Student .

( )

2006

**TRIAL HIGHER SCHOOL
CERTIFICATE
EXAMINATION**

Chemistry

General Instructions

* Reading time – 5 minutes
* Working time – 3 hours
* Write using black or blue pen
* Draw diagrams using pencil
* Approved calculators may be used
* Write your student number in the space provided

Total marks – 100

Section I   Pages 2 - 19

75 marks
This section has two parts, Part A and Part B

Part A – 15 marks
* Attempt Questions 1-15
* Allow about 30 minutes for this part

Part B – 60 marks
* Attempt Questions 16-28
* Allow about 1 hour and 45 minutes for this part

Section II   Pages 20 - 31

25 marks
* Attempt ONE Question from Questions 29-33
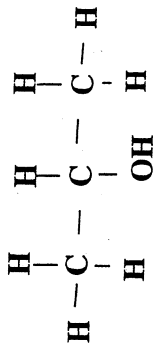* Allow about 45 minutes for this section

---

Student

2006

**TRIAL HIGHER SCHOOL
CERTIFICATE EXAMINATION**

Chemistry

Multiple Choice Answer Sheet

1.   A ◯   B ◯   C ◯   D ◯
2.   A ◯   B ◯   C ◯   D ◯
3.   A ◯   B ◯   C ◯   D ◯
4.   A ◯   B ◯   C ◯   D ◯
5.   A ◯   B ◯   C ◯   D ◯
6.   A ◯   B ◯   C ◯   D ◯
7.   A ◯   B ◯   C ◯   D ◯
8.   A ◯   B ◯   C ◯   D ◯
9.   A ◯   B ◯   C ◯   D ◯
10. A ◯   B ◯   C ◯   D ◯
11. A ◯   B ◯   C ◯   D ◯
12. A ◯   B ◯   C ◯   D ◯
13. A ◯   B ◯   C ◯   D ◯
14. A ◯   B ◯   C ◯   D ◯
15   A ◯   B ◯   C ◯   D ◯

1 Which of the following is the correct IUPAC name for the molecule below.

$$H-C-C-C-H$$

(with H, OH, H below and H, H, H above the structure)

(A) 2-propane
(B) 2-hydroxypropane
(C) 2-propanol
(D) 2-hydroxypropanol

2 What is the oxidation state of manganese in potassium permanganate, $KMnO_4$.

(A) -1
(B) +3
(C) +7
(D) +8

3 Which of the following nuclei is most likely to undergo nuclear decay?

(A) carbon-12
(B) potassium-39
(C) cobalt-60
(D) lead-207

4 Which of the following are significant industrial sources of sulfur dioxide?

(A) lightning and bacteria
(B) bacteria and volcanoes
(C) internal combustion engine and air conditioning units
(D) coal burning power stations and metal ore smelting

5 Which of the following is the conjugate acid of water?

(A) H_3O^+
(B) OH
(C) H_2O_2
(D) Cl

6 Which of the following is the common name for 2-hydroxypropane-1,2,3-tricarboxylic acid?

(A) acetic acid
(B) citric acid
(C) ascorbic acid
(D) sulfuric acid

7 Who defined an acid as a substance containing replaceable hydrogen?

(A) Lavoisier
(B) Davy
(C) Arrhenius
(D) Lowry and Brönsted

8 Which of the following equations describes a buffer?

(A) $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$
(B) $CH_3COOH(aq) + H_2O(l) \Leftrightarrow CH_3COO^-(aq) + H_3O^+(aq)$
(C) $H_2SO_4(aq) + H_2O(l) \Leftrightarrow HSO_4^-(aq) + H_3O^+(aq)$
(D) $NH_3(aq) + H_2O(l) \Leftrightarrow NH_4^+(aq) + OH^-(aq)$

9 What is the pH of a 1.5×10^{-4} mol L^{-1} solution of sulfuric acid assuming complete ionization?

(A) 4.0
(B) 3.8
(C) 3.5
(D) 1.5

10 Which of the following pairs are isomers?

(A) graphite and diamond

(B) carbon-12 ($^{12}_{6}C$) and carbon-14 ($^{14}_{6}C$)

(C) cyclohexane and cyclohexene

(D) cyclohexane and 1-hexene

11 Which of the following statements about cellulose is correct?

(A) Cellulose is a condensation biopolymer synthesized from glucose monomers.

(B) Cellulose is an addition biopolymer synthesized from glucose monomers.

(C) Cellulose is a natural monomer from which many useful products are made.

(D) Cellulose is a monomer that contains a carbon chain structure similar to that found in most fuels.

12 To which area has Atomic Absorption Spectroscopy contributed the most?

(A) The analysis of organic water pollutants.

(B) The identification and effects of trace elements.

(C) The analysis of pollutant gas levels in the atmosphere.

(D) The identification of metal ions in water.

13 Which of the following is the major origin of *Halons* in the atmosphere?

(A) Air conditioning units.

(B) Dry cleaning processes.

(C) Aerosol cans.

(D) Fire extinguishers.

14 The table below gives the results of some tests performed on water from four different sites.

Test	Site Q	Site R	Site S	Site T
Total dissolved solids (ppm)	550	120	50	635
Phosphate (ppm)	2.2	0.02	0.01	1.1
Dissolved oxygen (ppm)	2.5	5.0	7.0	3.5
Micro-organisms (CFU/100 mLª)	190	220	1	2

Which site is most likely to be down stream from a farm?

(A) Site Q

(B) Site R

(C) Site S

(D) Site T

15 A student performed an investigation to measure the sulfate content of ammonium sulfate lawn fertilizer by precipitating the sulfate as barium sulfate (BaSO₄) and weighing the precipitate. His results are tabulated below.

What was weighed	Mass (g)
Ammonium sulfate fertiliser sample	2.00
Clean filter paper	1.05
Filter paper + dry barium sulfate precipitate	1.88
	0.85

What is the percentage of sulfate, by mass, in the measured ammonium sulfate fertilizer?

(A) 17.1 %

(B) 24.4 %

(C) 41.5 %

(D) 72.7 %

Section I (continued)

Part B – 60 marks
Attempt Questions 16 – 28
Allow about 1 hour and 45 minutes for this part.

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Marks

Question 16 (6 marks)

Ethanol can be produced by *the addition of water to ethylene* OR by *fermentation of sugars*.

(a) Give the equation for the production of ethanol by the addition of water to ethylene.

....   1

(b) Outline how ethanol can be produced by fermentation in the school laboratory.

Cotton Plug

....   2

....

....

(c) Discuss ONE advantage and ONE disadvantage of the potential wide-scale use of ethanol as an alternative fuel to petrol in cars.   3

only 10% in conventional car engines

....

....

....

....

7

Question 17 (6 marks)

A student set up the apparatus below to determine the molar heat of combustion of three liquid alkanols.

thermometer

tin can

200 mL water
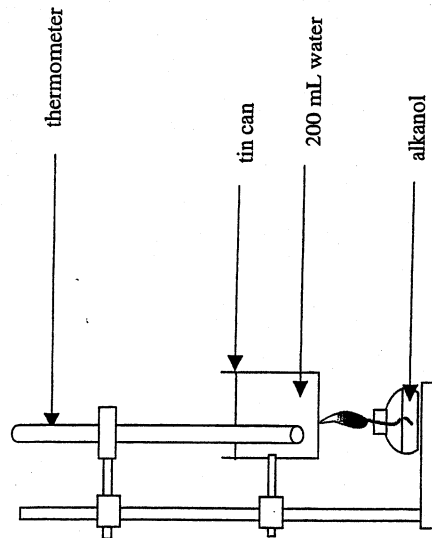
alkanol

Her results are tabulated below.

Alkanol	Water temperature (°C)		Mass of spirit burner containing alkanol (g)		Molar Heat of Combustion (kJmol⁻¹)
	Initial	Final	Initial	Final	
Ethanol	20	35	42.6	41.8	x
1-propanol	20	44	42.1	40.9	-1206
1-butanol	20	52	45.4	44.7	-1256

8

(a) Calculate the molar heat of combustion for ethanol from the student's data provided in the table.

3

....

....

(b) Explain the trend in heat of combustion for the three alkanols.

1

....

....

(c) The value obtained by the student for 1-butanol is significantly lower than the theoretical value of –2676kJ mol⁻¹.

2

Describe and explain ONE way that the student could modify the experiment to obtain a more accurate result.

(handwritten annotations in margin)

....

....

A Galvanic cell may be constructed by placing one half-cell in a porous pot inside another half-cell as shown below.

Glass container
Sn(s)
Porous pot
Sn²⁺(aq)
Ag(s)
Ag⁺(aq)
V
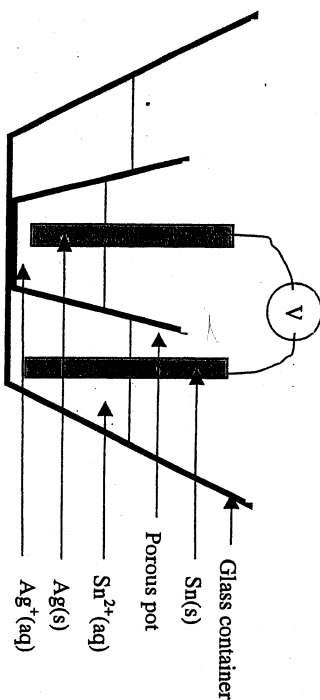
(a) Identify the *anode*.

1

......Sn......

(b) Use the standard potentials supplied to calculate the theoretical voltage of this cell.

1

....

....

(c) Explain the function of the *porous pot*.

2

....

....

....

Question 19 (6 marks)

$$A(g) + B(g) \rightleftharpoons X(g)$$
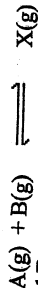
When two gases, A and B, are reacted, partial conversion to product X occurs according to the equation above. The following data provide information about the percentage composition of the gaseous mixture at equilibrium under various conditions.

At constant pressure:

Temperature (°C)	100	200	300	400	500
Percentage of X in the mixture	50	35	23	14	8

At constant temperature:

Pressure (MPa)	5	10	15	20	25
Percentage of X in the mixture	12	18	25	34	44

(a) From the above data, is the formation of X from A and B endothermic or exothermic? Briefly explain your answer.

_____

_____

_____   **2**

(b) State qualitatively what combination of temperature and pressure conditions (i.e. high or low) would give the highest percentage of X at equilibrium.

Temperature: _____

Pressure: _____   **2**

(c) Suggest a means of increasing the amount of product in this reaction other than by altering the temperature or pressure. Explain your answer.

_____

_____

_____   **2**

Question 20 (3 marks)

Special techniques are used to ensure accuracy when preparing a standard solution and conducting a titration.

Describe TWO such techniques for the preparation of the standard solution OR TWO such techniques for conducting the titration.

Explain how each assists in obtaining a precise result.

electronic balance

....

....

....

....   **3**

Question 21 (4 marks)

During this course you will have studied the use of catalysts in a number of different reactions and processes.

(a) Identify one chemical reaction or process that uses a catalyst.

.........Haber process.........   **1**

(b) Name the catalyst used.

.........Zeolite.........   **1**

(c) Explain how the catalyst functions in this process.

.........graphite / Iron.........

.........core of the.........
.........Esterifcation.........   **2**

11   12

Question 22 (7 marks)

Copper carbonate ($CuCO_3$) is decomposed to carbon dioxide and copper (II) oxide when heated.

The volume of carbon dioxide produced can be measured by displacing water.

CuCO₃

CO₂

H₂O
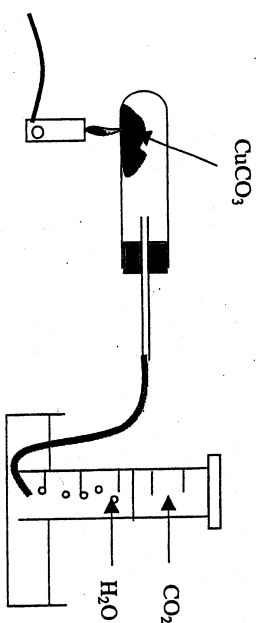
The results of an investigation into the decomposition of copper(II)carbonate are tabulated below.

Time (sec)	Gas Volume at 25°C and 100 kPa (mL)
10	20
30	66
50	84
70	90
100	92
130	92

13

Question 22 (continued)

(a) Write the equation for the decomposition of copper carbonate.   1

.... $CuCO_3(s) \rightarrow CuO$ ....

(b) Graph the results from this experiment.   3
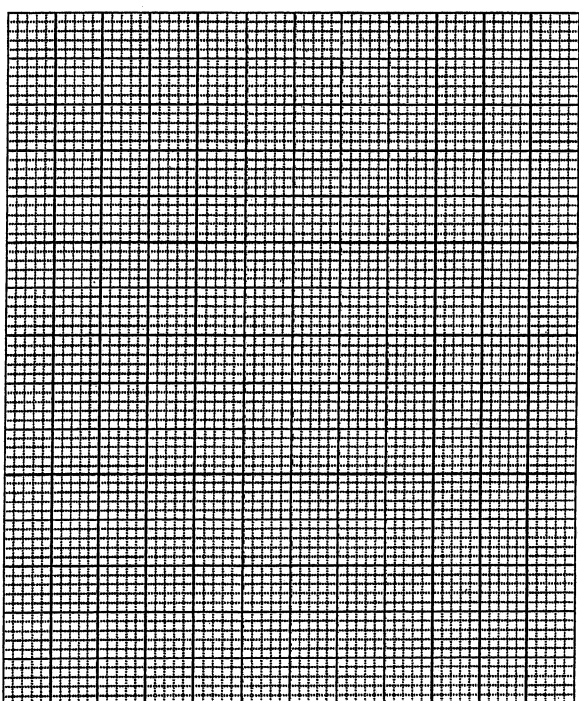
Time

(c) Calculate the initial mass of copper carbonate heated.   2

....

use

....

....

(d) Assess the validity of the procedure for collecting the gas.   1

not valid

....

the $H_2O + CO_2 \rightleftharpoons H_2CO_3$

$CO_3 \rightleftharpoons$ convey
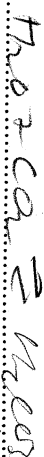
volume

so lower than actual, co_2 also left in tube

Question 24 (10 marks)

(a) (i) Define acids and bases according to the Bronsted-Lowry theory.

2

(ii) In the following two reactions, state whether HCO_3^- behaves as an acid or a base.
Explain your answer in each case.

1. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + HCO_3^-(aq)$
2. $HCO_3^-(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + CO_3^{2-}(aq)$

2

(b) The pH of a 0.001 $mol L^{-1}$ solution of hydrochloric acid and the pH of a 0.056 $mol L^{-1}$ of ethanoic acid is 3.

(i) Compare the concentration of each acid. Explain your answer.

2

(ii) Compare the strength of each acid. Explain your answer.

2

(iii) Compare the hydrogen ion concentration in the solutions of each acid.
Explain your answer.

2

16

Question 23

A chemist performed the tests shown in the flow chart below to determine the cation(s) present in a water sample.

Water Sample

add HCl → white precipitate $Ag Cl$ or $Pb Cl_2$

white precipitate → filter off precipitate → filtrate

filtrate → add NaOH → blue precipitate $Cu OH$

filtrate → add H_2SO_4 → no reaction

blue precipitate → add excess ammonia → deep blue solution

(i) What cation(s) is/are present in the solution?

1

(ii) Write balanced chemical equations for the FIRST TWO reactions in the flow chart sequence.

2

15

Question 25 (4 marks)

Ions such as lead, phosphate and copper can move from farms and industry into the environment where they can cause problems.

Describe :   evidence for the need to monitor levels of ONE named ion used by society.

2

....

....

....

....

....

....

....
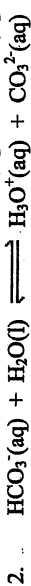
Question 26 (3 marks)

Hydronium, H_3O^+, ammonium, NH_4^+, and ozone, O_3, each have a *coordinate covalent bond*.

(a) Define *coordinate covalent bond*.

1

....

....

(b) Draw a Lewis electron dot structure of one of these molecules/ions and identify the position of the *coordinate covalent bond*.

2

Question 27 (6 marks)

Ozone is being gradually removed from the stratosphere by our use of CFC's.

(a) Identify ONE CFC molecule that has caused problems.

1

.... $CFCl_3$ ....

(b) Give equations to demonstrate the removal of ozone from the atmosphere by this CFC.

2

....

....

....

(c) Evaluate the effectiveness of replacement chemicals for CFC's.

3

....

....

....

....

....

....

Section II

25 marks

Attempt ONE question from Questions 28, 29.

Allow about 45 minutes for this section.

Answer in a writing booklet. Extra booklets are available.

Show all relevant working in questions involving calculations.

Question 28   Industrial Chemistry ....

Question 29   Shipwrecks, Corrosion and Conservation ....

Marks

Question   – Industrial Chemistry (25 marks)

(a) (i) Identify a natural product, (not a fossil fuel), that is a shrinking world resource.   **1**

(ii) Discuss the issues associated with the increasing need for this resource.   **3**

(iii) Identify a possible replacement for this resource or outline current research into finding a replacement.   **1**

(b) Dinitrogen tetroxide (N_2O_4) is a colourless gas. It exists in equilibrium with nitrogen dioxide (NO_2), a brown gas.

$$N_2O_4(g) \Leftrightarrow 2NO_2(g) \qquad K = 5.5 \times 10^{-3} \text{ at } 25°C$$

(i) Write the expression for the equilibrium constant for this reaction.   **1**

(ii) Some pure NO_2 is placed in a gas syringe at 25°C and allowed to reach equilibrium. Keeping the volume constant, the temperature is then raised to 35°C. The brown colour becomes more intense.   **2**

Explain whether the forward reaction is endothermic or exothermic.

(iii) 2×10^{-3} moles of N_2O_4 was placed in a 100 mL syringe at 25°C and given time to come to equilibrium with NO_2. Two minutes later 6×10^{-4} moles of NO_2 were measured in the container.   **2**
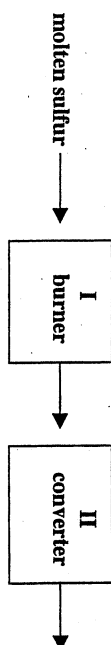
Calculate whether the system had reached equilibrium.

Question   continues

20

Question 29 (continued)

(c) Sulfuric acid can be produced from mined sulfur via the Contact Process.

The first two stages in the industrial production of sulfuric acid by this process are represented below.
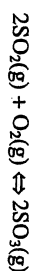
molten sulfur ⟶ | **I** burner | ⟶ | **II** converter | ⟶

(i) Give a reason why, in stage I, the molten sulfur is sprayed into the burner rather than being allowed to flow through it. **1**

(ii) A conflict is involved in choosing the best temperature to be used in stage II, where the reaction is: **2**

$$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$$

Describe the nature of the conflict and explain how the conflict is resolved.

(iii) Describe by using an equation/s a specific example of sulfuric acid acting as an oxidizing agent. **1**

(iv) What are the safety precautions necessary for the transport and storage of concentrated (98%) sulfuric acid? Explain the reasons for the precautions you specify. **3**
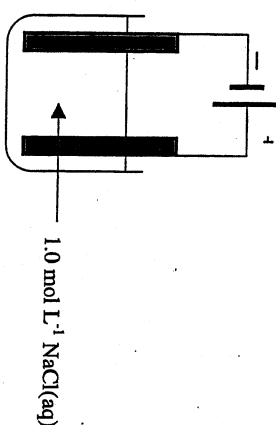
Question continues

21

Question 29 (continued)

(d) A student carries out the electrolysis of a 1.0 mol L^{-1} solution of sodium chloride using inert graphite electrodes.

The setup for this experiment is shown below.

⟶ 1.0 mol L^{-1} NaCl(aq)

(i) Write a half-equation for the reaction that would occur at the cathode. **1**

(ii) Two different gases are produced at the anode. **1**

Write a half-equation for a reaction that results in the production of one of these gases.

(iii) Using the same current and electrodes, the student carries out a second electrolysis, this time of molten sodium chloride instead of a solution. What difference, if any, would you expect in the products formed at the anode and cathode? **2**

Give equations for any different relevant oxidation and/or reduction reactions occurring.

(e) Sodium hydroxide and chlorine are the products of the chlor-alkali industry. Three types of electrolytic cell can be used to produce these products.

(i) State two problems associated with the use of the diaphragm cell. **2**

(ii) State one advantage and one disadvantage of using the mercury cell. **2**

22

## Question 29 – Shipwrecks, Conservation and Corrosion (25 marks)

Marks

(a) In 1780 Luigi Galvani generated an electric current by taking two wires made of different metals, at one end joining them together and at the other end placing them on a dissected frog's leg muscle.

The muscle contracted, prompting Galvani to coin the term *animal electricity*.

Outline how a more recent chemist, Alessandro Volta, interpreted Galvani's results and describe how he built on Galvani's work. **3**

(b) The experiment below was set up to investigate the factors that affect the rate of electrolysis.

Pt electrodes

KBr ($1 \, mol \, L^{-1}$)
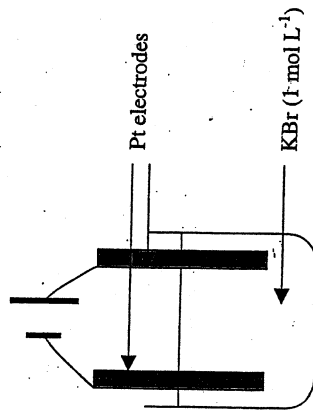
(i) Give the half-equation for the reaction occurring at the cathode. **1**

(ii) Calculate the voltage required for the reaction to proceed. **1**

(iii) In some investigations, reaction rate can be measured by recording the change in temperature.

Describe what the investigator could have recorded as a measure of reaction rate in this investigation. **1**

(iv) Identify one other factor that the investigator may have varied and give the likely result of varying this factor on reaction rate. **2**

(c) Describe how the process of *cathodic protection* minimizes rusting of iron in marine environments in terms of oxidation and reduction. **4**

Question 29 continues

23

Question 29 – Shipwrecks, Conservation and Corrosion (25 marks)

Marks

(d) (i) Describe the mechanism of corrosion of iron. **4**

(ii) Explain how coating the surface of iron with zinc can offer protection from corrosion. Include in your explanation the equation that describes this protection. **4**

(e) (i) The electrodes in an electrolytic cell are given the names anode and cathode. What processes occur at the surface of these electrodes in electrolysis? **2**

(ii) List three factors that can affect the products that are formed in an electrolysis reaction. **3**

24

1 What is a free radical?

(A) An atom or molecule with an unpaired electron.
(B) A particle that is free to move in a chemical reaction.
(C) A charged particle that is free to move.
(D) An organo-halogen compound.

2 Which of the following is the catalyst used in the Haber process?

(A) iron-iron oxide
(B) zeolite
(C) conc H_2SO_4
(D) V_2O_5

3 Which of the following substances could not be produced by ethene undergoing an addition reaction?

(A)

```
    H   H
    |   |
H — C — C — H
    |   |
    H   H
```

(B)

```
    H   Cl
    |   |
H — C — C — H
    |   |
    H   H
```

(C)

```
    H   H
    |   |
Br— C — C — H
    |   |
    H   Br
```

(D)

```
    H   Cl
    |   |
H — C — C — H
    |   |
    H   Cl
```

4 Which of the following statements best describes condensation polymerisation?

(A) The reaction between many units, whereby the units link to each other across their double bonds to form a chain.
(B) The reaction between many units, whereby the functional groups of the units react in such a way as to form a chain and expel water molecules.
(C) The reaction between many units, whereby the amine group of one molecule reacts with the carboxyl group of the next to form a chain and expel water.
(D) The reaction between many units, whereby the units link to each other to form a chain and to expel many small molecules.

5 Which of the following represents the ideal conditions for fermentation to occur?

(A) Air is excluded; zymase(yeast) is added; $\approx 35°C$.
(B) Conc. H_2SO_4 is added; zymase(yeast) is present; $\approx 35°C$.
(C) Mixture is oxygenated; zymase(yeast) is added; $\approx 25°C$.
(D) Low O_2 environment; zymase(yeast) is added; mixture is refluxed.

6 The first four steps in the decay series for Uranium 238 can be represented as follows:

$$^{238}_{92}U \xrightarrow[Step1]{\alpha} \ ^{234}_{90}Th \xrightarrow[Step2]{?} \ ^{234}_{91}Pa \xrightarrow[Step3]{?} \ ^{234}_{92}U \xrightarrow[Step4]{\alpha} \ ^{230}_{90}Th$$
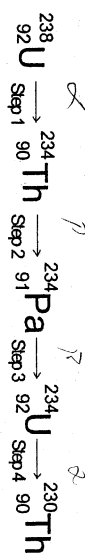
The types of radiation which accompany each of steps 1 to 4, are respectively-

(A) $\beta, \alpha, \alpha, \beta$
(B) $\alpha, \beta, \gamma, \delta$
(C) $\alpha, \beta, \beta, \alpha$
(D) $\beta, \gamma, \gamma, \beta$

7 Which of the compounds below are isomers?

(I)

```
    Cl  Cl  H
    |   |   |
Cl— C — C — C — F
    |   |   |
    H   H   F
```

(II)

```
        Cl
        |
F — C — C — Cl
    |   |
    Cl  F
```
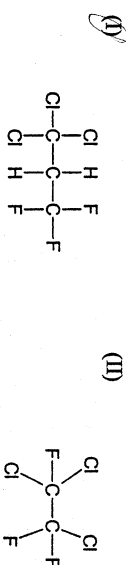
(III) 1,1,1-trichloro-2,2,2-trifluoroethane

(IV) 3,3,3-trichloro-1,1,1-trifluoropropane

(A) (I) and (IV)
(B) (II) and (III)
(C) (I) and (II)
(D) (III) and (IV)

8 A lawn food containing 56.6% ammonium sulfate (FW = 132) was analysed by precipitating the sulfate as barium sulfate (FW = 233). What is the mass of dry barium sulfate expected from 1.00g of the lawn food?

(A) 0.566g
(B) 1.00g
(C) 1.77g
(D) 2.00g

9 What is the change in pH when 10mL of 0.1M $HCl_{(aq)}$ is diluted with 990mL of deionised water?

$10 \rightarrow 1000$

$\times 100$

(A) increase by 2
(B) decrease by 2
(C) increase by 3
(D) decrease by 3

10 How is a Bronsted-Lowry acid best described?

(A) A substance which forms H^+ ions in water
(B) A substance which contains oxygen
(C) A substance which is a proton donor
(D) A substance which contains hydrogen

11 What is the name of the ester below?
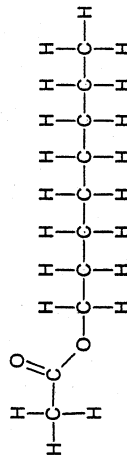
(A) ethyl octanoate
(B) octyl ethanoate
(C) methyl octanoate
(D) heptyl ethanoate

12 Which of the salts below produces a basic solution when dissolved in water?

(A) NH_4Cl
(B) KNO_3
(C) KCH_3CH_2COO
(D) $FeCl_3$

13 A galvanic cell is set up using magnesium and copper half-cells. The equation for the reaction in the cell is:

$$Mg_{(s)} + Cu^{2+}_{(aq)} \rightarrow Mg^{2+}_{(aq)} + Cu_{(s)}$$
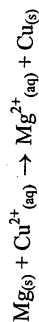
Which of the following statements applies when the galvanic cell is producing electricity?

(A) The mass of the copper electrode decreases.
(B) Electrons flow from the copper half-cell to the magnesium half-cell.
(C) Electrons are lost from magnesium atoms.
(D) Anions flow through the salt bridge from the magnesium half-cell to the copper half-cell.

14 Which of the following solutions contains the greatest number of moles of solute?

(A) 10.0mL of 0.50M $HCl_{(aq)}$ 0.5
(B) 20.0mL of 0.40M $HCl_{(aq)}$ 0.8
(C) 30.0mL of 0.30M $HCl_{(aq)}$ 0.9
(D) 40.0mL of 0.20M $HCl_{(aq)}$ 0.8

15 Which of the following statements best describes how a catalyst operates in a reversible reaction?

(A) The catalyst increases the enthalpy change of the reverse reaction.
(B) The catalyst decreases the enthalpy change of the forward reaction.
(C) The catalyst decreases the activation energy of both the forward and backward reactions.
(D) The catalyst increases the activation energy of the reverse reaction.

Part B
Total marks (69)
Attempt ALL Questions
Allow about 2 hours for this Part

Answer the questions in the spaces provided
Show **all** relevant working in questions involving calculations

Question 16 (6 marks)   **Marks**
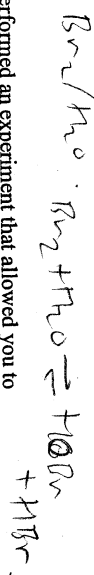
At the start of the HSC course you performed an experiment that allowed you to distinguish between alkanes and alkenes.

(a)   Identify an alkane and an alkene which you used in this experiment plus any other reagents used.   2

cyclohexane, cyclohexene - colourless,
Bromine water - orange,
decolourisation

$Br_2/H_2O \cdot Br_2 + H_2O \rightleftharpoons HOBr + HBr.$

(b)   Identify the hazards involved in this experiment.   2

toxic,
flammable,
safety
Br - toxic, respiratory   *fume cupboard.*

(c)   Write an equation for any reaction which occurred.   2

$+ Br_2 + H_2O \rightarrow$ [ring structure with OH and Br] $+ HBr.$

2-bromo-1-hydroxy cyclohexane
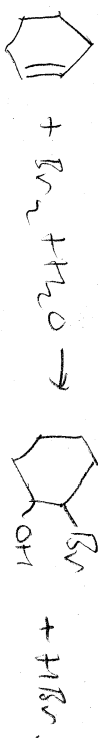
Question 17 (3 marks)   3

Distinguish between stable and radioactive isotopes and identify the conditions under which a nucleus is unstable.

Unstable isotope - spontaneously emit radiation
(radio isotope)   O.R.I. + transmutation

Stable do not
chemically...
> 83
p:n ratio unbalanced, whole zone of
stability

Question 18 (2 marks)   2

Complete the following table, which refers to a number of titrations carried out in a school laboratory using solutions in the range 0.1-0.5M.

Titrant	Other reactant	Appropriate indicator
HCl	NaOH	both
CH₃COOH	LiOH	phenolphthalein
NH₃	HNO₃	methyl orange

Marks

Question 19 (4 marks)

(a) Draw a labelled diagram of an operating galvanic cell that is made up of two half cells, each containing a metal in contact with its ions. Label the cathode, the anode, and the salt bridge.

cotton wool

3

(b) Calculate the voltage of this cell under standard conditions.

....

....

1

BLANK PAGE

Class

Candidate Number

Marks

Question 20 (3 marks)

Explain why the Haber process is based on a delicate balancing act involving reaction energy, reaction rate and equilibrium.

....

....

....

....

....

....

....

3

Question 21 (3 marks)

Compare one physical and one chemical property of the oxygen allotropes O_2 and O_3 and account for the differences on the basis of structure and bonding.

reactivity $O_3 > O_2$

$mp = melting, density$

dispersion

....

....

....

3

Class

Candidate Number

Marks

Question 22 (4 marks)

Consider the data on the greenhouse gases presented in the graph below.

The greenhouse gas and deuterium (δD) records for the past 650,000 years from ice cores. δD, the deviation of the deuterium/hydrogen ratio from an isotope standard, is a proxy for air temperature; more positive values indicate warmer conditions.
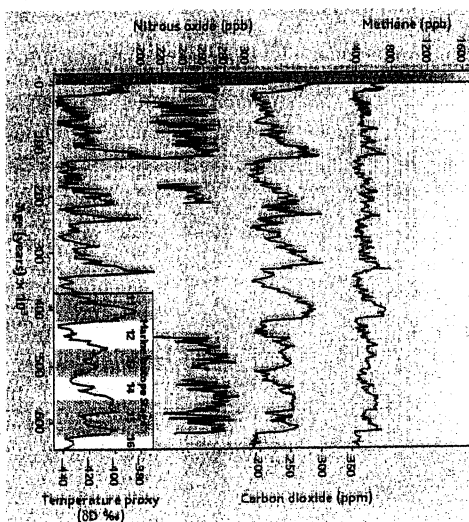
(a) Which gas was most abundant in the atmosphere 500 000 years ago?

CH_4

1

(b) Write chemical formulas for the three gases.

CH_4 CO_2 N_2O

1

(c) Assess the validity of the claim that these three gases are greenhouse gases.

high T , high T

....

....

2

Marks

Question 23 (4 marks)

Discuss the use of neutralisation in dealing with an acid spill in a laboratory.

4

$H_2SO_4 + Na_2CO_3 \rightarrow Na_2SO_4 + H_2O$

....

....

....

....

....

....
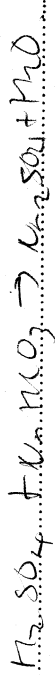
Marks

Question 24 (4 marks)

One acidic oxide found in the atmosphere is $SO_{2(g)}$.

(a) Name one natural and one industrial source of $SO_{2(g)}$.

1

....

....

(b) Write an equation to demonstrate the acidic nature of $SO_{2(g)}$.

1

$SO_2 + H_2O \rightleftharpoons H_2SO_3 \rightleftharpoons H^+ + HSO_3^-$
↑
acid
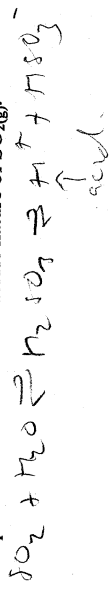
(c) At 25°C and 100kPa, what volume of $SO_{2(g)}$ would be needed to produce 500mL of 1.05M sulfurous acid?

2

....

....

....

....

Marks

Question 25 (5 marks)

In an experiment to determine the ammonia concentration in a bottle of cloudy ammonia, a student transferred a 25.00mL aliquot of cloudy ammonia to a 250.0mL volumetric flask and made it up to 250.0 mL with deionised water. The contents of this volumetric flask were thoroughly mixed. The student then titrated 25.00mL aliquots of this solution against 0.2530M HCl and obtained an average titre volume of 22.50mL. Assume the density of the ammonia solution is 0.950 g/mL.

Calculate the concentration of NH_3 in the cloudy ammonia as %w/w (grams per 100g of solution).

5

BLANK PAGE

Marks

Question 27 (8 marks)

Human activity has caused changes in the composition and structure of the atmosphere.

(a)   Identify the origins of CFCs and halons in the atmosphere.   **1**

spray cans - ref, eih con

(b)   Explain the impacts of CFCs and halons on the atmosphere.   **4**

$CCl_3F \rightarrow CCl_2F + Cl$

$Cl + O_3 \rightarrow ClO + O_2 \ldots$

Question 27 continued on next page.

Marks

Question 26 (7 marks)

Chemical monitoring of the concentrations of ions such as Mg^{2+}, Ca^{2+}, NO_3^-, PO_4^{3-} is important to manage the quality of water resources.

For one cation and one anion from the list above:

(a)   Identify a possible source and state whether the source is natural or a result of human activity.   **2**

(b)   Explain why monitoring and management of the concentrations of the two ions you have chosen is important.   **2**

(c)   Discuss the range and chemistry of tests used to monitor one of the ions you have chosen.   **3**

APS

Class	Candidate Number

Question 27 continued

Marks

(c)   Assess the measures being taken to alleviate the problems associated with CFCs.

3

Montreal protocol.

....

....

....

....

....

....

Class	Candidate Number

Question 28 (8 marks)

Marks

(a)   Draw the structural formulas of 1-hexanol and propanoic acid. Circle and name the functional groups in these molecules.

2

....

....

(b)   1-hexanol and 3,3-dimethyl-1-butanol are isomers. Explain why 1-hexanol has a higher boiling point than 3,3-dimethyl-1-butanol.

2

....

....

....
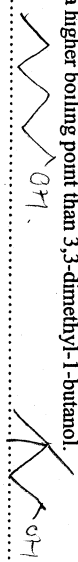
(c)   Draw a fully labelled diagram of the apparatus needed to esterify 1-hexanol and propanoic acid in a school laboratory.

2
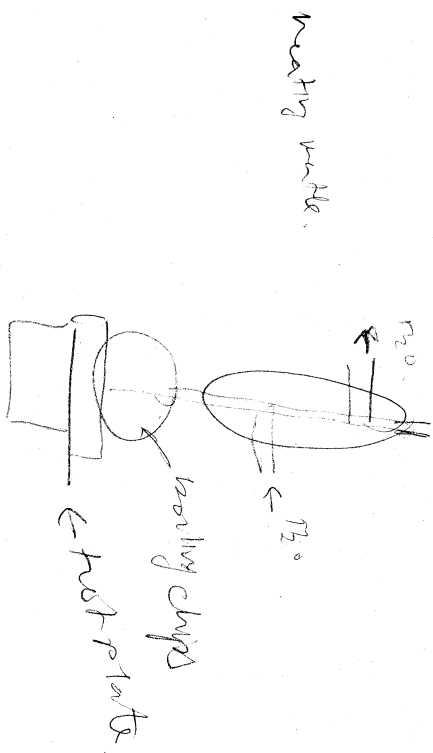
Question 26 continued on next page.

Marks

Question 29 (8 marks)

It has been said that in the 21st century wars will be fought for access to natural resources such as oil and water, and some people feel that this has already begun.

Discuss the need for alternative sources of the compounds presently obtained from petrochemicals and evaluate the effect that using these alternative sources will have on environmental concerns such as global warming.

8

....

....

....

....

....

....

....

....

....

....

....

....

....

Marks

Question 26 continued

(d)   Explain why the apparatus you drew in (c) would be more appropriate than the apparatus below.

2

beaker
gauze
tripod
bunsen

....

....

....

....

Class ☐

Candidate Number ☐

Marks

Question 30 (16 marks)

(a) Most sulfuric acid is manufactured on the industrial scale using the Contact process which involves the conversion of sulfur dioxide gas into sulfur trioxide gas.

   (i) Write a chemical equation for this reaction and an expression for the equilibrium constant, K. **1**

   (ii) How does an increase in pressure affect the value of the equilibrium constant? **1**

(b) Nitrogen dioxide is a poisonous brown gas which may be involved in the production of photochemical smog. **4**

   In an experiment 5.0 mol of dinitrogen tetraoxide were added to a 20L vessel and the system reached equilibrium. At equilibrium 3.8 mol of dinitrogen tetraoxide remained. Calculate the equilibrium constant, K, for this reaction:

$$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$$

(c)
   (i) Describe one reaction in which concentrated sulfuric acid is acting as an oxidant. Include a relevant chemical equation. **2**

   (ii) Describe one reaction in which concentrated sulfuric acid is acting as a dehydrating agent. Include a relevant chemical equation. **2**

(d) During your practical work you have performed a first-hand investigation to analyse the effect of disturbing an equilibrium reaction.

   (i) Outline the procedure you used in this investigation. **3**

   (ii) Explain how you analysed the equilibrium reaction in a qualitative way. **3**

JAG
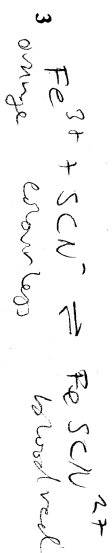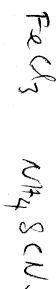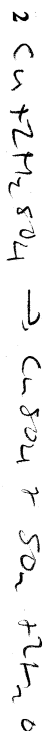
SECTION I

(75 marks)

PART A

15 multiple choice questions, worth 1 mark each.
Use the separate Answer Sheet.

1   Ethene is a very reactive molecule. The reactivity of this molecule is due to:

(A)   it being a hydrocarbon molecule.
(B)   it being a two carbon organic molecule.
(C)   the reactive C – H bonds present.
(D)   the presence of a double covalent bond in the molecule.

2   Cellulose is a biopolymer. It is formed:

(A)   by a process of addition polymerisation.
(B)   as a long branched chain of monomer units.
(C)   with the elimination of a water molecule as the pairs of monomers combine.
(D)   with water acting as a catalyst.

3

$$
\begin{array}{ccccccc}
 & & H & & H & & H \\
 & & | & & | & & | \\
H & - & C & - & C & - & C & - & H \\
 & & | & & | & & | \\
 & & H & & H & & H \\
\end{array}
$$

The IUPAC name for the alkanol is:

(A)   3 – pentanol.
(B)   2 – pentanol.
(C)   2 – pentane – ol.
(D)   4 – pentane – ol.

4   The redox reaction for the cell Mn/Mn²⁺//Ag⁺/Ag is:

(A) $Ag(s) + Mn(s) \longrightarrow Mn^{2+}(aq) + Ag^+(aq)$
(B) $2Ag^+(aq) + 2e^- \longrightarrow 2Ag(s)$
(C) $Mn(s) + 2Ag^+(aq) \longrightarrow 2Ag(s) + Mn^{2+}(aq)$
(D) $Mn^{2+}(aq) + e^- \longrightarrow Ag^+(aq)$

5   Argon –41 is a radioactive isotope. It has 18 protons and 23 nutrons in its nucleus. From the relative number of protons and neutrons in its nucleus it can be determined that argon –41 is most likely:

(A)   an alpha emitter.
(B)   a beta emitter.
(C)   a gamma emitter.
(D)   produces X–rays as it decays.

6   Which of the following does NOT apply to indicators?

(A)   Are usually vegetable dyes
(B)   Are used to determine the acidity or alkalinity of substances
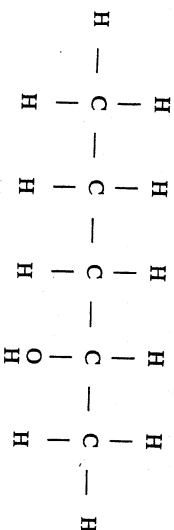(C)   Change colour over their acidity/alkalinity range
(D)   Are all acids

7   Concentrations of sulfur dioxide and oxides of nitrogen are increased in the atmosphere by a number of human activities. The main human activity that can release both these gases are:

(A)   increased use of fertilisers.
(B)   combustion of fossil fuels.
(C)   industrial extraction of metals from their ores.
(D)   the use of motor vehicles.

8   Which of the following activities would result in an increase of 2 pH units?

(A)   Diluting 10mL of 0.1 mol L⁻¹ HCl to 200 mL.
(B)   Diluting 10mL of 0.1 mol L⁻¹ NaOH to 200 mL.
(C)   Diluting 10mL of 0.1 mol L⁻¹ HCl to 1000 mL.
(D)   Diluting 10mL of 0.1 mol L⁻¹ NaOH to 1000 mL.

9   Which entry in the table below correctly identifies a Bronsted-Lowry acid-base pair?

	Acid	Base
(A)	H_2F_2	HF
(B)	H_2O	OH⁻
(C)	HCO_3^-	H_2CO_3
(D)	CH_3COOH	CH_3OH

10   Which of the following is NOT a common use of esters?

(A)   As a solvent.
(B)   As a colouring agent.
(C)   As a component in flavourings or essences.
(D)   As a component in perfumes.

11 Incomplete combustion of hydrocarbons may result in the production of undesirable substances. Two such substances are:

(A) nitrogen oxides and sulfur dioxide.
(B) water and carbon dioxide.
(C) water and carbon.
(D) carbon monoxide and carbon.

12 Why would a catalyst be used in the following reaction?

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \quad \Delta H = -92.4 \text{ kJ mol}^{-1}$$
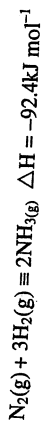
(A) To enable the reaction to produce more product.
(B) To enable the reaction to occur at a high pressure.
(C) To enable the reaction to occur at a high temperature.
(D) To enable equilibrium to be reached more quickly by lowering the reaction temperature.

13 The technique of atomic absorption spectroscopy is used to:

(A) measure dissolved oxygen levels in water.
(B) measure trace concentrations of metal ions.
(C) measure hardness of water.
(D) measure ozone concentration in the troposphere.

14 The constitutional formulae of four carbon-based compounds are given below:

$CHCl_2CH_2F$	CH_3CH_3	$CClF_2CCl_2F$	CCl_3CBrF_2
W	X	Y	Z
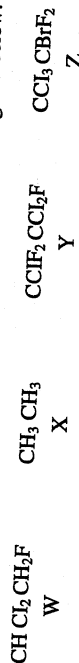
These compounds belong to the classes of halons, CFCs, HCFCs and hydrocarbons. What is the classification of the compounds in the order shown (W, X, Y and Z)?

(A) CFC, halon, hydrocarbon, HCFC.
(B) halon, hydrocarbon, CFC, HCFC.
(C) HCFC, hydrocarbon, CFC, halon.
(D) hydrocarbon, halon, CFC, HCFC.

15 Which quality of water is being tested by determining the percentage of light that is transmitted or scattered through a standard depth of the water?

(A) hardness
(B) turbidity
(C) dissolved oxygen
(D) acidity

END OF PART A

6

PART B
(60 marks)

Marks

QUESTION 16 (5 marks)

The production of ethylene from ethanol can be expressed as follows:

$$\text{ethanol} \xrightarrow{\text{catalyst X}} \text{ethene} + \text{compound Y}$$

(i)   Identify compound Y.   1

(ii)   Identify catalyst X.   1

(iii) One of the many uses of ethanol is an alternative car fuel. Discuss the advantages and disadvantages of its use.   3

QUESTION 17 (4 marks)

One cell which has been investigated as an alternative to the lead-acid cell is the rechargeable sodium-sulfur cell, where the electrodes consist of molten sodium and sulfur.

(a)   Construct an equation for the anode reaction in a sodium-sulfur cell.   1

QUESTION 17 (Continued)

Marks

(b) Identify an advantage of the sodium-sulfur cell, when compared to the lead-acid cell.　　1

(c) Assess ONE chemical safety issue to be considered with the use of a sodium-sulfur cell and recommend steps taken to observe this safety.　　2

QUESTION 18　(5 marks)

A gauge to monitor the thickness of cardboard as it is produced in a paper mill consists of a source of beta rays and a detector. The detector registers changes in the intensity of radiation passing through the cardboard.

(a) Justify the use of beta radiation for this application.　　2

(b) Identify a suitable instrument to serve as the detector for this gauge.　　1

(c) Describe advantages of this type of gauge compared with a mechanical instrument such as callipers.　　2

QUESTION 19　(4 marks)

Marks

Plant growth is affected by the audity and alkalinity of soils.

Table I shows the pH range of a number of indicators.

Table II shows soil pH values below which growth of the listed plants is restricted.

TABLE I

Indicator	Colour in solution of low pH	Colour in solution of high pH	Approximate pH range
Thymol Blue	red	yellow	1.2 – 2.8
Bromocresol green	yellow	blue	3.8 – 5.4
Methyl red	pink	yellow	4.4 – 6.2
Bromothymol blue	yellow	blue	6.0 – 7.6
Phenol red	yellow	red	6.8 – 8.4
Phenolphthalein	colourless	red	8.3 – 10.0
Alizarin yellow	yellow	lilac	10.1 –12.0

TABLE II

Crop	pH
potatoes	4.9
apples	5.0
cabbages	5.4
wheat	5.5
beans	6.0
lettuces	6.1

(a) Define the term 'acid-base indicator'.　　1

QUESTION 19 (Continued)

(b) Describe and justify a procedure that you would carry out to explain how indicators could be used to check whether the pH of the soil in a particular area is suited for growing wheat.

3

_____

_____

_____

_____

_____

_____

_____

_____

QUESTION 20 (6 marks)

(a) Use LeChatelier's Principle to relate the increase in the burning fossil fuels to possible increase in the acidity of the oceans. Include equations.

3

_____

_____

_____

_____

_____

_____

_____

_____

_____

QUESTION 21 (6 marks)

The graph below shows the pH during an acid-base titration. The base solution, with volume 25.00mL had an initial concentration of 0.100 mol L^{-1}.

Acid-base Titration Curve
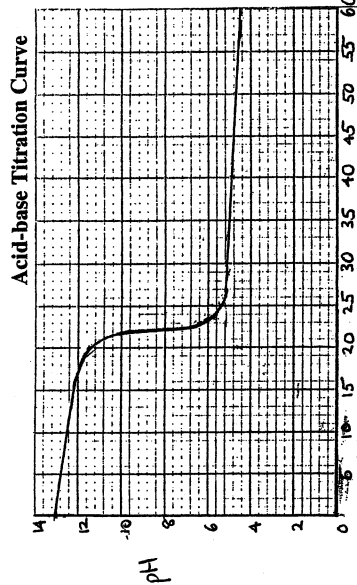
(a) Describe one method which may be used to measure the pH of the solution during titration in the laboratory. Assess the accuracy of your method.

2

_____

_____

_____

(b) Identify a possible base, and an acid for this titration curve.

1

_____

(c) Using data from the graph, determine the concentration of the acid. (Assume that both the acid and base are monoprotic.)

2

_____

_____

_____

_____

QUESTION 21 (Continued)

Marks

(d) Determine the pH of the acid used in this titration.

1

QUESTION 22   (5 marks)

The table shows the boiling point for an alkanol, an alkanoic acid and an ester of the same molecular mass.

Compound	Molecular mass	Boiling point, °C
1-pentanol	88	138
butanoic acid	88	164
methyl propanoate	88	80

(a) Explain the difference in boiling points of the compounds shown in the table.

2

(b) Identify the two compounds needed to make methyl propanoate.

1

QUESTION 22 (Continued)

Marks

(c) When making methyl propanoate a catalyst was added to the reactants and the mixture was then refluxed. Name the catalyst used and outline why the mixture was refluxed.

2

QUESTION 23   (5 marks)

(a) Outline the role of a chemist employed in a specific industry or enterprise. Identify the branch of chemistry and ONE chemical principle used by this chemist.

3

QUESTION 23 (Continued)

Marks

(b) Discuss the need for collaboration between chemists as they collect and analyse data.

2

_____

_____

_____

_____

QUESTION 24 (5 marks)

(a) In terms of water quality, what do the letters BOD stand for?

1

_____

_____

(b) Why is it important to monitor BOD?

1

_____

_____

:) Describe briefly how BOD is monitored?

2

_____

_____

_____

A 100mL sample of water from a dam was analysed by volumetric analysis. The average of three titrations was 3.90mL using 0.025 moles per litre sodium thiosulfate. Calculate the dissolved oxygen concentration in parts per million.

1

_____

_____

_____

QUESTION 25 (4 marks)

Cobalt is a trace element essential in the metabolism of many animals including sheep.

Soils must contain cobalt at concentrations of more than 0.05 ppm if the sheep grazing on that land are to remain healthy.

A chemist was assigned the task of analysing a farmer's soil to see if it was suitable for raising sheep. The chemist used Atomic Absorption Spectroscopy (AAS) as a means of measuring the concentration of cobalt in the soil.

Justify the procedure he should follow in order to prepare the soil and the equipment for analysis using AAS.

4

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

QUESTION 26   (6 marks)

Marks

The percentages of ammonia in the equilibrium mixtures, formed during the synthesis of this compound from its constituent elements, are shown below for various conditions for the reaction:

$$N_2(g) + 3H_2(g) \equiv 2NH_3(g)$$
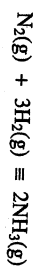
Temperature (°C)	Amount of ammonia (in percent) Pressure in Atmospheres			
	200	400	1000	
200	90	97	99	
400	39	69	80	
600	8	24	32	
700	4	12	16	

(a)   Plot a graph with the given data.

2
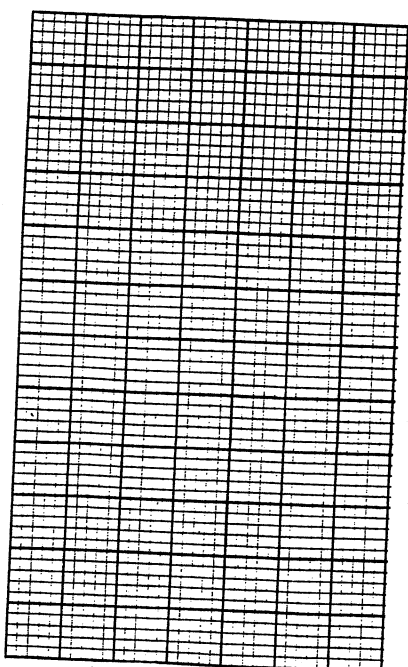
(b)   Describe AND explain the effects of pressure on the percentage yield of ammonia at equilibrium.

2

QUESTION 26 (Continued)

Marks

(c)   Explain why ammonia is produced at temperatures of $400^0C - 500^0C$.

2

QUESTION 27   (5 marks)

The graph below plots the ozone levels in the stratosphere measured at a station in Antarctica from 1957 to 1997.
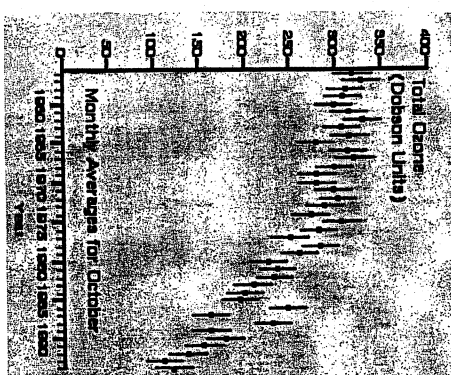
(a)   Construct an electron dot (Lewis diagram) structure for ozone.

1

Marks

QUESTION 20 (Continued)

(b) Define the term "buffer" in relation to acid-base systems and describe ONE
     example of buffer action in a natural system. Include equations.   **3**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Marks

QUESTION 27 (Continued)

(b) Analyse the graph above and describe the changes observed.   **1**

_____

_____

(c) Discuss, using relevant chemical equations, the effect of chlorofluorocarbons
     (CFC's) on ozone levels in the upper atmosphere.   **3**

_____

_____

_____

_____

_____

_____

_____

END OF PART B

Question 25 (6 marks)

As the demand for drinking water increases, it has become necessary to monitor levels of contaminants and to develop new technologies for treating impure water sources.

(a) To measure the concentration of chloride ions in a sample of water, 20.0 mL of this water was titrated with 0.0050 mol L^{-1} silver nitrate using a suitable indicator such as potassium chromate. The volume of the titre was 8.0 mL.

(i) Write an ionic equation for the precipitation reaction.   1

....

....

(ii) Calculate the concentration of the chloride ions in ppm (mg L^{-1}).   2

....

....

....

....

(b) Describe the design and composition of microscopic membrane filters and explain how they purify contaminated water.   3

....

....

....

....

....

Question 26 (5 marks)

(a) Describe, using equations, how the compound 1,1-dichloro-1,1-difluoro methane contributes to ozone depletion.   3

....

....

....

....

....

(b) During your study of ozone depletion you gathered secondary information to evaluate the effectiveness of alternative chemicals to replace CFC's.
Describe how you processed and analysed the gathered information.
State how you assessed the reliability of the data obtained.   2

....

....

....

....

(c) Propanoic acid is monoprotic. Determine the concentration of the acid from the titration results. **2**

....

....

....

(d) Is propanoic acid a strong or weak acid? Justify your response using two different pieces of evidence from the data and responses above. **2**

....

....

....

Question 22 (5 marks)

(a) Write an equation for the esterification reaction used to prepare propyl butanoate. **2**

....

(b) Describe the effect of using concentrated sulfuric acid on the yield and rate in this process. **2**

....

....

....

(c) Identify one use of esters in processed food. **1**

....

....

Question 23 (5 marks)

Explain why monitoring of the reaction vessel used in the Haber process is crucial, and describe the monitoring required.

....

....

....

....

....

....

Question 24 (4 marks)

Some students measured the sulfate content of lawn fertiliser. The value they obtained was 68.4 % and the value quoted on the packet was 72.7 %.

Explain the chemistry involved in this analysis and one possible cause for the inaccurate result.

....

....

....

....

....

Question 20 (7 marks)

An environmental officer measured the pH of a lake near a zinc mine and smelter. The zinc sulfide mined was roasted in air to produce crude zinc. The pH of the lake was 5.5.

(a) Write an equation for the release of sulfur dioxide into the environment.

1

....

(b) What volume of gas (at SLC) would be released per tonne (1000kg) of zinc sulfide refined?

2

....

....

....

(c) Evaluate reasons for concern about the release of this gas into the environment.

4

....

....

....

....

....

....

Question 21 (8 marks)

A data logger with a pH probe attached was used in the titration of 30mL of dilute propanoic acid with 0.010 mol L^{-1} sodium hydroxide to determine its concentration. The following results were obtained.

Volume of NaOH added (mL)	pH	Volume of NaOH added (mL)	pH
0	5.0	14	7.7
2	5.5	15	9.0
4	5.9	16	10.3
6	6.1	18	10.6
8	6.3	20	10.9
10	6.4	22	11.0
12	6.7	24	11.1
13	7.0	26	11.2

(a) Draw a graph of pH versus volume of NaOH added on the grid supplied.

3
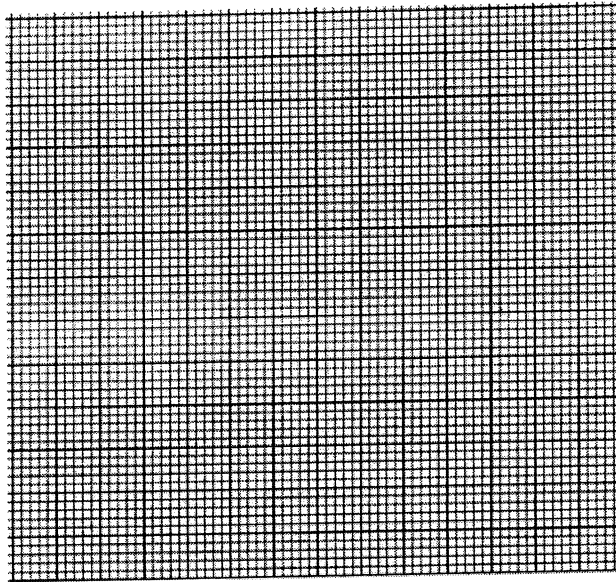
(b) Use the graph to determine the volume of NaOH used to reach the equivalence point

1

....

Question 17 (3 marks)

Using specific examples, compare addition and condensation polymerisation reactions.

3

....

....

....

....

....

Question 18 (5 marks)

Discuss one recent development in polymer science that alleviates the uncertainty about future sources of raw materials for current polymers.

Refer to one specific polymer and include details of how it can be made.

5

....

....

....

....

....

....

....

Question 19 (8 marks)

A galvanic cell operating under standard conditions and using nickel as the cathode, produced an emf of 1.44 volts.

(a) Identify the element reacting as the anode and justify your choice.

2

....

....

....

(b) Draw a labelled diagram of this galvanic cell.

3

(c) Explain what is meant by standard conditions.

2

....

....

(d) Identify the oxidising agent in this cell.

1

....

Chemistry

Section I (continued)

Part B – 60 marks
Attempt Questions 16 – 26
Allow about 1 hour and 45 minutes for this part.

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Marks

Question 16 (4 marks)

Explain why the chemical properties of alkanes and alkenes are very different. Outline an experiment you performed to demonstrate this difference.

4

....

....

....

....

....

....

....

....

---

14 Which of the following procedures would be most useful to identify some unknown anions in a sample of water?

(A) Flame tests
(B) AAS
(C) IR spectroscopy
(D) Precipitation reactions

15 A simple way of detecting ozone in polluted air is to bubble the air through potassium iodide solution.

$$O_3(g) + 2H^+(aq) + 2I^-(aq) \rightarrow I_2(aq) + H_2O(l) + O_2(g)$$

What mass of iodine (in g) would be produced from 0.02g of ozone?

(A) 0.79
(B) 1.06
(C) 1.59
(D) 3.17

7 A student tested household cleaning substances with litmus and recorded the following results:

Cleaning solution	Blue litmus	Red litmus
X	blue	red
Y	blue	blue
Z	red	red

Which of the solutions is most likely to contain ammonia?

(A) X and Y
(B) X and Z
(C) Y only
(D) Z only

8 Which of the following equations shows water behaving as an amphiprotic species?

(A) $H_2O(l) + H^+(aq) \quad \square \quad H_3O^+(aq)$
(B) $H_2O(l) + OH^-(aq) \quad \square \quad H_3O^+(aq) + O^{2-}(aq)$
(C) $2H_2O(l) \quad \square \quad 2H^+(aq) + 2OH^-(aq)$
(D) $2H_2O(l) \quad \square \quad H_3O^+(aq) + OH^-(aq)$

9 Select the most accurate value for the pH of a 0.04 M solution of H_2SO_4.

(A) 1.1
(B) 1.4
(C) 2.5
(D) 3.2

10 Polluting nitrogen oxides are produced by petrol fuelled cars in the endothermic reaction

$N_2(g) + O_2(g) \quad \square \quad 2NO(g)$

Select, from the alternatives provided, the most effective method to minimise this pollution.

(A) Increase the pressure of the system.
(B) Decrease the pressure of the system.
(C) Increase the amount of available oxygen.
(D) Decrease the temperature of the system.

11 In a particular titration, acid is measured by the pipette and alkali by the burette. Which of the following should be used to rinse the conical flask used in this titration?

(A) The acid solution
(B) The alkali solution
(C) The standard solution
(D) Distilled water

12 Select the substance which contains a coordinate covalent bond.

(A) :C::O:

(B) :N::N:

(C) :O::O:

(D) H:C:::N:

13 The following measurements have been made at different stages in a river as it flows from the mountains, through farms, cleared land and a city, and then to the ocean.

| Sample	L	M	N	O
pH	6.5	6.6	9.2	7.6
DO (ppm)	5.7	8.7	6.0	2.2
TDS (ppm)	400	50	200	250
Turbidity (NTU)	90	4	30	65

Which of the measurements is most likely to be the clean mountain stream?

(A) L
(B) M
(C) N
(D) O

1 Which of the following substances can be cracked as the industrial source of ethylene?

(A) Cellulose
(B) Alkanols
(C) Carbohydrates
(D) Alkanes

**2** Select the correct structure of the monomer used to prepare poly(vinyl chloride).

(A)

(B)

(C)

(D)
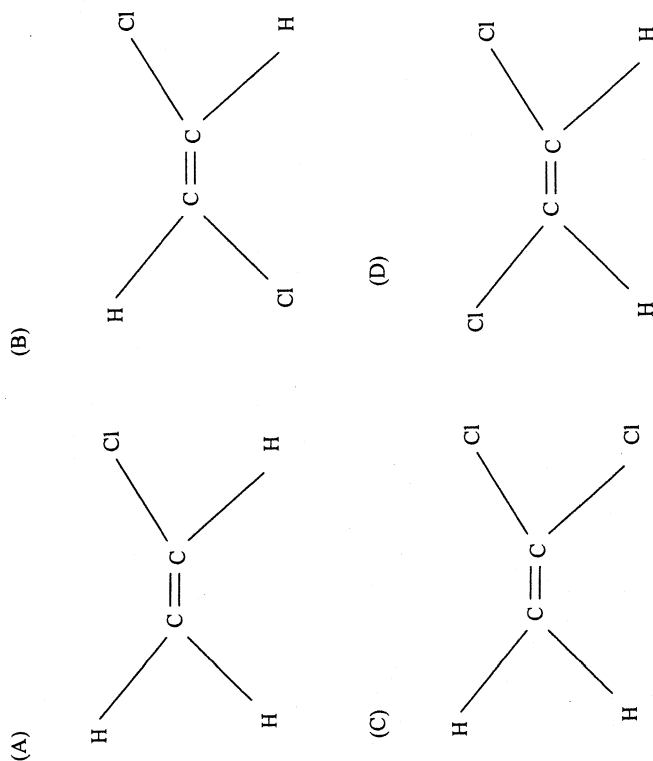
3 Select the correct value for the oxidation number of sulfur in $S_2O_3^{2-}$

(A) -2
(B) $+2$
(C) $+4$
(D) $+6$

4 Which of the following would be the most appropriate risk management strategy for the testing of bond saturation in hydrocarbons.

(A) Ensure you do not touch the equipment in the experiment.
(B) Pour wastes carefully down the sink so that they do not splash.
(C) Use chemicals in a fume cupboard if practicable.
(D) Heat all substances on an electric stove and not with a naked flame.

5 Select the correct alternative statement about the dry cell battery shown below.
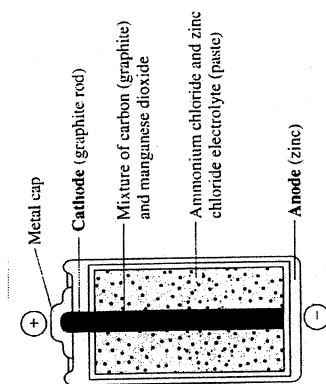
(A) Oxidation of Mn^{4+} occurs on the surface of the graphite rod.
(B) Graphite acts as a catalyst for the oxidation of the Mn^{4+}.
(C) Oxidation of the zinc chloride occurs on the surface of the zinc anode.
(D) Oxidation of the zinc casing occurs at the anode.

6 Which of the following statements about the aqueous solutions of the oxides of Group 1 elements is valid?

(A) They are acidic.
(B) They are basic.
(C) Their pH is less than 7.
(D) Their pH is equal to 7.

3

4

Sydney Girls High School

2006

HSC TRIAL EXAMINATION

Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen
- Board-approved calculators may be used
- A data sheet and Periodic Table are provided at the back of this paper.
- Draw diagrams using pencil

Total marks – 100

Section I Pages 3–16

75 marks

This section has two parts, Part A and Part B

Part A – 15 marks
- Attempt questions 1–15
- Allow about 30 minutes for this part

Part B – 60 marks
- Attempt questions 16–26
- Allow about 1 hour and 45 minutes for this part

Section II Page 17

25 marks
- Attempt question 27
- Allow about 45 minutes for this section

Section I

75 marks

Part A – 15 marks
Attempt questions 1 – 15
Allow about 30 minutes for this part

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample   2 + 4 =   (A) 2   (B) 6   (C) 8   (D) 9

A ◯   B ●   C ◯   D ◯

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ●   B ✖   C ◯   D ◯

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

correct

A ✖   B ●   C ◯   D ◯

Student Number