**ANDERSON JUNIOR COLLEGE**
**2009 PRELIMINARY EXAMINATION**
**HIGHER 1**

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**CHEMISTRY** **8872/01**

Paper 1 Multiple Choice **18 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 and PDG.
Write your NRIC / FIN and shade the digits accordingly.

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.

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.

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## Section A

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

**1** Copper, in the form of $CuFeS_2$, is extracted from ores in copper mines. The ore contains 1.0 % by mass of copper.

What percentage of the ore contains $CuFeS_2$, if it is the only copper-containing component of the ore?

**A** 1.0 % **B** 2.9 % **C** 3.46 % **D** 34.6 %

**2** When the salt $(C_2H_5)_4N^+Cl^-$ is treated with hydrogen chloride, a white ionic solid **E** is formed.

When **E** is dissolved in water, a 20 $cm^3$ sample of the solution requires 24 $cm^3$ of 0.1 mol $dm^{-3}$ NaOH for neutralization.

Another 20 $cm^3$ sample of the solution requires 48 $cm^3$ of 0.1 mol $dm^{-3}$ $AgNO_3$ for complete precipitation of chloride as AgCl.

What could be the formula of the anion in **E**?

**A** $HCl_2^-$ **B** $HCl_3^{2-}$ **C** $H_2Cl_3^-$ **D** $H_2Cl_5^{3-}$

**3** Wines often contain a small amount of sulfur dioxide that is added as a preservative. The sulfur dioxide content of a wine can be found by titrating with aqueous iodine, $I_2$, to give iodide, $I^-$. The sulfur dioxide becomes oxidised in the process.

$$SO_2 + 2H_2O \rightarrow SO_4^{2-} + 4H^+ + 2e^-$$

In an experiment, a student found that the sulfur dioxide in a 100 $cm^3$ sample of white wine reacted with exactly 20.00 $cm^3$ of 0.01 mol $dm^{-3}$ aqueous iodine.

What is the concentration of sulfur dioxide in the sample of white wine, in mol $dm^{-3}$?

**A** $1.00 \times 10^{-4}$ **B** $2.00 \times 10^{-4}$ **C** $1.00 \times 10^{-3}$ **D** $2.00 \times 10^{-3}$

**4** Chlorine has the electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$.

Which chlorine compound is **not** likely to exist?

**A** $KClO_5$ **B** CuCl **C** $Cl_2O_7$ **D** $Cl_2O$

**5** Gallium nitride, GaN, could revolutionise the design of electric light bulbs because only a small length used as a filament gives excellent light at low cost.

Gallium nitride is an ionic compound containing the $Ga^{3+}$ ion.

What is the electronic configuration of the nitrogen ion in gallium nitride?

**A** $1s^2\ 2s^2$

**B** $1s^2\ 2s^2\ 2p^3$

**C** $1s^2\ 2s^2\ 2p^4$

**D** $1s^2\ 2s^2\ 2p^6$

**6** Gaseous particle **G** has a proton number n and a charge of + 1.
Gaseous particle **H** has a proton number of (n + 1) and is isoelectronic with **G**.
**G** and **H** have the same number of neutrons.

Which of the following statements **incorrectly** describes **G** and **H**?

**A** The charge on **G** is half that on **H**.

**B** **G** has a larger ionic radius than **H**.

**C** **G** requires lesser energy than **H** when a further electron is removed from each particle.

**D** **G** will be deflected by a larger magnitude than **H** when each particle is passed through an electric field.

**7** In which of the following reactions is the bond angle in the product greater than that in the **first** reactant?

**A** $H_2O + H^+ \rightarrow H_3O^+$

**B** $CO_2 + OH^- \rightarrow HCO_3^-$

**C** $C_2H_4 + H_2 \rightarrow C_2H_6$

**D** $CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

**8** When two liquids are mixed, heat may be evolved if intermolecular forces formed are stronger than those broken, even if there is no chemical reaction.

Which pair of liquids, when mixed, will give out heat?

**A** $CH_3Cl$ and $C_6H_{14}$

**B** $CH_2Cl_2$ and $(CH_3)_2CO$

**C** $CCl_4$ and $(CH_3)_2CO$

**D** $CCl_4$ and $CH_3CH_2OH$

**9** Which of the following statements **cannot** be explained by hydrogen bonding?

**A** Ice floats on water.

**B** Propanoic acid has a higher boiling point than methyl ethanoate.

**C** The relative molecular mass of ethanoic acid is 120 in the gaseous state under high pressure.

**D** Sodium hydrogen carbonate is soluble in water.

**10** Given the following standard enthalpy changes,

$\Delta H^{\theta}_{c}$ (C) = - 394 kJ mol$^{-1}$

$\Delta H^{\theta}_{c}$ ($H_2$) = - 286 kJ mol$^{-1}$

$\Delta H^{\theta}_{f}$ ($C_2H_5OH$) = - 278 kJ mol$^{-1}$

What is the standard enthalpy change of combustion of ethanol, $C_2H_5OH$?

**A** - 402 kJ mol$^{-1}$

**B** - 758 kJ mol$^{-1}$

**C** - 1368 kJ mol$^{-1}$

**D** - 1924 kJ mol$^{-1}$

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

Ethanol is prepared industrially by the reaction of ethene and steam in the presence of a catalyst.

$$C_2H_4\ (g) + H_2O\ (g) \longrightarrow C_2H_5OH\ (g)$$

What is the enthalpy change for the reaction?

**A** - 50 kJ $mol^{-1}$

**B** + 50 kJ $mol^{-1}$

**C** - 310 kJ $mol^{-1}$

**D** + 310 kJ $mol^{-1}$

**12** In the presence of dilute sulfuric acid, sodium chromate(VI), $Na_2CrO_4$, reacts as follows:

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

Which one of the following statements is **correct**?

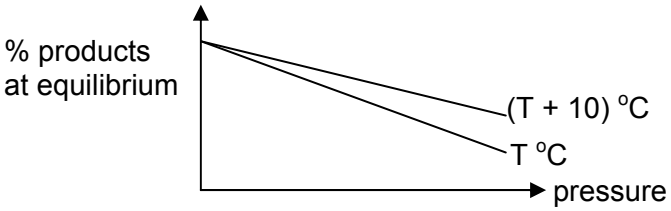
**A** When a few drops of sodium hydroxide is added to a solution of sodium dichromate, $Na_2Cr_2O_7$, the solution turns yellow.

**B** In the forward reaction, chromium has undergone oxidation.

**C** When the pressure is increased, the yellow solution of sodium chromate(VI), $Na_2CrO_4$, turns orange .

**D** The equilibrium constant, $K_c$, of this reaction has the unit, $dm^6\ mol^{-2}$.

**13** The graphs below show how the percentage of gaseous products present at equilibrium vary with temperature and pressure.




Which one of the following reactions could the graph represent?

**A** $H_2\ (g) + I_2\ (g) \rightleftharpoons 2HI\ (g)$ $\quad \Delta H = +\ 53\ kJ\ mol^{-1}$

**B** $N_2O_4\ (g) \rightleftharpoons 2NO_2\ (g)$ $\quad \Delta H = +\ 57\ kJ\ mol^{-1}$

**C** $N_2\ (g) + 3H_2\ (g) \rightleftharpoons 2NH_3\ (g)$ $\quad \Delta H = -\ 92\ kJ\ mol^{-1}$

**D** $2Fe\ (s) + \frac{3}{2}O_2\ (g) \rightleftharpoons Fe_2O_3\ (s)$ $\quad \Delta H = -\ 822\ kJ\ mol^{-1}$

**14** The pH of normal human blood is 7.4. Strenuous exercise can cause the condition called acidosis in which the pH falls. If the pH drops to 6.8, death may occur.

How many times greater is the hydrogen ion concentration in blood at pH 6.8 compared with that at pH 7.4?

**A** 0.6 **B** 2.0 **C** 4.0 **D** 8.0

**15** If the rate of decay of a radioactive isotope decreases from 200 counts per minute to 25 counts per minute in 1 day, what is its half-life?

**A** 2 hours **B** 4 hours **C** 6 hours **D** 8 hours

**16** Fibre glass can be considered to be a mixture of ionic oxides and giant covalent oxides. Which of the following is **not** a constituent of fibre glass?

**A** $SO_2$ **B** $SiO_2$ **C** $Na_2O$ **D** MgO

**17** Which of the following elements forms an insoluble oxide and a chloride which is readily hydrolysed?

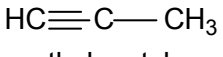
**A** magnesium

**B** phosphorus

**C** silicon

**D** sodium

**18** What is the total number of $\sigma$ (sigma) and $\pi$ (pi) bonds in a methylacetylene molecule?



methylacetylene

| | $\sigma$ | $\pi$ |
|---|---|---|
| **A** | 4 | 4 |
| **B** | 5 | 3 |
| **C** | 6 | 2 |
| **D** | 7 | 1 |

**19** Samples of the gases $CH_4$ and $Cl_2$ are mixed together and irradiated with light.

Which compound is **not** produced in the reaction?

**A** $HCl$

**B** $H_2$

**C** $CH_3Cl$

**D** $CH_2Cl_2$

**20** Straight chain alkanes undergo cracking under high temperature and in the presence of a catalyst. Which of the following does not represent a correct cracking reaction?

**A** $C_{10}H_{22} \rightarrow C_6H_{14} + 2C_2H_4$

**B** $C_{13}H_{28} \rightarrow C_7H_{16} + 2CH_3CH{=}CH_2$

**C** $C_7H_{16} \rightarrow CH_3CH{=}CH_2 + CH(CH_3)_3$

**D** $C_{11}H_{24} \rightarrow C_4H_{10} + CH_2{=}CH_2 + C_5H_{10}$

**21** Which of the following gives the largest number of isomers on reacting with hot ethanolic potassium hydroxide?

**A** $(CH_3)_3CCl$

**B** $CH_3CH_2CHClCH_3$

**C** $(CH_3)_2CHCHClCH_3$

**D** $CH_3CH_2CHClCH_2CH_3$

**22** Which of the following salts would produce the most alkaline solution when dissolved in water?

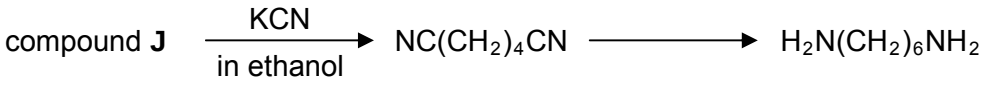
**A** $C_2H_5ONa$

**B** $C_2H_5CO_2Na$

**C** $CH_2ClCO_2Na$

**D** $C_2H_5NH_3Cl$

**23** The reaction scheme outlines the production of one of the monomers of nylon 6,6 from compound **J**.




Which compound could be **J**?

**A** $OHC(CH_2)_4CHO$

**B** $HO_2C(CH_2)_4CO_2H$

**C** $HO(CH_2)_4OH$

**D** $Cl(CH_2)_4Cl$

**24** Which reaction yields a carbon compound incorporating deuterium, D? [D = $^2H$]

**A** $CH_3CH_2CN \xrightarrow[D_2O]{NaOD}$

**B** $CH_3CD(OD)CO_2H \xrightarrow[heat]{\text{acidified } KMnO_4}$

**C** $CH_3CH_2COCH_3 \xrightarrow[D_2O]{LiAlD_4}$

**D** $(CH_3)_3COH \xrightarrow{\text{conc } H_2SO_4}$

**25** Which pair of reactions could have the same intermediate?

**I** $CH_3CH_2CH_3 \rightarrow$ intermediate $\rightarrow (CH_3)_2CHCN$
**II** $CH_3CH(OH)CH_3 \rightarrow$ intermediate $\rightarrow (CH_3)_2C(OH)CN$
**III** $CH_3CH = CH_2 \rightarrow$ intermediate $\rightarrow CH_3CH(OH)CH_3$
**IV** $CH_3CO_2CH_2CH_2CH_3 \rightarrow$ intermediate $\rightarrow CH_3CH_2CH_2Br$

**A** **I** and **II**

**B** **I** and **III**

**C** **II** and **IV**

**D** **III** and **IV**

## 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 these statements is or 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.

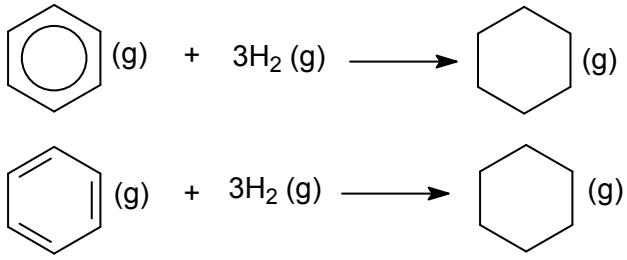
**26** Which statements about a 28.0 g sample of $^{14}N_2$ are correct?

**1** The number of molecules is half the number of atoms in 32.0 g of $^{16}O_2$.

**2** The number of atoms is twice the number of atoms in 4.0 g of $^{4}He$.

**3** The number of atoms is the same as the number of atoms in 24.0 g of $^{12}C$.

**27** Under high pressure and in the presence of a catalyst, benzene and a hypothetical compound cyclo-1,3,5-hexatriene undergo hydrogenation to form cyclohexane in the reactions shown.




Which of the following statements are **incorrect**?

**1** Benzene is more stable than cyclo-1,3,5-hexatriene.

**2** Benzene undergoes substitution reaction to form cyclohexane.

**3** The enthalpy change of combustion of benzene is more exothermic than that of cyclo-1,3,5-hexatriene.

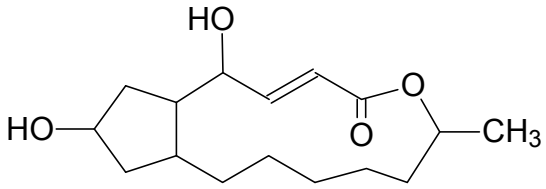
**28** Which of the following statements about the Period 3 elements are **true**?

**1** Atomic radii decrease from sodium to chlorine.

**2** Their oxides become more acidic from sodium to chlorine.

**3** The maximum oxidation state is shown by silicon.

**29** Brefeldin A is an antibiotic.




Brefeldin A

Which of the following reagents react with Brefeldin A?

**1** acidified $K_2Cr_2O_7$

**2** anhydrous $SOCl_2$

**3** 2,4–dinitrophenylhydrazine

**30** Compound **K** can be found in bananas and compound **L** is an isomer of **K**.

$CH_3CO_2CH_2CH_2CH(CH_3)_2$ **K**

$CH_3COCH_2CH_2C(OH)(CH_3)_2$ **L**

Which of the following reagents can be used to distinguish between compounds **K** and **L**?

**1** acidified $KMnO_4$

**2** sodium metal

**3** alkaline aqueous iodine