

NANYANG JUNIOR COLLEGE  
JC 2 PRELIMINARY EXAMINATION  
Higher 1

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**CHEMISTRY**

Paper 1 Multiple Choice

**8872/01**

**25 September 2009**

**50 minutes**

Additional Materials: Multiple Choice Answer Sheet  
Data Booklet

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**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and tutor's name 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.

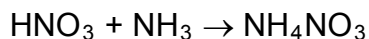
This document consists of **14** printed pages.

**[Turn over**

## Section A

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

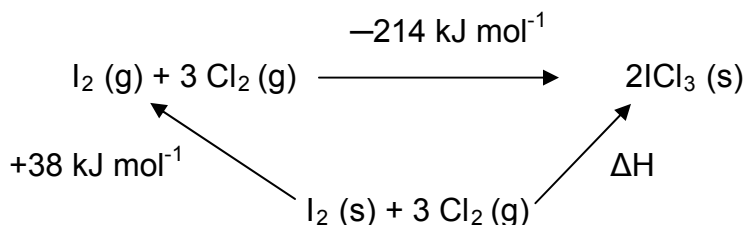
- 1 How many cations are present in 0.5 moles of sodium carbonate?
- A** 0.5  
**B** 1.0  
**C**  $3.01 \times 10^{23}$   
**D**  $6.02 \times 10^{23}$
- 2 Ammonium nitrate can be produced by reaction between nitric acid and ammonia as shown below. If the yield of the reaction is 65 %, determine the volume of  $5.0 \text{ mol dm}^{-3}$  nitric acid required to react with ammonia (excess) to form 20 kg of ammonium nitrate.



- A**  $32.5 \text{ dm}^3$   
**B**  $50 \text{ dm}^3$   
**C**  $77 \text{ dm}^3$   
**D**  $385 \text{ dm}^3$
- 3 When potassium chlorate(V),  $\text{KClO}_3$ , is heated at its melting point, it disproportionates to potassium chlorate(VII),  $\text{KClO}_4$ , and potassium chloride.
- What is the maximum number of moles of potassium chlorate(VII) which can be produced from 0.1 mol potassium chlorate(V)?
- A** 0.1  
**B** 0.08  
**C** 0.075  
**D** 0.06

- 4 The use of the *Data Booklet* is relevant to this question.  
Which of the species contains 18 neutrons and 18 electrons?
- A  $^{33}\text{P}^{2-}$
  - B  $^{33}\text{S}^{2-}$
  - C  $^{33}\text{P}^{3-}$
  - D  $^{33}\text{S}^{3-}$
- 5 Ga, Ge, As and Se are successive elements in Period 4. Which of the following statements is true?
- A  $\text{Ga}^{2+}$  and Ni are isoelectronic.
  - B Both Se and Ge have two unpaired electrons at ground state.
  - C First ionisation energy of Se is greater than that of As as the effective nuclear charge increases across the period.
  - D As has only three unpaired electrons, thus the highest fluoride formed is  $\text{AsF}_3$ .
- 6 A solution of ammonia in water contains
- A simple molecules only.
  - B simple molecules and hydrogen bonded molecules only.
  - C simple molecules, hydrogen bonded molecules and ions.
  - D ions only.
- 7 Which one of the following pairs do the molecules have similar shapes?
- A  $\text{AlCl}_3$  and  $\text{PCl}_3$
  - B  $\text{BF}_3$  and  $\text{NH}_3$
  - C  $\text{BeCl}_2$  and  $\text{H}_2\text{O}$
  - D  $\text{AlCl}_3$  and  $\text{BCl}_3$

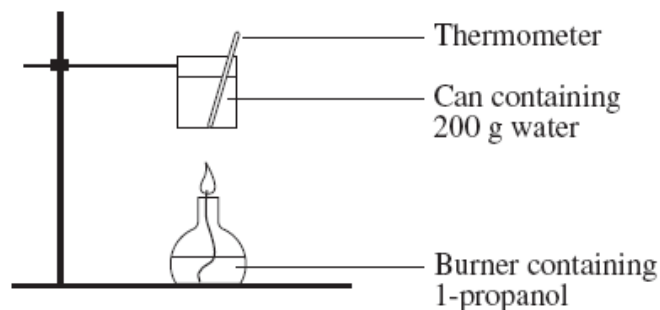
- 8 The boiling point of 2,2-dimethylpropane is lower than that of pentane because
- A 2,2-dimethylpropane is not polar whereas pentane is polar.
  - B a molecule of 2,2-dimethylpropane has more electrons than a molecule of pentane.
  - C a molecule of 2,2-dimethylpropane has less surface area of contact with other molecules than those of pentane and thus experiences weaker induced dipole-dipole attraction.
  - D molecules of 2,2-dimethylpropane do not form hydrogen bond but those of pentane do.
- 9 Given the following enthalpy changes:



What is the standard enthalpy change of formation of solid iodine trichloride,  $\text{ICl}_3$ ?

- A  $+176 \text{ kJ mol}^{-1}$
- B  $+138 \text{ kJ mol}^{-1}$
- C  $-88 \text{ kJ mol}^{-1}$
- D  $-138 \text{ kJ mol}^{-1}$

- 10 A student used the apparatus below to determine the molar heat of combustion of propanol.



The following results were obtained:

Mass of 1-propanol burnt = 0.60 g  
Mass of water heated = 200 g  
Initial temperature of water = 21.0°C

The enthalpy of combustion of 1-propanol is  $-2021 \text{ kJ mol}^{-1}$ . Assuming no heat loss, what would be the final temperature of the water? The use of the Data Booklet is relevant to this question.

- A 24.2°C
- B 29.1°C
- C 45.2°C
- D 48.4°C

- 11 Consider the following equilibrium reaction in a closed vessel:

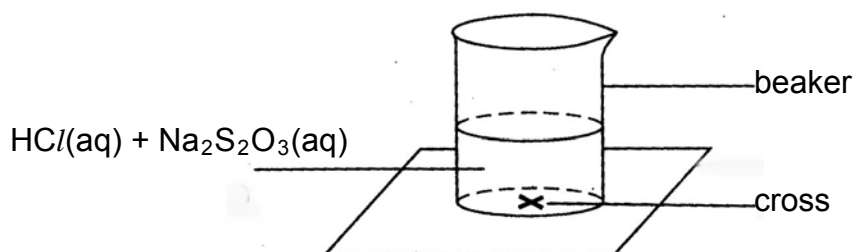
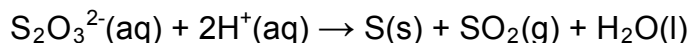


At 800°C, the equilibrium constant is 0.236 atm.

Which one of the following statements is **TRUE** about the equilibrium?

- A The position of the equilibrium shifts to the right when temperature is decreased.
  - B The position of the equilibrium shifts to the right when pressure is decreased.
  - C The value of the equilibrium constant decreases with increasing temperature.
  - D The value of the equilibrium constant decreases when less  $\text{CaCO}_3$  is used.
- 12 The biological fluid that maintains blood pH is blood plasma. It is composed of  $\text{H}_2\text{CO}_3(\text{aq})$  and  $\text{HCO}_3^-(\text{aq})$ . The **ionic equation** that represents the reaction of hydrochloric acid with this buffer is
- A  $\text{HCl} + \text{H}_2\text{CO}_3 \rightarrow \text{Cl}^- + \text{H}_3\text{CO}_3^+$
  - B  $\text{H}_3\text{O}^+ + \text{HCO}_3^- \rightarrow \text{H}_2\text{O} + \text{H}_2\text{CO}_3$
  - C  $\text{H}_3\text{O}^+ + \text{H}_2\text{CO}_3 \rightarrow \text{H}_2\text{O} + \text{H}_3\text{CO}_3^+$
  - D  $\text{HCl} + \text{HCO}_3^- \rightarrow \text{Cl}^- + \text{H}_2\text{CO}_3$
- 13 What is the final pH of a solution formed by mixing equal volumes of two solutions of pH 2.0 and 4.0?
- A 2.0
  - B 2.3
  - C 3.0
  - D 3.3

- 14 The kinetics of the reaction between  $\text{H}^+(\text{aq})$  and  $\text{S}_2\text{O}_3^{2-}(\text{aq})$  can be investigated experimentally by varying the volumes of  $\text{HCl}(\text{aq})$  and  $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$  used and determining the time taken,  $t$ , for the formation of sulphur to completely obscure the cross as shown in the diagram.



The table below shows the experimental results obtained.

Experiment	Volume used / $\text{cm}^3$			$t / \text{s}$
	$1.0 \text{ mol dm}^{-3}$ $\text{HCl}(\text{aq})$	$0.040 \text{ mol dm}^{-3}$ $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$	$\text{H}_2\text{O}(\text{l})$	
1	10.0	5.0	25.0	170
2	15.0	5.0	20.0	170
3	15.0	10.0	15.0	85
4	20.0	20.0	0.0	<b>x</b>

What is the value of **x** in Experiment 4?

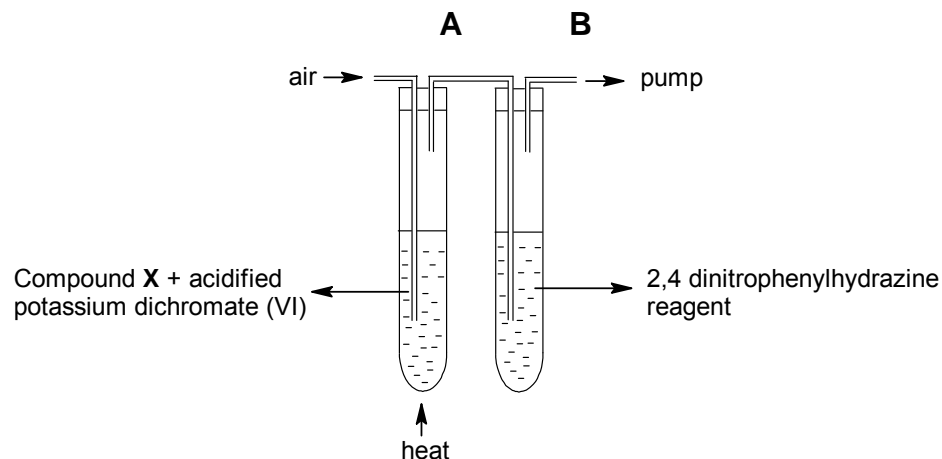
- A 21  
B 43  
C 85  
D 170
- 15 What is observed when magnesium chloride is added to water?

	Solubility in water	pH of resulting solution
A	Dissolves	2
B	Dissolves	6.5
C	Insoluble	7
D	Very slightly soluble	8

- 16 In which of the following pairs is the radius of the second atom greater than that of the first atom?
- A Na, Mg
  - B Sr, Ca
  - C P, N
  - D Cl, Br
- 17 Consider the sequence of oxides  $\text{Na}_2\text{O}$ ,  $\text{SiO}_2$ ,  $\text{P}_4\text{O}_{10}$ . Which factor decreases from  $\text{Na}_2\text{O}$  to  $\text{SiO}_2$  and also from  $\text{SiO}_2$  to  $\text{P}_4\text{O}_{10}$ ?
- A covalent character
  - B melting point
  - C pH when mixed with water
  - D solubility in aqueous alkali
- 18 Which reagent and conditions are used to bring about the reaction from methylbenzene to 4-chloromethylbenzene?
- A Chlorine in the dark
  - B Chlorine with aluminium chloride
  - C Chlorine with uv light
  - D Concentrated hydrochloric acid heated under reflux



- 19 In the given apparatus set-up, compound **X** is found to give a green solution in test-tube **A** and an orange precipitate in test-tube B.



Which of the following is likely to be compound **X**?

- A  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
  - B  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$
  - C  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{CH}_3$
  - D  $\text{CH}_3\text{COCH}_2\text{CHO}$
- 20 1 mol of compound **X** reacts with 2 mol of HCN, and compound **X** changes the colour of hot acidified sodium dichromate(VI) from orange to green.

What could **X** be?

- A  $\text{CH}_3\text{COCH}_2\text{COCH}_3$
- B  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
- C  $\text{H}_2\text{C}=\text{CHCH}_2\text{CHO}$
- D  $\text{CHOCH}_2\text{CH}_2\text{CHO}$

- 21 Which of the following isomers of  $C_5H_{11}Br$  gives the greatest number of different alkenes on treatment with hot ethanolic sodium hydroxide?

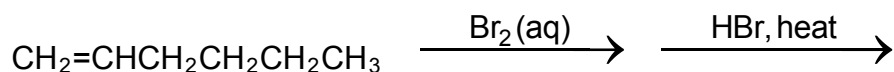
- A  $CH_3CH_2CH(CH_3)CH_2Br$   
 B  $CH_3CH_2CH_2CHBrCH_3$   
 C  $CH_3CH_2CHBrCH_2CH_3$   
 D  $CH_3CH_2CH_2CH_2CH_2Br$

- 22 A halogen compound, **W**, is heated in a sealed tube with ammonia while a nitrile, **X**, is reacted with lithium aluminium hydride in dry ether. Which of the following pairs of **W** and **X** give the same product?

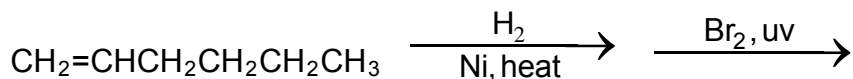
- |   | <b>W</b>            | <b>X</b>               |
|---|---------------------|------------------------|
| A | $BrCH_2CO_2H$       | $HO_2CCH_2CN$          |
| B | $CH_3OCH_2CH_2F$    | $CH_3OCH_2CN$          |
| C | $(CH_3)_2CHCl$      | $(CH_3)_2CHCN$         |
| D | $C_6H_5CHICH_2CH_3$ | $C_6H_5CH(CN)CH_2CH_3$ |

- 23 Which two-staged process will **not** give a good yield of 1,2-dibromohexane?

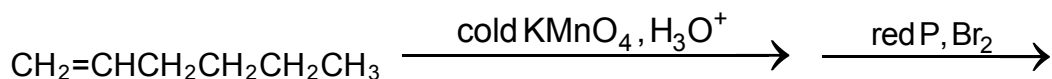
A



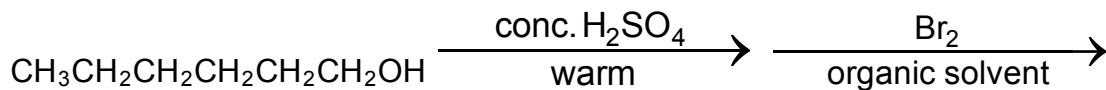
B



C



D



- 24 Which compound is a product of hydrolysis of  $\text{CH}_3\text{CO}_2\text{C}_3\text{H}_7$  by boiling hydrochloric acid?
- A  $\text{CH}_3\text{COCl}$
  - B  $\text{C}_3\text{H}_7\text{CO}_2\text{H}$
  - C  $\text{C}_3\text{H}_7\text{OH}$
  - D  $\text{C}_3\text{H}_7\text{COCl}$
- 25 For which one of the following can a solution of iodine in aqueous sodium hydroxide be used to distinguish between members of the pair?
- A  $\text{CH}_3\text{CHO}$  and  $\text{CH}_3\text{COCH}_3$
  - B  $\text{CH}_3\text{CH}_2\text{CHO}$  and  $\text{CH}_3\text{COCH}_3$
  - C  $\text{CH}_3\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{CHO}$
  - D  $\text{CH}_3\text{CH}_2\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$

## 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

<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 only</b> is correct

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

- 26** A liquid **L**, gives a white precipitate when shaken **for some time** with cold ethanolic silver nitrate.

What could be **L**?

- 1** chlorohexane
- 2** 1-chloropentane
- 3** Chlorobenzene

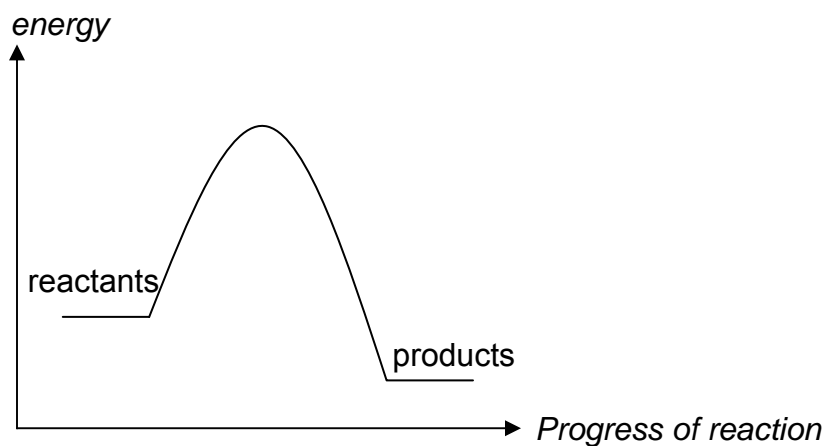
- 27** 
$$\begin{array}{ccc} & k_1 & \\ \text{Given, reactant} & \rightleftharpoons & \text{products} \\ & k_{-1} & \end{array}$$

Which of the following changes will cause both of the rate constants,  $k_1$  and  $k_{-1}$  to be increased?

- 1** introducing a catalyst
- 2** heating the equilibrium mixture
- 3** increasing the concentrations of the reactants.

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

- 28 The diagram below represents the reaction profile of a typical reaction.



- 1 The product formed is energetically more stable than the reactants.
  - 2 The reaction is favoured by an increase in temperature.
  - 3 There is an intermediate formed in the reaction.
- 29 Which of the following compounds will react with sodium metal to release hydrogen?
- 1  $\text{CH}_3\text{CH}_2\text{OH}$
  - 2  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
  - 3  $\text{C}_2\text{H}_5\text{COOH}$

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

- 30** Boron is a non-metallic element which is placed above aluminium in Group III of the Periodic Table. It forms a compound with nitrogen known as boron nitride which has a graphite structure.

Which of the following conclusions can be drawn from this information?

- 1 The empirical formula of boron nitride is BN.
- 2 The boron and nitrogen atoms are likely to be arranged alternately in a hexagonal pattern.
- 3 Boron nitride has a layer structure with van der Waal's forces between layers.