Curriculum Council

Tertiary Entrance Examination, 2003

Question/Answer Booklet

CHEMISTRY

Please place your student identification label in this box

Student Number: In figures | | | | | | | | |

In words _____

_____

Time allowed for this paper

Reading time before commencing work: Ten minutes
Working time for paper: Three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Separate Multiple Choice Answer Sheet
Chemistry Data Sheet (inside front cover of this Question/Answer Booklet)
Question Sheet for Part 4 (inside front cover of this Question/Answer Booklet)

To be provided by the candidate

Standard items: Pens, pencils, eraser or correction fluid, ruler
Special items: A 2B, B or HB pencil for the separate Multiple Choice Answer Sheet and calculators satisfying the conditions set by the Curriculum Council for this subject.

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Part		Number of questions available	Number of questions to be attempted	Suggested working time	Marks available
1	Multiple choice	30	All	55	60 (30%)
2	Short answers	12	All	60	70 (35%)
3	Calculations	5	All	45	50 (25%)
4	Extended answers	2	1	20	20 (10%)
				Total marks	200 (100%)

Instructions to candidates

1. The rules for the conduct of Tertiary Entrance Examinations are detailed in the booklet *TEE Handbook*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions:

   Part 1 Answer **all** questions, using a 2B, B or HB pencil, on the separate Multiple Choice Answer Sheet. Do **not** use a ball point or ink pen.

   If you consider that two or more of the alternative responses are correct, choose the one you think is best. If you think you know an answer, mark it even if you are not certain you are correct. Marks will not be deducted for incorrect answers.

   Feel free to write or do working on the question paper; many students who score high marks in the Multiple Choice Section do this.

   Parts 2, 3 and 4 Write your answers in the spaces provided in this Question/Answer Booklet. A blue or black ball point or ink pen should be used.

   Questions containing specific instructions to show working should be answered with a complete, logical, clear sequence of reasoning showing how the final answer was arrived at; correct answers for such questions which do not show working will not be awarded full marks.

   The questions for Part 4 have been repeated on a removable sheet so that you can refer more easily to the questions while answering.

3. The examiners recommend that you spend your reading time mainly reading the instructions to candidates and Parts 2, 3 and 4.

4. **Chemical equations**
   For full marks, chemical equations should refer only to those species consumed in the reaction and the new species produced. These species may be **ions** [for example $Ag^+(aq)$], **molecules** [for example $NH_3(g)$, $NH_3(aq)$, $CH_3COOH(l)$, $CH_3COOH(aq)$] or **solids** [for example $BaSO_4(s)$, $Cu(s)$, $Na_2CO_3(s)$].

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PART 1 (60 marks)

Answer ALL questions in Part 1 on the separate Multiple Choice Answer Sheet provided, using a 2B, B or HB pencil. Each question in this part is worth 2 marks.

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1. Which one of the following compounds will have geometric (*cis/trans*) isomers?

   (a) 1,1-dichloroethane

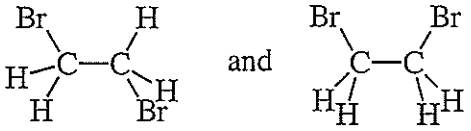
   (b) 1,2-dichloroethane

   (c) 1,1-dichloroethene

   (d) 1,2-dichloroethene

2. Which of the following pairs of compounds are isomers?

   I $HCOOCH_3$ and CH_3COOH

   II 

   III $CH_3CH_2CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_3$ and $CH_3CH\underset{\displaystyle CH_3}{\underset{|}{C}}H_2CH_2CH_3$

   (a) (I) only

   (b) (II) only

   (c) (III) only

   (d) all of the above

3. How many alkenes have the molecular formula C_4H_8?

   (a) 3

   (b) 4

   (c) 5

   (d) 6

4. Element A has the valence electron configuration of s^2 and element B has the valence electron configuration of s^2p^5. What will be the most likely formula of the compound formed between the two elements?

   (a) AB

   (b) AB_2

   (c) A_2B

   (d) AB_3

5. Which statement best describes a covalent bond?

   (a) The atoms have a noble gas electron configuration.

   (b) The atoms have formed an infinite network.

   (c) There is greater attraction of electrons to the more electronegative atom.

   (d) There is simultaneous attraction of both nuclei to a shared electron pair.

6. Which one of the following compounds contains only covalent bonds between its atoms?

   (a) CO_2

   (b) KNO_3

   (c) NaCl

   (d) NH_4Cl

7. How many orbitals can be found in the d subshell of the 3rd principal energy level?

   (a) 3

   (b) 5

   (c) 8

   (d) 10

8. Which of the following substances contains dispersion forces?

I CO_2

II CH_3CH_2OH

III SiO_2

(a) I only

(b) I and II only

(c) I, II and III

(d) None of the above.

9. Consider the following set of successive ionisation energies (MJ mol^{-1}).

0.74 1.45 7.73 10.54 13.63

Which of the following elements is most likely to have such a set of ionisation energies?

(a) C

(b) K

(c) Mg

(d) O

10. Which of the following has the highest first ionisation energy?

(a) F

(b) Mg

(c) S

(d) Si

11. Which one of the following determines which element an atom will be?

(a) Its electric charge

(b) Its electron configuration

(c) Its number of neutrons

(d) Its number of protons

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12. Which set of the following 0.1 mol L^{-1} solutions when mixed will produce only a white precipitate?

(a)	Zinc nitrate	Copper sulfate	Barium chloride	Sodium carbonate
(b)	Barium chloride	Sodium nitrate	Potassium chloride	Aluminium sulfate
(c)	Zinc nitrate	Potassium chloride	Sodium nitrate	Aluminium nitrate
(d)	Barium nitrate	Sodium hydroxide	Potassium chloride	Copper nitrate

13. Which one of the following statements about the transition state in a chemical reaction is **false**?

(a) The transition state corresponds to a point where bond breaking and bond forming is occurring.

(b) The transition state is the highest energy state in the reaction.

(c) The transition state is unstable and will only exist for a short period of time.

(d) The transition state will be the same for a reaction whether a catalyst is used or not.

14. For an exothermic reaction, which one of the following statements is true?

(a) The potential energy of the products is greater than that of the reactants.

(b) The reverse reaction has a higher activation energy than the forward reaction.

(c) The reverse reaction is also exothermic.

(d) The transition state for the reverse reaction has higher potential energy than that for the forward reaction.

15. Which one of the following arranges the substances in order of strongest to weakest reducing agent?

(a) $C\ell_2 > A\ell^{3+} > Na^+$

(b) $C\ell_2 > Si > Mg$

(c) $Mg > A\ell > C\ell^-$

(d) $Na^+ > A\ell^{3+} > C\ell^-$

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Questions 16, 17 and 18 are about the following reaction:

$$4NH_3(g) + 3O_2(g) \rightleftharpoons 2N_2(g) + 6H_2O(g) \qquad \Delta H = -1267 \text{ kJ}$$

Three changes can be made to the reaction:

I adding a catalyst

II heating the mixture

III increasing the pressure

16. Which of the changes will increase the yield of the forward reaction?

(a) I only

(b) II only

(c) III only

(d) none of the above

17. Which of the changes will increase the rate of the forward reaction?

(a) I only

(b) I and II only

(c) I and III only

(d) I, II and III

18. Which one of the options represents the equilibrium constant for the reaction?

(a) $K = \dfrac{[N_2]^2\,[H_2O]^6}{[NH_3]^4\,[O_2]^3}$

(b) $K = \dfrac{[NH_3]^4\,[O_2]^3}{[N_2]^2\,[H_2O]^6}$

(c) $K = \dfrac{[NH_3]^4 + [O_2]^3}{[N_2]^2 + [H_2O]^6}$

(d) $K = \dfrac{[N_2]^2}{[NH_3]^4\,[O_2]^3}$

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19. A saturated solution of $PbC\ell_2$ is in contact with excess undissolved solid.

$$PbC\ell_2(s) \rightleftharpoons Pb^{2+}(aq) + 2C\ell^-(aq)$$

A small quantity of $KC\ell(s)$ is stirred into the solution. What would happen to the mixture?

I The concentration of $C\ell^-(aq)$ increases.

II The concentration of $Pb^{2+}(aq)$ decreases.

III The mass of $PbC\ell_2(s)$ increases.

IV The $KC\ell(s)$ will not dissolve in this solution.

(a) I only

(b) IV only

(c) I and II only

(d) I, II and III only.

20. Using the standard reduction potential tables predict which one of the following reactions will possibly occur spontaneously.

(a) $3H_2O_2 + 2NO \rightarrow 2NO_3^- + 2H_2O + 2H^+$

(b) $2Fe^{2+} + O_2 + 2H^+ \rightarrow 2Fe^{3+} + H_2O_2$

(c) $Mg^{2+} + Zn \rightarrow Mg + Zn^{2+}$

(d) $Mn^{2+} + 2H_2O + Br_2 \rightarrow MnO_2 + 4H^+ + 2Br^-$

21. Which one of the following equations does **not** represent an oxidation-reduction reaction?

(a) $2MnO_4^- + 2H_2O + 3C_2O_4^{2-} \rightarrow 2MnO_2 + 6CO_3^{2-} + 4H^+$

(b) $Cr_2O_7^{2-} + H_2O \rightarrow 2CrO_4^{2-} + 2H^+$

(c) $2Br_2 + N_2H_5^+ \rightarrow N_2 + 5H^+ + 4Br^-$

(d) $6I^- + 14H^+ + Cr_2O_7^{2-} \rightarrow 3I_2 + 7H_2O + 2Cr^{3+}$

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22. In which one of the following is the oxidation number of nitrogen lower than in any of the other substances listed?

(a) $Cu(NO_3)_2$

(b) N_2

(c) N_2H_4

(d) NO_2

23. An electrochemical cell based on the following reaction has an $E^o = 1.03$ V.

$$C\ell_2 + 2V^{3+} + 2H_2O \rightarrow 2VO^{2+} + 4H^+ + 2C\ell^-$$

What is the standard reduction potential for the reduction of VO^{2+} to V^{3+} ?

(a) -3.05 V

(b) -0.33 V

(c) +0.33 V

(d) +3.05 V

24. Which one of the following equations best represents the reaction occurring in a dry cell?

(a) $2MnO_2 + 2NH_4C\ell + Zn \rightarrow ZnC\ell_2 + 2NH_3 + H_2O + Mn_2O_3$

(b) $Zn + Ag_2O \rightarrow ZnO + 2Ag$

(c) $2PbSO_4 + 2H_2O \rightarrow PbO_2 + Pb + H_2SO_4$

(d) $2H_2 + O_2 \rightarrow 2H_2O$

25. An element 'X' forms a chloride $XC\ell_3$. Which can **not** be X?

(a) Al

(b) Fe

(c) N

(d) Sr

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26. In the production of aluminium, alumina is electrolysed in a cryolite solution. Why is the recovery of aluminium based on electrolysis?

(a) Aluminium is amphoteric, so alumina dissolves in sodium hydroxide solution.

(b) Aluminium is a reactive metal, so alumina is not easily reduced.

(c) Cryolite lowers the melting temperature of the alumina.

(d) Electrical power is expensive.

27. Consider the following three statements (I – III) about neutralisation reactions.

I A neutralisation reaction is a reaction between an acid and a base.

II At the equivalence point of a neutralisation reaction the pH of the resulting solution will be 7.

III Salts are obtained from neutralisation reactions.

Which statement or combination of statements is always correct?

(a) Only I

(b) Only I and II

(c) Only I and III

(d) I, II and III

28. What is the pH of 0.0050 mol L^{-1} solution of $Ba(OH)_2$?

(a) 2.00

(b) 2.30

(c) 11.70

(d) 12.00

29. Which one of the following equations does **not** represent the donation and acceptance of protons?

(a) $Zn + 2H^+ \rightleftharpoons Zn^{2+} + H_2$

(b) $NH_3 + OH^- \rightleftharpoons NH_2^- + H_2O$

(c) $HOC\ell + C_6H_5COO^- \rightleftharpoons OC\ell^- + C_6H_5COOH$

(d) $C_6H_5COOH + HCO_3^- \rightleftharpoons C_6H_5COO^- + H_2CO_3$

30. For the following equation

$$H_2SO_3 + H_2O_2 \rightarrow H_2SO_4 + H_2O$$

which one of the following statements is true?

(a) Hydrogen peroxide is acting as an acid.

(b) Hydrogen peroxide is acting as an acid and a base.

(c) Hydrogen peroxide is acting as an oxidising agent only.

(d) Hydrogen peroxide is acting as an oxidising and reducing agent.

END OF PART 1

PART 2 (70 marks)

Answer ALL questions in Part 2 in the spaces provided below.

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1. Write equations for any reactions that occur in the following procedures. If no reaction occurs write 'no reaction'.

   In each case describe in full what you would observe, including any
   - colours
   - odours
   - precipitates (give the colour)
   - gases evolved (give the colour or describe as colourless).

   If no change is observed, you must state this as the observation.

(a) Dilute hydrochloric acid solution is added to magnesium metal.

Equation _____

Observation _____

_____

[3 marks]

(b) Dilute phosphoric acid is added to a barium chloride solution.

Equation _____

Observation _____

_____

[3 marks]

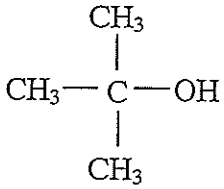
(c) Excess concentrated ammonia solution is added to a silver nitrate solution.

Equation _____

Observation _____

_____

[3 marks]

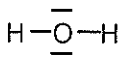
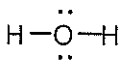
(d)  is added to a dilute acidified solution of potassium dichromate.

Equation _____

Observation _____

_____

[3 marks]

2. For each species listed in the table below draw the structural formula, representing all valence shell electron pairs either as : or as —
[for example, water  or  or  and so on]

Species	Structural formula (showing all valence shell electrons)
Ammonium chloride, $NH_4C\ell$	
Carbonate ion, CO_3^{2-}	
Ethanal, (acetaldehyde), CH_3CHO	

[6 marks]

3. Write the electron configuration (using s, p, d notation) for the following species:

(a) S^{2-} _____

(b) K _____

[2 marks]

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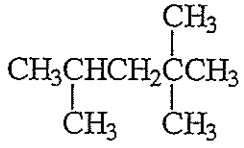
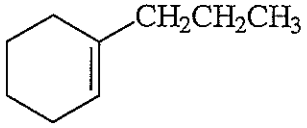
4. Identify by name or formula an example of each of the following.

Description	Name or Formula
A green ionic solid	
An amphoteric oxide	
A cycloalkene	
A transition metal complex ion	
A suitable indicator for a titration between acetic acid (ethanoic acid) and sodium hydroxide	
An electrical conductor	
A covalent network	
A reactant used in the blast furnace	

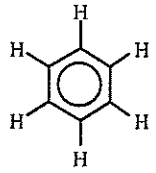
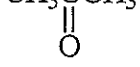
[8 marks]

5. Write IUPAC names for the following compounds.

Compound	Name
$C\ell_3CCH_3$	
$CH_3COOCH_2CH_3$	
	
	

[8 marks]

6. Indicate in which of the following organic liquids hydrogen bonding exists by writing either YES or NO in the appropriate box.

Compound	**Is H-bonding present? (YES or NO)**
CH_3NH_2	
	
$CH_3CH_2CH_2F$	
CH_3COOH	
	

[5 marks]

7. Consider the electrolysis of molten salt, NaCℓ(ℓ), and of salt water, 1 mol L^{-1} NaCℓ(aq), with inert electrodes. Write the equations for the anode and cathode reactions for each case:

NaCℓ(ℓ)

anode:

cathode:

NaCℓ(aq)

anode:

cathode:

[4 marks]

8. The pH of a 0.0010 mol L^{-1} solution of HCℓ is 3. The pH of a 1.0 mol L^{-1} solution of CH_3COOH is also about 3. Explain these observations using equations where appropriate.

[4 marks]

9. 3 mol L^{-1} HCℓ is added dropwise to a colourless solution. After the addition of a number of drops, a white solid is formed. After addition of further HCℓ, the solid dissolves.

Write a possible formula for the reacting solute in the original colourless solution, and for the white solid.

solute:

solid:

[2 marks]

Write equations to represent the two reactions observed.

[4 marks]

10. Write an equation for the dissolution of gold in the CIP process.

What conditions would be expected to optimise the yield of this reaction? Are these used in practice? If not, explain why not.

[4 marks]

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11. Briefly explain why gold is used for connecting plugs on computer cables and other electronic devices.

[2 marks]

12. You have four sample bottles known to contain individually solid samples of sugar ($C_{12}H_{22}O_{11}$), sodium chloride, alumina (Al_2O_3) and sodium phosphate.
Describe a sequence of chemical tests to identify each of the substances, distinguishing it from the others, stating which substance is identified at each stage, and explaining why (an equation may be used for this). Solubility tests are acceptable, tasting is not. The first test is given for you.

Test	Substance identified	Explanation / Equation
solubility in water		

[9 marks]

END OF PART 2

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PART 3 (50 marks)

Answer ALL questions in Part 3. The calculations are to be set out in detail in this Question/Answer Booklet. Marks will be allocated for correct equations and clear setting out, even if you cannot complete the problem. When questions are divided into sections, clearly distinguish each section using (a), (b), and so on. Express your final numerical answers to three (3) significant figures where appropriate, and provide units where applicable. Information which may be necessary for solving the problems is located on the separate Chemistry Data Sheet. Show clear reasoning: if you don't, you will lose marks.

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1. Pure metallic nickel can be obtained from crude nickel by reaction with carbon monoxide. This reaction occurs at 50°C and produces nickel carbonyl, $Ni(CO)_4$, which is a gas.

   (a) Write an equation for the reaction between nickel and carbon monoxide to produce nickel carbonyl.

   [2 marks]

   (b) What mass of crude nickel will react with 2.76×10^3 L of CO at 103.6 kPa and 50°C if the purity of the nickel is 80.0%?

   [6 marks]

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2. Citric acid, a carboxylic acid responsible for the sour taste of lemon juice, contains only carbon, hydrogen and oxygen.

1.383 g of anhydrous citric acid is burned in dry oxygen to give 1.900 g of CO_2 and 0.518 g of H_2O.

(a) Calculate the empirical formula of citric acid.

[7 marks]

(b) The molecular weight of citric acid is 192.1. What is its molecular formula?

[1 mark]

(c) Given that one mole of citric acid reacts with three moles of potassium hydroxide, suggest a structural formula for citric acid.

[2 marks]

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3. 1.074 g of copper metal was added to 10.0 mL of a 6.00 mol L^{-1} solution of nitric acid. The reaction that occurred can be represented by the following equation:

$$8HNO_3 + 3Cu \rightarrow 2NO + 3Cu(NO_3)_2 + 4H_2O$$

(a) What volume of nitrogen monoxide will be produced at 120.0 kPa and 35°C?

[6 marks]

(b) Calculate the number of moles of the excess reactant.

[3 marks]

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4. Nickel is recovered from Western Australian ores in a number of steps including leaching where the nickel is dissolved out of its ore.

The nature of the nickel ion solution obtained by leaching was investigated by connecting two laboratory electrolytic cells in series for a period of 3.05 hours. In the first cell, containing a solution of copper sulfate ($CuSO_4$), 110.0 g of copper was deposited on the cathode. In the second cell, containing a solution of nickel ions, 102.0 g of nickel was deposited on the cathode.

(a) Write an equation for the cathode reaction in the copper cell.

[1 mark]

(b) Calculate the average current which flowed through the cells.

[4 marks]

At the end of the processing operation, nickel metal is obtained by "electrowinning", that is reducing a solution of nickel ions in an electrolytic cell.

(c) Using the data provided, determine the valency of the nickel ion in the electrowinning solution.

[2 marks]

(d) How long would an electrowinning cell take to produce 1.000 tonne (1000 kg) of nickel at a current of 10 000 amps?

[3 marks]

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5. In a test to determine the level of alcohol in the blood of a motorist, 5.00 mL of blood was added to 100.0 mL of 0.005961 mol L^{-1} acidified potassium dichromate solution. The mixture was heated to 70°C for four hours so that all of the ethanol in the blood sample was oxidized to acetic (ethanoic) acid. This reaction can be represented by the following equation:

$$3CH_3CH_2OH + 2Cr_2O_7^{2-} + 16H^+ \rightarrow 3CH_3COOH + 4Cr^{3+} + 11H_2O$$

The volume of the mixture was made up to 150.0 mL by the addition of distilled water.

A titration was then done to find the amount of potassium dichromate left after the reaction. 30.00 mL aliquots of the reaction mixture were titrated against a 0.04104 mol L^{-1} solution of iron(II) sulfate.

(a) Write an equation for the reaction between potassium dichromate solution and the iron(II) sulfate solution.

[2 marks]

(b) The following titration results were obtained. Complete the table.

	1	2	3	4
Final volume (mL)	17.56	33.50	18.53	34.43
Initial volume (mL)	0.50	17.56	2.55	18.53
Titre				

[1 mark]

(c) Calculate the concentration of ethanol in the blood in
(i) mol L^{-1}
(ii) g L^{-1}

[8 marks]

(d) The legal limit for ethanol in the blood is 50 mg per 100 mL of blood. Was this blood sample under or over the limit? (You must show reasoning).

[2 marks]

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PART 4 (20 marks)

Answer ONE of the following two extended answer questions. Each question is worth 20 marks. Marks are awarded for the relevant chemical content of your answer, and also for coherence and clarity of expression. Where applicable use equations, diagrams and illustrative examples of the chemistry you are describing.

Your answer should be presented in about 1½ - 2 pages. Begin your essay on the lined page following the end of the questions.

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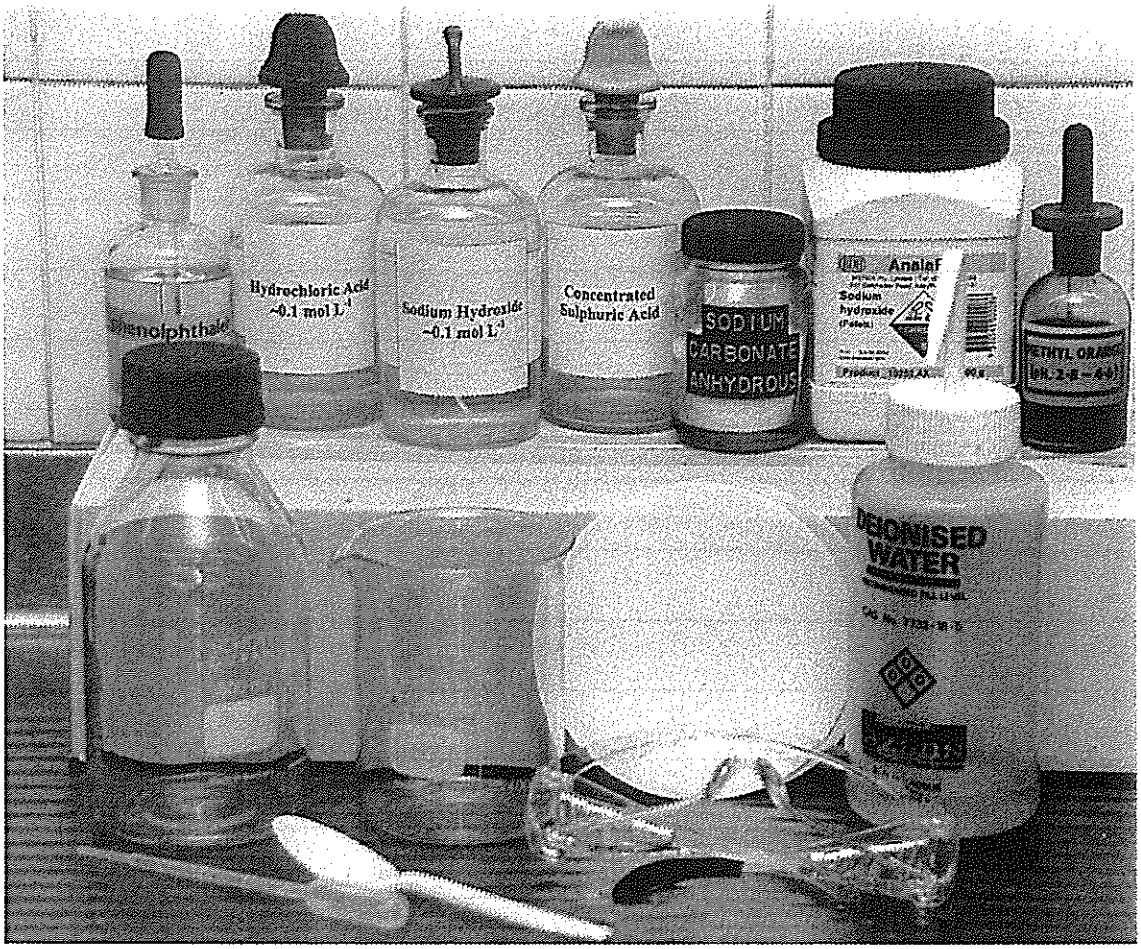
1. Wine contains hundreds of compounds. The main components of wine are water, ethanol and various acids. Wine can be analysed for the ethanol and acid content. Whilst there are several acids present, it is assumed for the purpose of analysis that all acid is present in the form of tartaric acid, $C_4H_2(OH)_2(COOH)_2$, a weak diprotic acid. Most wines contain around 7 g L^{-1} of tartaric acid.

   You have been given a bottle of white wine for analysis and have been asked to determine the acid content. The equipment (including chemicals) from which you may choose what you need to work with is shown in the photographs. You have access to more of any of the items shown, but not to any other materials or equipment.

   Give a detailed account of the laboratory procedures that you would use to determine the acid content of the wine. You should include in your answer any relevant chemical equations. Identify sources of error in the experiment and describe how you would minimise such errors. You are NOT required to give an example of the calculations involved in this analysis.



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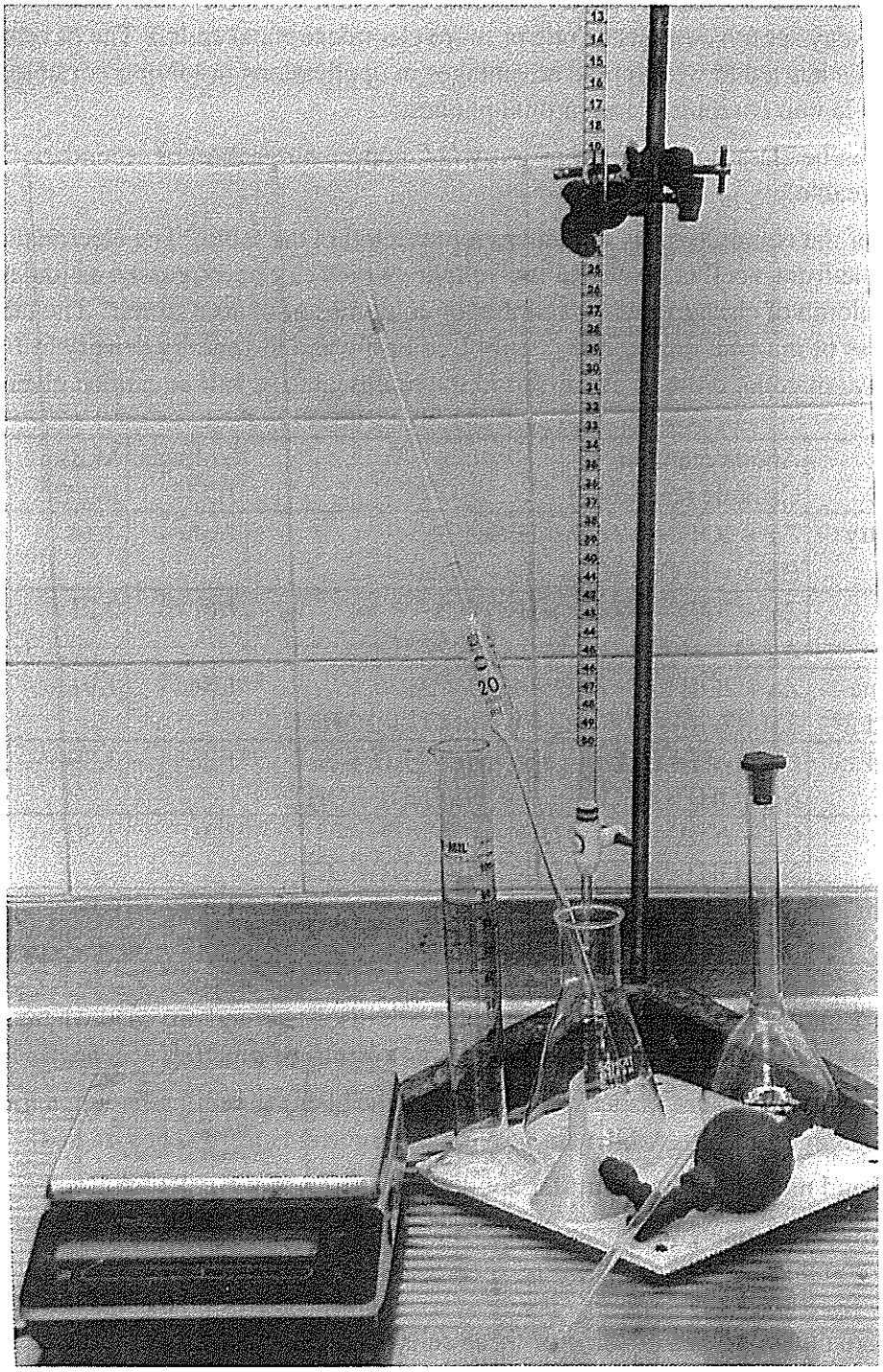

2. "Batteries" are extensively used to operate electronic devices. (The "battery" referred to in everyday speech consists of one or more electrochemical cells.) The development of new cells has led to widespread advantages in applications involving portable devices such as laptop computers and mobile phones.

Cells can be classified as either primary (1°, non-rechargeable) or secondary (2°, rechargeable).

Some of the common types of cell are represented in the table. The electrical energy available from a cell is related to the voltage (which can be expressed as joules (energy) per coulomb of charge) and the number of coulombs of charge stored. The table gives the mass of material required to supply 1 coulomb and the energy density in J g^{-1}, based on active material only, as expressed in the representative half equations given.

Cell type	Anode reaction Cathode reaction	Voltage JC^{-1}	Mass $mg\ C^{-1}$	Density $J\ g^{-1}$
mercury 1°	$Zn + 2OH^- \rightarrow ZnO + H_2O + 2e^-$ $HgO + H_2O + 2e^- \rightarrow Hg + 2OH^-$	1.35	2.14	632
silver 1°	$Zn + 2OH^- \rightarrow ZnO + H_2O + 2e^-$ $Ag_2O + H_2O + 2e^- \rightarrow 2Ag + 2OH^-$	1.6	2.21	722
alkaline 1° and 2°	$Zn + 2OH^- \rightleftharpoons ZnO + H_2O + 2e^-$ $2MnO_2 + H_2O + 2e^- \rightleftharpoons Mn_2O_3 + 2OH^-$	1.54	1.91	804
NiMH 2°	$(ZrNi_2)H + OH^- \rightleftharpoons (ZrNi_2) + H_2O + e^-$ $NiO(OH) + H_2O + e^- \rightleftharpoons Ni(OH)_2 + OH^-$	1.3	3.89	334
nicad 2°	$Cd + 2OH^- \rightleftharpoons Cd(OH)_2 + 2e^-$ $NiO(OH) + H_2O + e^- \rightleftharpoons Ni(OH)_2 + OH^-$	1.3	2.30	565
lithium 2°	$Li \rightleftharpoons Li^+ + e^-$ $Li^+ + MnO_2 + e^- \rightleftharpoons LiMnO_2$	3.4	0.97	3773

Mercury and silver cells have slow rates of self discharge and are used where small currents are drawn from small cells over long periods of time (eg watches).

Slightly larger cells are made from Zn/MnO_2, the alkaline version having a lower rate of self discharge and better ability to provide large currents (eg torches, radios).

NiMH and nicad cells have similar applications to Zn/MnO_2 cells.

Lithium cells, although expensive, are widely used in digital cameras, mobile phones and laptop computers.

Compare the properties of some of these cells with those that you have studied. Discuss why they are suited to their most common applications. (Issues such as the toxicity of Hg and Cd and the high cost of Ag etc also impact on the choice for a given use.) Describe and discuss the distinction between primary and secondary cells. Include a discussion of the basis of operation of both types of cells and the chemical principles involved.

END OF QUESTIONS

Check that you have written your Student Number on the front cover of this booklet

Write your response to Part 4 below.

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