



Write your name here

Surname

Other names

Scholarship Examination

Subject: CHEMISTRY

Time: 1 Hour

You must have:

Calculator
Ruler

Total Marks

60

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name.
- Answer **all** questions.
- Answer the questions in the spaces provided
 - *There may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 60
- Each multiple choice question is a mark
- The marks for **each** question are shown in brackets
 - *Use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English (languages please change this).
- Try to answer every question.
- Check your answers if you have time at the end.

THE PERIODIC TABLE

Period	1	2	3	4	5	6	7	0										
	Group																	
1	<table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">H</td> <td style="text-align: center;">Hydrogen</td> <td style="text-align: center;">1</td> </tr> </table>								1	H	Hydrogen	1						
1	H	Hydrogen	1															
2	7 Li Lithium 3	9 Be Beryllium 4						11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10					
3	23 Na Sodium 11	24 Mg Magnesium 12						27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18					
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36	
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

Q1.

Calcium hydroxide, Ca(OH)_2 , is slightly soluble in water.

(a) Calcium hydroxide can be made by the reaction of calcium with water.

(i) Write the chemical equation for this reaction.

..... [2]

(ii) Name another substance that reacts with water to form calcium hydroxide.

..... [1]

(b) When calcium hydroxide dissolves in water, it dissociates into ions and forms a weakly alkaline solution.

(i) Suggest the pH of aqueous calcium hydroxide.

..... [1]

(ii) Give the formula of the ion responsible for making the solution alkaline.

..... [1]

(c) Limewater is a saturated solution of calcium hydroxide, $\text{Ca(OH)}_2(\text{aq})$.

(i) Name the gas limewater is used to test for.

..... [1]

(ii) Suggest what is meant by the term *saturated solution*.

.....

..... [2]

(iii) Describe how you would make a sample of limewater starting with solid calcium hydroxide.

.....

.....

..... [2]

(iv) Describe how you would test for the presence of calcium ions in a sample of limewater.

test

observations

.....

[3]

(d) A 25.0 cm³ sample of limewater is placed in a conical flask. The concentration of Ca(OH)₂ in the limewater is determined by titration with dilute hydrochloric acid, HCl.

(i) Name the item of apparatus used to measure the volume of acid in this titration.

..... [1]

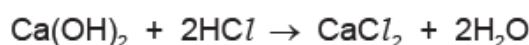
(ii) State the type of reaction which takes place.

..... [1]

(iii) As well as limewater and dilute hydrochloric acid, state what other type of substance must be added to the conical flask.

..... [1]

(iv) The equation for the reaction is shown.



20.0 cm³ of 0.0500 mol/dm³ HCl reacts with the 25.0 cm³ of Ca(OH)₂.

Determine the concentration of Ca(OH)₂ in g/dm³. Use the following steps.

- Calculate the number of moles in 20.0 cm³ of 0.0500 mol/dm³ HCl.

..... mol

- Determine the number of moles of Ca(OH)₂ in 25.0 cm³ of the limewater.

..... mol

- Calculate the concentration of Ca(OH)₂ in mol/dm³.

..... mol/dm³

- Determine the concentration of Ca(OH)₂ in g/dm³.

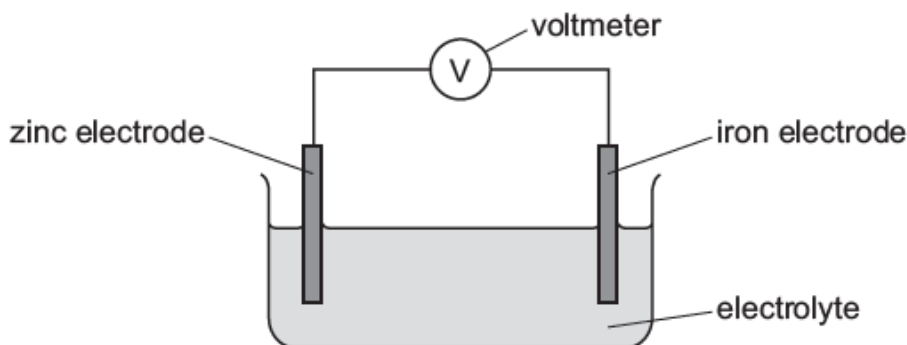
..... g/dm³
[5]

[Total: 21]

Q2.

This question is about chemical reactions and electricity.

(a) The diagram shows the apparatus used in the production of electrical energy in a simple cell.



The zinc electrode dissolves in the electrolyte forming $\text{Zn}^{2+}(\text{aq})$ ions.

(i) Draw an arrow on the diagram to show the direction of electron flow. [1]

(ii) Write the ionic half-equation for the reaction that occurs when the zinc electrode dissolves.

..... [2]

(b) The reading on the voltmeter can be increased if either zinc or iron is replaced by another metal.

(i) Name a metal that can replace zinc and increase the reading on the voltmeter.

..... [1]

(ii) Name a metal that can replace iron and increase the reading on the voltmeter.

..... [1]

(c) Fuel cells are used to generate electricity.

(i) Name the reactants in a fuel cell.

..... [1]

(ii) Name the waste product of a fuel cell.

..... [1]

(d) Electricity can be used to break down aqueous or molten ionic compounds.

(i) Name the process which uses electricity to break down aqueous or molten ionic compounds.

..... [1]

(ii) Explain why the ionic compound needs to be aqueous or molten.

..... [1]

(e) Brine is concentrated aqueous sodium chloride.

(i) Name three substances which are manufactured by passing electricity through brine.

1

2

3

[3]

(ii) Name a different substance formed when molten sodium chloride is used instead of concentrated aqueous sodium chloride.

..... [1]

[Total: 13]

Q3.

The names of four esters are listed.

methyl propanoate

ethyl propanoate

propyl propanoate

butyl propanoate

(a) Esters are a family of organic compounds with similar chemical properties. They can be represented by the formula $C_nH_{2n}O_2$.

(i) State the name given to a family of organic compounds with similar chemical properties.

..... [1]

(ii) Explain why members of a family of organic compounds have similar chemical properties.

..... [1]

(iii) State the name given to a formula such as $C_nH_{2n}O_2$.

..... [1]

(iv) Determine the value of 'n' in butyl propanoate.

..... [1]

(b) All four of the esters in the list are liquids at room temperature.

Name the technique used to separate ethyl propanoate from a mixture of the four esters.

..... [2]

(c) All four esters can be made by reacting different alcohols with the same substance.

(i) Name this substance and draw its structure. Show all of the atoms and all of the bonds.

name

structure

[2]

(ii) Name the alcohol used to make methyl propanoate.

..... [1]

(d) Other esters, not in the list, have the same molecular formula as propyl propanoate, but different structures.

(i) State the term used to describe substances with the same molecular formula but different structures.

..... [1]

(ii) Name two esters with the same molecular formula as propyl propanoate.

1

2

[2]

(e) Polyesters can be made from the two different molecules shown.



and



(i) Complete the diagram to show a section of the polyester made from these two molecules. Include all of the atoms and all of the bonds in the linkages.



[3]

(ii) Name the type of polymerisation that takes place when this polymer forms.

..... [1]

(iii) Name a polyester.

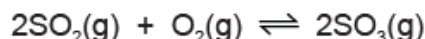
..... [1]

[Total: 17]

Q4.

Sulfuric acid is manufactured by an industrial process. Sulfur is obtained from sulfur-containing metal ores.

The sulfur in the metal ore is converted to sulfur dioxide which is then oxidised to sulfur trioxide as shown.



(a) Name a metal ore which contains sulfur.

..... [1]

(b) Describe the process which converts metal ores to sulfur dioxide.

..... [1]

(c) Name the industrial process used to manufacture sulfuric acid.

..... [1]

(d) The reaction that produces sulfur trioxide is an equilibrium. The forward reaction is exothermic.

(i) State the temperature and pressure used to make sulfur trioxide.

temperature = °C

pressure = atm
[2]

(ii) Name the catalyst used.

..... [1]

(iii) Describe two features of an equilibrium.

1

2

[2]

(iv) State the effect, if any, on the position of equilibrium when the following changes are made.

Explain your answers.

temperature is increased

.....

[1]

[Total: 9]