RAFFLES INSTITUTION
2014 YEAR 6 PRELIMINARY EXAMINATION

Higher 1

CHEMISTRY
8872/01

Paper 1 Multiple Choice **26 September 2014**

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Do not open this question booklet until you are told to do so.

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number in the spaces provided on the Answer Sheet.

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 to be correct and record your choice with a soft pencil on the separate Answer Sheet.

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 **11** 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 and record your choice on the OMR Answer Sheet provided.

1 *Use of the Data Booklet is relevant to this question.*
In which of the following are there one mole of the stated particles?

A electrons in 2 g of hydrogen gas

B oxygen atoms in 22.4 dm^3 of oxygen gas at s.t.p.

C hydrogen ions in 1 dm^3 of 1 mol dm^{-3} aqueous sulfuric acid

D hydrogen sulfide molecules in 34.1 g of hydrogen sulfide gas

2 The relative isotopic mass and percentage abundance of each isotope present in a sample of neon are shown in the table.

Relative isotopic mass	% abundance
20	90.92
21	0.26
22	8.82

Based on these figures, what is the relative atomic mass of neon to two decimal places?

A 20.20 **B** 20.18 **C** 20.17 **D** 20.16

3 A disproportionation reaction is a reaction in which an element in a species undergoes both oxidation and reduction simultaneously.
Which of the following is **not** a disproportionation reaction?

A $3ClO^- \rightarrow 2Cl^- + ClO_3^-$

B $H_2C_2O_4 \rightarrow H_2O + CO + CO_2$

C $H_2O + 2NO_2 \rightarrow HNO_2 + HNO_3$

D $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$

4 The table below 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

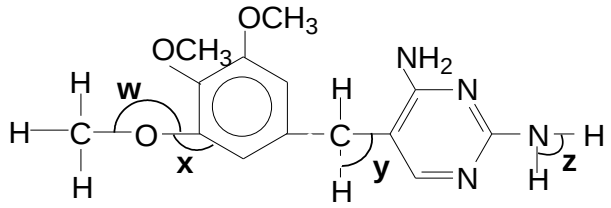
Which of the following chloride is **X** likely to form?

A **X**C*l* **B** **X**Cl_2 **C** **X**Cl_3 **D** **X**Cl_4

5 Which of the following has the same electronic configuration as the chloride ion, Cl^-?

A Ca^{2+} **B** Na^+ **C** Ne **D** F^-

6 *Trimethoprim* (TMP) is used for the treatment and prevention of urinary tract infection, traveller's diarrhea, respiratory and middle ear infections. It has the following structure.



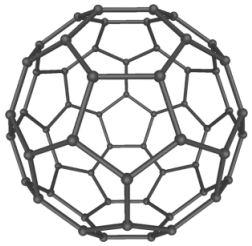
In which sequence are the bond angles quoted in decreasing order?

A **w** = **y** > **x** > **z**
B **x** > **y** > **w** > **z**
C **x** > **y** > **z** > **w**
D **w** > **x** > **y** > **z**

7 In which pair does **L** have a higher boiling point than **M**?

	L	**M**
A	ethanol	water
B	butane	2–methylpropane
C	*trans*–but–2–ene	*cis*–but–2–ene
D	2–hydroxybenzoic acid	4–hydroxybenzoic acid

8 Buckminsterfullerene, the molecule C_{60},is a form of carbon.



The bonding in buckminsterfullerene is similar to that in graphite.

Which property does buckminsterfullerene possess?

A It will be stronger than diamond.

B It will possess delocalised electrons.

C It will easily be deformed by pressure.

D It undergoes complete combustion to give carbon dioxide and water.

9 Given: $2Ag_2O(s) + C(s) \rightarrow 4Ag(s) + CO_2(g)$ $\Delta H^{\ominus} = -331.5$ kJ mol^{-1}

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H^{\ominus} = -393.5$ kJ mol^{-1}

What is the standard enthalpy change of formation of silver(I) oxide, $Ag_2O(s)$?

$$2Ag(s) + ½\ O_2(g) \rightarrow Ag_2O(s)$$

A – 31.0 kJ mol^{-1}

B – 62.0 kJ mol^{-1}

C – 166 kJ mol^{-1}

D + 166 kJ mol^{-1}

10 Given that the enthalpy change of the reaction below,

$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$ $\Delta H^{\ominus} = -114$ kJ mol^{-1}

what is the most likely value for the standard enthalpy change of the following reaction?

$Ba(OH)_2(aq) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$

A –57 kJ mol^{-1} **B** –76 kJ mol^{-1} **C** –114 kJ mol^{-1} **D** –228 kJ mol^{-1}

11 For the reaction: $H_2O(g) + C(s) \rightleftharpoons H_2(g) + CO(g)$ $\Delta H = +131\ kJ\ mol^{-1}$

Which of the following can be deduced about the proportion of carbon monoxide and hydrogen in the equilibrium mixture?

A It will be higher when more C(s) is used.

B It will be higher when a catalyst is used.

C It will be higher when the temperature is increased at constant volume.

D It will be higher when the volume of the vessel is halved at constant temperature.

12 Some data on two acid-base indicators are shown in the table below:

Indicator	Approximate working range	Colour in	
		Acid	Alkali
methyl orange	3.2 – 4.4	red	yellow
bromothymol blue	6.0 – 7.6	yellow	blue

Which one of the following conclusions can be drawn about a solution in which methyl orange is yellow and bromothymol blue is yellow?

A It is weakly basic.

B It is weakly acidic.

C It could be a solution of sodium chloride.

D It could be a solution of sodium ethanoate.

13 Bromine and methanoic acid react as follows:

$$Br_2(aq) + HCO_2H(aq) \rightarrow 2Br^-(aq) + 2H^+(aq) + CO_2(g)$$

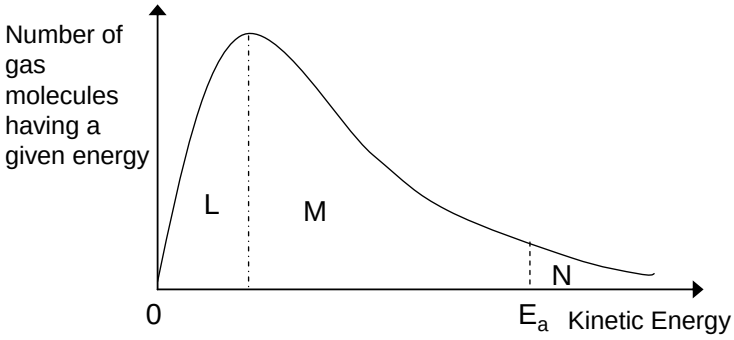
The experimentally determined rate equation was found to be:

$$rate = k[Br_2][HCO_2H]$$

What will be the effect on rate when the reaction mixture was mixed with an equal volume of water?

A 1/4 **B** 1/2 **C** 1/8 **D** 4

14 The Boltzmann distribution shows the number of molecules having a particular kinetic energy at a constant temperature.



If the temperature is decreased by 10 ºC, what happens to the size of the areas labelled **L**, **M** and **N**?

	L	**M**	**N**
A	decreases	decreases	decreases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	decreases	increases

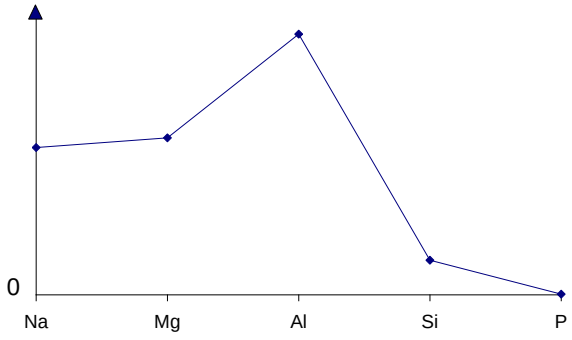
15 An element **X**

- forms an oxide with a melting point of 2072 °C and is insoluble in water;
- forms a chloride with a melting point of 193 °C and dissolves in water to form a solution of pH 3.

What element is **X** likely to be?

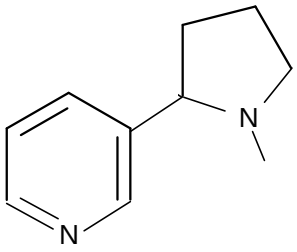
A Na **B** Mg **C** A*l* **D** P

16 What property of the elements from Na to P is shown by the graph?



A electrical conductivity
B First ionisation energy
C Ionic radius
D melting point

17 Nicotine is a stimulant contributing to the dependence-forming properties of tobacco smoking.



What is the empirical formula of nicotine?

A C_5H_7N

B $C_9H_{12}N_2$

C $C_9H_{13}N_2$

D $C_{10}H_{14}N_2$

18 Upon complete combustion, a hydrocarbon **X** produces 44 g of carbon dioxide and 24 g of steam. Which of the following is the molecular formula of **X**?

A C_3H_6

B C_3H_8

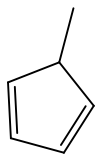
C C_4H_8

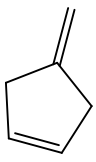
D C_4H_{10}

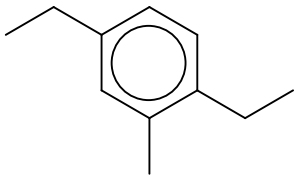
19 Some bromobutanes were separately treated with hot ethanolic sodium hydroxide. Two of these gave the same hydrocarbon, C_4H_6. From which pair of bromobutanes was this hydrocarbon obtained?

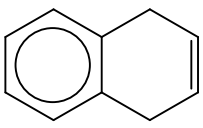
A	$CH_3CH_2CH_2CH_2Br$	and	$CH_3CH_2CH(Br)CH_3$
B	$CH_3C(Br)_2CH_2CH_3$	and	$BrCH_2CH_2CH_2CH_2Br$
C	$CH_3CH(Br)CH(Br)CH_3$	and	$BrCH_2CH_2CH_2CH_2Br$
D	$CH_3CH_2CH_2CH_2Br$	and	$CH_3CH_2CH_2CHBr_2$

20 Which of the following will **not** liberate 2 mol of carbon dioxide when 1 mol of the compound is treated with excess hot acidified potassium manganate(VII)?

A 

B 

C 

D 

21 Which pair of reactions could have the same common intermediate?

W $CH_3CH_2CH_3 \rightarrow$ intermediate $\rightarrow (CH_3)_2CHCN$

X $CH_3CH(OH)CH_3 \rightarrow$ intermediate $\rightarrow (CH_3)_2C(OH)CN$

Y $CH_3CH{=}CH_2 \rightarrow$ intermediate $\rightarrow CH_3CH(OH)CH_3$

Z $CH_3CO_2CH_2CH_2CH_3 \rightarrow$ intermediate $\rightarrow CH_3CH_2CH_2Br$

A **W** and **X**

B **W** and **Y**

C **X** and **Z**

D **Y** and **Z**

22 Which of the following statements is true about 3-methylbutan-2-ol?

A It decolourises hot acidified potassium dichromate(VI).

B It reacts with sodium carbonate to liberate carbon dioxide gas.

C It reacts with excess concentrated sulfuric acid at 170 ^{o}C to give 3 different alkenes.

D It is formed by heating 2-bromo-3-methylbutane with aqueous sodium hydroxide.

23 Which of the following pairs of reagents can **both** be used separately to distinguish $CH_3COCH_2CH_3$ and $CH_3CH(OH)CH{=}CH_2$?

A	alkaline aqueous iodine	and	sodium metal
B	2,4-dinitrophenylhydrazine	and	hot acidified potassium manganate(VII)
C	Tollens' reagent	and	bromine in tetrachloromethane
D	H_2, nickel catalyst, heat	and	hot acidified potassium dichromate(VI)

24 Which of the following gives the correct hydrolysis products for 2-methylpropyl butanoate?

A $(CH_3)_2CHCO_2H$ and $(CH_3)_2CHCH_2OH$

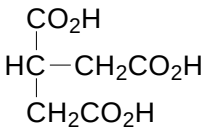
B $CH_3CH_2CH_2CO_2H$ and $CH_3CH_2CH(CH_3)OH$

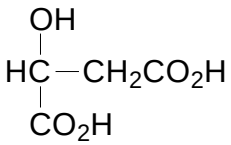
C $CH_3CH_2CH_2CO_2H$ and $(CH_3)_2CHCH_2OH$

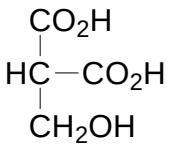
D $CH_3CH(CH_3)CO_2H$ and $CH_3CH_2CH_2CH_2OH$

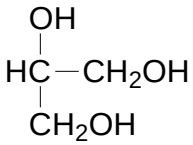
25 Ethanoic acid is prepared industrially by the direct carbonylation of methanol using a rhodium catalyst.

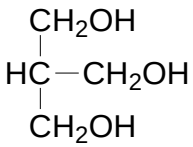
$$CH_3OH + CO \xrightarrow[\text{catalyst}]{\text{rhodium}} CH_3CO_2H$$

Which compound could be used to produce  by this method?

A 

B 

C 

D 

Section B

For each of the following questions, 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, 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 CO_3^{2-} and SO_3^{2-} are common polyatomic anions. Which of the following statements are true about these two anions?

1 CO_3^{2-} contains 32 electrons.

2 The bond angle in CO_3^{2-} is larger than the bond angle in SO_3^{2-}.

3 Both C and S have an oxidation state of +4 in CO_3^{2-} and SO_3^{2-} respectively.

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

1 It reduces the half-life of the reaction.

2 It lowers the activation energy of the reaction.

3 It increases the average kinetic energy of the reacting particles.

28 0.1 mol of each of the following was added to 100 cm^3 of water separately. Which of the following shows the resulting solutions in increasing pH value?

1 Na_2O, MgO, Al_2O_3

2 $SiCl_4$, $AlCl_3$, $MgCl_2$

3 H_2SO_4, HCl, CH_3CO_2H

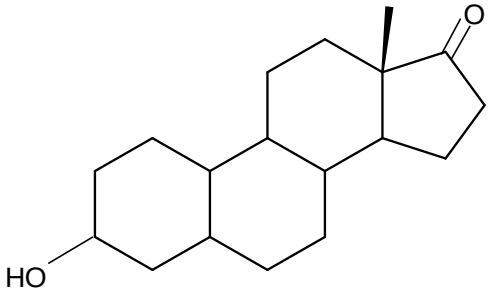
29 Which of the following set of reagents and conditions can be used to form the organic product $CH_3CH(OH)CH_2CO_2H$ from $CH_3COCH_2CO_2H$?

1 H_2 , nickel catalyst, 140 ^oC

2 $NaBH_4$, room temperature

3 $LiAlH_4$, dry ether, room temperature

30 Compound **X** is a derivative of Estrone, the most predominant type of estrogen found in post-menopausal women.



X

Which of the following involving **X** are correct?

1 One mole of **X** reacts with excess sodium to form one mole of hydrogen gas.

2 **X** gives an orange precipitate with 2,4-dinitrophenylhydrazine.

3 **X** reacts with phosphorus pentachloride to liberate steamy white fumes.

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