



**CATHOLIC JUNIOR COLLEGE**  
**JC2 PRELIMINARY EXAMINATIONS**  
**Higher 1**

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**CHEMISTRY**

**Paper 1 Multiple Choice**

**8872/01**

**Wednesday 3<sup>rd</sup> September 2014**  
**50 minutes**

Additional Materials: Multiple Choice Answer Booklet  
Data Booklet

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**READ THESE INSTRUCTIONS FIRST**

Write your name and HT group on all the work you hand in.

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 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.

**Section A**

For each question there are **four** possible answers, **A**, **B**, **C** and **D**. Choose the one you consider to be **correct** and record your choice in soft pencil on the **separate Answer Sheet** provided.

- 1 Neurological disorders due to mercury poisoning occur when mercury forms a 1:1 complex with lipoyl groups, which are vital for glucose metabolism.  
Calculate the mass of mercury required to complex all the lipoyl groups in 5.0 kg of body fluid.

[Average concentration of lipoyl groups in body fluid =  $1.0 \times 10^{-8} \text{ mol kg}^{-1}$ ]

**A**  $4.0 \times 10^{-7} \text{g}$     **B**  $2.0 \times 10^{-6} \text{g}$     **C**  $2.5 \times 10^{-6} \text{g}$     **D**  $1.0 \times 10^{-5} \text{g}$

- 2 In a titration, a sample of  $0.05 \text{ mol dm}^{-3}$  of sulfuric acid was found to require  $15.00 \text{ cm}^3$  of  $10.50 \text{ g dm}^{-3}$  solution of potassium hydroxide for complete neutralisation.

Which of the following shows the correct volume of acid used in the titration?

**A**  $14.1 \text{ cm}^3$     **B**  $28.1 \text{ cm}^3$     **C**  $42.2 \text{ cm}^3$     **D**  $56.1 \text{ cm}^3$

- 3 In an experiment,  $37.50 \text{ cm}^3$  of  $0.100 \text{ mol dm}^{-3}$  solution of aqueous sodium sulfite reacted exactly with  $25.0 \text{ cm}^3$  of  $0.100 \text{ mol dm}^{-3}$  of a metallic salt.

The half equation for the oxidation of the sulfite ion is shown below.



If the new oxidation number of the metal is 0, what was its original oxidation number?

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

- 4 Potassium ferricyanide,  $\text{K}_3\text{Fe}(\text{CN})_x$ , is commonly used in photography. Given that the 1 mole of  $\text{K}_3\text{Fe}(\text{CN})_x$  has a mass of 329.3 g, calculate the percentage by mass of C in the compound.
- A 47.4%      B 23.7%      C 21.9%      D 14.6%
- 5 Which of the following has more neutrons than electrons and more electrons than protons?
- A  $^{37}\text{Cl}^-$       B  $^{48}\text{Ti}^{4+}$       C  $^{79}\text{Br}^+$       D  $^{32}\text{S}^{2-}$
- 6 Which of the following statement regarding isotopes is correct?
- A Graphite is an isotope of diamond.  
B Isotopes have the same number of neutrons.  
C Isotopes have the same density.  
D Isotopes have similar chemical properties.
- 7 Which one of the following statements about the properties of silicon dioxide is correct?
- A It exists as simple molecules with intermolecular van der Waals' forces of attraction.  
B It is a non-conductor of electricity.  
C It can dissolve in water to produce  $\text{Si}^{4+}$  and  $\text{O}^{2-}$  ions.  
D Each silicon atom is bonded to oxygen atoms in a trigonal planar arrangement.

- 8 Which option shows, in ascending order, the correct sequence of the magnitude of lattice energies of the following compounds?

I NaCl

II RbCl

III MgS

IV BaS

A I, II, III, IV

B II, I, IV, III

C III, IV, I, II

D IV, III, II, I

- 9 From which of the following reactions can the bond energy of the Si–Cl bond be determined by using **only** the standard enthalpy change of the reaction?

A  $\text{SiCl}_4(l) \rightarrow \text{SiCl}_4(g)$

B  $2 \text{Cl}_2(g) + \text{Si}(s) \rightarrow \text{SiCl}_4(g)$

C  $\text{SiCl}_4(g) \rightarrow \text{Si}(g) + 4 \text{Cl}(g)$

D  $\text{SiCl}_4(g) \rightarrow \text{SiCl}_2(g) + \text{Cl}_2(g)$

- 10 Which of the following statement is always true about a system in dynamic equilibrium?

A The addition of a catalyst can affect the position of the equilibrium.

B The rate of forward reaction is the same as the rate of backward reaction.

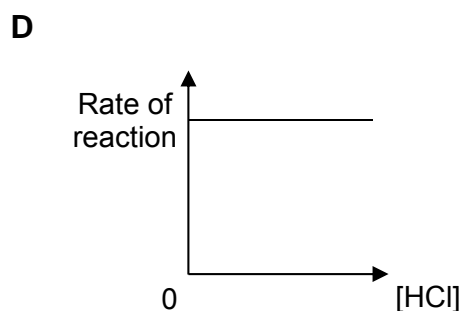
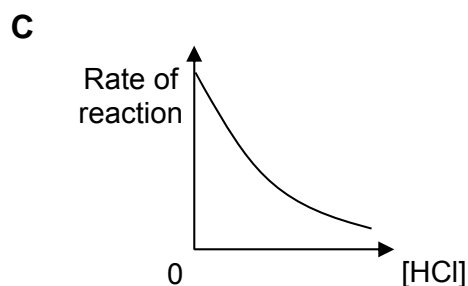
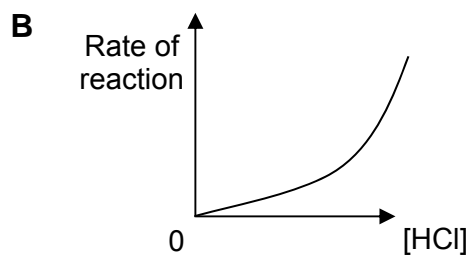
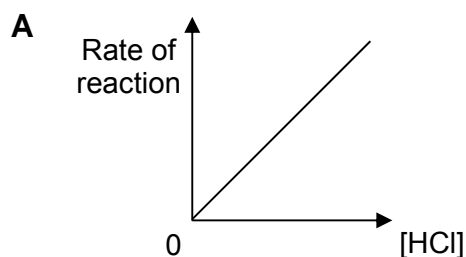
C The concentration of products is constantly changing at dynamic equilibrium.

D At dynamic equilibrium, the concentration of products is the same as that of the reactants.

- 11 A mixture was made by adding  $10\text{ cm}^3$  of a solution of pH 1 to  $30\text{ cm}^3$  of another solution of pH 5. What is the final pH of the mixture?
- A** 1.6                      **B** 2.5                      **C** 3.0                      **D** 4.0
- 12 Which of the following pairs of solutions will produce an acidic buffer solution upon mixing equal volumes of each solution?
- A**  $1.50\text{ mol dm}^{-3}$  of HCl and  $1.00\text{ mol dm}^{-3}$  of NaOH  
**B**  $1.00\text{ mol dm}^{-3}$  of  $\text{CH}_3\text{CO}_2\text{H}$  and  $2.00\text{ mol dm}^{-3}$  of NaOH  
**C**  $0.50\text{ mol dm}^{-3}$  of  $\text{H}_2\text{SO}_4$  and  $2.00\text{ mol dm}^{-3}$  of  $\text{NH}_3(\text{aq})$   
**D**  $1.00\text{ mol dm}^{-3}$  of  $\text{C}_6\text{H}_5\text{CO}_2\text{H}$  and  $0.50\text{ mol dm}^{-3}$  of KOH
- 13 The rate of decay of a radioactive isotope (a first order reaction) was found to decrease from 200 counts per minute to 12.5 counts per minute after 48 hours. What is the half-life of this isotope?
- A** 6 hours                      **B** 12 hours                      **C** 18 hours                      **D** 24 hours

- 14 Methyl ethanoate,  $\text{CH}_3\text{CO}_2\text{CH}_3$ , undergoes hydrolysis in water in the presence of  $\text{HCl}$ , which catalyses the reaction.

Which of the following graphs would confirm that the rate of reaction is first order with respect to  $\text{HCl}$ ?



- 15 Element **X** has a melting point of  $97.8^\circ\text{C}$  and has high electrical conductivity. The oxide of **X** dissolves readily in water to produce a solution which turns red litmus paper blue. However, the chloride of **X** dissolves in water to give a neutral solution. Which group does element **X** most likely belong to?

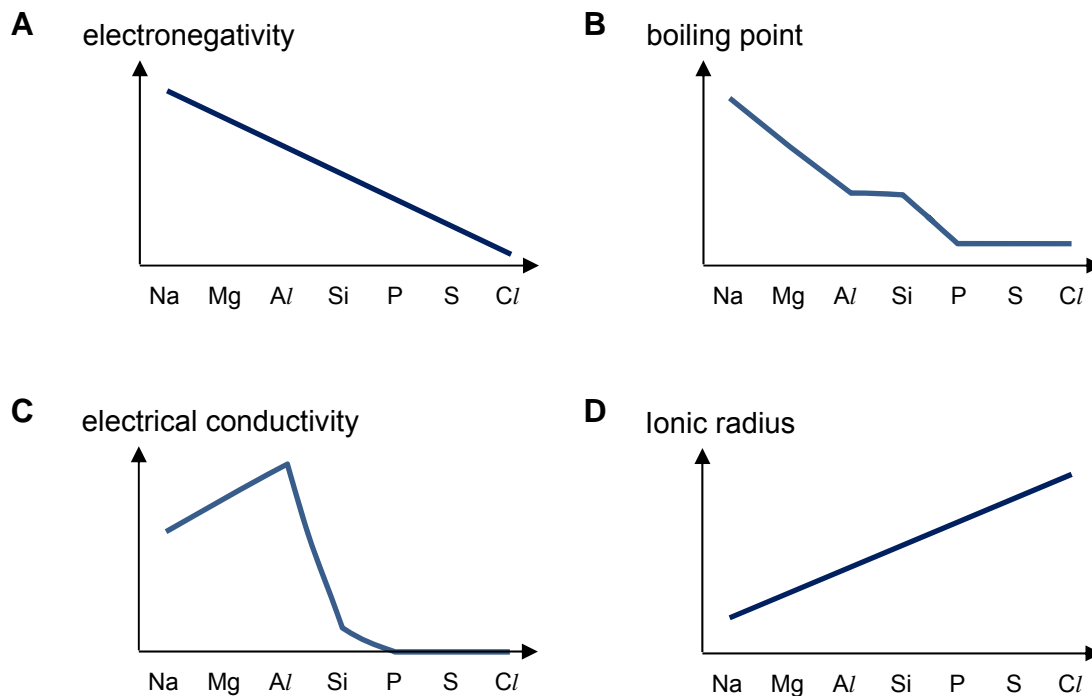
**A** I

**B** II

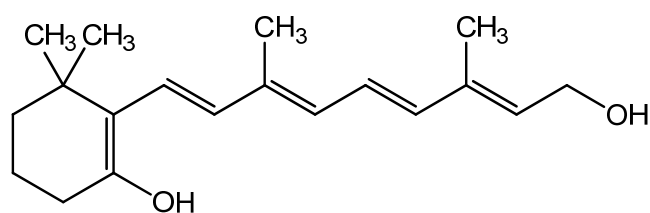
**C** III

**D** IV

16 Which of the following shows the correct trend for Period 3 elements?



17 Vitamin A is essential to the human body as it is needed for growth and development of the immune system. The structure of a molecule of vitamin A is shown as follows:



Vitamin A

Which of the following will **not** result in an observable change when reacted with Vitamin A?

- A** Hot alkaline  $\text{KMnO}_4$
- B**  $\text{SOCl}_2$ , heat under reflux
- C**  $\text{Br}_2(\text{aq})$ , room temperature
- D**  $\text{PCl}_3$ , room temperature

18 How many structural isomers can  $C_4H_9Cl$  form?

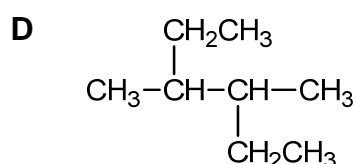
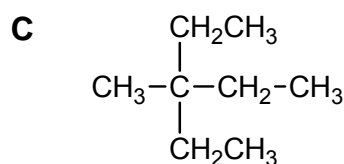
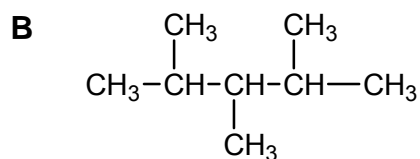
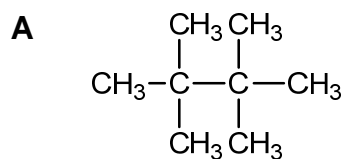
A 3

B 4

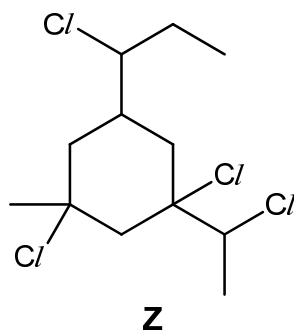
C 5

D 6

19 Hydrocarbon **X** reacts with bromine gas in the presence of UV light to form 3 mono-brominated products. Which of the following is a possible structure of **X**?



20 Compound **Z**, the major product, is obtained when compound **Y** is reacted with gaseous  $\text{HCl}$ . How many pairs of geometric isomers does the compound **Y** have?



A 1

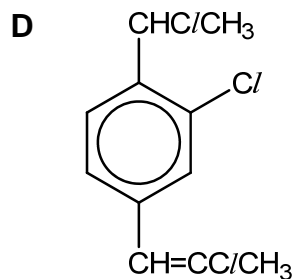
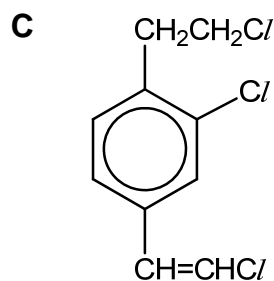
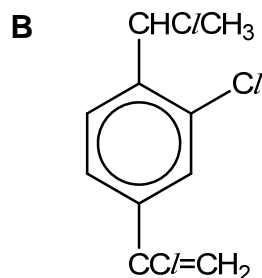
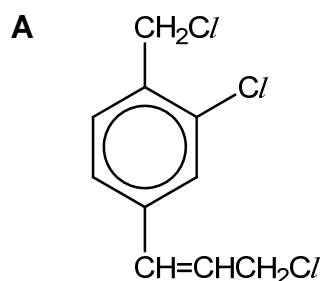
B 2

C 3

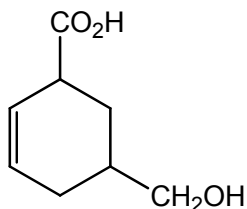
D 4



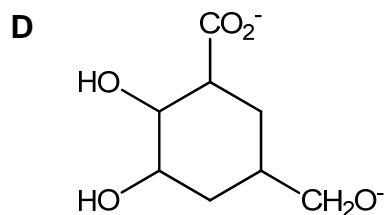
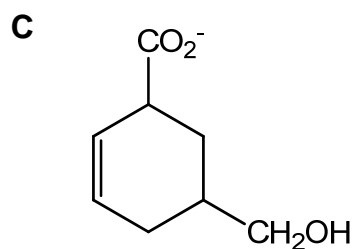
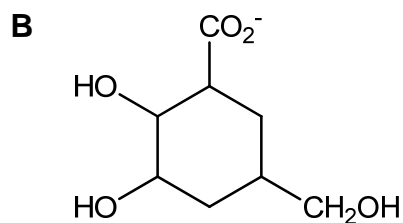
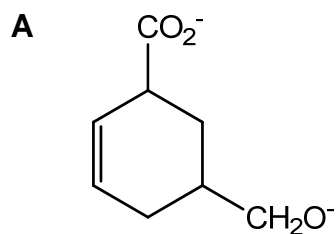
- 21 0.050 mol of compound **P** is first heated with excess aqueous potassium hydroxide. Nitric acid followed by aqueous silver nitrate was then added before filtration was carried out. Given that 14.4 g of precipitate is obtained, which of the following is a possible structure of **P**?



- 22 Excess aqueous sodium hydroxide is added to the molecule shown as follows.



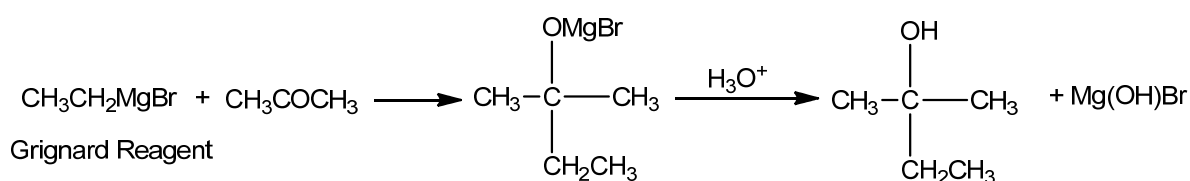
Which structure represents the organic ion produced?



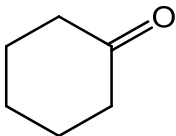
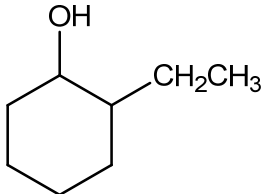
23 Which of the following statements is **not** true about ethanol?

- A It produces yellow precipitate when reacted with NaOH(aq) and I<sub>2</sub>
- B It can react with NaBr and concentrated H<sub>2</sub>SO<sub>4</sub> heated under reflux.
- C It can react with KCN to produce an organic compound with 3 carbon atoms.
- D It produces brown precipitate when heated under reflux with alkaline KMnO<sub>4</sub>

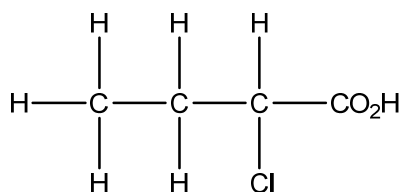
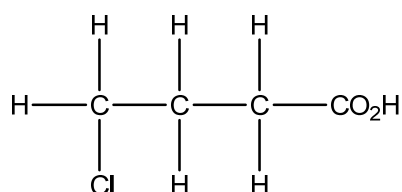
24 In a Grignard reaction, the Grignard reagent reacts with carbonyl compounds to yield alcohols. One example of such reaction is shown as follows:



Which of the following alcohols is **not** a possible product when the Grignard reagent shown above is reacted with the corresponding carbonyl compound?

	Carbonyl compound	Alcohol produced
A	$\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$	$\text{H}-\overset{\text{OH}}{\underset{\text{CH}_2\text{CH}_3}{\text{C}}}-\text{H}$
B	$\text{CH}_3\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$	$\text{CH}_3\text{CH}_2-\overset{\text{OH}}{\underset{\text{CH}_2\text{CH}_3}{\text{C}}}-\text{H}$
C	$\text{CH}_3\underset{\text{CH}_3}{\text{CH}}\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$	$\text{CH}_3\underset{\text{CH}_3}{\text{CH}}\text{CH}_2-\overset{\text{OH}}{\underset{\text{CH}_2\text{CH}_3}{\text{C}}}-\text{CH}_3$
D		

- 25 The structure of two organic acids, **X** and **Y** are shown as follows.

**X****Y**

Which of the following statement is true about these two acids?

- A** **X** has a higher pK<sub>a</sub> value than **Y**.
- B** Only **Y** can produce effervescence when reacted with NaHCO<sub>3</sub>.
- C** Only **X** can undergo elimination to form a pair of geometric isomers.
- D** Both acids can be reduced to form primary alcohols when reacted with NaBH<sub>4</sub> in methanol.

## 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 that you consider to be correct).

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

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1, 2 and 3</b> are correct	<b>1 and 2</b> only are correct	<b>2 and 3</b> only are correct	<b>1</b> only is correct

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

**26** Which of the following compounds is able to form hydrogen bonding with water molecules?

- 1**  $\text{CH}_3\text{CH}_2\text{NH}_2$
- 2**  $\text{CH}_3\text{CH}_2\text{CHO}$
- 3**  $\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$

**27** The kinetics of the reaction  $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$  were investigated and the results are given in the following table.

<b>Experiment</b>	<b>[A]</b>	<b>[B]</b>	<b>Relative Rate</b>
<b>1</b>	x	y	r
<b>2</b>	2x	y	2r
<b>3</b>	3x	3y	3r

Which of the following statements is correct?

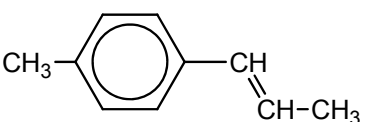
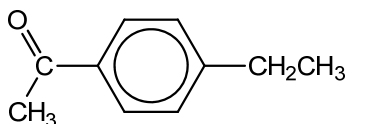
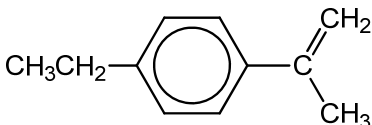
- 1** The reaction is first order with respect to A.
- 2** The rate of reaction is independent of the concentration of B.
- 3** The units for the rate constant,  $k$ , is  $\text{mol}^{-1} \text{dm}^3 \text{s}^{-1}$ .

- 28** Elements diagonally adjacent to each other in the Periodic Table have similar properties. For example, beryllium has properties similar to aluminium.

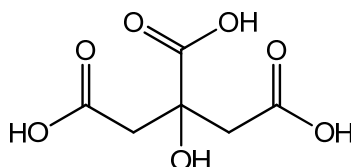
Which of the following statements regarding beryllium is correct?

- 1 Beryllium oxide is amphoteric.
  - 2 Beryllium chloride is able to polymerise due to dative covalent bonds.
  - 3 Beryllium oxide has high melting point.
- 29** An organic compound, **U**, is heated under reflux with acidified  $\text{KMnO}_4$  and the organic only product formed obtained is benzene-1,4-dicarboxylic acid.

Which of the following is a possible structure of compound **U**?

- 1 
- 2 
- 3 

- 30** Citric acids which can be found in citrus fruits are usually used as a natural preservatives and food additive. A molecule of citric acid is shown as follows.



Which of the following statements is true about citric acid?

- 1 One mole of citric acid can react with 4 moles of  $\text{PCl}_5(\text{s})$  at r.t.p.
- 2 One mole of citric acid can react with 4 moles of  $\text{NaOH}(\text{aq})$  at r.t.p.
- 3 After heating with acidified  $\text{KMnO}_4$ , the product formed is able to form orange crystals with 2,4-dinitrophenylhydrazine.

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