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PIONEER JUNIOR COLLEGE, SINGAPORE

**JC2 PRELIMINARY EXAMINATIONS
HIGHER 1**

CHEMISTRY

8872/01

Paper 1 Multiple Choice

24 September 2009

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.

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

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.

This document consists of **10** 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.

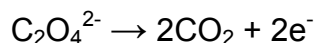
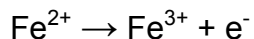
- 1 What is the **minimum** volume of air required for complete combustion of 10 cm³ of a hydrocarbon, C₃H₄? (Assume that air contains one-fifth oxygen by volume and that both gas volumes are measured at the same temperature and pressure.)

A 40 cm³ **B** 50 cm³ **C** 200 cm³ **D** 250 cm³

- 2 What are the oxidation states of chlorine in these three chlorine compounds?

chlorine compounds	NaCl	NaClO	NaClO ₃
A	-1	+1	+5
B	+1	-1	+5
C	+1	-1	+7
D	+2	-1	+7

- 3 Consider the following half-equations.



What volume of 0.01 mol dm⁻³ KMnO₄ is required to oxidise 15 cm³ of an acidified solution of 0.01 mol dm⁻³ FeC₂O₄?

A 6 cm³ **B** 9 cm³ **C** 15 cm³ **D** 25 cm³

- 4 What is the relative energy between the 3*d* and the 4*s* subshells in chlorine atom and chromium atom respectively?

	chlorine atom	chromium atom
A relative energy between 3 <i>d</i> and 4 <i>s</i> subshell	4 <i>s</i> > 3 <i>d</i>	4 <i>s</i> > 3 <i>d</i>
B relative energy between 3 <i>d</i> and 4 <i>s</i> subshell	4 <i>s</i> > 3 <i>d</i>	4 <i>s</i> < 3 <i>d</i>
C relative energy between 3 <i>d</i> and 4 <i>s</i> subshell	4 <i>s</i> < 3 <i>d</i>	4 <i>s</i> > 3 <i>d</i>
D relative energy between 3 <i>d</i> and 4 <i>s</i> subshell	4 <i>s</i> < 3 <i>d</i>	4 <i>s</i> < 3 <i>d</i>

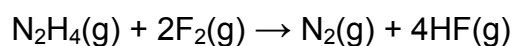
- 5 What is the bond angle of O – C – O in CO_3^{2-} ion?
- A 180° B 120° C 109.5° D 107°

- 6 In which of the following pairs do the molecules have similar shapes?

- A BeCl_2 and H_2O
 B BF_3 and NH_3
 C CO_2 and SO_2
 D AlCl_3 and BCl_3

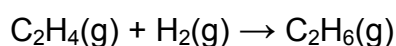
- 7 *Use of the Data Booklet is relevant to this question.*

What is the enthalpy change of reaction of the following reaction?



- A $-1206 \text{ kJ mol}^{-1}$
 B -372 kJ mol^{-1}
 C $+372 \text{ kJ mol}^{-1}$
 D $+1206 \text{ kJ mol}^{-1}$

- 8 What is the enthalpy change of the reaction shown below?



You are given the following enthalpy changes.

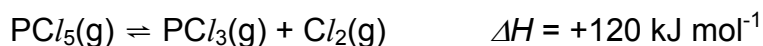
$\Delta H_f(\text{H}_2\text{O})$	-286 kJ mol^{-1}
$\Delta H_c(\text{C}_2\text{H}_4)$	$-1411 \text{ kJ mol}^{-1}$
$\Delta H_c(\text{C}_2\text{H}_6)$	$-1569 \text{ kJ mol}^{-1}$

- A -128 kJ mol^{-1}
 B $-1357 \text{ kJ mol}^{-1}$
 C $+128 \text{ kJ mol}^{-1}$
 D $+1357 \text{ kJ mol}^{-1}$

- 9 250 cm³ of 0.50 mol dm⁻³ KOH(aq) at 29.0 °C were mixed in a polystyrene cup, of negligible heat capacity, with an equal volume of 0.50 mol dm⁻³ HCl(aq) at the same initial temperature. The final temperature was 32.4 °C.

What is the enthalpy change of neutralisation of the reaction?

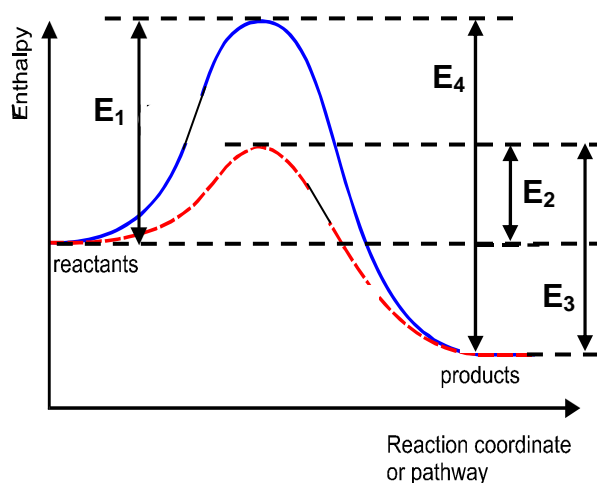
- A + 28.4 kJ mol⁻¹
 - B + 56.8 kJ mol⁻¹
 - C - 28.4 kJ mol⁻¹
 - D - 56.8 kJ mol⁻¹
- 10 Which statement about the effect of a catalyst on a reversible reaction is correct?
- A It increases the rate constant for both the forward reaction and the reverse reaction.
 - B It increases the rate constant for the forward reaction but not of the reverse reaction.
 - C It increases the equilibrium constant for the forward reaction.
 - D It increases the yield of the product in an equilibrium.
- 11 An equilibrium is represented by the following equation.



Which of the following changes would increase both the value of the equilibrium constant, K_c , and the proportion of PCl_3 at equilibrium?

- A increasing the concentration of PCl_5
 - B increasing the temperature
 - C decreasing the pressure
 - D adding a catalyst
- 12 An enzyme, found in the stomach, operates at maximum efficiency when in an aqueous solution buffered around pH 5.
- Which combination of substances, when dissolved in 10 dm³ of water, would give the necessary buffer solution?
- A 0.5 mol of NaOH and 1.0 mol of HCl
 - B 0.5 mol of NaOH and 1.0 mol of CH_3COOH
 - C 0.5 mol of NH_3 and 1.0 mol of HCl
 - D 0.5 mol of NH_3 and 1.0 mol of NaCl

13. A 2.0 dm^3 solution of a strong acid has pH 2. What volume of water is needed to be added to it to increase the pH of the solution to pH 3?
- A 1.0 dm^3
 B 3.0 dm^3
 C 18.0 dm^3
 D 20.0 dm^3
14. The following energy pathway diagram represents a reaction occurring with and without a catalyst.



Which of the following statements is correct?

- A The activation energy for the reverse catalysed reaction is E_4 .
 B The forward reaction, with catalyst, is endothermic.
 C The enthalpy change of reaction is $E_4 - E_3$.
 D The enthalpy change of reaction is unchanged by using a catalyst.
15. **P**, **Q** and **R** are elements in the same period of the Periodic Table. The oxide of **P** is amphoteric, the oxide of **Q** is basic and the oxide of **R** is acidic.

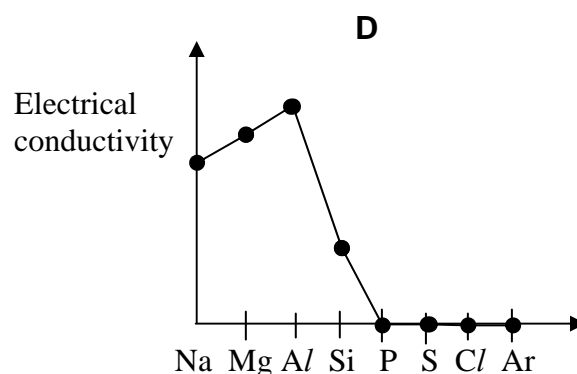
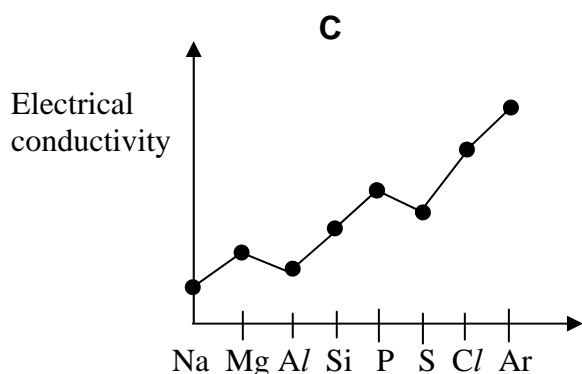
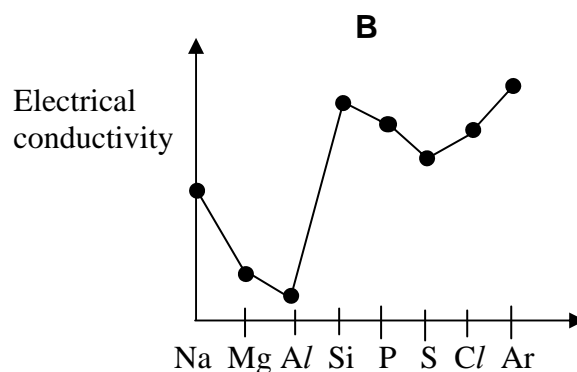
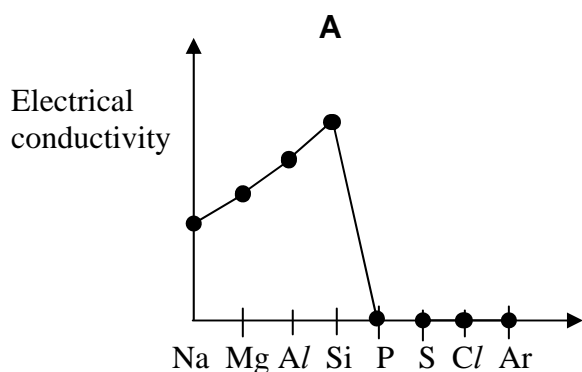
What is the order of increasing atomic (proton) number for these elements?

- A **PQR** B **PRQ** C **QPR** D **QRP**

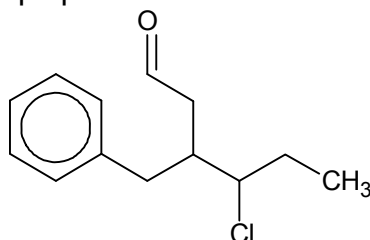
16 Which property of the first six elements of period 3, from sodium to sulfur, continuously increases numerically?

- A atomic radius
- B electronegativity
- C first ionisation energy
- D melting point

17 Which graph best shows the variation of electrical conductivity of the third period elements?



18 What are the functional groups present in the molecule shown below?

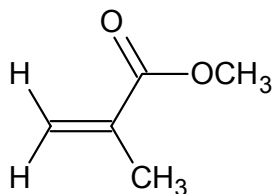


- A phenyl, ketone and tertiary alkyl halide
- B phenyl, ketone and secondary alkyl halide
- C phenyl, aldehyde and tertiary alkyl halide
- D phenyl, aldehyde and secondary alkyl halide

19 How many possible isomers with at least one bromine can be produced by the substitution of C_2H_6 with Br_2 in uv light?

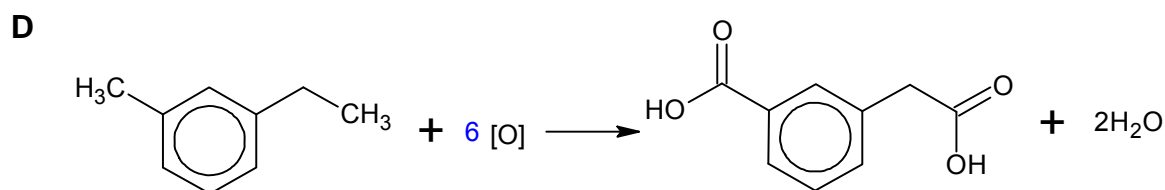
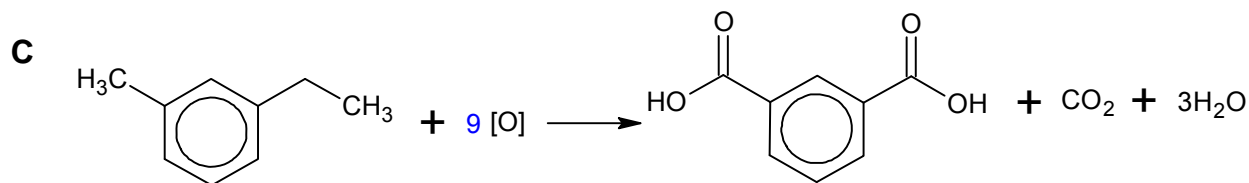
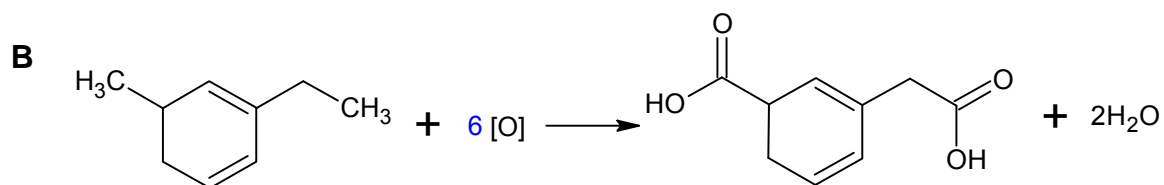
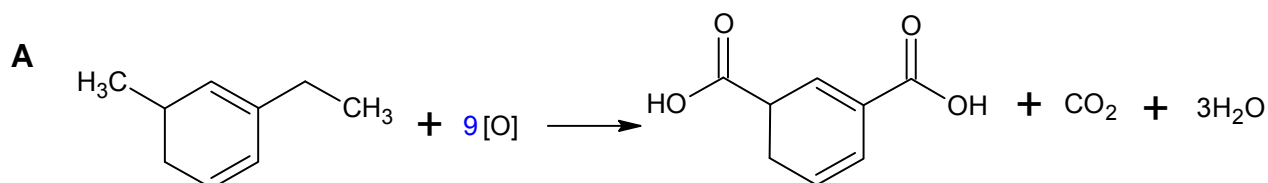
- A 7 B 8 C 9 D 10

20 Which of the following statement is true of the organic compound shown below?



- A It is a cis isomer.
 B It has three sp^2 carbon atoms and two sp^3 carbon atoms.
 C It has 7 σ and 2 π bonds.
 D It will form a ketone as one of the products with hot acidified $K_2Cr_2O_7(aq)$.

21 Which one of the following reactions shown below is correct?



- 22** Which one of the following pairs of reagents **cannot** be used to prepare $\text{CH}_3\text{CH}_2\text{Cl}$?
- A** $\text{CH}_3\text{CH}_2\text{OH} + \text{NaCl}$
 - B** $\text{CH}_2=\text{CHCl} + \text{H}_2$
 - C** $\text{CH}_3\text{CH}_2\text{OH} + \text{PCl}_5$
 - D** $\text{CH}_2=\text{CH}_2 + \text{HCl}$
- 23** Which reagent could detect the presence of added alcohol in petrol consisting mainly of a mixture of alkanes and alkenes?
- A** Na
 - B** Br_2 in CCl_4
 - C** $\text{KMnO}_4(\text{aq})$
 - D** 2,4-dinitrophenylhydrazine
- 24** For which one of the following pairs of compounds can a solution of iodine in aqueous sodium hydroxide be used to distinguish between members of the pair?
- A** CH_3CHO and CH_3COCH_3
 - B** $\text{CH}_3\text{CH}_2\text{CHO}$ and CH_3COCH_3
 - C** $\text{CH}_3\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$
 - D** $\text{CH}_3\text{CO}_2\text{H}$ and $\text{CH}_3\text{CO}_2\text{CH}_3$
- 25** What are the products formed when the ester, $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$, reacts with hot $\text{HCl}(\text{aq})$?
- A** $\text{CH}_3\text{CO}_2\text{H}$ and $\text{C}_2\text{H}_5\text{OH}$
 - B** $\text{C}_2\text{H}_5\text{CO}_2\text{H}$ only
 - C** $\text{CH}_3\text{CO}_2\text{H}$ and CH_3OH
 - D** $\text{CH}_3\text{CO}_2\text{H}$ and $\text{C}_2\text{H}_5\text{Cl}$

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

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 molecules are able to use their underlined H atoms to form hydrogen bonds with water molecules?

- 1** $\text{C}_2\text{H}_5\text{O}\underline{\text{H}}$
- 2** $\text{CH}_3\text{C}\underline{\text{H}}_2\text{F}$
- 3** $\text{CH}_3\text{C}\underline{\text{H}}\text{O}$

27 For which of the following classes of reaction is the enthalpy change always exothermic?

- 1** formation
- 2** combustion
- 3** neutralisation

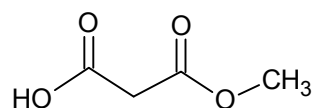
28 Which statements are correct about sodium, magnesium and aluminium?

- 1** All their oxides react with hydrochloric acid to form a salt and water.
- 2** All their oxides are soluble in water forming an alkaline solution.
- 3** All their chlorides are acidic in aqueous solution.

- 29** Which of the following starting reagents and conditions will form $\text{CH}_3\text{CH}_2\text{NH}_2$ from $\text{CH}_3\text{CH}_2\text{Br}$?

	<i>reagents</i>	<i>conditions</i>
1	$\text{CH}_3\text{CH}_2\text{Br}$	excess $\text{NH}_3(\text{g})$ in sealed tube, heat
2	CH_3Br	KCN in ethanol, heat followed by LiAlH_4 in dry ether
3	$\text{CH}_3\text{CH}_2\text{Br}$	KCN in ethanol, heat followed by $\text{H}_2\text{SO}_4(\text{aq})$, heat

- 30** Which of the following properties does the compound shown below possess?



- 1** It produces steamy misty fumes with PCl_5 .
- 2** One mole of the compound reacts with one mole of cold $\text{NaOH}(\text{aq})$.
- 3** One mole of the compound reacts with one mole of hot $\text{NaOH}(\text{aq})$.