ANGLO-CHINESE JUNIOR COLLEGE
DEPARTMENT OF CHEMISTRY
Preliminary Examination

CHEMISTRY **8872/01**
Higher 1

Paper 1 Multiple Choice

24 August 2017

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 fluids.
Write your name, index number and tutorial class 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.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **16** 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 Ether has the formula, CH_3OCH_3.

In a sample of ether, 8.7 % contains the ^{18}O isotope, with the rest contains the ^{16}O isotope.

What is the relative molecular mass of ether in this sample?

A 46.2

B 46.8

C 47.2

D 47.8

2 Copper reacts with dilute nitric acid to produce nitrogen dioxide gas. The balanced ionic equation is given.

$$Cu + 2H^+ + 2HNO_3 \rightarrow Cu^{2+} + 2NO_2 + 2H_2O$$

Which of the following is correct?

	Oxidation state of N in		Role of copper
	HNO_3	NO_2	
A	+5	-3	Reducing agent
B	+5	+4	Reducing agent
C	-5	-3	Oxidising agent
D	-5	+4	Oxidising agent

3 10 cm^3 of propane was completely burnt in x cm^3 of excess oxygen. After cooling to room temperature, the volume of the residual gas was 60 cm^3. The residual gas was passed through aqueous sodium hydroxide was passed through and the volume reduced to y cm^3.

Which of the following is correct?

	x	y
A	50	30
B	60	20
C	70	20
D	80	30

4 An organic compound with the formula $C_xH_yO_2$ has undergone incomplete combustion, producing carbon dioxide and carbon monoxide in the ratio of 99 : 1.

The equation may be represented as follows:

$$C_xH_yO_2 + \underline{\ a\ }O_2 \rightarrow \underline{\ b\ }CO + \underline{\ c\ }CO_2 + 0.5y\ H_2O$$

a, b and c can be expressed in terms of x and y.

Which of the following is correct?

	a	b	c
A	99x + 0.5x + 0.25y - 1	x	99x
B	99x + 0.5x + 0.25y	x	99x
C	0.99x + 0.005x + 0.25y- 1	0.01x	0.99x
D	0.99x + 0.005x + 0.25y	0.01x	0.99x

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

The components of a 100 g sample of fertilizer is as shown in the table below:

Element	Mass / g
N	15
P	30
K	15
Other Elements	40

The recommended usage of fertilizer is 14 g of fertilizer per 5 dm^3 of water.

What is the concentration of nitrogen atoms in this recommended solution?

A 0.03 mol dm^{-3}

B 0.15 mol dm^{-3}

C 0.42 mol dm^{-3}

D 0.75 mol dm^{-3}

6 The elements **X** and **Y** are in Group 16 and 17 respectively in the same period.

Which of the following statements regarding **X** and **Y** is most likely to be true?

A **Y** has more unpaired electrons than **X**.

B **Y** atom is bigger than **X** atom.

C **X** is more electronegative than **Y**.

D The first ionisation energy of **X** will likely be less endothermic than that of **Y**.

7 The table gives the successive ionisation energies for an element *X*.

	1st	2nd	3rd	4th	5th	6th
Ionisation energy/ kJ mol $^{-1}$	950	1800	2700	4800	6000	12300

What could be the formula of the fluoride of *X*?

A *X*F

B XF_2

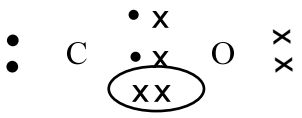
C XF_3

D XF_4

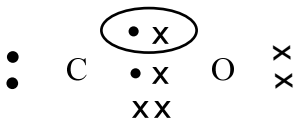
8 'Dot-and-cross' diagrams for CO are shown below.

Which circle pair of electrons represent a co-ordinate bond?

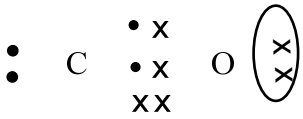
A



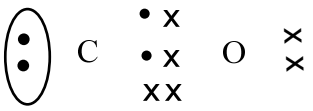
B



C



D



9 Which of the following molecules is linear and non-polar?

A CS_2

B SCN

C SO_2

D SiO_2

10 Consider the following four compounds.

1 $CH_3CH_2CH_2F$

2 $CH_3CH_2CH_2OH$

3 $CH_3CH_2CH_2CH_3$

4 $(CH_3)_3CH$

What is the order of increasing boiling points of the compounds (from lowest to highest)?

A $2 \longrightarrow 1 \longrightarrow 3 \longrightarrow 4$

B $4 \longrightarrow 3 \longrightarrow 2 \longrightarrow 1$

C $3 \longrightarrow 1 \longrightarrow 2 \longrightarrow 4$

D $4 \longrightarrow 3 \longrightarrow 1 \longrightarrow 2$

11 The enthalpy changes for two reactions are given by the equations:

$$2Cr(s) + \frac{3}{2}O_2(g) \rightarrow Cr_2O_3(s) \qquad \Delta H = -1130 \text{ kJ mol}^{-1}$$

$$C(s) + ½\ O_2(g) \rightarrow CO(g) \qquad \Delta H = -110 \text{ kJ mol}^{-1}$$

What is the enthalpy change, in kJ mol^{-1}, for the following reaction?

$$3C(s) + Cr_2O_3(s) \rightarrow 2Cr(s) + 3CO(g)$$

A -800

B +800

C -1460

D +1460

12 Hydrogencarbonate may react with acid according to the equation below.

$HCO_3^-(aq) + H^+(aq) \longrightarrow H_2O(l) + CO_2(g)$ $\Delta H^\theta = +12.7$ kJ mol^{-1}

Using the following enthalpy changes of formation provided, what is the standard enthalpy change of formation of $H^+(aq)$?

species	ΔH_f^θ / kJ mol^{-1}
$H_2O(l)$	–285.8
$CO_2(g)$	–393.5
$HCO_3^-(aq)$	–692.0

A –25.4 kJ mol^{-1}

B 0.0 kJ mol^{-1}

C +25.4 kJ mol^{-1}

D +1384 kJ mol^{-1}

13 In an experiment, 70 cm^3 of water at 25 ºC was brought to boil by burning butane in excess oxygen. Calculate the volume of butane required if this process is only 85 % efficient.

[ΔH_c (butane) = –2877 kJ mol^{-1}; c = 4.2 J g^{-1} K^{-1}; Molar volume of gas under the given conditions = 24 dm^3]

A 0.0721 dm^3 **B** 0.156 dm^3 **C** 0.184 dm^3 **D** 0.216 dm^3

14 Which statement concerning the equilibrium reaction given below is correct?

$$2CrO_4^{2-}(aq) + 2H^+(aq) \rightleftharpoons Cr_2O_7^{2-}(aq) + H_2O(l)$$

yellow orange

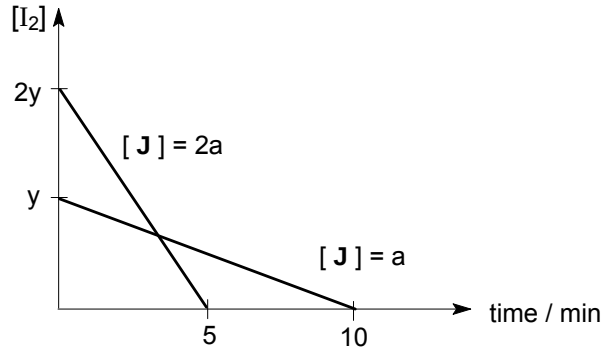
A It is a redox reaction.

B The equilibrium constant, K_c, has the units of mol^{-2} dm^6.

C The colour of the solution change from orange to yellow when pH increases.

D The addition of a catalyst will result in an increase in the concentration of $Cr_2O_7^{2-}(aq)$.

15 The kinetics of the reaction between iodine and compound **J** is investigated.



What conclusions can be drawn from the graphs?

A The reaction is second order with respect to compound **J** because rate of reaction increases by four times when its concentration is increased by two times.

B Both iodine and compound **J** react in equal mole ratio.

C The reaction is first order with respect to iodine because half-life is constant.

D The overall order of the reaction is 1.

16 **X**, **Y** and **Z** are elements in Period 3 of the Periodic Table.

A mixture containing the oxides of **X**, **Y** and **Z** was dissolved in excess dilute sulfuric acid and filtered. The oxide of **Z** was collected as a residue. When excess dilute sodium hydroxide was added to the filtrate, only a white precipitate of the hydroxide of **Y** was formed.

What are the possible identities of **X**, **Y** and **Z**?

	X	**Y**	**Z**
A	Mg	A*l*	P
B	A*l*	Mg	P
C	Mg	A*l*	Si
D	A*l*	Mg	Si

17 The oxide and chloride of an element **X** are separately mixed with water. The two resulting solutions have the same effect on litmus solution.

What is element **X**?

A Sodium

B Magnesium

C Aluminum

D Phosphorus

18 Which property of benzene is reflected as a consequence of the delocalised electrons present in its molecule?

A Benzene is cyclic.

B Benzene is a planar molecule.

C Benzene is a good conductor of electricity.

D Substitution on benzene takes place more easily than addition reactions.

19 2-methylpropylamine, $(CH_3)_2CHCH_2NH_2$ can be produced by the following reaction scheme starting with compound **B**.

$$\mathbf{B} \xrightarrow[\text{ethanol}]{\text{KCN in}} \mathbf{C} \xrightarrow{\text{reduction}} \text{2-methylpropylamine}$$

Which one of the following compounds is **B** likely to be?

A $CH_3CH_2CH_2Br$

B $CH_3CHBrCH_3$

C CH_3CH_2CHO

D CH_3COCH_3

20 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 $CH_3CH_2CH_2CH_2CH_2Br$

21 Four drops of 1-chorobutane, 1-bromobutane and 1-iodobutane were separately added to three test-tubes containing 1.0 cm^3 of aqueous silver nitrate at 60 °C. The following reaction occurred.

$$H_2O(l) + R–X(l) + Ag^+(aq) \rightarrow R–OH(aq) + AgX(s) + H^+(aq)$$

[R: C_4H_9–; X: halogen]

Which of the following best explains why the rate of formation of cloudiness (precipitate) in the tubes was in the order RC*l* < RBr < RI?

A The R–X bond polarity decreases from RC*l* to RI.

B The bond energy of R–X decreases from RC*l* to RI.

C The solubility of AgX(s) decreases from AgC*l* to AgI.

D The ionisation energy of the halogen decreases from C*l* to I.

22 Which one of the following compounds:

(i) is unaffected by hot alkaline potassium manganate(VII);

(ii) produces 0.5 mol of hydrogen when 1 mol of compound is treated with excess sodium?

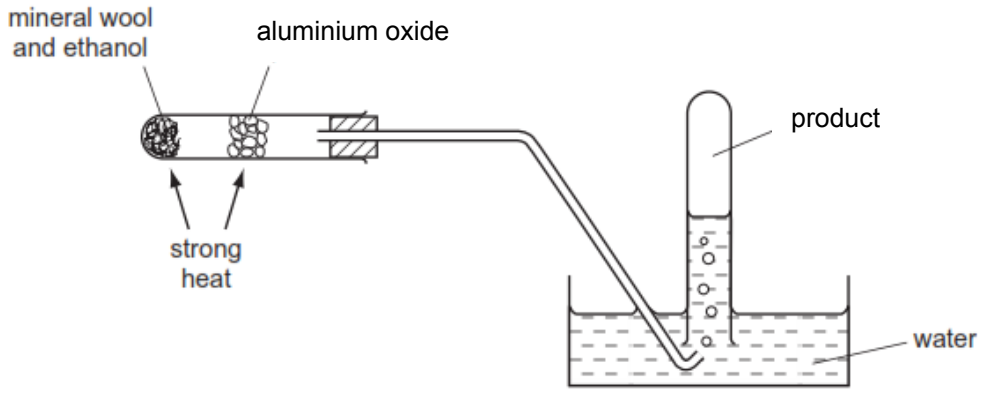
A $(CH_3)_2C(OH)C(OH)(CH_3)CH_2CH_3$

B $(CH_3)_2CHCH_2OH$

C $(CH_3)_3COH$

D $CH_3CH(OH)CH(OH)CH_3$

23 The diagram shows an experimental set-up.



Which compound can be produced by using the above apparatus?

A Oxygen

B Hydrogen

C Ethene

D Ethane

24 An alcohol of molecular formula $C_4H_{10}O_2$ contains two -OH groups and has an unbranched carbon chain.

On reaction with an excess of acidified potassium manganate(VII), this alcohol is converted into a compound of molecular formula $C_4H_6O_4$.

To which two carbons in the chain of the alcohol are the two -OH groups attached?

A 1st and 2nd

B 1st and 3rd

C 1st and 4th

D 2nd and 3rd

25 Which of the following reagents and conditions can distinguish between ethyl methanoate and ethyl ethanoate?

A Heat with NaOH(aq)

B Heat with H_2SO_4(aq)

C Heat with NaOH(aq) followed by Na_2CO_3(aq)

D Heat with acidified $KMnO_4$(aq)

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 The pH range and colour changes for two indicators are given below.

Indicator	pH range
X	violet 3.0 – 5.0 red
Y	yellow 5.6 – 7.6 blue

Which of the following solutions will give a red solution when indicator **X** is used and a yellow solution when indicator **Y** is used?

1 0.1 mol dm^{-3} HX (K_a = 2.5 x 10^{-10} mol dm^{-3})

2 0.1 mol dm^{-3} CH_3COOH (K_a = 1.8 x 10^{-5} mol dm^{-3})

3 0.1 mol dm^{-3} HC*l*

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.

27 The graph below shows the Boltzmann distribution of molecular energies at a given temperature.

As temperature increases, which statements are correct?

1 The proportion of molecules with any given energy increases.

2 The maximum of the curve is displaced to the right.

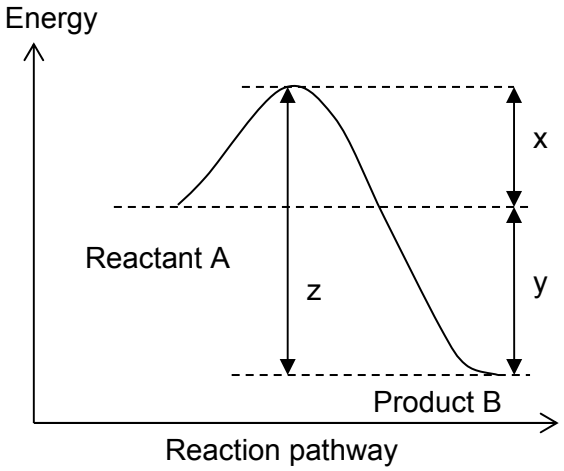
3 The proportion of molecules with energies above any given value increases.

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.

28 The energy profile for a reversible reaction is shown below.



Which of the following statement is/are **correct**?

1 The reaction from **B** to **A** is endothermic.

2 The activation energy of the reaction **A** to **B** is *x*.

3 The activation energy of the reaction **B** to **A** is *z* - *y*.

29 Which of the following show an increase in radius?

1 A*l* < Mg < Na

2 Cl^- < S^{2-} < P^{3-}

3 Na^+ < Ca^{2+} < K^+

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

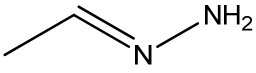
A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

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

30 The use of *Data Booklet* is relevant to this question.

Carbonyl compounds react with hydrazine, N_2H_4, in the same manner as 2,4-dintrophenylhydrazine.

Which of the following are correct?

1 The product is  when ethanal reacts with hydrazine.

2 The enthalpy change of the reaction is negative.

3 It is a condensation reaction.

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