Cambridge Assessment

O Level

Chemistry

Session: 1984 June
Type: Question paper
Code: 5070

CHEMISTRY **5070/1**

ORDINARY LEVEL

PAPER 1

(1 *hour*)

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

Read these notes carefully

There are forty questions in this test. For each question, five suggested answers are given: you are to choose the most appropriate one and indicate it on the separate answer sheet.

Read the instructions on the separate answer sheet very carefully.

This test is made up of questions of two types. For each type of question, instructions about how to choose the most appropriate answer are given.

Attempt **all** *the questions. Marks will not be deducted for wrong answers: your total score on this test will be the number of correct answers given.*

Ask any questions now before the test begins.

Mathematical tables are available.

A copy of the Periodic Table and other data are given overleaf.

1 mole of gas occupies 24 000 cm^3 at room temperature and pressure or 22 400 cm^3 at s.t.p.

The Faraday constant = 96 500 C (coulombs)/mol.

The Avogadro constant = 6×10^{23}/mol.

In this paper, relative atomic mass (A_r) *may be read as* atomic weight,
relative molecular mass (M_r) *as* molecular weight,

chlorate(I)	*as*	hypochlorite,	ethanoate	*as*	acetate,
dichromate(VI)	*as*	dichromate,	ethanoic acid	*as*	acetic acid,
manganate(VII)	*as*	permanganate,	ethanol	*as*	ethyl alcohol,
nitrate	*as*	nitrate(V),	ethene	*as*	ethylene,
nitric acid	*as*	nitric(V) acid,	methylbenzene	*as*	toluene.
sulphate	*as*	sulphate(VI),			
sulphite	*as*	sulphate(IV),			
sulphur(VI) oxide	*as*	sulphur trioxide,			
sulphuric acid	*as*	sulphuric(VI) acid.			

The Periodic Table

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group VIII
								1 H 1									4 He 2
7 Li 3	9 Be 4											11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10
23 Na 11	24 Mg 12											27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18
39 K 19	40 Ca 20	45 Sc 21	48 Ti 22	51 V 23	52 Cr 24	55 Mn 25	56 Fe 26	59 Co 27	59 Ni 28	64 Cu 29	65 Zn 30	70 Ga 31	73 Ge 32	75 As 33	79 Se 34	80 Br 35	84 Kr 36
85 Rb 37	88 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	— Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	La to Lu	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	— Po 84	— At 85	— Rn 86
— Fr 87	— Ra 88	— Ac 89	— Th 90	— Pa 91	— U 92												

In each box: a X b — a = relative atomic mass, X = atomic symbol, b = atomic number

Section A

Five possible answers, labelled **A, B, C, D** *and* **E** *are given for each question. Choose the one which you consider to be correct.*

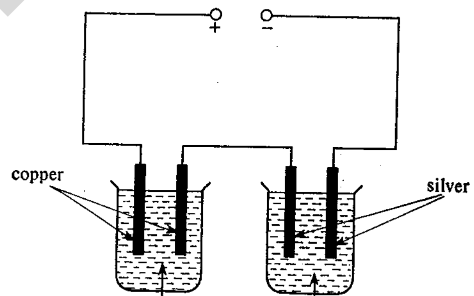
1 The six elements with atomic numbers 3, 11, 19, 37, 55 and 87 are referred to as Group One of the Periodic Table. The six elements are placed in the same Group because they all have

A metallic properties.
B densities less than that of water.
C one electron in the outer shell.
D many white compounds.
E a valency of one.

2 A sodium atom has mass number 23 and atomic number 11. It follows that the atom contains

A 11 electrons.
B 11 neutrons.
C 12 protons.
D 23 neutrons.
E 23 protons.

3 A circuit is connected as shown in the diagram below and a current passed for a certain time.



If 1.28 g of copper are deposited, what will be the mass of silver deposited?

A 0.54 g **B** 0.64 g **C** 1.08 g **D** 2.16 g **E** 4.32 g

4 Which one of the substances in the table below, **A, B, C, D** or **E**, has the typical properties of a covalent compound?

	melting point /°C	*boiling point* /°C	*electrical conductivity at room temperature*
A	−39	361	conducts
B	−21	105	non-conductor
C	636	1300	non-conductor
D	782	1600	non-conductor
E	3727	4829	conducts

5 The table below shows the results of experiments to measure the volume of dilute sulphuric acid (Column 1) needed to neutralise the mass of sodium hydroxide (Column 2) dissolved in the volume of water (Column 3).

Experiment	Column 1 *Volume of sulphuric acid required* /cm³	Column 2 *Mass of sodium hydroxide* /g	Column 3 *Volume of water* /cm³
1	20	1	20
2	40	2	40
3	40	2	20
4	?	1	40

From these results, what volume of sulphuric acid is needed to neutralise the sodium hydroxide in the fourth experiment?

A 5 cm³
B 10 cm³
C 20 cm³
D 40 cm³
E 80 cm³

6 The element with electronic configuration 2, 8, 6

A forms an ionic compound with sodium.
B is a metal.
C forms an ion of charge 2+.
D reacts only with non-metals.
E has 6 protons in each atom.

7 What volume of oxygen is required to completely burn 1 dm³ of methane (CH_4) measured under the same conditions of temperature and pressure?

A 1 dm³
B 2 dm³
C 3 dm³
D 4 dm³
E 5 dm³

8 Sodium is manufactured by

A reducing sodium oxide with carbon monoxide.
B decomposing sodium carbonate followed by reduction of the oxide.
C heating sodium sulphide in air followed by reduction of the oxide.
D electrolysis of molten sodium chloride.
E electrolysis of aqueous sodium chloride.

9 Which one of the following is formed by one mole of electrons during electrolysis?

A 103.5 g of lead from Pb^{2+}
B 71 g of chlorine from Cl^-
C 64 g of copper from Cu^{2+}
D 11.5 g of sodium from Na^+
E 2 g of hydrogen from H^+

10 Which one of the following statements is correct concerning the electrolysis of aqueous copper(II) sulphate between platinum electrodes?

A Hydrogen is given off at the negative electrode.
B Oxygen is given off at the positive electrode.
C The mass of the negative electrode remains constant.
D The mass of the positive electrode decreases.
E There is no change in the colour of the solution.

11 A pupil was asked to write down five pieces of information that could be obtained from the equation

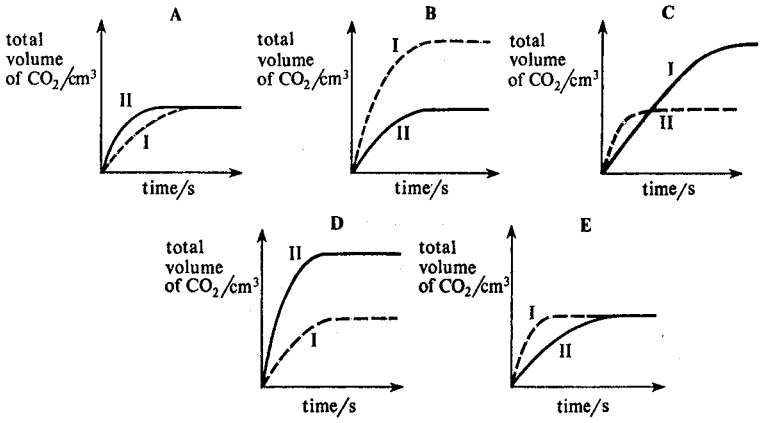
$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g) \qquad \text{exothermic}$$

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

A Magnesium chloride is soluble in water.
B Magnesium has been oxidised.
C One mole of magnesium produces one mole of hydrogen molecules.
D The total energy of the products is greater than that of the reactants.
E Magnesium is above hydrogen in the reactivity series.

12 In two separate experiments, the reaction of calcium carbonate with an excess of dilute hydrochloric acid was investigated. The calcium carbonate used in Experiment I was more finely divided than that used in Experiment II; all other conditions were identical in both experiments.

Which of the following graphs best illustrates the results?



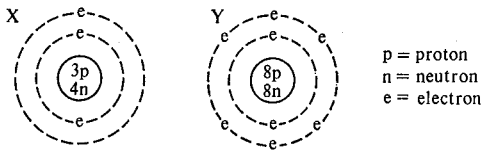
13 In which one of the following pairs of substances does the named element have the same oxidation number (state)?

A chlorine in Cl_2 and HCl
B iron in $FeCl_2$ and $FeCl_3$
C manganese in MnO_2 and $MnCl_2$
D nitrogen in NH_3 and HNO_3
E sulphur in SO_3 and Na_2SO_4

14 What could be the pH of a dilute solution of a weak acid?

A 1 **B** 4 **C** 7 **D** 10 **E** 13

15 The diagrams below illustrate the structures of the atoms of two elements X and Y.



When these two elements combine together to form a compound, what will be the mass of one mole of this compound?

A 11 g
B 14 g
C 23 g
D 30 g
E 34 g

16. Which one of the elements listed below is likely to be a transition metal?

element	*density*	*melting point*	*appearance of chloride*
A	high	high	coloured
B	high	low	coloured
C	low	high	white
D	low	low	coloured
E	low	low	white

17 Which one of the following statements concerning the Periodic Table is correct?

A All groups contain both metals and non-metals.
B In Group VII, the melting point of the elements increases with atomic number.
C In Group I, reactivity decreases with increasing atomic number.
D Elements in a period become more metallic with increasing atomic number.
E Atoms of elements in the same group have the same number of electrons.

18 The table below refers to four metals and some of their compounds.

Metal	*Action of dilute sulphuric acid on metal*	*Effect of hydrogen on heated oxide*	*Action of metal on a solution of the sulphate of J*
G	hydrogen evolved	reduced	no reaction
H	no reaction	reduced	no reaction
I	hydrogen evolved	no action	*J* formed
J	hydrogen evolved	no action	no reaction

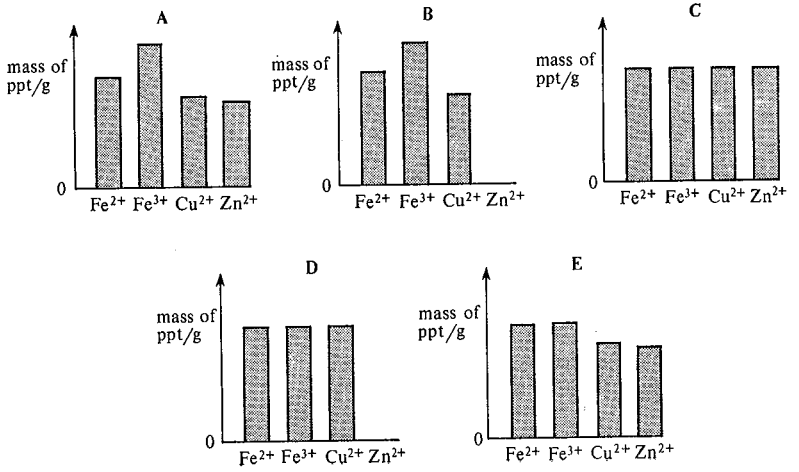
Which one of the following is the order of reactivity?

	most reactive ⟶			*least reactive*
A	*H*	*G*	*J*	*I*
B	*H*	*J*	*G*	*I*
C	*I*	*J*	*G*	*H*
D	*I*	*H*	*G*	*J*
E	*J*	*G*	*H*	*I*

19 Which one of the following correctly describes the solution formed and the gas evolved when potassium reacts with cold water?

	solution	*gas*
A	acidic	neutral
B	alkaline	acidic
C	alkaline	neutral
D	neutral	alkaline
E	neutral	neutral

20 Four separate solutions are prepared so that each solution contains 1 g of one of the ions Fe^{2+}, Fe^{3+}, Cu^{2+}, Zn^{2+}. To each solution is added an excess of sodium hydroxide solution and the mass of any resulting precipitate is found. Which one of the following diagrams, **A**, **B**, **C**, **D**, or **E**, illustrates the results?



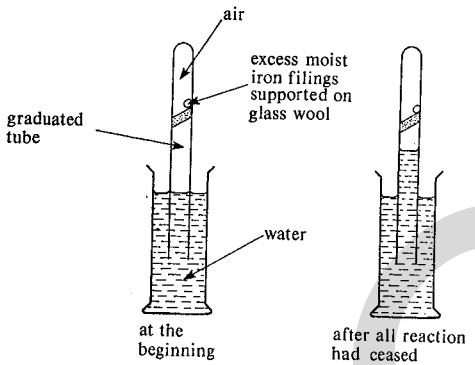
21 Which one of the following ions does **not** exist?

A $Ca^{2+}(aq)$
B $Fe^{2+}(aq)$
C $Mg^{2+}(aq)$
D $Na^{2+}(aq)$
E $Zn^{2+}(aq)$

22 Which one of the following elements burns in excess oxygen to form a neutral oxide?

A carbon
B hydrogen
C magnesium
D sulphur
E zinc

23 The apparatus shown below was set up.



Which one of the following statements is correct?

A The volume of gas remaining was about one fifth of the original volume.
B The proportion of nitrogen in the gas remaining was 79% by volume.
C In this experiment, iron acts as a catalyst.
D Iron does not react with the gas left in the tube.
E Air is a compound containing oxygen and nitrogen.

24 Which one of the following processes does **not** involve either oxidation or reduction?

A manufacture of iron from haematite
B manufacture of ammonium sulphate from ammonia and sulphuric acid
C manufacture of ammonia from nitrogen and hydrogen
D manufacture of zinc from zinc blende (ZnS)
E manufacture of sulphuric acid from sulphur

25 Which one of the following equations represents the catalysed reaction used in the manufacture of sulphuric acid by the Contact process?

A $S + O_2 \rightarrow SO_2$
B $2S + 3O_2 \rightarrow 2SO_3$
C $2SO_2 + O_2 \rightarrow 2SO_3$
D $SO_3 + H_2O \rightarrow H_2SO_4$
E $2H_2SO_3 + O_2 \rightarrow 2H_2SO_4$

26 Which one of the following methods is used for the laboratory preparation of gaseous hydrogen chloride?

A adding concentrated sulphuric acid to solid sodium chloride
B adding concentrated nitric acid to solid sodium chloride
C heating solid sodium chloride
D electrolysing aqueous sodium chloride
E passing chlorine into water

27 Which one of the following formulae represents a compound that reacts with sodium to give hydrogen?

A C_2H_6
B C_2H_5OH
C C_2H_4
D $CH_3CO_2C_2H_5$
E C_4H_{10}

28 All members of an homologous series

A have the same empirical formula.
B have the same melting and boiling points.
C have the same number of carbon atoms.
D undergo similar reactions.
E contain the same number of bonds.

29 To help diagnose illness, doctors often need to know which amino acids are present in blood or urine. Which one of the following methods is commonly used to separate and identify amino acids?

A chromatography
B distillation
C filtration
D recrystallisation
E sublimation

30 Which one of the following does **not** change when ethene is polymerised to form poly(ethene)?

A melting point
B boiling point
C density
D molecular formula
E percentage composition

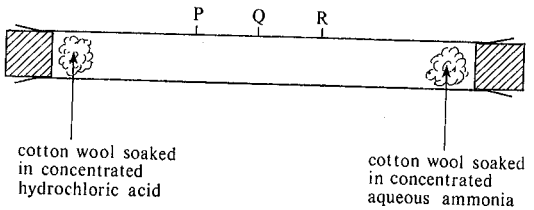
Section B

For each of the questions in this section one or more of the three numbered statements **1** *to* **3** *may be correct. Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements which you consider to be correct). The responses* **A** *to* **E** *should be selected on the basis of*

A	B	C	D	E
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct	**3** only is correct

No other combination of statements is used as a correct response.

31 An experiment was set up as shown in the diagram below with two pieces of cotton wool placed in opposite ends of the tube at the same time.



Which of the following statements are correct?

1 The molecules of ammonia and hydrogen chloride diffuse.
2 The ammonia and hydrogen chloride combine to form ammonium chloride.
3 After some time a white ring is observed at R.

32 Which of the following *underlined* substances can be purified by crystallisation?

1 sodium nitrate contaminated with a small quantity of sodium chloride
2 ethanol contaminated with a small quantity of water
3 lead(II) sulphate contaminated with a small quantity of lead(II) chloride

33 Which of the following conduct electricity?

1 solid sucrose
2 liquid bromine
3 aqueous sodium chloride

34 Which of the following reactions produces a metal?

1 passing hydrogen over heated magnesium oxide
2 electrolysing molten sodium chloride
3 adding zinc to aqueous copper(II) sulphate

A	B	C	D	E
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct	**3** only is correct

No other combination of statements is used as a correct response.

35 Which of the following processes release energy?

1 breaking the H—Cl bond in hydrogen chloride
2 photosynthesis of a carbohydrate
3 combustion of a hydrocarbon

36 The reaction shown below is reversible.

$$N_2(g) + 3H_2(g) \overset{\text{catalyst}}{\rightleftharpoons} 2NH_3(g)$$

Therefore, in the presence of a suitable catalyst

1 ammonia dissociates into its elements.
2 some of each gas will be present even after a long period of time.
3 less than two molecules of ammonia are formed for each molecule of nitrogen used up.

37 The reaction between molten sodium and hydrogen may be represented by the equation

$$2Na(l) + H_2(g) \longrightarrow 2Na^+H^-(s).$$

Which of the following are correct statements about this reaction or its product?

1 Each hydrogen molecule gains one electron.
2 Sodium atoms are oxidised by loss of electrons.
3 Electrolysis of the molten product gives hydrogen at the positive electrode.

38 Which of the following properties are characteristic of acids?

1 They react with copper to form hydrogen and a salt.
2 They react with sodium carbonate to form carbon dioxide and water.
3 They produce hydrogen ions in aqueous solution.

39 Which of the following statements about ammonia gas are correct?

1 It forms salts with acids.
2 It reacts with heated copper(II) oxide to form copper, nitrogen and water.
3 It has the formula NH_4.

40 Which of the following equations represent reactions which may occur when carbon dioxide is passed through lime water?

1 $CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$
2 $CO_2 + CaCO_3 + H_2O \rightarrow Ca(HCO_3)_2$
3 $CO_2 + 2OH^- \rightarrow CO_3^{2-} + H_2O$

CHEMISTRY

5070/2

ORDINARY LEVEL

PAPER 2 THEORY

(One and a half hours)

Answer all the questions in Section A and any two questions from Section B in the spaces provided on the question paper. If any extra sheets of paper are used they should be tied loosely to this booklet.

Unless otherwise stated, equations must be given wherever possible and diagrams where they are helpful. Names, not symbols, should be used in descriptive work for all reacting substances and for the products formed.

Essential working must be shown.

Mathematical tables are available.

A copy of the Periodic Table and other data are given overleaf.

Detach pages 5 to 10 and the data page before handing in this booklet.

The intended marks for questions or parts of questions are given in brackets [ ].

1 mole of gas occupies 24 000 cm^3 at room temperature and pressure or 22 400 cm^3 at s.t.p.

The Faraday constant = 96 500 C (coulombs)/mol.

The Avogadro constant = 6×10^{23}/mol.

In this paper, relative atomic mass (A_r) *may be read as* atomic weight,
relative molecular mass (M_r) *as* molecular weight,

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dichromate(VI)	*as*	dichromate,	ethanoic acid	*as*	acetic acid,
manganate(VII)	*as*	permanganate,	ethanol	*as*	ethyl alcohol,
nitrate	*as*	nitrate(V),	ethene	*as*	ethylene,
nitric acid	*as*	nitric(V) acid,	methylbenzene	*as*	toluene.
sulphate	*as*	sulphate(VI),			
sulphite	*as*	sulphate(IV),			
sulphur(VI) oxide	*as*	sulphur trioxide,			
sulphuric acid	*as*	sulphuric(VI) acid.			

The Periodic Table

Group	I	II	III	IV	V	VI	VII	VIII
								4 He 2
	7 Li 3	9 Be 4	11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10
	23 Na 11	24 Mg 12	27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18
	39 K 19	40 Ca 20	45 Sc 21	48 Ti 22	51 V 23	52 Cr 24	55 Mn 25	56 Fe 26	59 Co 27	59 Ni 28	64 Cu 29	65 Zn 30	70 Ga 31	73 Ge 32	75 As 33	79 Se 34	80 Br 35	84 Kr 36
	85 Rb 37	88 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	— Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
	133 Cs 55	137 Ba 56	La to Lu	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	— Po 84	— At 85	— Rn 86
	— Fr 87	— Ra 88	— Ac 89	— Th 90	— Pa 91	— U 92		

In each box: a = relative atomic mass, X = atomic symbol, b = atomic number

1 H 1

Section A

Answer **all** *the questions in this Section in the spaces provided.*
Thirty-five marks are allocated to this Section.

A1 Use the following information to answer the questions below about the elements **A**, **B**, **C**, **D** and **E**.

element	atomic number	mass number	electronic structure
A	3	7	2, 1
B	18	40	2, 8, 8
C	8	16	2, 6
D	12	24	2, 8, 2
E	19	39	2, 8, 8, 1

(*a*) Which element has 22 neutrons in each atom? .....

(*b*) Is the bonding between **C** and **E** ionic or covalent? .....

(*c*) Which element is a noble gas? .....

(*d*) Which two elements form ions with the same electronic structure as neon? .....

(*e*) Which two elements are in the same Group of the Periodic Table? .....

[6 *marks*]

A2 Using the Periodic Table provided, arrange the elements calcium, chromium, fluorine, iodine, magnesium and manganese into three pairs such that each member of a pair has similar reactions.

(*a*) ..... and .....

(*b*) ..... and .....

(*c*) ..... and .....

[3 *marks*]

A3 Rewrite the following equations correctly balanced. The formulae and symbols given are correct.

(*a*) $Al(s) + CuSO_4(aq) \rightarrow Cu(s) + Al_2(SO_4)_3(aq)$

.....

(*b*) $Fe^{3+}(aq) + I^-(aq) \rightarrow Fe^{2+}(aq) + I_2(aq)$

.....

[2 *marks*]

A4 Ethyl ethanoate can be prepared by the following reaction:

$$C_2H_5OH + CH_3CO_2H \rightleftharpoons CH_3CO_2C_2H_5 + H_2O$$

(*a*) What is meant by the symbol $\rightleftharpoons$? .....

.....

(*b*) State the essential experimental conditions required to make ethyl ethanoate by this reaction.

.....

(*c*) Name the homologous series of which ethyl ethanoate is a member.

.....

[4 *marks*]

A5 Give **three** ways in which the speed of the reaction between zinc and dilute sulphuric acid can be increased.

(i) .....

(ii) .....

(iii) .....

[3 *marks*]

A6 In what way is each of the following statements **false**?

(*a*) Hydrogen chloride is a good conductor of electricity when it is dissolved in any liquid.

.....

.....

(*b*) One difference between a metal and a non-metal is that a metal can form an ion but a non-metal cannot form an ion.

.....

.....

[4 *marks*]

A7 Using only the metals aluminium, copper, iron, sodium and zinc, answer the following questions. (A metal may be used once, more than once or not at all.)

(*a*) Which metal reacts quickly with cold water?

.....

(*b*) Which metal does *not* react with dilute hydrochloric acid?

.....

(*c*) Name one metal that forms an ion in which the metal has an oxidation state (number) of +1.

.....

(*d*) Name two metals that form coloured ions.

.....

(*e*) Name two metals that form amphoteric oxides.

.....

(*f*) Which two metals form oxides which can be reduced by carbon monoxide?

.....

[9 *marks*]

A8 Name the homologous series represented by each of the following general formulae.

(*a*) C_nH_{2n+2} .....

(*b*) $C_nH_{2n+1}OH$ .....

State **two** general characteristics of an homologous series, other than the existence of a general formula.

(i) .....

(ii) .....

[4 *marks*]

Section B

Answer **two** *questions from this Section on the ruled paper that follows.*

Any extra sheets used should be tied loosely to this booklet.

Each question is allocated fifteen marks.

B1 Suggest explanations for the following observations, and write equations for the reactions described.

(*a*) (i) When manganese(IV) oxide is added to aqueous hydrogen peroxide, a colourless gas is given off. The gas relights a glowing splint. The mass of manganese(IV) oxide remains unchanged throughout the experiment.

(ii) When manganese(IV) oxide is heated with concentrated hydrochloric acid, a green gas is given off. The gas bleaches damp litmus paper. The manganese(IV) oxide reacts forming manganese(II) chloride. [6 *marks*]

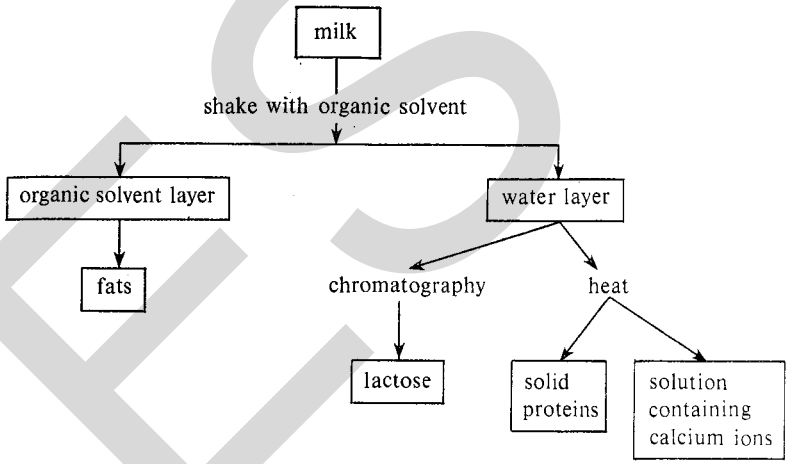
(*b*) (i) When dilute sulphuric acid is exactly neutralised by aqueous sodium hydroxide the resulting mixture is a very good conductor of electricity.

(ii) When dilute sulphuric acid is exactly neutralised by aqueous barium hydroxide the resulting mixture is a very poor conductor of electricity. [4 *marks*]

(*c*) (i) When iron is added to aqueous copper(II) sulphate, the colour of the solution changes from blue to pale green and a pink precipitate is formed.

(ii) When iron is added to aqueous iron(III) chloride, the colour of the solution changes from yellow to pale green, but no precipitate is formed. [5 *marks*]

B2 Milk contains water, proteins, carbohydrates, fats and salts. The diagram shows a way of obtaining these substances from milk.



(*a*) How would you show that milk contains water? [2 *marks*]

(*b*) (i) Name an organic solvent that does not mix with water.

(ii) Suggest how the fats can be obtained from the organic solvent layer. [2 *marks*]

(*c*) Describe briefly, with the aid of a diagram, any chromatography experiment that you have carried out. [4 *marks*]

(*d*) A protein is a naturally occurring macro-molecule. Draw a simple diagram to show the structure of a protein. (Your diagram should clearly show the linkages in the macro-molecule.) [1 *mark*]

(*e*) Name a synthetic polymer that possesses the same linkages as fats. [1 *mark*]

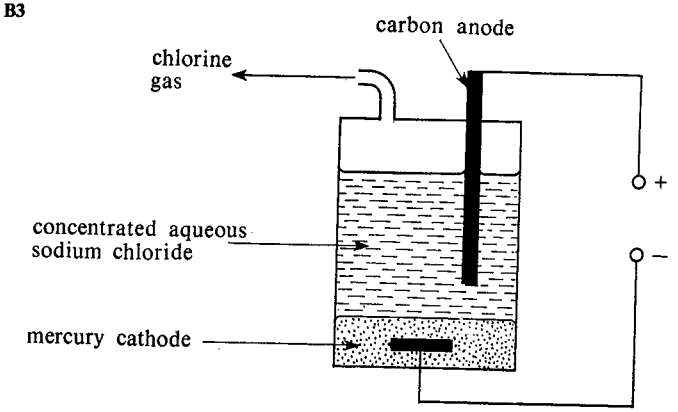
(*f*) How would you show the presence of calcium ions in an aqueous solution? [2 *marks*]

(*g*) The molecular formula of lactose is $C_{12}H_{22}O_{11}$.

(i) Describe what you would expect to observe if concentrated sulphuric acid was added to pure solid lactose.

(ii) Suggest how lactose could be broken down into simpler sugars such as glucose ($C_6H_{12}O_6$). [3 *marks*]

B3



When concentrated aqueous sodium chloride was electrolysed using the above apparatus, chlorine gas was given off at the anode. At the cathode no gas was given off, but sodium ions were discharged, setting free sodium, which dissolved in the mercury to form sodium amalgam. Sodium amalgam (a mixture) can be represented by the formula Na/Hg. When sodium amalgam was added to water, hydrogen gas, sodium hydroxide and mercury were formed.

(*a*) Write the equation for the formation of chlorine at the anode. [1 *mark*]

(*b*) Construct the equation for the addition of sodium amalgam (Na/Hg) to water. [1 *mark*]

(*c*) How would you show that hydrogen gas was given off? [2 *marks*]

(*d*) Give one large scale use for each of the following:

(i) hydrogen, (ii) sodium hydroxide. [2 *marks*]

(*e*) If, in the above experiment, 2 amps were passed for 482.5 minutes, and the sodium amalgam formed was added to 1.5 dm^3 of water, calculate:

(i) the number of coulombs passed,

(ii) the number of moles of sodium produced at the cathode,

(iii) the concentration in mol/dm^3 of the sodium hydroxide formed. [5 *marks*]

(*f*) How can solid sodium hydroxide be obtained from the aqueous solution? [1 *mark*]

(*g*) Chlorine is used for the manufacture of chloroethene (vinyl chloride), C_2H_3Cl.

This substance has a similar structure to ethene. Chloroethene (vinyl chloride) undergoes addition polymerisation to give a polymer.

(i) Draw the full structural formula of chloroethene (vinyl chloride).

(ii) Suggest a name for the polymer and give one of its uses. [3 *marks*]

B4 (*a*) Describe briefly the preparation of ammonia from an ammonium salt. (A diagram of the apparatus is not required.) [3 *marks*]

(*b*) (i) Explain why ammonia cannot be dried using concentrated sulphuric acid.

(ii) Suggest a suitable substance for drying ammonia. [2 *marks*]

(*c*) When dry ammonia is passed over heated sodium, hydrogen and the solid, sodamide ($NaNH_2$) are formed. Sodamide reacts violently with cold water to give sodium hydroxide and ammonia.

(i) Why must the ammonia be dried before reacting with sodium?

(ii) Draw a diagram to show how you would collect the hydrogen, free from ammonia, in this experiment.

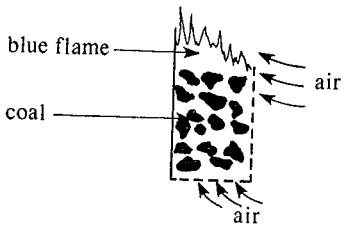
(iii) Briefly explain how your method removes the ammonia. [4 *marks*]

(*d*) (i) Construct the equation, including state symbols, for the reaction between sodium and ammonia.

(ii) If, in this experiment, 240 cm^3 of hydrogen were formed at room temperature and pressure, what mass of sodamide was obtained? [4 *marks*]

(*e*) What would you observe if aqueous iron(III) chloride were added to the solution obtained by adding sodamide to water? [2 *marks*]

B5 Coal contains the elements carbon, hydrogen, nitrogen, oxygen, phosphorus and sulphur. Coal burns in air, in a coal fire (see diagram) with a blue flame.



(*a*) (i) The blue flame above a coal fire is carbon monoxide burning. How is the carbon monoxide formed? Give the equation for carbon monoxide burning.

(ii) Name the element (present in coal) that burns with a blue flame to form a gas with a pungent smell. [3 *marks*]

If coal is heated in the absence of air, it produces coke, coal tar (a mixture of oils), ammonia and coal gas (a mixture containing carbon monoxide and hydrogen).

(*b*) Suggest how the mixture of oils in coal tar could be separated. [1 *mark*]

(*c*) What would you observe if coal gas were passed over heated copper(II) oxide? Explain your observations. [3 *marks*]

(*d*) Suggest a reason why natural gas is safer than coal gas for use as a domestic fuel. [1 *mark*]

(*e*) Give one industrial use in each case of (i) coke, (ii) ammonia. [2 *marks*]

(*f*) Hydrogen and carbon monoxide can be converted into methanol (CH_3OH). Construct the equation for this reaction. [1 *mark*]

(*g*) When 100 g of coal was completely burned in oxygen, it produced 330 g of carbon dioxide. Calculate the percentage by mass of carbon in this sample of coal. [3 *marks*]

(*h*) Name a suitable substance for absorbing carbon dioxide. [1 *mark*]

CHEMISTRY **5070/3 (U.K. & Carib.)**

ORDINARY LEVEL

PRACTICAL A

(*Two hours*)

Answer **all three** *questions.*

Question 1 *carries* 40% *of the total marks and questions* 2 *and* 3 *each carry* 30%. *Show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper. (The use of spare paper for rough working is allowed but such paper should* **not** *be submitted to the examiner.)*

Mathematical tables are available.

Candidates using semi-micro methods in Questions 2 *and* 3 *should modify the instructions as appropriate to the size of apparatus and the techniques they are using.*

The intended marks for questions or parts of questions are given in brackets [ ].

1 You are required to investigate the speed of the reaction between sulphuric acid and magnesium.

BA 1 is a solution of sulphuric acid.

Six pieces of magnesium are provided, each approximately 1 cm in length.

(*a*) (i) Use the measuring cylinder to place 60 cm^3 of **BA 1** in a 250 cm^3 beaker. Using the same cylinder, add 40 cm^3 of water, stir the mixture and record the temperature.

Temperature = ... °C

Noting the time as you do so, drop one of the pieces of magnesium into the acid and immediately push it below the surface. (Do not roll or bend the ribbon.) Use the rod provided to stir gently, taking care to keep the metal below the surface and away from the side of the beaker. Note the time, to the nearest second, when the last trace of metal disappears. Keep this solution.

(ii) Again noting the time, add a second piece of magnesium to the solution from (*a*) (i) and proceed exactly as before. Continue in this way until five pieces of magnesium have been added. After timing the disappearance of the fifth piece, record the temperature of the mixture. Do not throw the solution away as it will be required, together with the sixth piece of magnesium, for experiment (b).

Temperature = ... °C

(iii) Record in column B the time in seconds that each piece of magnesium takes to react with the acid. Add these times to obtain the time taken for a given number of pieces to react. Record these times in column D.

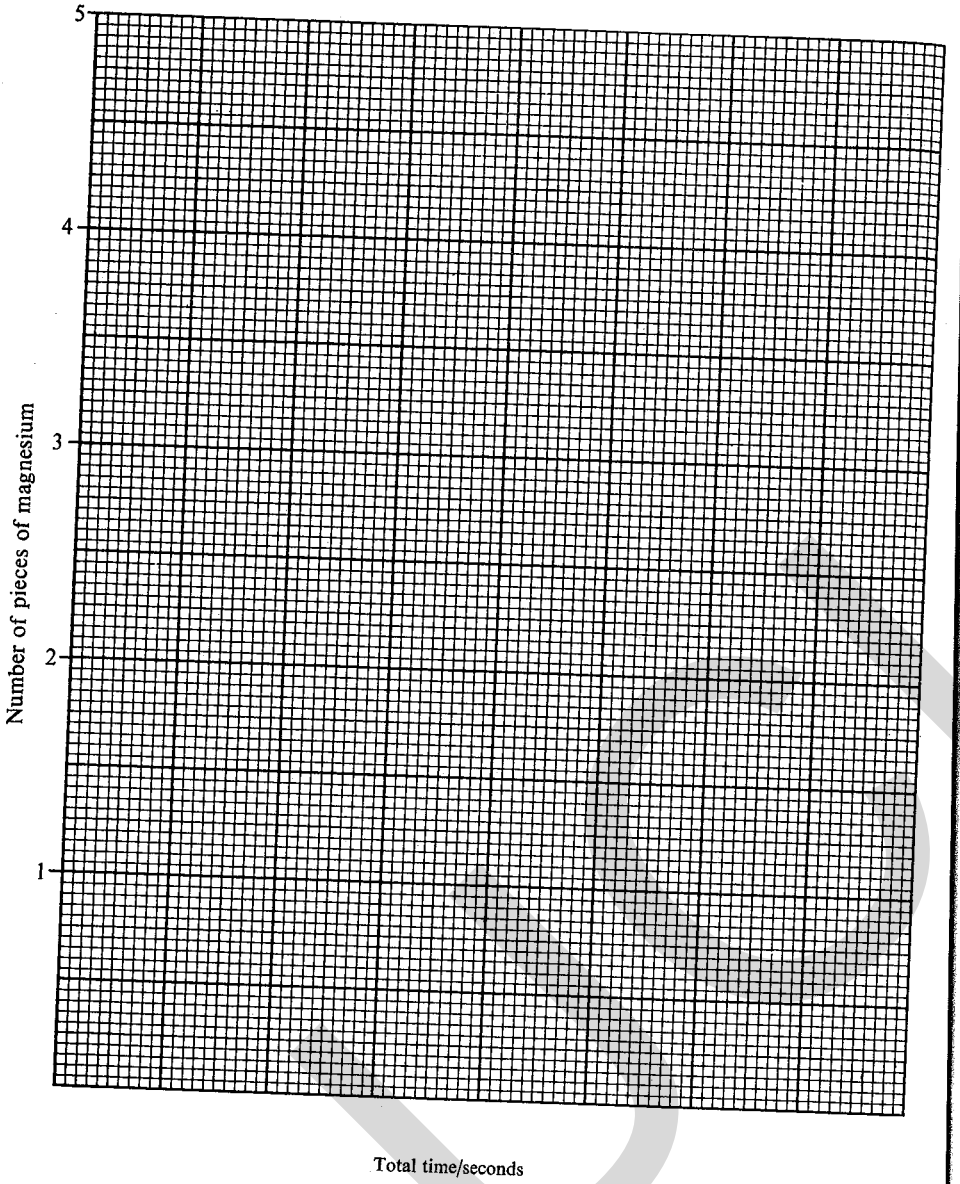
A	B	C	D
Piece of magnesium	Time taken to react /seconds	Number of pieces added	Total time taken for this number of pieces to react /seconds
first		1	
second		2	
third		3	
fourth		4	
fifth		5	

[5 *marks*]

(*b*) Add the aqueous copper(II) sulphate provided to the solution remaining from (*a*) (ii) and drop in the remaining piece of magnesium. Record the time taken for the metal to react, using the same method as before.

Answer .....seconds. [1 *mark*]

(*c*) Plot a graph of the number of pieces added (column C) against total time taken (column D) on the grid opposite. [1 *mark*]



(*d*) What conclusion about the speed of the reaction can you draw from your graph? [1 *mark*]

.....

.....

(*e*) Suggest the approximate time in seconds you would expect the reaction to take if

(i) all five pieces were dropped into the acid at the same instant,

(ii) a single piece of length 5 cm was dropped into the acid.

Answers (i) ..... seconds.

(ii) ..... seconds. [2 *marks*]

(*f*) What conclusion about the energy change in this reaction can you draw from the temperatures recorded in (*a*) (i) and (*a*) (ii)? [1 *mark*]

.....

.....

(*g*) What is the effect of copper(II) sulphate on the speed of the reaction? [1 *mark*]

.....

2 The solution **BA 2** contains two metallic ions. Place not more than 1 cm depth in a boiling tube and add aqueous sodium hydroxide until the tube is approximately half full. Stir carefully and filter the mixture, retaining both the residue and the filtrate. Carry out the following experiments on the filtrate and the residue and record the results in the spaces provided in the table.

Test No.	Experiment	Observations
1	To a few cm^3 of the filtrate add dilute nitric acid, a little at a time, with constant stirring, until the mixture is acidic to litmus or pH paper.	
2	Use the dropper provided to add aqueous ammonia, drop by drop, with constant stirring, to the solution remaining after test 1. Continue until there is no further change.	
3	Make a solution from the residue by pouring dilute nitric acid through the filter paper. (A few cm^3 should be sufficient and it does not matter if some of the residue remains.) Add aqueous sodium hydroxide to the resulting solution until there is no further change.	

[5 *marks*]

Use the results of these experiments **and no others** to identify the metallic ions in **BA 2** and, for each ion, record the test number(s) on which you base your conclusion.

Conclusion	Test number on which your conclusion is based
One metallic ion is	
The other metallic ion is	

[4 *marks*]

3 In Table 1, describe in detail one test for an oxidising agent, one test for a reducing agent and one test for a chloride. In each test describe what you would expect to observe if the result was positive.

Table 1 Tests

The test for an oxidising agent is carried out as follows: A positive result is indicated by
The test for a reducing agent is carried out as follows: A positive result is indicated by
The test for a chloride is carried out as follows: A positive result is indicated by

[4 *marks*]

Carry out each of these tests on solutions **BA 3**, **BA 4** and **BA 5**. Between them, these solutions contain at least one example of each type of substance; more than one may be present in the same solution. Record your results by entering + if positive, or − if negative in the appropriate space in Table 2. Nothing else should be written in this table.

Table 2 Results

Solution	Test for oxidising agent	Test for reducing agent	Test for chloride
BA 3			
BA 4			
BA 5			

[5 *marks*]

PRACTICAL CHEMISTRY INSTRUCTIONS

PRACTICAL A

ORDINARY LEVEL

PAPER 5070/3 (U.K.)

15 JUNE 1984

For question 1

Candidates will require the following:

(i) A solution of sulphuric acid of approximate concentration 1 mol dm^{-3}, labelled **BA 1**. Allow each candidate 100 cm^3.

(ii) A test-tube labelled copper(II) sulphate containing about 5 cm^3 of approximately 0.5 mol dm^{-3} copper(II) sulphate.

(iii) Magnesium ribbon, which must be cleaned with fine grade emery paper and cut into 1 cm lengths to the nearest mm. Each candidate will require six pieces. Some spare pieces should be available in case of mishap.

The following apparatus should be provided for each candidate:

a 250 cm^3 beaker, a 100 cm^3 measuring cylinder, a stirring rod and a 100 °C thermometer reading to 1 °C.

Candidates will be required to measure an interval of time of not more than a few minutes to the nearest second.

(A wall clock with centre second hand in view of all candidates may be suitable. Alternatively individual wrist watches could be used. Stop clocks or stop watches are unnecessary.)

The Supervisor is asked to carry out the experiment at the same time as the candidates and to record the results and plot the graph on a spare copy of the question paper which must be enclosed with the scripts. The question paper should be clearly labelled 'Supervisor's Results' followed by the number of the centre. **Unless this is done candidates may be unavoidably penalised.**

For question 2

(i) A solution containing approximately 0.2 mole each of calcium ion and zinc ion in 1 dm^3, labelled **BA 2**. This can be prepared by first dissolving 59 g of $Zn(NO_3)_2.6H_2O$ in 1 dm^3 of water. 47 g of $Ca(NO_3)_2.4H_2O$ is then dissolved in this solution. Allow each candidate about 5 cm^3.

(ii) Litmus or pH paper.

(iii) Two boiling tubes, a rod for stirring, a dropper, a filter funnel and a supply of filter paper. (A coarse grade paper is preferable.)

For question 3

(i) A solution of iron(III) chloride of approximate concentration 0.25 mol dm^{-3} (i.e. approximately 68 g of $FeCl_3.6H_2O$ per dm^3) labelled **BA 3**. Include approximately 50 cm^3 of dilute hydrochloric acid per dm^3 to prevent hydrolysis.

(ii) A solution of tin(II) chloride labelled **BA 4** prepared by adding 100 cm^3 of concentrated hydrochloric acid to 19 g of $SnCl_2.2H_2O$. This mixture should be warmed until a clear solution is obtained, then cooled and diluted with distilled water to 1 dm^3.

(iii) Approximately 20 volume hydrogen peroxide labelled **BA 5**.

Candidates will require approximately 20 cm^3 of each of these solutions.

Reagents used in testing for anions, oxidising agents and reducing agents.

In both questions 2 and 3, candidates will require a supply of test-tubes approximately 125 mm × 16 mm.

In all questions, more material may be issued if required, without penalty, but this should not be necessary.

Candidates are allowed to refer to note books and text-books during the examination.

In order to check the suitability of apparatus and material the teacher responsible for preparing the examination is allowed to consult the separate question paper on receipt at the Centre. The question paper **must be kept under suitable security at all times until after the day of the examination.**

The teacher is strongly advised to try out all experiments well before the examination.

The standard Report Form to be included with the scripts is given on page 5. Please detach and enclose it with the scripts in the normal way.

CHEMISTRY 5070/6

ORDINARY LEVEL

PAPER 6

ALTERNATIVE-TO-PRACTICAL

(1 *hour*)

Answer **all** *the questions in the spaces provided on the question paper.*

The intended marks for questions or parts of questions are given in brackets [ ].

Names, not symbols, should be used in descriptive work for all reacting chemicals and for the products formed.

Essential working must be clearly shown.

Mathematical tables are available.

A copy of the Periodic Table and other data are given overleaf. The data page should be detached before handing in this booklet.

1 mole of gas occupies 24 000 cm^3 at room temperature and pressure or 22 400 cm^3 at s.t.p.

The Faraday constant = 96 500 C (coulombs)/mol.

The Avogadro constant = 6×10^{23}/mol.

In this paper, relative atomic mass (A_r) *may be read as* atomic weight,
relative molecular mass (M_r) *as* molecular weight,

chlorate(I)	*as*	hypochlorite,	ethanoate	*as*	acetate,
dichromate(VI)	*as*	dichromate,	ethanoic acid	*as*	acetic acid,
manganate(VII)	*as*	permanganate,	ethanol	*as*	ethyl alcohol,
nitrate	*as*	nitrate(V),	ethene	*as*	ethylene,
nitric acid	*as*	nitric(V) acid,	methylbenzene	*as*	toluene.
sulphate	*as*	sulphate(VI),			
sulphite	*as*	sulphate(IV),			
sulphur(VI) oxide	*as*	sulphur trioxide,			
sulphuric acid	*as*	sulphuric(VI) acid.			

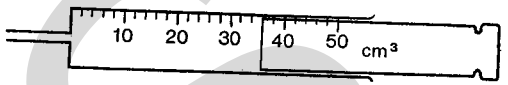
The Periodic Table

Group	I	II	III	IV	V	VI	VII	VIII
								$^{4}_{2}He$
			$^{11}_{5}B$	$^{12}_{6}C$	$^{14}_{7}N$	$^{16}_{8}O$	$^{19}_{9}F$	$^{20}_{10}Ne$
	$^{7}_{3}Li$	$^{9}_{4}Be$						
	$^{23}_{11}Na$	$^{24}_{12}Mg$	$^{27}_{13}Al$	$^{28}_{14}Si$	$^{31}_{15}P$	$^{32}_{16}S$	$^{35.5}_{17}Cl$	$^{40}_{18}Ar$
	$^{39}_{19}K$	$^{40}_{20}Ca$	$^{70}_{31}Ga$	$^{73}_{32}Ge$	$^{75}_{33}As$	$^{79}_{34}Se$	$^{80}_{35}Br$	$^{84}_{36}Kr$
	$^{85}_{37}Rb$	$^{88}_{38}Sr$	$^{115}_{49}In$	$^{119}_{50}Sn$	$^{122}_{51}Sb$	$^{128}_{52}Te$	$^{127}_{53}I$	$^{131}_{54}Xe$
	$^{133}_{55}Cs$	$^{137}_{56}Ba$	$^{204}_{81}Tl$	$^{207}_{82}Pb$	$^{209}_{83}Bi$	$^{-}_{84}Po$	$^{-}_{85}At$	$^{-}_{86}Rn$
	$^{-}_{87}Fr$	$^{-}_{88}Ra$						

In each box: a = relative atomic mass, X = atomic symbol, b = atomic number

$^{1}_{1}H$	$^{45}_{21}Sc$	$^{48}_{22}Ti$	$^{51}_{23}V$	$^{52}_{24}Cr$	$^{55}_{25}Mn$	$^{56}_{26}Fe$	$^{59}_{27}Co$	$^{59}_{28}Ni$	$^{64}_{29}Cu$	$^{65}_{30}Zn$							
	$^{89}_{39}Y$	$^{91}_{40}Zr$	$^{93}_{41}Nb$	$^{96}_{42}Mo$	$^{-}_{43}Tc$	$^{101}_{44}Ru$	$^{103}_{45}Rh$	$^{106}_{46}Pd$	$^{108}_{47}Ag$	$^{112}_{48}Cd$							
	La to Lu	$^{178}_{72}Hf$	$^{181}_{73}Ta$	$^{184}_{74}W$	$^{186}_{75}Re$	$^{190}_{76}Os$	$^{192}_{77}Ir$	$^{195}_{78}Pt$	$^{197}_{79}Au$	$^{201}_{80}Hg$							
	$^{-}_{89}Ac$	$^{-}_{90}Th$	$^{-}_{91}Pa$	$^{-}_{92}U$													

1 What is the volume, to the nearest cm^3, of gas in the syringe?



Answer .....

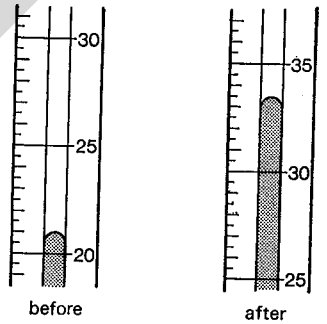
[1 *mark*]

2 Some powdered sulphur was heated gently until it just melted. It was allowed to cool. Describe the appearance of the crystals formed.

Answer .....

[1 *mark*]

3 A thermometer was placed in a volume of water and a white powder was then dissolved in the water. A blue solution was formed. The diagrams show the thermometer readings in °C before and after the addition of the powder.



What was the thermometer reading before the addition of the powder?

.....

[1 *mark*]

What was the thermometer reading after the addition of the powder?

.....

[1 *mark*]

Name the white powder.

Answer .....

[1 *mark*]

Is the dissolving of the white powder an exothermic or an endothermic process?

.....

[1 *mark*]

Name another compound that would cause a rise in temperature when dissolved in water.

.....

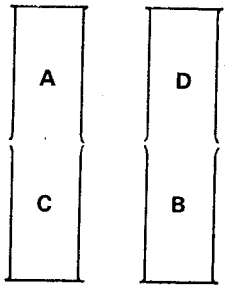
[1 *mark*]

Questions **4** *to* **10**. *In these questions, place a tick in the box* [√] *against the best answer.*

4 The diagram shows two gas jars, **A** and **B**, containing carbon dioxide and two gas jars, **C** and **D**, containing air free of carbon dioxide.

After half a minute, each gas jar was tested for the presence of carbon dioxide. In which gas jars would carbon dioxide be found?

(*a*) **A** and **D** only ☐
(*b*) **B** and **C** only ☐
(*c*) **A, B, C** and **D** ☐



[1 *mark*]

5 Some burning magnesium ribbon was plunged into a gas jar containing oxygen. It burned fiercely producing a white ash. A little water was added to the ash, which was then tested with red and blue litmus paper.

What would be observed?

(*a*) Blue litmus would turn red. ☐
(*b*) Red litmus would turn blue. ☐
(*c*) Neither red nor blue litmus would change colour. ☐ [1 *mark*]

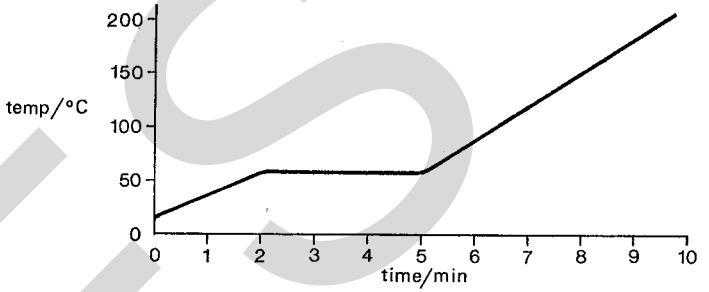
6 Which is the correct method to make a 10% solution of sulphuric acid from concentrated sulphuric acid and water?

(*a*) Slowly add 90 g of water to 10 g of acid with constant stirring. ☐
(*b*) Slowly add 10 g of acid to 90 g of water with constant stirring. ☐
(*c*) Pour 10 g of acid and 90 g of water into a beaker at the same time. ☐ [1 *mark*]

7 How could a student decide whether a sample of dilute nitric acid is contaminated with hydrochloric acid?

(*a*) by adding aqueous barium chloride ☐
(*b*) by adding aqueous silver nitrate ☐
(*c*) by determining its boiling point ☐ [1 *mark*]

8 A pure solid was heated in a test tube. Its temperature was recorded every minute for 10 minutes. The diagram below shows the graph of the results.



What was the appearance of the substance after 3 minutes of heating?

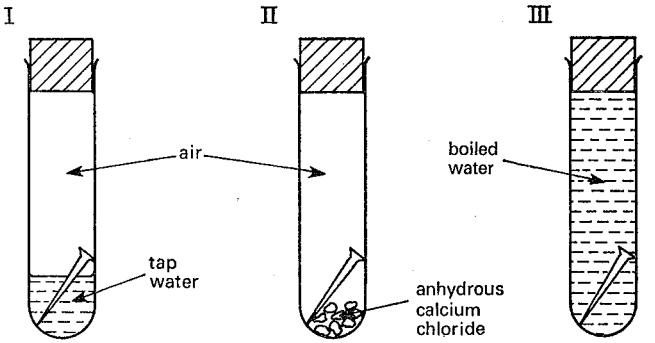
(*a*) a liquid only ☐
(*b*) a solid only ☐
(*c*) both liquid and solid ☐ [1 *mark*]

9 Small equal volumes of ethanol and ethanoic acid and a few drops of concentrated sulphuric acid were heated together for a few minutes. The mixture was then poured into a beaker containing a large volume of water.

What would be observed?

(*a*) an odourless liquid ☐
(*b*) a sweet smelling liquid ☐
(*c*) a sharp smelling liquid ☐ [1 *mark*]

10 The diagrams show three iron nails contained in test tubes under different conditions.



In which tube or tubes will the iron nail rust?

(*a*) tube I only ☐
(*b*) tubes I and II only ☐
(*c*) tubes I and III only ☐ [1 *mark*]

11 The following table shows the tests which a student performed on an unknown substance, **C**, and the conclusions made from the observations. Complete the table.

Test	Observation	Conclusion
1. Prepare a solution of **C** in water, and add aqueous ammonia until there is no further reaction.		Copper(II) hydroxide was first formed and this dissolved in excess aqueous ammonia to form a complex ion.
2. Heat **C** in a dry test tube.		Substance **C** is a hydrate. Both nitrogen dioxide and oxygen gases were evolved. Copper(II) oxide remained.
3.		Nitrate ions confirmed.

Conclusion: Substance **C** is.....

[11 *marks*]

12 A student was required to determine the concentration of hydrogen ions, $H^+(aq)$, in the liquid contained in a bottle labelled 'Acid'.

(*a*) To do so, he decided to prepare 100 cm³ of a standard solution of sodium carbonate, Na_2CO_3, (solution **A**). His results were as follows:

Mass of weighing bottle = 11.62 g
Mass of weighing bottle + anhydrous sodium carbonate = 16.92 g
Volume of standard solution **A** = 100 cm³

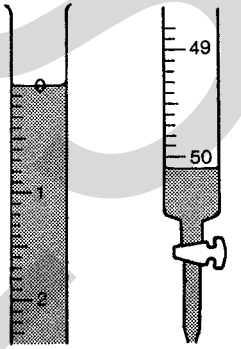
(i) Calculate the concentration, in g/dm³, of solution **A**.

Answer Solution **A** contains.....g/dm³, of sodium carbonate. [2 *marks*]

(ii) Calculate the concentration, in mol/dm³, of solution **A**.

Answer Solution **A** contains.....mol/dm³ of sodium carbonate. [2 *marks*]

(*b*) 10.0 cm³ of solution **A** were pipetted into a titration flask. The 'Acid' was put into a burette. A titration was performed, using an indicator. Shown below are parts of the burette with the liquid levels before and after the titration.



Because of this result the student decided to take a further 10.0 cm³ of his standard solution **A** and dilute it to 50 cm³ to make standard sodium carbonate solution **B**.

Why was solution **A** unsuitable for the titration?

Answer .....

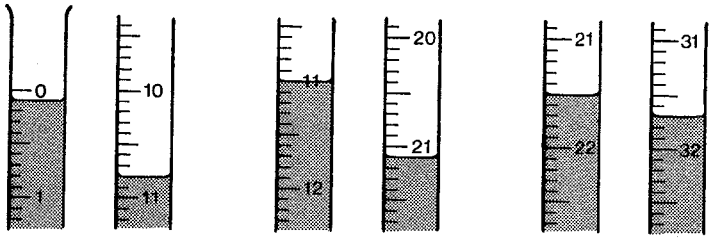
[1 *mark*]

(*c*) Calculate the concentration, in mol/dm³, of solution **B**.

Answer Solution **B** contains.....mol/dm³ of sodium carbonate. [1 *mark*]

(*d*) Three titrations were performed of 'Acid' against 10.0 cm³ portions of solution **B**.

First titration Second titration Third titration



Use the above diagrams to complete the following results table.

Titration	First	Second	Third
Final burette reading/cm³			
First burette reading/cm³			
Volume of 'Acid' used/cm³			

[4 *marks*]

Summary

..... cm^3 of **B** required..... cm^3 of 'Acid'.

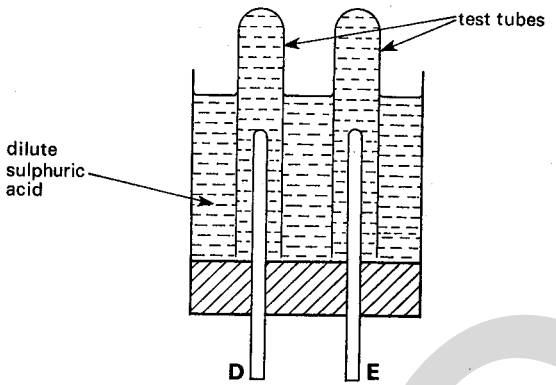
(*e*) Carbonate ions react with hydrogen ions according to the following equation.

$$2H^+(aq) + CO_3^{2-}(aq) \longrightarrow H_2O(l) + CO_2(g)$$

Calculate the number of moles of hydrogen ions in 1 dm^3 of 'Acid'.

Answer 'Acid' contains..... mol/dm^3 of hydrogen ions. [3 *marks*]

13 A student was supplied with the apparatus shown below, in order to collect and identify the products of electrolysis of dilute sulphuric acid.



(*a*) The student connected electrodes **D** and **E** to a 6 volt direct current supply of electricity. Bubbles of gas were produced, but only very slowly. When the tubes were raised, bubbles were produced more rapidly. Explain this observation.

Answer .....

[1 *mark*]

(*b*) Unequal volumes of colourless gases collected in the tubes. When sufficient gas had been collected, they were removed and a burning splint was applied to each.

The gas in the tube over **D** 'popped'. Name this gas.

Answer .....

[1 *mark*]

The gas in the tube over **E** made the splint burn more brightly. Name this gas.

Answer .....

[1 *mark*]

(*c*) At which electrode, **D** or **E**, would the greater volume of gas have been produced?

Answer .....

[1 *mark*]

(*d*) Would **D** have been connected to the positive or negative terminal of the 6 volt supply?

Answer .....

[1 *mark*]

(*e*) What gases would have been collected if concentrated aqueous sodium chloride replaced the dilute sulphuric acid? How would they have been identified?

Answer	Gas collected	Test	Observation
Electrode D			
Electrode E			

[4 *marks*]

14 A student wished to prepare crystals of hydrated calcium chloride $CaCl_2.6H_2O$ from calcium carbonate, $CaCO_3$. He added an excess of marble chips to some dilute hydrochloric acid in a beaker.

(*a*) What would have been observed?

Answer .....

[1 *mark*]

(*b*) The reaction took a long time to complete. What two changes could have been made to the procedure which would have completed the reaction more quickly?

Answer First change .....

Second change.....

[2 *marks*]

(*c*) How would the unreacted calcium carbonate have been removed?

Answer .....

[1 *mark*]

(*d*) Finally the clear solution was evaporated to dryness, but crystals were not obtained. What remained instead?

Answer .....

[1 *mark*]

(*e*) What should the final procedure have been in order to obtain crystals of hydrated calcium chloride?

Answer .....

.....

[2 *marks*]

15 This question concerns experiments with some of the elements of Group I of the Periodic Table.

(*a*) Sodium is stored under a liquid. Name a suitable liquid.

Answer .....

Explain why sodium is stored under this liquid.

Answer .....

.....

[2 *marks*]

(*b*) A piece of sodium was cut with a sharp knife.

Describe the appearance of the surface over the next minute.

Answer .....

.....

[2 *marks*]

(*c*) The sodium was placed in a trough of water. It floated, melted, flew about the surface and finally disappeared.

What would be the result of adding litmus or pH paper to the solution in the trough?

Answer .....

[1 *mark*]

(*d*) What differences would be observed if a piece of (i) lithium, (ii) potassium, were placed in the trough of water?

Answer (i) .....

.....

(ii) .....

.....

[2 *marks*]