

Centre Number	Candidate Number	Candidate Name
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NAMIBIA SENIOR SECONDARY CERTIFICATE

PHYSICAL SCIENCE ORDINARY LEVEL

4323/2

PAPER 2

2 hours

Marks 100

2019

Additional Materials: Non-programmable calculator
Ruler

INSTRUCTIONS AND INFORMATION TO CANDIDATES

- Candidates answer on the Question Paper in the spaces provided.
- Write your Centre Number, Candidate Number and Name in the spaces provided on top of this page.
- Write in dark blue or black pen.
- You may use a soft pencil for any diagrams, graphs or rough working.
- Do not use correction fluid.
- Do not write in the margin *For Examiner's Use*.
- Answer **all** questions.
- The number of marks is given in brackets [] at the end of each question or part question.
- You will lose marks if you do not show your working or if you do not use appropriate units.
- Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall $g = 10 \text{ m/s}^2$).
- The Periodic Table is printed on page 20.

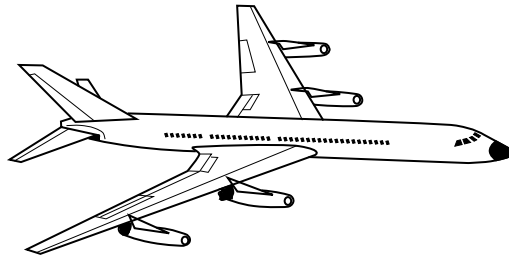
For Examiner's Use	
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This document consists of **20** printed pages.



Republic of Namibia
MINISTRY OF EDUCATION, ARTS AND CULTURE

- 1 An aeroplane of mass 1.12×10^5 kg accelerating constantly from rest along a runway.



- (a) Calculate the weight of the aeroplane.

Weight.....N [1]

- (b) Name **one** of the forces acting on the aeroplane apart from the weight.
..... [1]

- (c) The aeroplane starts from rest and after 50 s, the aeroplane reaches a speed of 70 m/s.
Calculate the
(i) acceleration of the aeroplane,

Acceleration m/s² [2]

- (ii) horizontal resultant force on the aeroplane.

Resultant force.....N [2]

- (d) State **one** form of energy that increases as the aeroplane gains height, while travelling at constant speed.
..... [1]
[7]

- 2 Sodium, Na, and chlorine, Cl, react to form sodium chloride, NaCl.
Sodium chloride is made up of sodium ion, Na⁺, and chloride ion, Cl⁻.

(a) Describe how a sodium ion, Na⁺, is formed.

..... [1]

(b) State the number of electrons in a chloride ion, Cl⁻.

..... [1]

(c) Hydrogen also reacts with chlorine to form hydrogen chloride, HCl.

(i) Name the type of bond present in hydrogen chloride.

..... [1]

(ii) Draw a structure of hydrogen chloride using the Lewis notation.

(d) Sodium chloride and hydrogen chloride consist of different types of bonds. [2]

(i) Complete the table to show the difference in the solubility of sodium chloride in water and in organic solvents.

Use the terms **soluble** and **insoluble** to indicate your answer.

	solubility	
	water	organic solvents
sodium chloride		

[1]

(ii) Explain in terms of intermolecular forces, why sodium chloride has a high melting point and hydrogen chloride has a low melting point.

.....

..... [1]

[7]

- 3 Fig. 3.1 shows an electric iron which contains a thermostat. The thermostat uses a bimetallic strip.

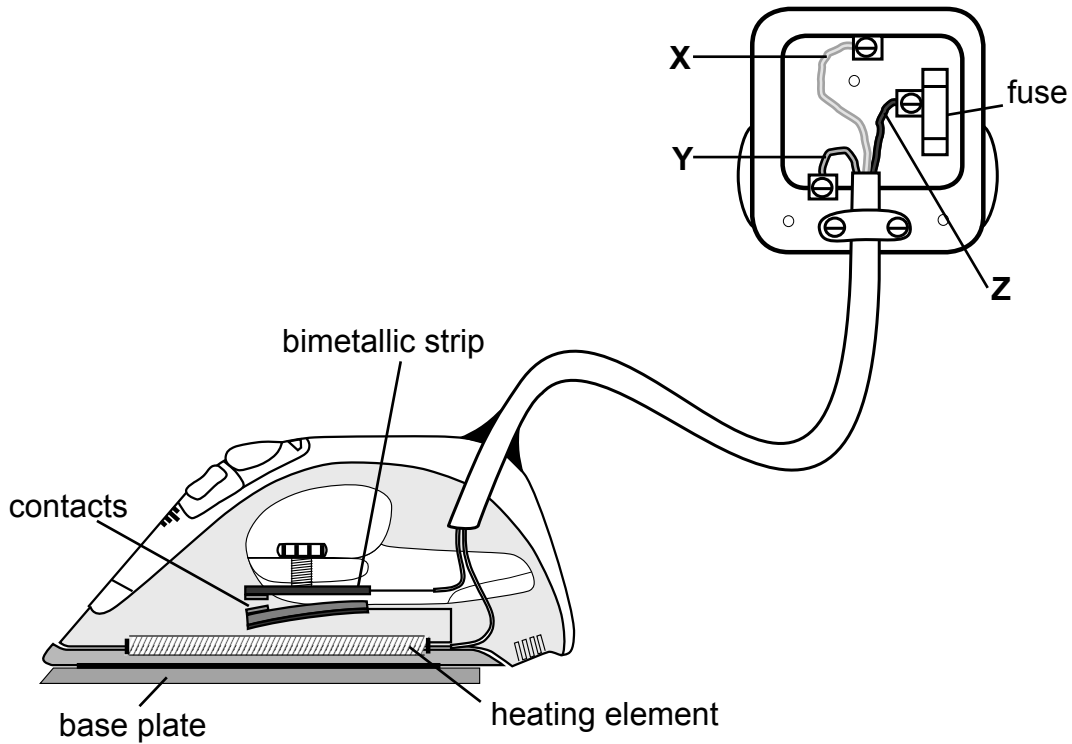


Fig. 3.1

- (a) When current is passed through the heating element, it gets very hot.
- (i) Name the main method of heat transfer from the heating element to the base plate.
- [1]
- (ii) With the help of a diagram, describe the structure of a bimetallic strip.

..... [2]

.....

.....

.....

- (iii) Explain how the bimetallic strip operates to control the temperature of the electric iron.

..... [2]

.....

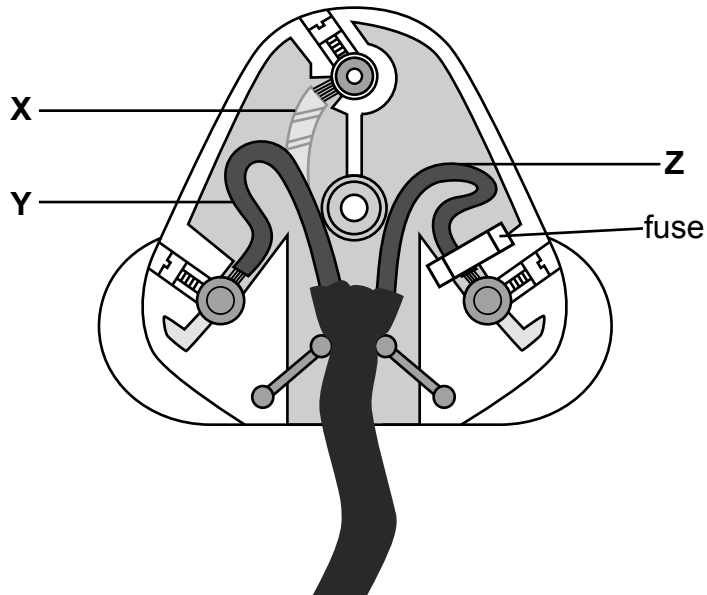
.....

.....

- (b) The electric iron is connected to a 240 V supply and dispates 1400 W of power. Calculate the current flowing in the iron.

Current..... A [2]

- (c) Use Fig. 3.1 to identify the wiring X, Y, Z of the electric plug and their corresponding colours.



X colour

Y colour

Z colour [3]

- (d) State **one** safety device in the use of the electric iron in Fig. 3.1.

..... [1]

[11]

- 4 Fig. 4.1 shows a setup of an experiment to investigate the effect of the size of marble chips on the rate of reaction with dilute hydrochloric acid.

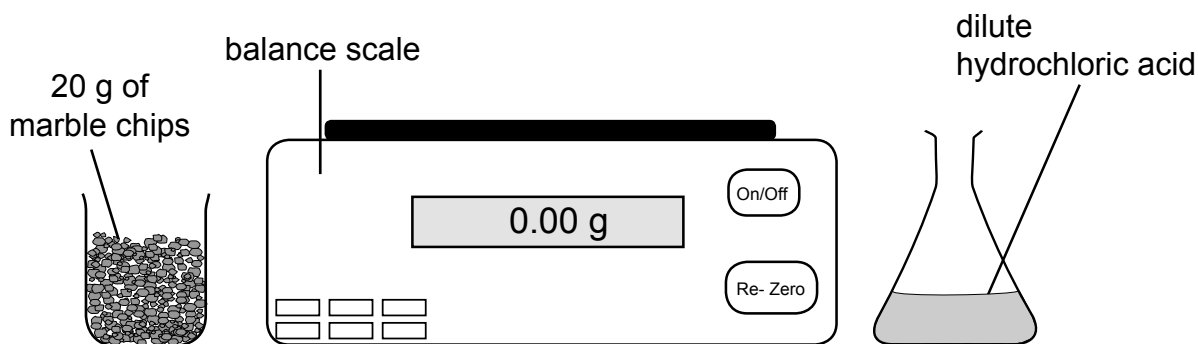


Fig. 4.1

The loss of mass was measured every one minute, and the results are sketched on a graph as shown in Fig. 4.2.

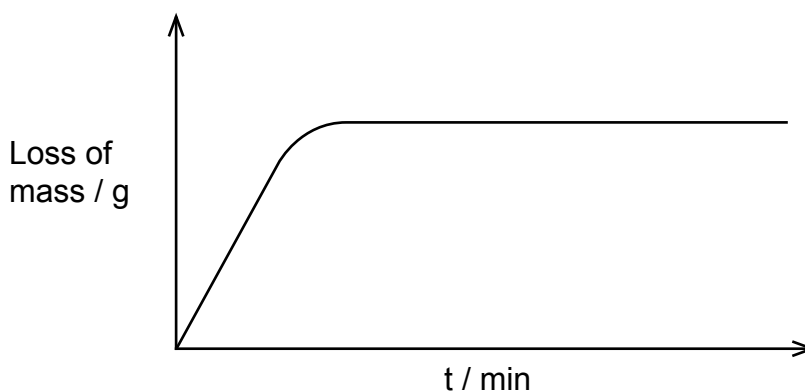


Fig. 4.2

- (a) The reaction of marble chips and dilute hydrochloric acid is exothermic.
Describe the meaning of exothermic.

.....
.....

[1]

- (b) The experiment was repeated with the same volume and same concentration of dilute hydrochloric acid and 20 g of powdered marble chips.

- (i) On Fig. 4.2, sketch a line to show the results of this second experiment. [2]
(ii) Explain your answer in (b)(i) in terms of the collision theory.

.....
.....
.....
.....

[2]

(c) Carbon dioxide gas is released in this reaction.

Describe the chemical test for CO₂.

Test

.....

Result.....

.....

[2]

(d) The equation for this reaction is given below.



Calculate the

(i) number of moles in 20 g of the marble chips (CaCO₃). [Ca:40, C:12, O:16]

Number of moles

[2]

(ii) mass of calcium chloride, CaCl₂ that was produced. [Ca:40, Cl:35.5]

Mass = g

[2]

[11]

- 5 Ted drops a stone in the water and observes wavefronts spread out from the stone as shown in Fig. 5.1.

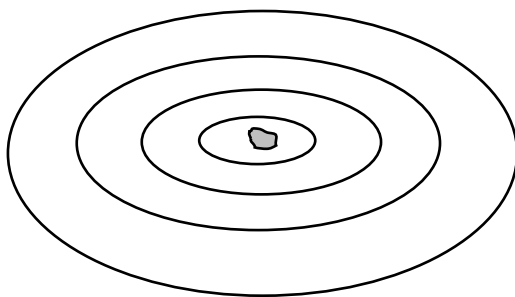


Fig. 5.1

- (a) Define the term *wavefront*.

.....

[1]

- (b) Ted observes two water waves pass a point in one second.

Calculate the

- (i) period of the waves,

Period =

[1]

- (ii) wavelength of the waves if they were travelling at 0.1 m/s.

Wavelength = m

[2]

(c) Ted used the ripple tank to demonstrate wave properties of water. Fig. 5.2 shows one of these properties.

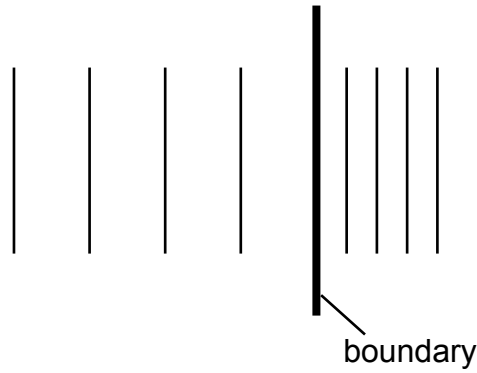


Fig. 5.2

- (i) Name the property demonstrated in Fig. 5.2.
..... [1]
- (ii) As the waves in Fig. 5.2 cross the boundary, the depth of the water changes. Indicate on Fig. 5.2, which side of the boundary is shallow and which side is deep. [1]
- (iii) When the wave crosses the boundary, its velocity changes.
State **one** other property of the wave that changes.
..... [1]

(d) Fig. 5.3 shows the results of another experiment in the ripple tank.

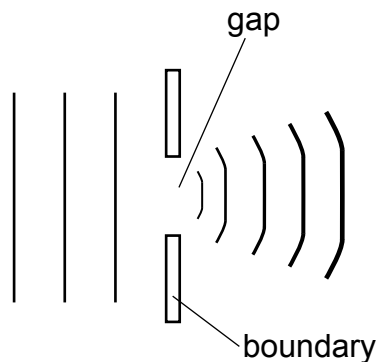


Fig. 5.3

- (i) Name the property demonstrated in Fig. 5.3.
..... [1]
- (ii) The experiment is done with a gap of similar size to the wavelength of the waves and repeated with a much wider gap.
Give the property of the patterns formed for each gap.
Narrow gap.....
.....
Wide gap.....
..... [2]

[10]

- 6 Fig. 6.1 shows the stages used in the laboratory preparation of the salt, copper (II) sulfate, from copper (II) oxide and dilute sulfuric acid.

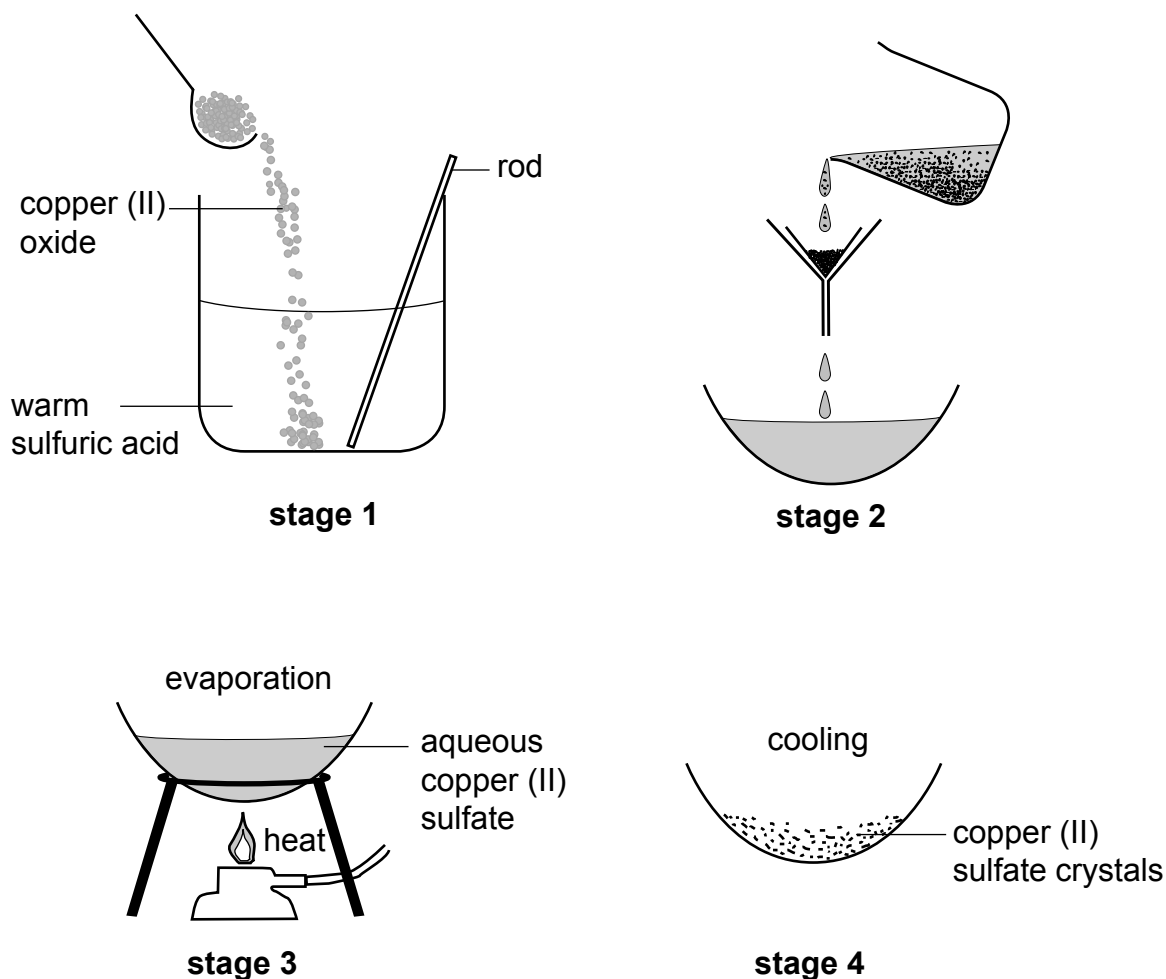


Fig. 6.1

- (a) Define *acid*, in terms of proton transfer.

..... [1]

- (b) Sulfuric acid is a strong acid.

State the pH of a strong acid.

..... [1]

- (c) Copper and oxygen reacts to form copper (II) oxide, CuO .

Suggest what type of oxide this is.

..... [1]

- (d) Copper (II) sulfate is a soluble salt.

- (i) State the name of the method used for preparing soluble salts from an aqueous solution.

..... [1]

- (ii) Explain the reason for filtering the copper (II) sulfate solution in **stage 2**.

..... [1]

(iii) Describe how you would obtain pure crystals of copper (II) sulfate from its solution in **stage 4**.

.....

.....

.....

.....

[2]

[7]

7 Fig. 7.1 shows a simple form of an alternating current (a.c.) generator.

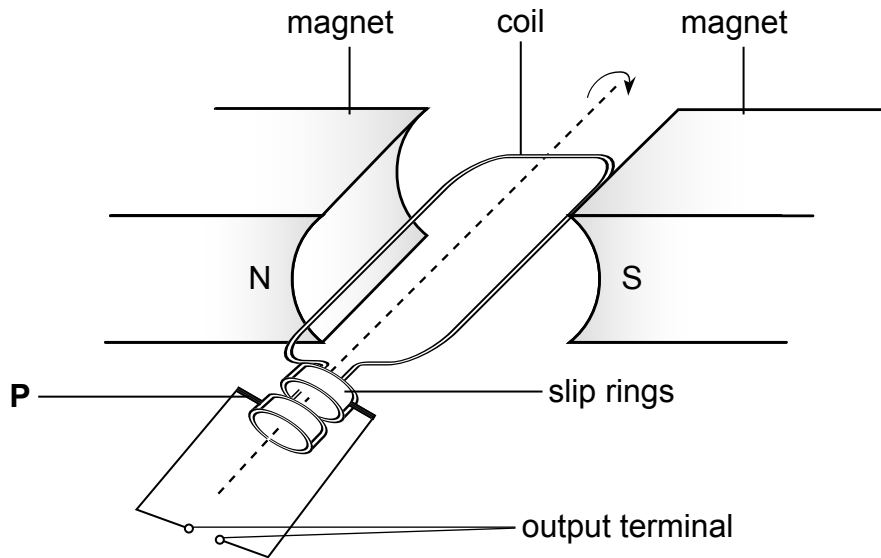


Fig. 7.1

(a) Define the term *electromotive force (e.m.f.)*.

.....

[1]

(b) Identify the part labelled **P**.

.....

[1]

(c) Sketch the voltage output graph for the induced e.m.f. showing **two** revolutions of the coil.



[2]

(d) State **one** way to increase the induced e.m.f.

.....

[1]

(e) Draw the circuit that could be connected to the output terminal to produce a direct current.

[1]

- (f) Transformers are essential in the transmission of electricity.
- (i) An alternating current in the primary coil of a transformer causes an e.m.f. in the secondary coil.

Name the process which causes this.

..... [1]

- (ii) A transformer with an input voltage of 18 V has 4 800 turns in the secondary coil and an output voltage of 240 V.

Calculate the number of turns in the primary coil. Write down the formula that you use.

Number of turns [3]

[10]

- 8 Fig. 8.1 shows a blast furnace, where iron is extracted from its ore.

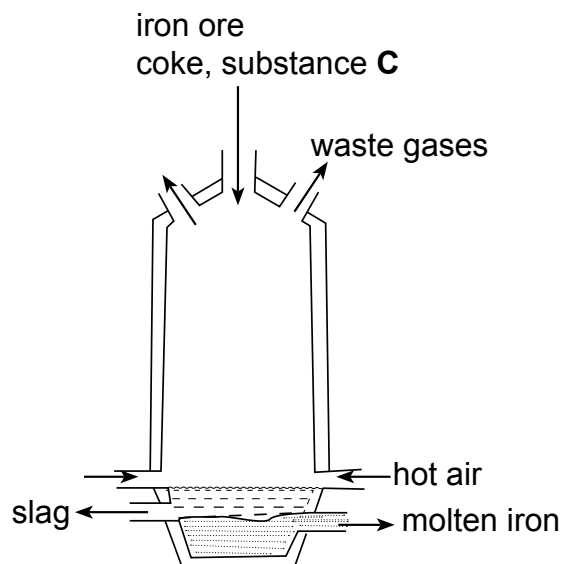
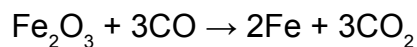


Fig. 8.1

The reaction equation is shown below.



- (a) Name substance **C**.

..... [1]

- (b) Carbon monoxide is formed from coke in two stages.

In stage 1, coke reacts (burns) in hot air to produce carbon dioxide.

- (i) Describe stage 2 of this reaction.

..... [1]

- (ii) Suggest the function of carbon monoxide in the extraction of iron from iron (III) oxide.

..... [1]

- (c) In another reaction, an iron nail is placed in blue copper (II) sulfate solution as shown in Fig. 8.2.

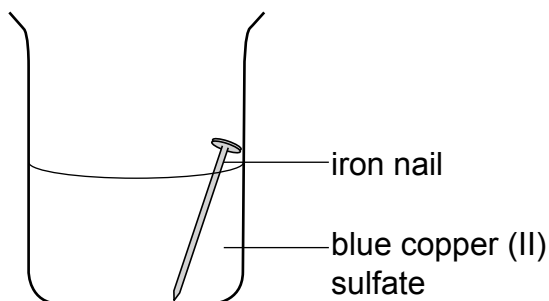


Fig. 8.2

- (i) Describe the observation that is made.

.....

[1]

- (ii) Explain why the iron nail reacts with copper (II) sulfate.

.....

[1]

- (iii) Give evidence from the information given in Fig. 8.2 that suggests that copper is a transition metal.

.....

[1]

- (d) Iron rusts.

Describe **one** method of rust prevention.

.....

[1]

[7]

- 9 Fig. 9.1 shows a flow chart of the production of limewater from limestone. Limestone is a form of calcium carbonate.

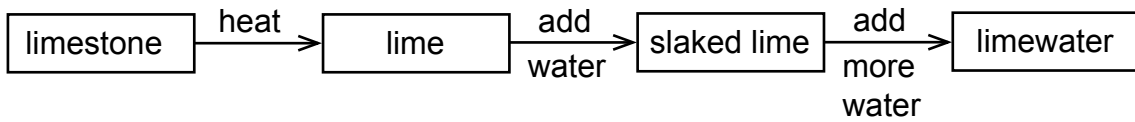
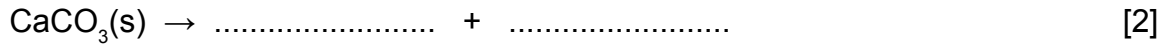


Fig. 9.1

- (a) Give the chemical name of slaked lime.

..... [1]

- (b) Complete the chemical equation to show the production of lime from limestone.



- (c) Give **one** use of limestone.

..... [1]

- (d) Calcium compounds such as limestone in rocks cause hardness in water.

- (i) State **one** compound that causes permanent hardness in water.

..... [1]

- (ii) Name **one** method of softening permanent hard water.

..... [1]

[6]

- 10 Fig.10.1 shows reactions of an unsaturated hydrocarbon **A**, which is the first in the homologous series of alkenes.

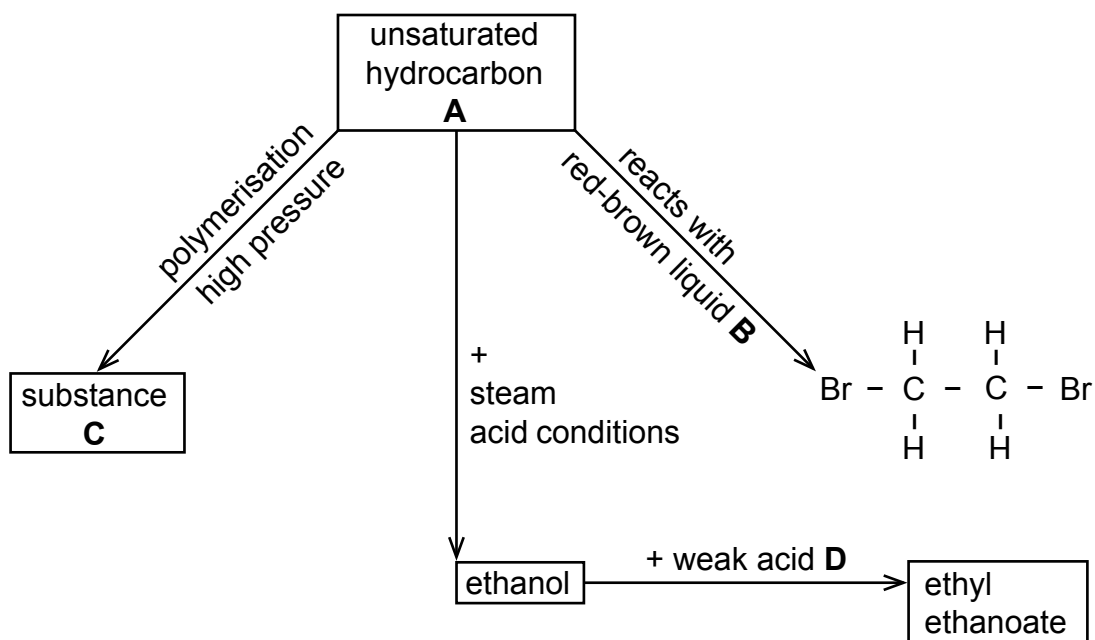


Fig. 10.1

- (a) Describe the meaning of the phrase homologous series.

.....

[1]

- (b) Deduce substances **A**, **B**, **C** and **D**.

A

B

C

D

[4]

- (c) Draw the structure of ethanol.

[2]

- (d) Give **one** use of ethanol.

.....

[1]

[8]

11 The types of radiation from a radioactive source are investigated by a scientist.

- (a) It was observed that the detector shows a count rate of 15 counts per minute even though there is no source present.

Explain why there is a count under these conditions.

..... [1]

- (b) The scientist then sets up the detector near to the radioactive source and observes the readings on the detector when different absorbers are placed between the source and the detector.

The readings are shown in Table 11.1.

Table 11.1

absorber	reading / counts per minute
none	3 329
sheet of paper	1 305
2 mm of aluminium	1 309
4 cm of lead	31

- (i) There are 3 types of radiation, alpha, beta and gamma.
Use Table 11.1 to determine which of these radiations were present in the radioactive source.

..... [2]

- (ii) State the number of protons and neutrons found in an alpha particle.

..... [2]

- (iii) Gamma rays pass between two electrically charged plates.

Describe what is observed.

..... [1]

- (c) Describe **one** safety precaution which must be taken when handling the radioactive source.

..... [1]

[7]

12 Table 12.1 shows sources of five pollutants, over a specified period of time.

Table 12.1

pollutant	source of pollution and mass of pollution produced / tonnes			
	cars	power stations	burning rubbish	other sources
sulfur dioxide	5	20	4	8
carbon monoxide	52	3	6	2
nitrogen dioxide	6	8	0.5	1
smoke	3	10	2	6
lead compounds	4	0	0	0

(a) Use Table 12.1 to determine which source produced the greatest mass of pollutants.

..... [1]

(b) Another pollutant, which is not listed in Table 12.1, is produced mostly by burning fossil fuels. This pollutant causes global warming.

(i) Name this pollutant.

..... [1]

(ii) State **one** effect of global warming.

..... [1]

(c) Carbon monoxide pollution is a major problem in cities.
Describe how carbon monoxide is formed.

..... [1]

(d) From the information in Table 12.1, the major source of sulfur dioxide is the power station.

(i) Suggest another industry in Namibia that could contribute to sulfur dioxide being formed.

..... [1]

(ii) Sulfur dioxide causes acid rain.

Name **one** other pollutant in the table that causes acid rain.

..... [1]

(e) According to Table 12.1, only cars emit lead compounds.

(i) Explain how the emission of lead compounds can be minimised in a car.

..... [1]

(ii) The catalytic converter in the car exhaust converts harmful gases into less harmless ones.

Name **two** gases that are released as products in the converter.

1

2 [2]

[9]

DATA SHEET
The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0
7	9	1							4
Li Lithium 3	Be Beryllium 4	H Hydrogen 1							He Helium 2
23	24								20
Na Sodium 11	Mg Magnesium 12								Ne Neon 10
39	40								40
K Potassium 19	Ca Calcium 20								Ar Argon 18
85	88								84
Rb Rubidium 37	Sr Strontium 38								Kr Krypton 36
133	137								131
Cs Caesium 55	Ba Barium 56								Xe Xenon 54
226	227								86
Fr Francium 87	Ra Radium 88								Rn Radon 86
*58 - 71 Lanthanoid series †90 - 103 Actinoid series									
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 20px;"> Key a X b </div> <div style="margin-right: 20px;"> a = relative atomic mass X = atomic symbol b = proton (atomic) number </div> </div>									

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).