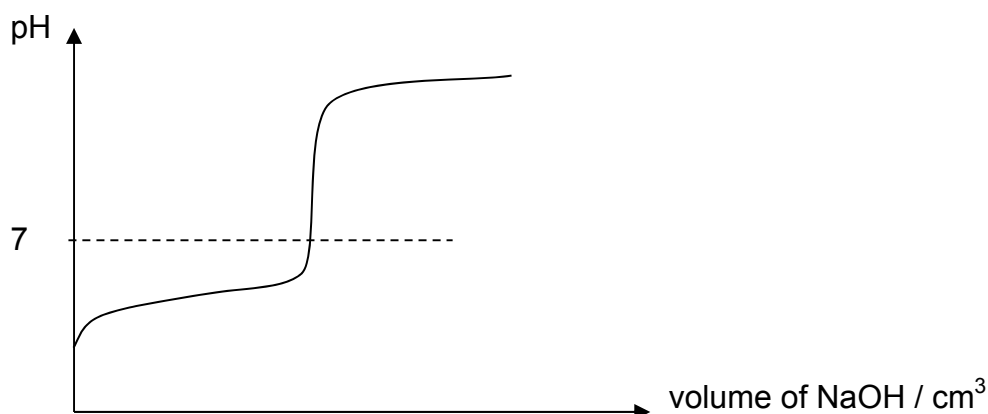
Which of the following statements explains the choice of the operating conditions?

- A** The V<sub>2</sub>O<sub>5</sub> catalyst increases the equilibrium yield of SO<sub>3</sub>.  
**B** At higher pressure, the rate of formation of SO<sub>3</sub> decreases.  
**C** At higher temperature, the equilibrium yield of SO<sub>3</sub> increases.  
**D** At lower temperature, the rate of formation of SO<sub>3</sub> decreases.

- 11 25 cm<sup>3</sup> of 0.40 mol dm<sup>-3</sup> H<sub>2</sub>SO<sub>4</sub> is added to 20.0 cm<sup>3</sup> of 0.75 mol dm<sup>-3</sup> KOH. What is the pH of the resultant solution?

- A** 0.11                      **B** 0.95                      **C** 2.30                      **D** 13.05

- 12 Propanoic acid has a  $K_a$  value of  $1.3 \times 10^{-5} \text{ mol dm}^{-3}$ . The graph below shows the titration of propanoic acid with aqueous sodium hydroxide.



What is a suitable indicator for the titration?

	Indicator	pH range
A	Methyl violet	0.5 to 1.4
B	Bromophenol blue	2.9 to 4.0
C	Methyl red	4.4 to 6.2
D	Thymolphthalein	9.3 to 10.5

- 13 A theoretical reaction involves  $E + F \longrightarrow \text{product}$ .

The rate equation is:

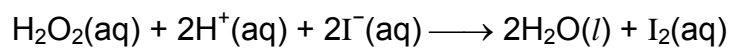
$$\text{rate} = k [E]^x [F]^y,$$

and the units of the rate constant,  $k$ , are  $(\text{mol dm}^{-3})^z \text{ s}^{-1}$ .

Which sets of the values of  $x$ ,  $y$  and  $z$  fit the above information?

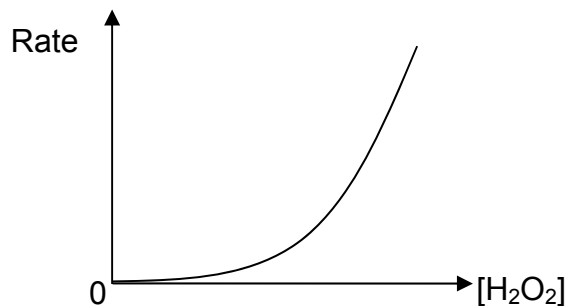
	$x$	$y$	$z$
A	0	0	0
B	0	0	1
C	0	1	1
D	1	1	1

14 The rate equation for the following reaction is  $\text{rate} = k [\text{H}_2\text{O}_2][\text{I}^-]$ .

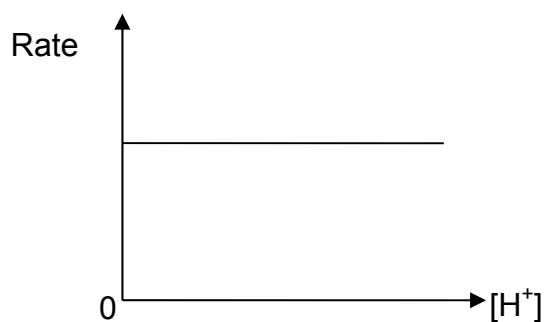


Which of the following graphs is correct for the reaction?

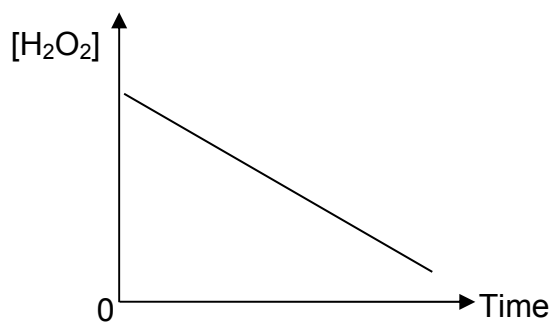
A



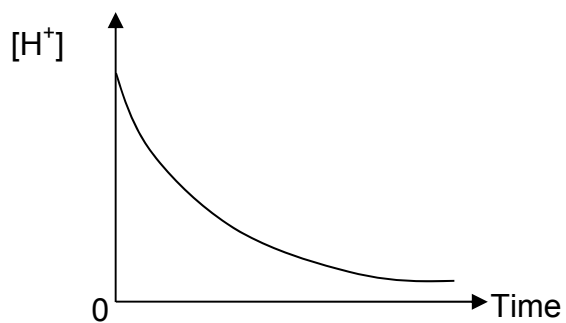
B



C



D



- 15 The Period 4 elements Ga, Ge, As and Se are the elements below Al, Si, P and S in the Periodic Table, a portion of which is shown below.

Period 3 elements	Al	Si	P	S
Period 4 elements	Ga	Ge	As	Se

The properties of each Period 4 element resemble those of the Period 3 element directly above it.

Which Period 4 elements form oxides that dissolve in water to give an acidic solution?

**A** As and Se

**B** As and Ga

**C** Ga and Ge

**D** Ge and Se

- 16 **G**, **H** and **J** are three elements found in Period 3 of the Periodic Table.

Among the elements in Period 3,

- the melting point of **G** is the highest.
- the electrical conductivity of **H** is the highest.
- the melting point of the oxide of **J** is the highest.

Which of the following elements is **not** represented by **G**, **H** or **J**?

**A** Na

**B** Mg

**C** Al

**D** Si

- 17 In each of the following pairs, one mole of each oxide is reacted separately with aqueous sodium hydroxide. Which of the following pair of oxides shows that each oxide requires a different number of moles of sodium hydroxide for complete reaction?

**A**  $P_4O_6$  and  $P_4O_{10}$

**B**  $SO_2$  and  $SO_3$

**C**  $Al_2O_3$  and  $SO_2$

**D**  $BeO$  and  $Al_2O_3$

- 18 How many isomeric esters have the molecular formula  $C_4H_8O_2$ ?

**A** 2

**B** 3

**C** 4

**D** 5

- 19** In the free radical substitution of alkanes with bromine, the hydrogen atoms in the alkane do not react at the same rate with bromine radicals. The following table provides the relative rates of reaction of the different types of hydrogen atoms in an alkane with bromine radicals.

Type of H atom	Primary, $-\text{CH}_3$	Secondary, $-\text{CH}_2$	Tertiary $-\text{CH}$
Relative rate of reaction with Br radical	1	4	6

When 2-methylbutane reacts with bromine in the presence of sunlight to give monosubstituted products, what is the expected ratio of primary to secondary to tertiary bromoalkanes formed?

- A 6 : 2 : 1  
 B 6 : 8 : 6  
 C 9 : 2 : 1  
**D 9 : 8 : 6**

- 20** Which one of the following, in alcoholic solution, produces a precipitate fastest when warmed with aqueous silver nitrate?

- A 1-bromobut-1-ene  
**B 1-bromobut-2-ene**  
 C 1-chlorobut-1-ene  
 D 1-chlorobut-2-ene

- 21** Which set of reagents **M** and **N** could be used in succession to convert (chloromethyl)benzene,  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$ , to phenylethanoic acid,  $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$ ?

	<b>M</b>	<b>N</b>
<b>A</b>	$\text{Cl}_2$ (aq)	$\text{NaOH}$ (aq)
<b>B</b>	$\text{NaOH}$ (aq)	$\text{K}_2\text{Cr}_2\text{O}_7$ (aq)
<b>C</b>	$\text{HCN}$ (trace $\text{NaCN}$ )	dilute $\text{HCl}$
<b>D</b>	<b>KCN (in ethanol)</b>	<b>dilute <math>\text{H}_2\text{SO}_4</math></b>



- 22 When an organic compound **P** was treated with phosphorus pentachloride, hydrogen chloride fumes was evolved. When **P** was warmed with acidified potassium dichromate(VI), the solution turned green.

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

- A  $\text{CH}_3\text{CH}_2\text{COOH}$
- B  $\text{CH}_3\text{CH}_2\text{CHO}$
- C  $(\text{CH}_3)_3\text{COH}$
- D  $(\text{CH}_3)_2\text{CHOH}$

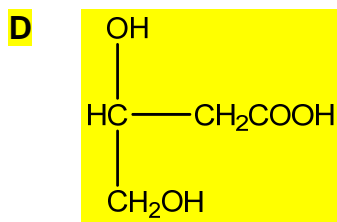
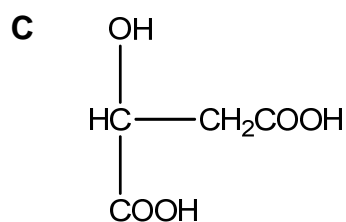
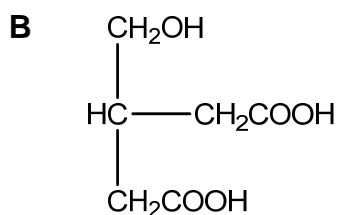
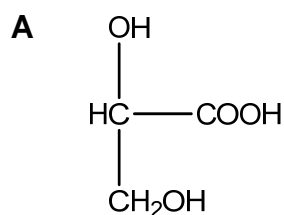
- 23 Which statement about ethanal and propanone is **not** correct?

- A Both give a positive tri-iodomethane test.
- B Both react with 2,4-dinitrophenylhydrazine reagent.
- C Both may be prepared by the oxidation of an alcohol.
- D Both react with warm acidified sodium dichromate(VI).

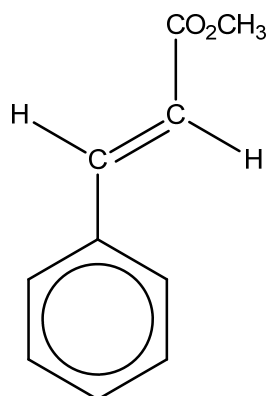
- 24 One industrial preparation of ethanoic acid is the direct carbonylation of methanol, using a rhodium catalyst.



Which compound could be expected to produce  $\begin{array}{c} \text{COOH} \\ | \\ \text{HC} - \text{CH}_2\text{COOH} \\ | \\ \text{CH}_2\text{COOH} \end{array}$  by this method?



- 25 The spicy aroma of *matsutake* mushroom, a Japanese delicacy, originates from *methyl cinnamate*.



*Methyl cinnamate*

Which of the following compounds is produced when *methyl cinnamate* is heated with acidified potassium dichromate(VI)?

- A benzoic acid
- B ethanoic acid
- C methanoic acid**
- D 1,2-ethanedioic acid

## Section B

For each of the questions 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 which 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 Which of the following contains approximately the same number of the stated particles as there are atoms in 18.0 g of water?

1 Number of ions in 158.2 g of sodium thiosulfate,  $\text{Na}_2\text{S}_2\text{O}_3$

2 Number of molecules in 6.0 g of hydrogen

3 Number of neutrons in 6.0 g of carbon

- 27 There are three isotopes of hydrogen;  $^1\text{H}$  (which is represented as H),  $^2\text{H}$  (which is known as deuterium, D) and  $^3\text{H}$  (which is known as tritium, T).

Which of the following species would have the same magnitude in terms of angle of deflection as  $\text{T}^+$  when passed through an electric field?

1  $\text{T}^-$

2  $\text{T}_2^{2+}$

3  $\text{HD}^+$

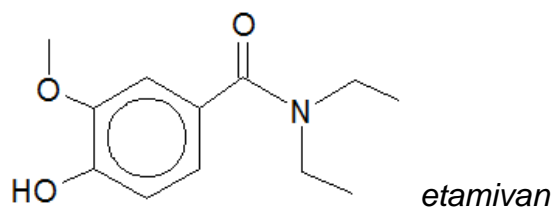
- 28 Which of the following statements about the properties of a catalyst are correct?

1 A catalyst increases the rate constant.

2 A catalyst increases the rate of the reverse reaction.

3 A catalyst increases the rate of collisions between the reacting particles.

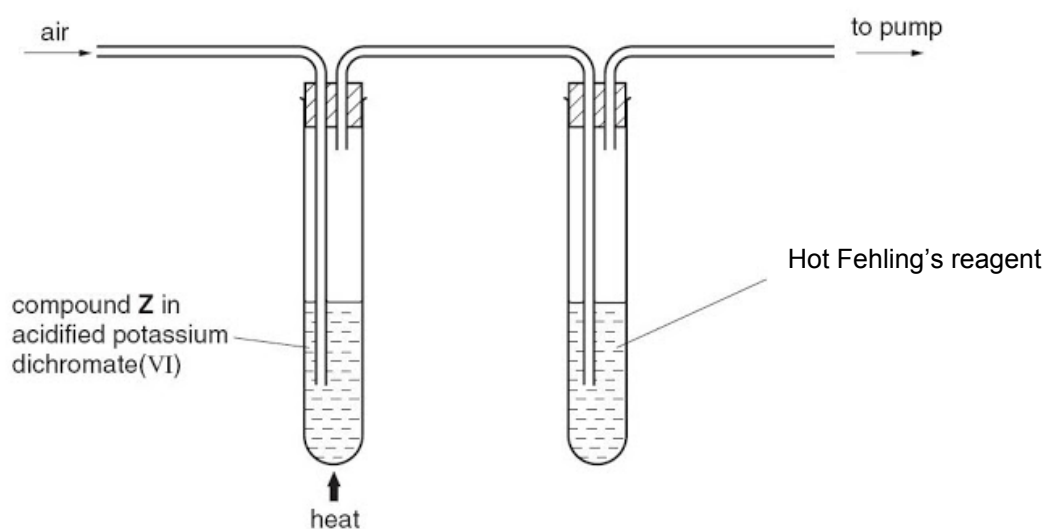
- 29 *Etamivan* is a banned drug in sports. It has the ability to increase respiratory rate and blood flow.



Which of the following functional groups are **not** present in *etamivan*?

- 1 alcohol
- 2 ketone
- 3 phenyl

- 30 When the apparatus below was used with compound **Z**, a brick red precipitate formed in the right-hand side tube.



Which of the following could be **Z**?

- 1  $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{OH}$
- 2  $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$
- 3  $\text{C}_6\text{H}_5\text{OH}$

**End of Paper 1**