CATHOLIC JUNIOR COLLEGE

PRELIMINARY EXAMINATION 2008

CHEMISTRY **8872/01**
Higher 1 **11 September 2008**

Paper 1 Multiple Choice

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use paper clips, highlighters, glue or correction fluid.
Write and shade your name, class and NRIC / FIN 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 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.
You may use a calculator.

There are a total of 9 printed pages including this cover page.

Section A

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

1 The *Star of Africa*, a 530 carats pear-shaped diamond, is the second largest cut diamond in the world. How many atoms of carbon are there in the *Star of Africa* if 1 carat is equivalent to 200 mg?

A 1.06×10^{28} **B** 1.06×10^{25} **C** 5.32×10^{27} **D** 5.32×10^{24}

2 An element **X** can exist in a few oxidation states.

30.00 cm^3 of an aqueous solution of 0.400 mol dm^{-3} $\mathbf{X^{2+}}$ required 40.00 cm^3 of 0.100 mol dm^{-3} of acidified $K_2Cr_2O_7$ (aq) for a complete reaction.

$$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$$

What is the final oxidation state of **X**?

A +4 **B** +3 **C** -1 **D** 0

3 Which of the following has no unpaired electrons in its valence shell?

A Mg^+ **B** Si **C** Cu^+ **D** Fe^{2+}

4 The successive ionisation energies of an element **Y** is given below.

787 1577 3231 4356 16091 19784 23783

Which Group does **Y** belong to?

A Group II **B** Group IV **C** Group V **D** Group VI

5 What is the electronic configuration of the atom of the element which is isoelectronic with PH_3?

A $1s^2\ 2s^2\ 2p^3$ **C** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

B $1s^2\ 2s^2\ 2p^6$ **D** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

6 In butanoic acid, $CH_3CH_2CH_2COOH(l)$, there are covalent bonds, hydrogen bonds and Van der Waals' forces. Which bonds or forces are broken when butanoic acid undergoes vapourisation?

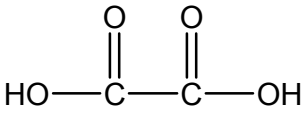
A only hydrogen bonds

B covalent bonds and hydrogen bonds

C covalent bonds and Van der Waals' forces.

D hydrogen bonds and Van der Waals' forces.

7 Ethanedioic acid has the following structure:



How many σ and π bonds are there in a molecule of ethanedioic acid?

	σ	π
A	3	4
B	5	2
C	5	4
D	7	2

8 Ethanol is much more soluble in water than ethyl ethanoate. Which of the following statements correctly accounts for this phenomenon?

A The covalent bonds in the ethanol molecules are weaker than those in the ethyl ethanoate molecules.

B Ethanol is a polar molecule but ethyl ethanoate is non-polar.

C Ethanol is able to form hydrogen bonds with water but ethyl ethanoate does not.

D Both ethanol and ethyl ethanoate are able to form hydrogen bonds with water, but the long carbon chain of ethyl ethanoate affects its solubility.

9 The bond dissociation energy of H-F is 565 kJ mol^{-1}. Which equation correctly describes the reaction whereby 565 kJ of energy is released?

A $HF(l) \rightarrow HF(g)$

B $H(g) + F(g) \rightarrow HF(g)$

C $HF(g) \rightarrow H(g) + F(g)$

D $\frac{1}{2} H_2(g) + \frac{1}{2} F_2(g) \rightarrow HF(g)$

10 The enthalpy change for the reaction given below is -114 kJ mol^{-1}.

$$H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$$

Given that $Mg(OH)_2$ is a strong base, what would be the expected enthalpy change for the following reaction?

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

A -57 kJ mol^{-1}

B -114 kJ mol^{-1}

C -171 kJ mol^{-1}

D -228 kJ mol^{-1}

11 Sulphuric acid is produced industrially via the *Contact process*. One of the steps in the production of the acid involves the oxidation of sulphur dioxide, SO_2 to sulphur trioxide SO_3 according to the following equation:

$$SO_2(g) + O_2(g) \rightleftharpoons SO_3(g) \quad \Delta H = -196 \text{ kJ mol}^{-1}$$

What is the effect of increasing pressure on the above equilibrium?

A The rate of formation of sulphur trioxide decreases.

B The equilibrium yield of sulphur trioxide will decrease.

C Both the equilibrium yield and rate of formation of sulphur trioxide will increase.

D The rate of formation of sulphur trioxide will decrease but the equilibrium yield of sulphur trioxide will increase.

12 The pH of water varies with temperature according to the table below.

temperature / °C	pH
25	7.0
62	6.5

Which of the following statements is **true**?

A Water is not a neutral liquid at 62 °C.

B The concentration of H^+ ions is higher than the concentration of OH^- ions in water at 62 °C.

C The ionic product of water, K_w decreases at higher temperature.

D The ionic dissociation of water is an endothermic process.

13 It is often stated that the rate of a typical reaction is roughly doubled by raising the temperature by 10 °C.

Which of the following statements best explains this observation?

A Raising the temperature by 10 °C doubles the average energy of each molecule.

B Raising the temperature by 10 °C doubles the average velocity of the molecules.

C Raising the temperature by 10 °C doubles the number of molecular collisions in a given time.

D Raising the temperature by 10 °C doubles the number of molecules having more than a certain minimum energy.

14 Carbon-dating is a technique commonly used for estimating the age of archeological samples. The amount of carbon-14 isotopes in an organism will decay upon its death with a constant half-life of 5700 years. If the amount of carbon-14 isotopes found in an animal fossil is only 25 % of the amount found in living tissues, what is the estimated age of the animal fossil?

A 1425 years old

B 4275 years old

C 5700 years old

D 11400 years old

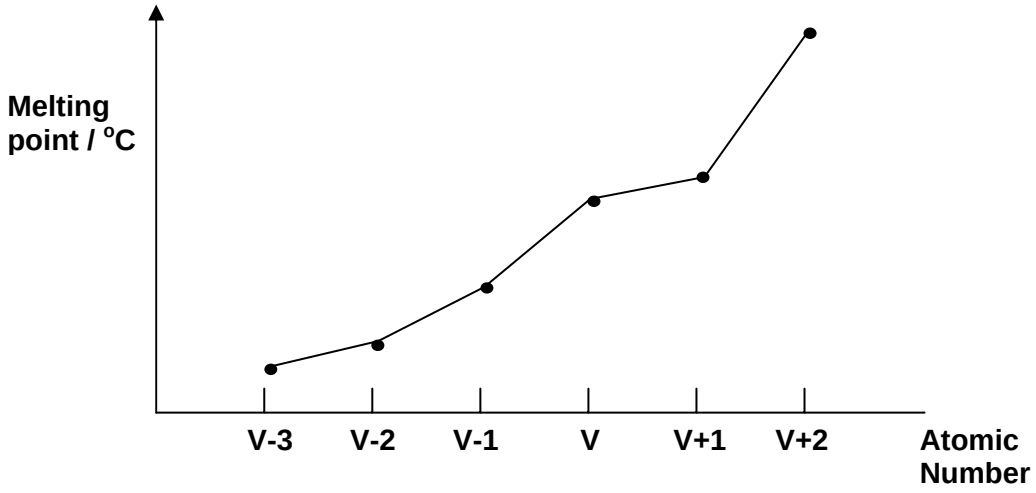
15 The pH of 1.0 mol dm^{-3} of the 2 chlorides, $MgCl_2$ and $AlCl_3$ are 6.0 and 3.0 respectively.

Using the ***Data Booklet***, which of the following will be the most likely pH of 1.0 mol dm^{-3} of $BeCl_2$?

A 2.5 **C** 6.5

B 4.5 **D** 8.5

16 The figure below shows the melting point trend of some of the elements from Periods 2 and 3 of the Periodic Table.



Which is the element with atomic number **V**?

	Element	Atomic Number
A	Na	11
B	Mg	12
C	Al	13
D	Si	14

17 Which of the following sets of compounds consists of a giant covalent structure, giant ionic structure and a simple covalent structure?

A Sodium ethanoate, phosphoric acid, barium chloride

B Ethyl ethanoate, sulphur trioxide, silicon dioxide

C Methanoic acid, aluminium sulphate, beryllium chloride

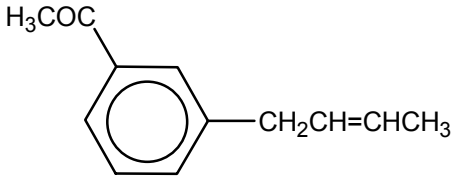
D Aluminium chloride, diamond, anhydrous sodium hydroxide

18 Which one of the following structural formulae exists in both *cis* and *trans* forms?

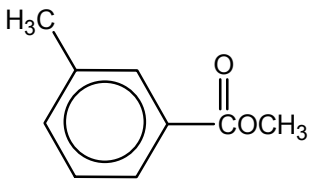
A $CCl_2{=}CHCH_3$ **C** $C_6H_5CH{=}C(CH_2Cl)_2$

B $C_6H_5CH{=}CFC_6H_5$ **D** $CH_3CH{=}CH_2$

19



Compound A



Compound B

Which of the following reagents will distinguish compound **A** from compound **B**?

A ethanolic KCN

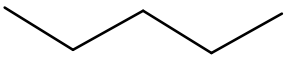
B hot acidified $KMnO_4$

C 2,4-dinitrophenylhydrazine

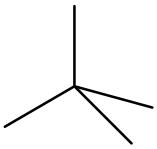
D Fehling's solution

20 Which of the following alkanes is the most volatile?

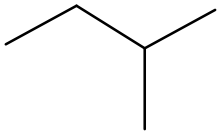
A



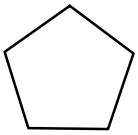
B



C



D



21 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 $CH_3CH_2CH_2CH_2CH_2Br$ and $CH_3CH_2CHBrCH_3$
B $CH_3CH_2CH_2CH_2Br$ and $BrCH_2CH_2CH_2CH_2Br$
C $CH_3CHBrCHBrCH_3$ and $BrCH_2CH_2CH_2CH_2Br$
D $CH_3CH_2CH_2CH_2Br$ and $CH_3CH_2CH_2CHBr_2$

22 Some alcohol was added to a type of petrol consisting mainly of a mixture of alkanes and alkenes.
Which reagent could be used to detect the presence of alcohol in the petrol?

A Na

B Br_2(in CCl_4)

C acidified $KMnO_4$(aq)

D 2, 4-dinitrophenylhydrazine

23 The table shows the results of simple tests performed on a compound **P**.

Reagents	Result
2, 4-dinitrophenylhydrazine	Positive
Tollen's reagent	Positive
Alkaline aqueous iodine	Positive

Based on the results of the tests, which of the following could be the identity of **P**?

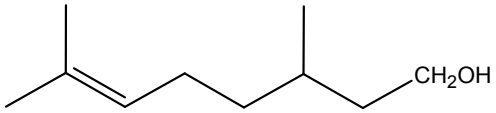
A CH_3CHO

B CH_3COCH_3

C CH_3CH_2CHO

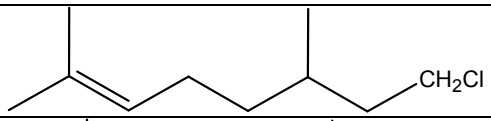
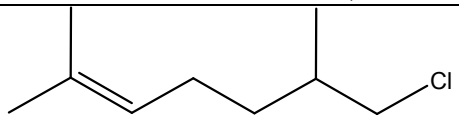
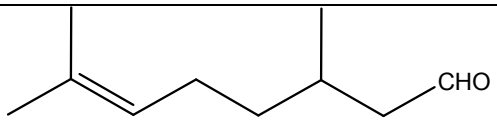
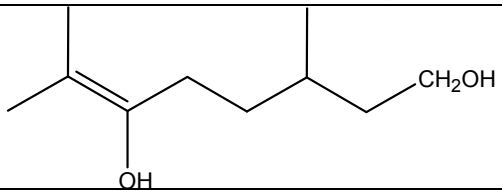
D $CH_3CH(OH)CH_3$

24 ***Citronellol*** is a colourless oily liquid having a rose-like odour. It is the active ingredient in over 30 essential oils and is a major component in perfumes, cosmetics and soaps. It may be prepared synthetically from compound **X** using reagent **Y**.

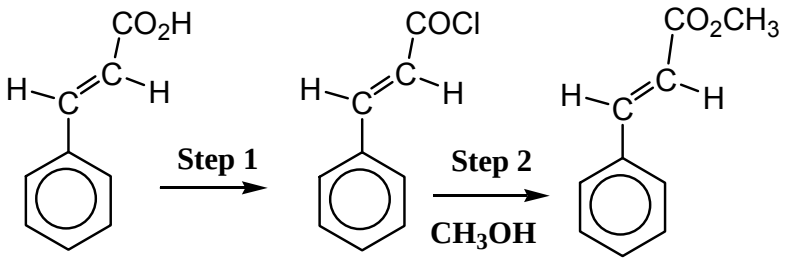


Citronellol

Which of the following sets of compounds and reagents is the correct combination?

	X	Y
A		KOH in ethanol
B		Aqueous NaOH
C		LiA/H_4
D		Conc. H_2SO_4 at 170°C

25 The ***Matsutake*** mushroom is a delicacy added to many Japanese foods. The spicy aroma of this mushroom is due to methyl cinnamate, which can be prepared in the laboratory according to the following reaction sequence.



Methyl Cinnamate

Which reagent could be used in **Step 1**?

A Cl_2 **C** CH_3Cl

B PCl_5 **D** KCl

Section B

For each of the following 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. 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 isotope gallium-67 ($^{67}_{31}Ga$) is used as a tumor-seeking agent for cancer diagnosis.

Which statements about an atom of gallium-67 are correct?

1 It contains 36 neutrons.

2 Its nucleus has a relative charge of +31.

3 It has a different number of neutrons from the atoms of other isotopes of gallium.

27 Elements **A, B** and **C** are in the same Period of the Periodic table.

The oxide of **A** gives an aqueous solution of pH more than 7.
The oxide of **B** reacts with both strong acids and strong alkalis.
The oxide of **C** gives an aqueous solution of pH less than 7.

Which of the following statements is true?

1 The electronegativity decreases in the order **C** > **B** > **A**.

2 **A, B** and **C** could be sodium, aluminium and phosphorous respectively.

3 The ionic radius decreases in the order **C** > **A** > **B**.

28 The values of two lattice energies are given below:

NaF, -915 kJ mol^{-1}

MgO, -3933 kJ mol^{-1}

Which of the following statements help to explain the difference between the two values?

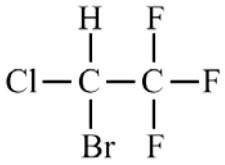
1 The two ions in each compound are isoelectronic.

2 The attraction between doubly charged ions is about four times that between singly charged ions.

3 The interionic distance in NaF is 0.102 nm and that in MgO is 0.074 nm.

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

29 Which of the following are correct statements about ***Halothane***, a widely used anaesthetic?

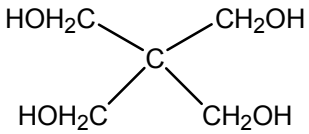


1 It is relatively unreactive.

2 It is a polar molecule.

3 It may cause depletion to the ozone layer.

30 ***Pentaerythriol*** is an intermediate used in the manufacture of paint.



Pentaerythritol

Which of the following statements about ***Pentaerythriol*** are correct?

1 It reacts with metallic sodium.

2 It decolourises acidified potassium manganate(VII) on warming.

3 It can undergo dehydration with addition of concentrated sulphuric acid to form alkenes.

CATHOLIC JUNIOR COLLEGE

JC2 PRELIMINARY EXAMINATION 2008

H1 CHEMISTRY (ANSWERS)

PAPER 1 (MCQ)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	A	C	B	D	D	D	D	B	B	C	D	D	D	A
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
B	D	B	C	B	C	A	A	C	B	A	A	C	A	B