CATHOLIC JUNIOR COLLEGE

CHEMISTRY **8872/01**
Higher 1

Paper 1 Multiple Choice

JC 2 Preliminary Examination 2009

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 in 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 question paper.
You may use a calculator.

There are a total of 8 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 Chlorine is a pungent gas which causes severe irritation to the eyes and respiratory system. The maximum safe tolerance level of chlorine gas in air is 0.005 mg dm^{-3}. How many chlorine molecules are there in 1 dm^3 of air at this tolerance level?

A $\frac{0.005}{6\times10^{23}}\times71$ **B** $\frac{0.005}{71}\times6\times10^{23}$

C $\frac{0.005}{1000}\times\frac{1}{71}\times6\times10^{23}$ **D** $\frac{0.005}{1000}\times71\times6\times10^{23}$

2 The principal ingredient listed for chocolate bars is sugars, typically about 47% of milk chocolate bars. If these sugars are represented by sucrose, $C_{12}H_{22}O_{11}$ (M_r = 342), how many moles of sugar are there in 1 kg of chocolate bars?

A 1.37 **B** 1.54 **C** 2.92 **D** 4.30

3 In an experiment, 25.0 cm^3 of 0.020 mol dm^{-3} $KMnO_4$(aq) were found to absorb and react with 12.0 cm^3 of nitrogen monoxide, NO, at room temperature and pressure. The half equation representing the reaction of $KMnO_4$(aq) is:

$$MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$$

Which one of the following is a possible nitrogen-containing product of this reaction?

A NO_2^- **B** N_2O_4 **C** NO_3^- **D** NH_3OH^+

4 Carbon-14 is radioactive and is used by archaelogists in carbon dating.

Which species has both the same number of neutrons as well as electrons as an atom of carbon-14?

A $^{13}C^-$ **B** $^{14}N^+$ **C** $^{16}O^{2+}$ **D** $^{17}F^+$

5 The first ionisation energies of five successive elements in the Periodic Table are 1400, 1310, 1680, 2080 and 494 kJ mol^{-1}. Where can these elements be found?

A The first five elements of a period.

B The last five elements of a period.

C The last element of one period and the first four elements of the next period.

D The last four elements of one period and the first element of the next period.

6 What is the shape of the Group V chloride ion $[SbCl_5]^{2-}$ according to Valence Shell Electron Pair Repulsion theory?

A octahedral **B** square pyramidal

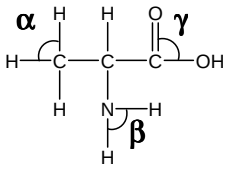
C pyramidal **D** trigonal bipyramidal

7 Which one of the following solids consists of atoms or molecules held together by van der Waals' forces?

A $CO_2(s)$ **B** $H_2O(s)$

C $SiO_2(s)$ **D** Cu(s)

8 Protein-containing food such as meat, poultry, fish, and dairy products are rich in alanine. The structure of alanine is shown below:



What are the approximate values of bond angles **α**, **β** and **γ** (in degrees) in the compound?

	α	**β**	**γ**
A	90	106	120
B	109	106	120
C	109	120	110
D	90	120	110

9 Given the following data, what is the standard enthalpy change of combustion of methanol, CH_3OH, in kJ mol^{-1}?

ΔH_c (graphite) = -394 kJ mol^{-1}

ΔH_f (water) = -286 kJ mol^{-1}

ΔH_f (methanol) = -239 kJ mol^{-1}

A -441 **B** -727 **C** -919 **D** -1205

10 Which one of the following enthalpy changes is positive?

A $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

B $C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

C $2Br(g) \rightarrow Br_2(g)$

D $Na(g) \rightarrow Na^+(g) + e^-$

11 When chlorine gas dissolves in water, a solution smelling of Cl_2 is produced:

$$Cl_2(g) + H_2O(l) \rightleftharpoons HClO(aq) + HCl(aq)$$

Which of the following will remove the smell of Cl_2?

A addition of concentrated HCl to the solution

B addition of NaOH to the solution

C decreasing the pressure of the system

D adding NaCl and allowing it to react with water

12 Which of the following reagents can be mixed to form an acidic buffer?

A HCN and NaCN **B** HNO_3 and $NaNO_3$

C NaOH and NaCl **D** HCl and NaOH

13 Which statement describes the effect of a catalyst on a reversible reaction?

A It increases the equilibrium constant for the forward reaction.

B It increases the yield of products in an equilibrium.

C It increases the rate constant for both the forward reaction and the reverse reaction.

D It increases the rate constant for the forward reaction but not that of the reverse reaction.

14 Which one of the following best explains the increase in the rate of reaction as the temperature increases?

A A considerably higher proportion of the molecules has the necessary minimum energy to react at higher temperature.

B The bonds in the reacting molecules are more easily broken as the temperature increases.

C The activation energy of the reaction is lowered at higher temperature.

D The molecular collisions become more violent at higher temperature.

15 The following elements are within the same period of the Periodic Table. Which one has the highest boiling point?

A Al **B** Mg **C** Na **D** S

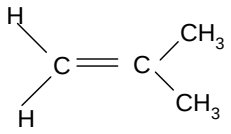
16 Which one of the following oxides is unlikely to dissolve in aqueous NaOH?

A Al_2O_3 **B** Cl_2O_7 **C** MgO **D** P_4O_{10}

17 An excess of cold water was added to 0.2 mol of a chloride of the third period of the Periodic Table at room temperature. 1.0 mol of HCl was formed. Which chloride was treated?

A $AlCl_3$ **B** PCl_3 **C** PCl_5 **D** $SiCl_4$

18 What is the total number of σ (sigma) bonds in a molecule of 2-methylpropene?



A 5 **B** 6 **C** 11 **D** 12

19 Compound **T** has the following structure.

1 2 3 4

$CH_3CH(OH)CH=CHBr$

Compound **T**

Which statement is **not** correct for compound **T?**

A The centre carbon atoms (2 and 3) are sp^3 hybridised.

B The terminal carbon atom (4) has trigonal planar geometry.

C **T** exhibits geometrical isomers.

D **T** can undergo a substitution reaction with PCl_5.

20 How many different chloroethanes are there with the formula $C_2H_{6-n}Cl_n$ (where n can be any integer from 1-6)?

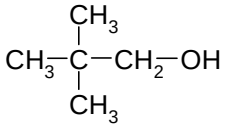
A 6 **B** 8 **C** 9 **D** 10

21 When treated with hot acidified aqueous potassium manganate(VII), a compound forms CH_3CO_2H and $CH_2(CO_2H)_2$ in a 2:1 ratio. Which of the following is most likely to be the compound?

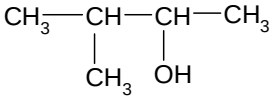
A $CH_3CH=CHCH_2CH=CHCH_3$ **B** $CH_3CH=CHCH_2CH_2CH_3$

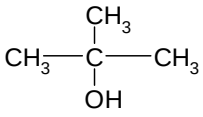
C $(CH_3)_2C=CHCH_2CH_2CH=CHCH_3$ **D** $CH_3CH=CHCH=CHCH_3$

22 Which of the following alcohols gives a yellow precipitate of CHI_3 upon reaction with alkaline aqueous iodine?

A 

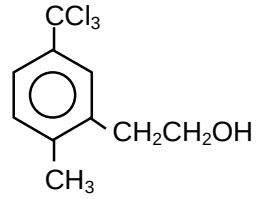
B $CH_3CH_2CH_2CH_2OH$

C 

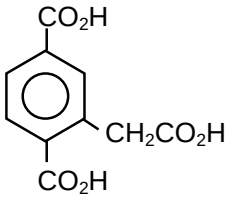
D 

23 Which of the following is produced when compound **U** is reacted with hot acidified potassium manganate(VII)?

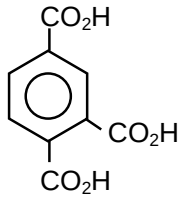
Compound **U**



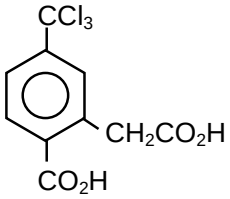
A



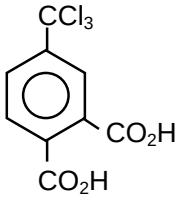
B



C



D



24 Which alcohol is used to manufacture the ester, $CH_3CH_2CH(OH)CO_2CH(CH_3)_2$?

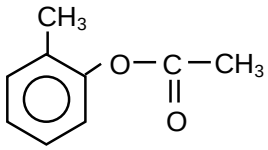
A CH_3CO_2H

B $CH_3CH(OH)CH_3$

C $CH_3CH_2CH_2OH$

D CH_3OH

25 Which one of the given reagents and conditions will **not** have a reaction with the following compound?



A acidified $K_2Cr_2O_7$, reflux

B aqueous alkaline I_2, warm

C Cl_2 with $AlCl_3$, in the dark

D Cl_2, uv light

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 Glucose can be regarded as a simple molecular solid of formula

$HOCH_2CH(OH)CH(OH)CH(OH)CH(OH)CHO$

It is soluble in water due to the hydrogen bonds formed between water and glucose.

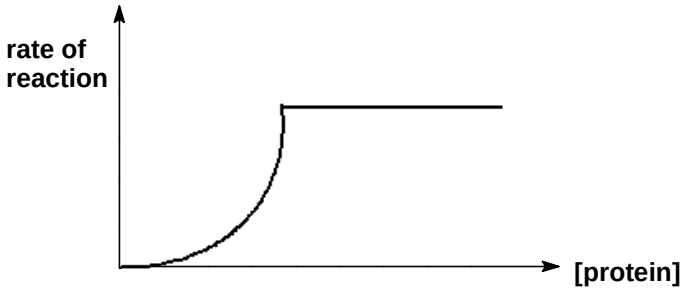
Which of the following statements are correct?

1 The –OH groups in glucose can form hydrogen bonds with water.

2 The oxygen in the aldehyde group in glucose can form hydrogen bonds with water.

3 All the hydrogen atoms in a molecule of glucose can form hydrogen bonds with water.

27 Pepsin is a biological catalyst found in gastric juice that speeds up the digestion of proteins. The graph below shows how the rate of a reaction varies with the protein (reactant) concentration for pepsin enzyme.



Which of the following can be deduced from the graph above?

1 The rate is second order at low protein concentration.

2 The rate is zero order at high protein concentration.

3 Increasing the protein concentration will increase the rate of reaction.

28 Which of the following statements about the Period 3 elements (Na to Ar) are true?

1 The atomic radii decrease from Na to Cl.

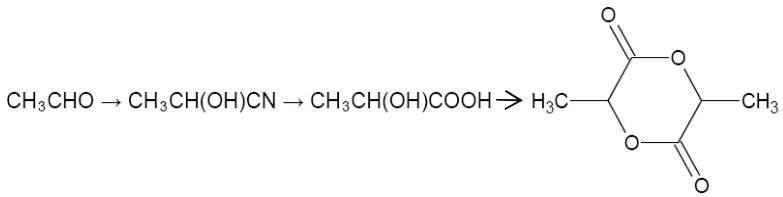
2 The ionic radii decrease from Na to Ar.

3 The maximum oxidation state is shown by Si.

29 Which of the following gives the correct order of acid strength (strongest first) for the three compounds in each set?

	strongest		**weakest**
1	$CH_2BrCH_2CO_2H$	$CH_2ClCH_2CO_2H$	$CH_2FCH_2CO_2H$
2	$CH_3CHClCO_2H$	$CH_2ClCH_2CO_2H$	$CH_3CH_2CO_2H$
3	CH_3CO_2H	H_2O	CH_3CH_2OH

30 Compound **V** is formed from ethanal via a series of reactions below.



Compound **V**

Which of the following reactions is represented in the sequence above?

1 addition

2 acid hydrolysis

3 esterification