RAFFLES JUNIOR COLLEGE
PRELIMINARY EXAMINATION 2008

HIGHER 1

CHEMISTRY 8872/01

Paper 1 Multiple Choice **19 September 2008**

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, Candidate Number on the Answer Sheet in the spaces provided.

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.

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 question booklet consists of **9** 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 An aqueous solution containing 1 mole of $S_2O_3^{2-}$ ions reduces 4 moles of bromine molecules. What is the sulphur-containing product of this reaction?

A H_2S **B** SO_2 **C** SO_4^{2-} **D** $S_4O_6^{2-}$

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

The pH of pure water is 7.0 at 298 K. Which of the following quantities is equal to the number of ions in 1 dm^3 of pure water at 298 K?

A The number of neutrons in 8.0×10^{-7} g of deuterium gas, D_2 ($D = {}^2H$).

B The number of atoms in 4.48×10^{-6} dm^3 of Cl_2 at s.t.p.

C The number of molecules in 1.44×10^{-4} g of Buckminsterfullerene, C_{60}.

D The number of anions in 1.0×10^{-14} dm^3 of 1.0 mol dm^{-3} $K_2C_2O_4(aq)$.

3 Self-igniting flares contain Mg_3P_2. With water, this produces diphosphane, P_2H_4, which is spontaneously flammable in air.

Which equation that includes the formation of diphosphane is balanced?

A $Mg_3P_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + P_2H_4$

B $Mg_3P_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + P_2H_4 + H_2$

C $2Mg_3P_2 + 12H_2O \longrightarrow 6Mg(OH)_2 + P_2H_4 + 2PH_3$

D $2Mg_3P_2 + 12H_2O \longrightarrow 6Mg(OH)_2 + 3P_2H_4$

4 The table below contains incomplete information about the two ions **X** and **Y**.

Ion	Mass number	Atomic number	Number of neutrons	Number of electrons	Charge of ion
X	59	27	**p**	**q**	+2
Y	79	**r**	45	36	**s**

Which of the following shows the missing numbers (**p**, **q**, **r** and **s)** in the table above?

	p	q	r	s
A	29	27	34	+2
B	32	27	34	–2
C	59	25	36	+2
D	32	25	34	–2

5 An element **Z** has a second ionisation energy higher than that of the element preceding it and the element after it in the Periodic Table.

What is the atomic number of **Z**?

A 10 **B** 13 **C** 14 **D** 15

6 Which of the following solids consists of particles held together only by van der Waals' forces?

A NaC*l* **B** H_2O **C** Cu **D** Ar

7 Which of the following is a non–polar molecule?

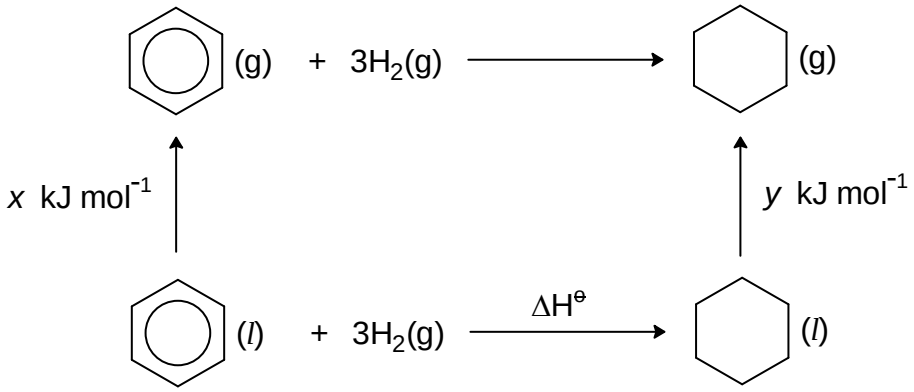
A C_6H_5Cl
B CH_2F_2
C CCl_4
D CO

8 C_2H_4 and C_2H_2 are unsaturated hydrocarbons. Which of the following statements is CORRECT regarding these two molecules?

A Both C_2H_4 and C_2H_2 have the same shape.
B C_2H_4 has more σ bonds but fewer π bonds than C_2H_2.
C The carbons in C_2H_4 and C_2H_2 are sp and sp^2 hybridised respectively.
D The carbon–carbon–hydrogen bond angle is larger in C_2H_4 than in C_2H_2.

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

Consider the energy cycle given below.



What is the standard enthalpy change of hydrogenation of benzene, $\Delta H^{\ominus}$, in kJ mol^{-1}?

A $x - y - 132$
B $x - y - 372$
C $y - x - 132$
D $y - x - 372$

10 Which one of the following best explains why the lattice energy of magnesium chloride is much more exothermic than that of lithium chloride?

A Magnesium has a greater electronegativity than lithium.

B Magnesium ions have a greater charge than lithium ions.

C Magnesium ions have a greater ionic radius than lithium ions.

D Magnesium ions have a greater polarising power than lithium ions.

11 A chemical plant illegally dumped some radioactive waste in a landfill. This waste composed of two radioactive isotopes **M** and **N** in the proportion 4:1. The decay of radioactive isotopes follows first-order kinetics. The half-life of **M** is 2 days whereas that of **N** is 4 days. By the time the authorities found out about this illegal dumping and analysed a sample of the waste, they found equal amounts of **M** and **N**. How long was the waste in the landfill before the authorities arrived?

A 2 days **B** 4 days **C** 8 days **D** 16 days

12 The following reaction is first order with respect to **G** and zero order with respect to **H**.

$$\mathbf{G} + \mathbf{H} \longrightarrow \text{products}$$

If the rate constant doubles for each 10 ^{o}C rise in temperature, which of the following sets of conditions will give the greatest rate of reaction?

	[**G**]/mol dm^{-3}	[**H**]/mol dm^{-3}	temperature/^{o}C
A	0.30	0.30	35
B	0.15	0.30	45
C	0.45	0.15	25
D	0.60	0.15	35

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

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

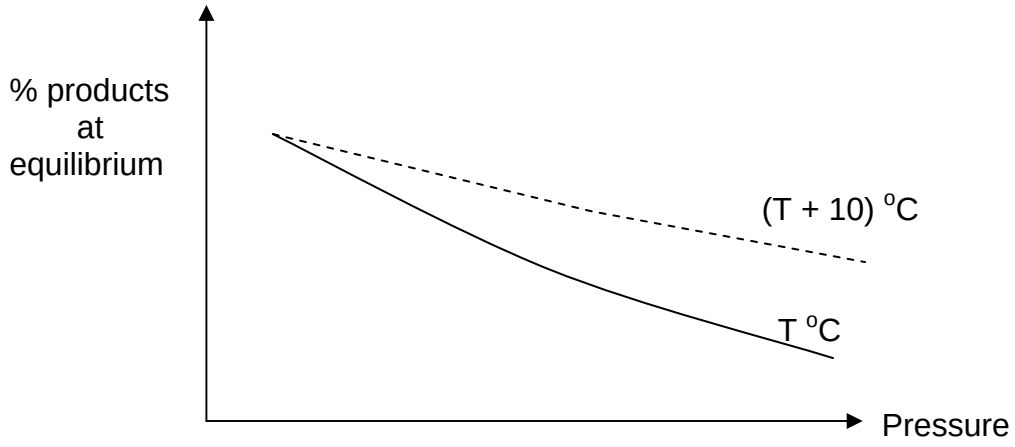
A A redox reaction is taking place.

B The equilibrium constant, K_c, has no units.

C A decrease in pH will result in an increase in the concentration of $Cr_2O_7^{2-}(aq)$.

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

14 The graphs below show the variation of the percentage of gaseous products present at equlibrium, with temperature and pressure.



Which one of the following systems could the graphs represent?

A	$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$	$\Delta H = -92$ kJ mol^{-1}
B	$3O_2(g) + 4NH_3(g) \rightleftharpoons 2N_2(g) + 6H_2O(g)$	$\Delta H = -1248$ kJ mol^{-1}
C	$2N_2(g) + O_2(g) \rightleftharpoons 2N_2O(g)$	$\Delta H = +82$ kJ mol^{-1}
D	$CO_2(g) + C(s) \rightleftharpoons 2CO(g)$	$\Delta H = +173$ kJ mol^{-1}

15 Which one of the following pairs will give a buffer solution when equal volumes of the two solutions are mixed?

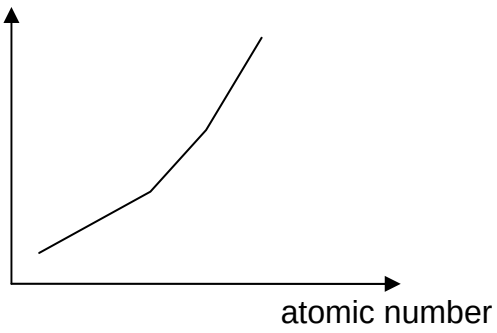
A 0.1 mol dm^{-3} NaOH and 0.1 mol dm^{-3} CH_3COOH

B 0.2 mol dm^{-3} $Ba(OH)_2$ and 0.1 mol dm^{-3} $H_2C_2O_4$

C 0.05 mol dm^{-3} $Ba(OH)_2$ and 0.2 mol dm^{-3} CH_3COOH

D 0.2 mol dm^{-3} NaOH and 0.1 mol dm^{-3} $H_2C_2O_4$

16 Which property when plotted against increasing atomic number gives the shape of the following graph?



A Boiling point of F_2, C*l*$_2$, Br_2 and I_2

B First ionisation energy of Mg, Ca, Sr and Ba

C Atomic radius of Na, Mg, A*l* and Si

D Electronegativity of F, C*l*, Br and I

17 Which of the following ions has the largest ionic radius?

A N^{3-} **B** F^{-} **C** Na^{+} **D** Mg^{2+}

18 How many isomers of molecular formula C_9H_{12} contain a benzene ring?

A 6 **B** 7 **C** 8 **D** 9

19 Which one of the following structures will have cis-trans isomers?

A $CH_3BrC{=}CCl_2$

B 

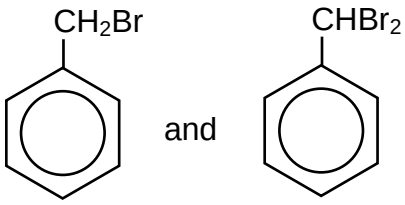
C $CH_2{=}CH{-}CH_2{-}CH{=}CH_2$

D $C_6H_5CH{=}CHCOOH$

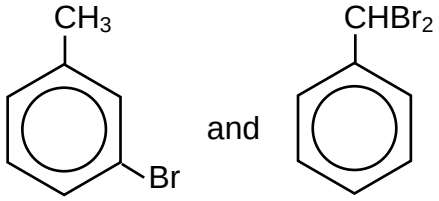
20 Iron filings were added to a solution containing equimolar quantities of methylbenzene and bromine. The mixture was immediately placed in the dark until no further change took place.

Which of the following are likely to have been the main products?

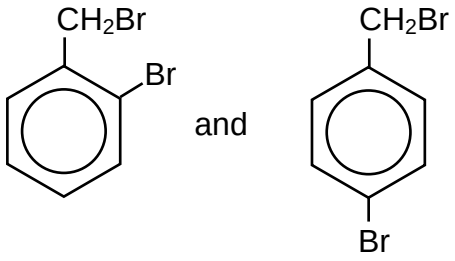
A



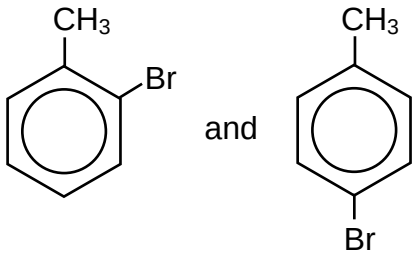
C



B



D



21 In the preparation of ethene, ethanol is added a drop at a time to a heated reagent **Y**. The impure ethene is washed by being bubbled through a solution **Z** and then collected. What could reagent **Y** and solution **Z** be?

	Y	**Z**
A	acidified $K_2Cr_2O_7$	dilute NaOH
B	concentrated H_2SO_4	dilute NaOH
C	concentrated H_2SO_4	dilute H_2SO_4
D	ethanolic NaOH	concentrated H_2SO_4

22 In the hydrogenation of $CH_2{=}CHCH_2CH{=}CH_2$ using platinum catalyst, the volume of hydrogen (measured at s.t.p.) that reacts with 1 mole of the compound could be

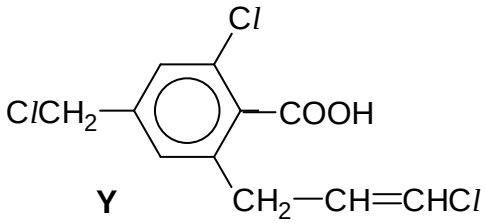
A 22.4 dm^3
B 24.0 dm^3
C 44.8 dm^3
D 67.2 dm^3

23 2–Methylpropanoic acid may be synthesised from 1–bromopropane through a series of reactions.

Which set of reagents, used in sequential order, would be the most suitable for this synthesis?

A aqueous KOH, acidified $KMnO_4$
B aqueous KOH, PCl_5, ethanolic KCN, dilute H_2SO_4
C ethanolic KOH, HBr, ethanolic KCN, dilute H_2SO_4
D ethanolic KOH, HBr, HCN with NaOH catalyst, dilute HCl

24 Consider the compound **Y**, which has the structural formula as shown.



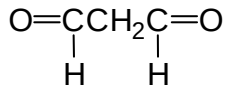
Y

1 mole of compound **Y** is warmed with excess aqueous sodium hydroxide. The resulting solution is cooled and acidified with dilute nitric acid. How many moles of silver chloride will be precipitated out when excess aqueous silver nitrate is then added?

A 0 **B** 1 **C** 2 **D** 3

25 When propane–1,3–diol is refluxed with an excess of acidified aqueous potassium dichromate(VI), the most likely reaction product is

A $HOCH_2CH_2CHO$

B 

C $HOCH_2CH_2COOH$

D $HOOCCH_2COOH$

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 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 statements correctly describes an electron shell with the principal quantum number, n = 3?

1 Electrons occupy its orbitals starting with that of lower energy first.

2 It is made up of 9 subshells.

3 A total of 8 electrons can be accommodated in this shell.

27 For the reaction: $2\mathbf{X} + 3\mathbf{Y} \rightleftharpoons 3\mathbf{E} + \mathbf{F} + 2\mathbf{G}$

3 mol of **X** and 4 mol of **Y** were mixed. At equilibrium, 1.5 mol of **E** is present. Which of the following are also present?

1 2.0 mol of **X**

2 2.5 mol of **Y**

3 1.0 mol of **G**

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 Which of the following statements describing the characteristics of elements within any one particular group of the Periodic Table are correct?

1 The first ionisation energies of the elements, generally decrease with increasing atomic number.

2 The melting point of the elements increase with increasing atomic number.

3 The elements are either all metals or all non-metals.

29 Which of the following reagents could be used to test for the presence of butanal in a mixture of butanal and butanone?

1 an aqueous solution containing $Ag(NH_3)_2^+$ (Tollens' reagent)

2 an alkaline solution containing complexed Cu^{2+} ions (Fehling's solution)

3 iodine and aqueous sodium hydroxide

30 When benzoic acid is esterified with methanol enriched with ^{18}O, the water produced is **not** enriched with ^{18}O. Which of the following conclusions can be drawn from this observation?

1 The oxygen in the water must be derived from the benzoic acid.

2 The O–H bond in the methanol breaks during the reaction.

3 The carbon–to–oxygen single bond of the –COOH group in the acid breaks during the reaction.

------ End of Paper ------

Answers

1 CCBDB DCBAB CDCDC AACDD BCCBD DADBA