



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CO-ORDINATED SCIENCES

0654/02

Paper 2 (Core)

May/June 2007

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use

1	
2	
3	
4	
5	
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7	
8	
9	
10	
11	
Total	

This document consists of **23** printed pages and **1** blank page.



1 (a) Fig. 1.1 shows the arrangement of molecules of water when it is a solid (ice), a liquid (water) and a gas (steam).

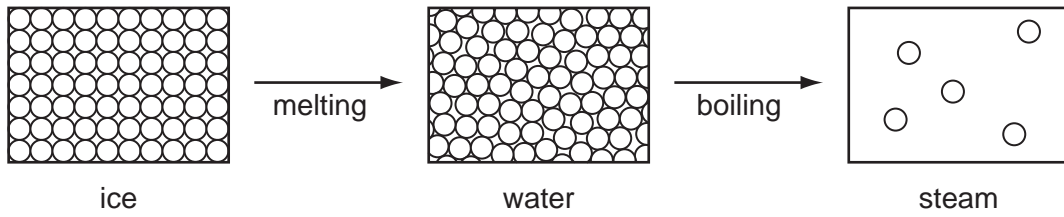


Fig. 1.1

Complete the table by putting ticks into the appropriate boxes.

state	molecules have least energy	molecules have most energy	molecules are least strongly attracted to each other	molecules occupy fixed positions
ice				
water				
steam				

[4]

(b) A beaker contains warm water.

Some of the water evaporates.

Describe and explain what is happening to the molecules as the water evaporates.

.....

.....

.....

.....

[2]

3

(c) Fig. 1.2 shows an ice cube with sides of 2 cm.
The ice cube has a mass of 7.36 g.

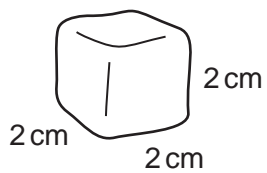


Fig. 1.2

Calculate the density of ice.

Show your working.

.....g/cm³ [2]

2 Fig. 2.1 shows the contents of the thorax and details of one alveolus.

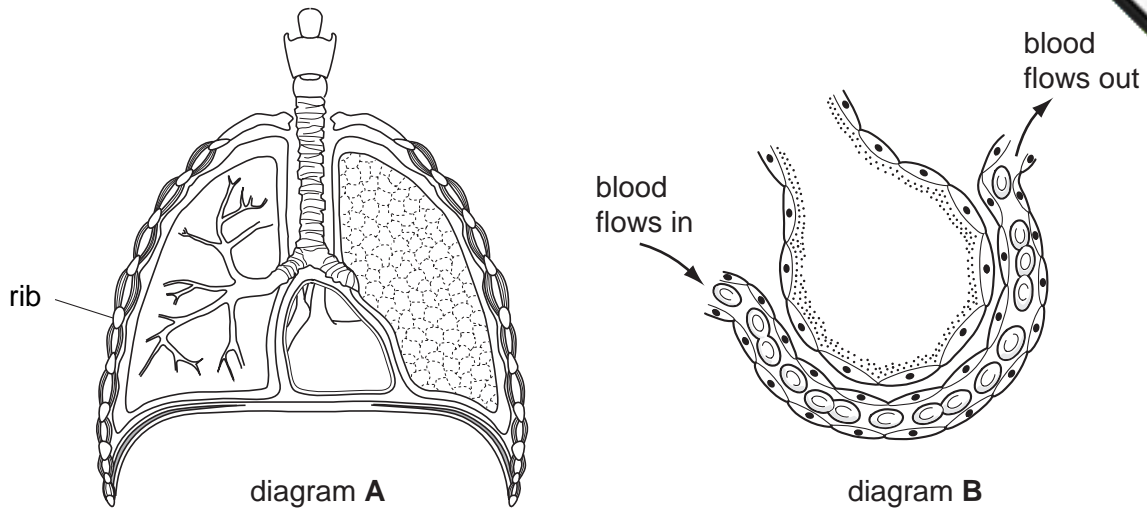


Fig. 2.1

(a) On diagram A, write the letter X in a place where the alveolus in diagram B could be found. [1]

(b) As air is drawn into the lungs, it flows through tubes lined with a tissue containing goblet cells and ciliated cells.

(i) Explain the meaning of the term *tissue*.

.....

.....

..... [2]

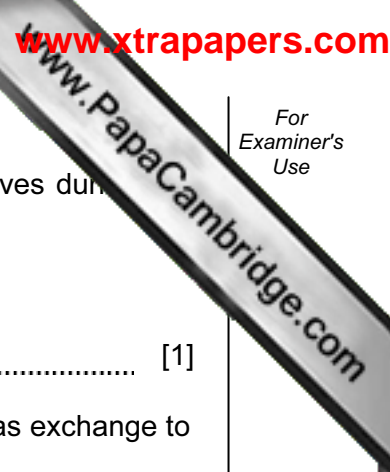
(ii) On diagram A, write the letter Y where this tissue could be found. [1]

(iii) Explain how this tissue helps to prevent infections in the lungs.

.....

.....

..... [2]



(c) (i) On diagram **B**, carefully draw an arrow to show where oxygen moves during gas exchange.

(ii) Name the process by which the oxygen moves.

..... [1]

(iii) Explain **one** way in which the structures shown in diagram **B** help gas exchange to occur efficiently.

.....
.....
.....
..... [2]

3 The following list shows some properties of the element copper.

- electrical conductor
- shiny
- high density
- sonorous
- malleable
- unreactive

(a) Choose **one** property from the list which explains each of the following statements.

(i) Copper metal sometimes occurs uncombined (native) in the Earth's crust.
..... [1]

(ii) Copper can be rolled into thin sheets.
..... [1]

(iii) Copper is widely used in the form of wire.
..... [1]

(b) A student carried out an experiment involving the black solid, copper(II) oxide. Fig. 3.1 shows details of her experiment.

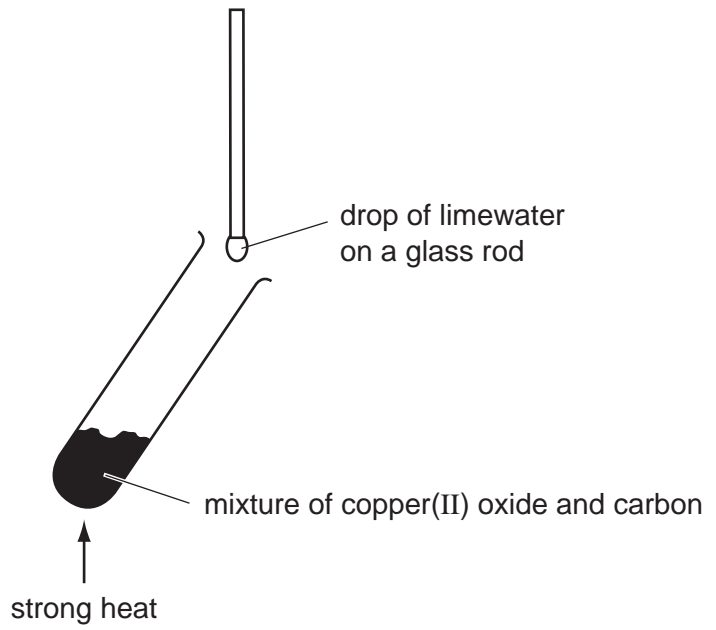


Fig. 3.1

During the reaction the student recorded the following observations.

- observations
1. After much heating, the mixture suddenly glowed even when the bunsen burner was removed.
 2. The drop of limewater went cloudy.
 3. When the mixture stopped glowing it contained traces of a brown solid.

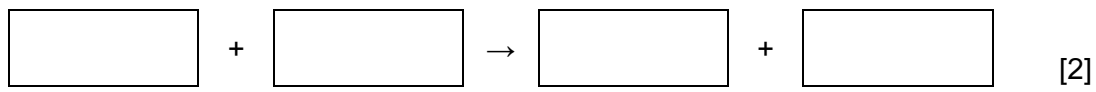
(i) State which observation, 1, 2 or 3, showed that an exothermic reaction had occurred.

..... [1]

(ii) Name the gas which is produced in this reaction.

..... [1]

(iii) Write a word equation for the reaction which occurred in the experiment in Fig. 3.1.



(c) Copper is a transition metal. State two properties of transition metals which are different from those of alkali metals.

1.
.....

2.
..... [2]

- 4 (a) A car of mass 1200 kg is travelling forward at a constant speed of 20 m/s. Fig. 4.1 shows the driving force and the frictional force acting on the car.

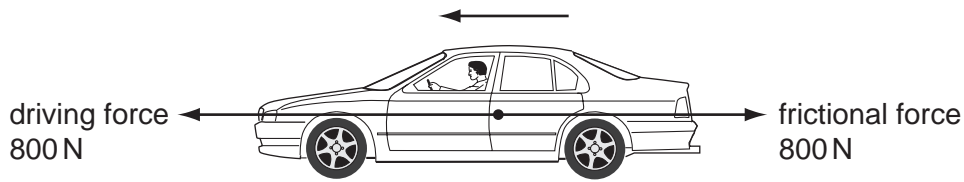


Fig. 4.1

- (i) Explain why the car does not accelerate.

.....
 [1]

- (ii) Calculate the distance travelled by the car in 30 seconds.

State the formula that you use and show your working.

formula used

working

..... m [2]

- (iii) Calculate the work done by the driving force in 30 seconds.

State the formula that you use and show your working.

formula used

working

..... J [2]

(b) A pedestrian steps into the path of the moving car. Fig. 4.2 shows a graph of the speed of the car changes from the moment when the driver sees the pedestrian until the car stops.

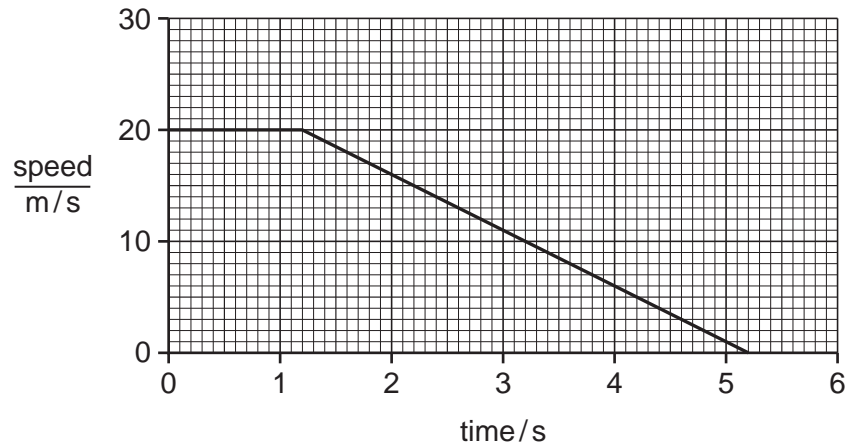


Fig. 4.2

How long does it take between the driver seeing the pedestrian and the brakes being applied?

Explain your answer.

time taken seconds

explanation

..... [2]

(c) A police car uses a siren and a blue light to alert people.

(i) Explain why sound needs a medium, such as air, to travel through.

.....
.....
..... [2]

(ii) How will the sound of the siren change if the amplitude of the sound waves emitted is increased?

..... [1]

(d) The police communicate using radio waves. Both blue light and radio waves are part of the electromagnetic spectrum.

(i) State **one** property which all electromagnetic waves have in common.

..... [1]

(ii) State **one** difference between blue light waves and radio waves.

..... [1]

5 Fig. 5.1 shows three bones from the arm and shoulder.

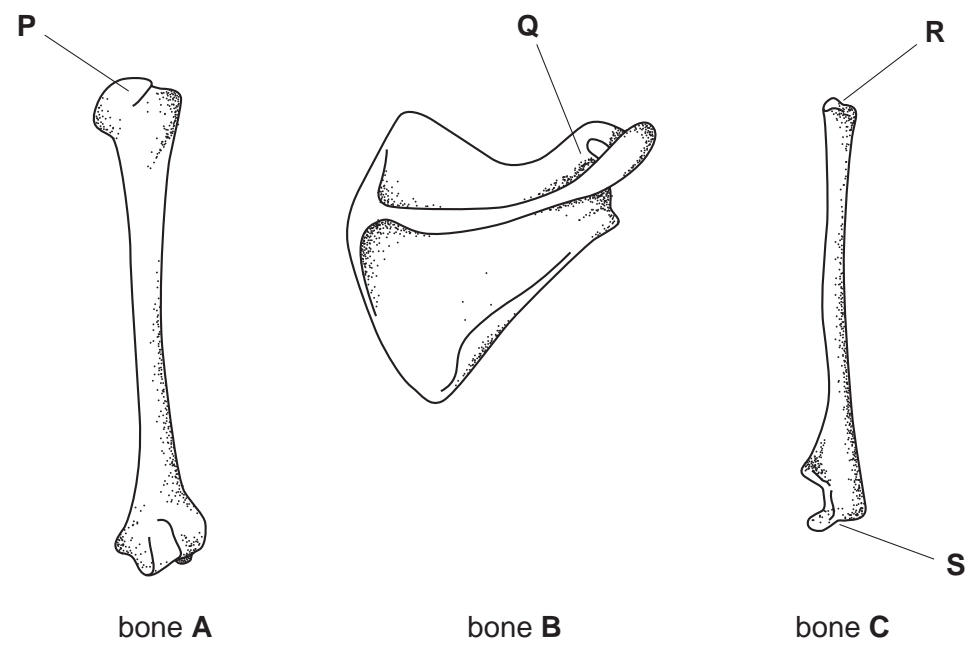


Fig. 5.1

(a) (i) Which bone, A, B or C, is the humerus?

..... [1]

(ii) Give the letter of the place on the bones with which P forms a joint.

..... [1]

(b) Describe how synovial fluid helps bones to move easily at a synovial joint.

.....
..... [1]

(c) Describe one difference between the properties of bone and cartilage, and explain how this helps them to carry out their functions.

difference

how this relates to their functions

.....

.....

..... [3]

6 (a) Glucose and starch are carbohydrates.

(i) The chemical formula of glucose is $C_6H_{12}O_6$.

State the total number of atoms which are combined in one molecule of glucose.

..... [1]

(ii) Starch is a polymer which has been formed from glucose.

Explain the meaning of this statement.

.....
.....
..... [2]

(b) Proteins are polymers which have been formed from amino acids.

Fig. 6.1 shows an amino acid called cysteine.

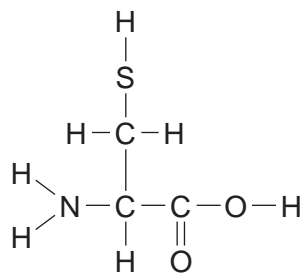


Fig. 6.1

(i) Give **one** reason why the molecule in Fig. 6.1 is not a carbohydrate.

.....
..... [1]

(ii) Cysteine was present in the bodies of sea creatures that long ago were changed into petroleum (crude oil). This means that petroleum contains sulphur.

Explain why sulphur should be removed from fuels made from petroleum.

.....
.....
.....
..... [3]

(c) Salicin is an analgesic which was first extracted from the bark and leaves of the tree. Chemists converted salicin into the more effective drug, aspirin.

(i) Why would a person take an analgesic?

.....
..... [1]

(ii) Suggest **one** reason why drugs like aspirin must be highly purified.

.....
..... [1]

7 In many power stations very hot steam under pressure is used to transfer energy to turbines. The turbines then turn the generators.

The heat energy to change water into steam may come from nuclear fuel or a fossil fuel.

When fossil fuels are burned to release their energy, waste products including carbon dioxide are produced.

(a) (i) Name the gas in the atmosphere which reacts with the elements in fossil fuels when they are burned.

..... [1]

(ii) Waste gases from power stations contribute to higher levels of carbon dioxide in the atmosphere.

What effect are these rising levels of carbon dioxide thought to have on the environment?

.....
..... [1]

(b) (i) Fossil fuels are non-renewable.

Explain the meaning of the term *non-renewable*.

..... [1]

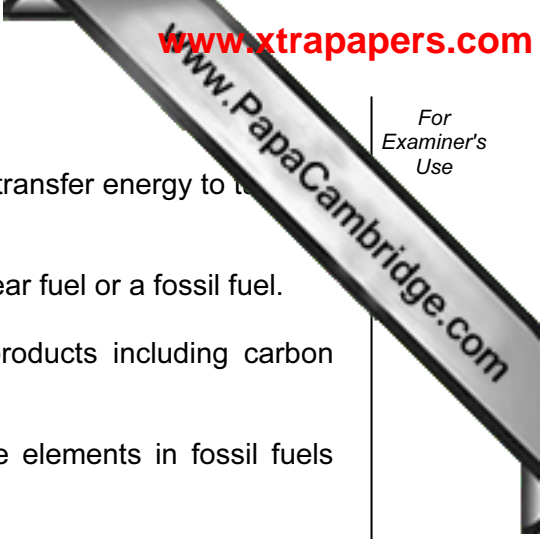
(ii) Name **one** renewable energy resource.

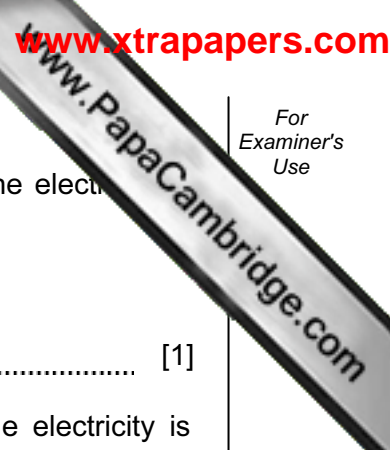
..... [1]

(c) Gas fired power stations are said to be 60% energy-efficient.

Explain what this means.

.....
..... [1]





(d) After electricity has been generated, the voltage is increased before the electricity is transmitted through power lines.

(i) Name the device which increases the voltage of the electricity.

..... [1]

(ii) Explain why it is advantageous to increase the voltage before the electricity is transmitted through power lines.

.....
..... [1]

(e) A turbine in a gas-fired power station is made of a nickel alloy.

(i) Explain the meaning of the term *alloy*.

..... [1]

(ii) Suggest a reason for using a nickel alloy rather than pure nickel.

..... [1]

8 (a) (i) Name a part of the cell in which chromosomes are found.

.....

(ii) What is the chemical from which chromosomes are made?

.....

[1]

If fruit flies are exposed to X-rays, mutations may take place in the cells of their testes and ovaries.

An experiment was carried out into the effect of different doses of X-rays on the sperm cells produced by male fruit flies. Fig. 8.1 shows the results.

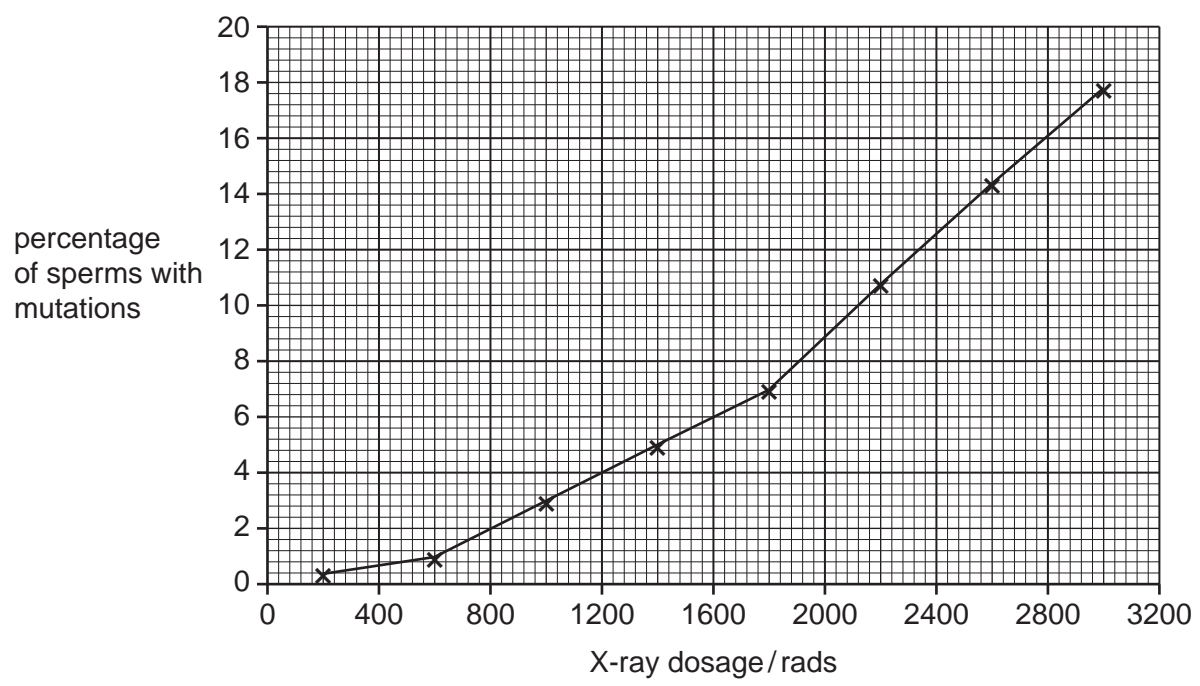


Fig. 8.1

(b) (i) State what is meant by a *mutation*.

.....

.....

[1]

(ii) Describe the effect of increasing the X-ray dose on the percentage of mutated sperms.

.....

.....

.....

[2]

(iii) If 200 sperms were exposed to an X-ray dosage of 1000 rads, use the graph to estimate the number that would have mutations.

..... [1]

(iv) Explain how X-rays cause mutations.

.....
.....
.....
..... [2]

(c) Fruit flies have four pairs of chromosomes in their cells.

Some of the mutations in the experiment above involved the loss of one chromosome.

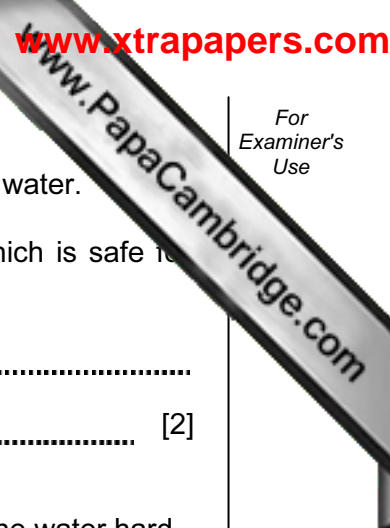
(i) How many chromosomes are there in a normal sperm of a fruit fly?

..... [1]

(ii) A fruit fly sperm that had lost one chromosome fertilised a normal egg.

How many chromosomes would there be in the zygote?

..... [1]



9 In many countries supplies of clean water for drinking are obtained from river water.

(a) State two processes that are used to convert river water into water which is safe for humans to drink.

- 1. [2]
- 2. [2]

(b) Safe drinking water may still contain dissolved compounds which make the water hard.

(i) Name a metallic element whose compounds cause hardness in water.
..... [1]

(ii) Suggest a reason why some natural water supplies are hard and others are not.
.....
..... [1]

(iii) Describe how a soap solution can be used to find out whether a sample of water is hard.
.....
.....
..... [2]

(iv) Some types of water are said to contain temporary hardness. Describe **one** way in which temporary hardness may be removed from water.
.....
..... [1]

(c) Some types of salt used to flavour food are mixtures of sodium chloride and potassium chloride. Sodium chloride and potassium chloride are both ionic compounds.

(i) Describe and explain the difference between a sodium atom and a sodium ion.

.....
.....
..... [2]

Sodium chloride and potassium chloride are both very soluble in water. Fig. 9.1 shows how the solubilities of these salts change with temperature.

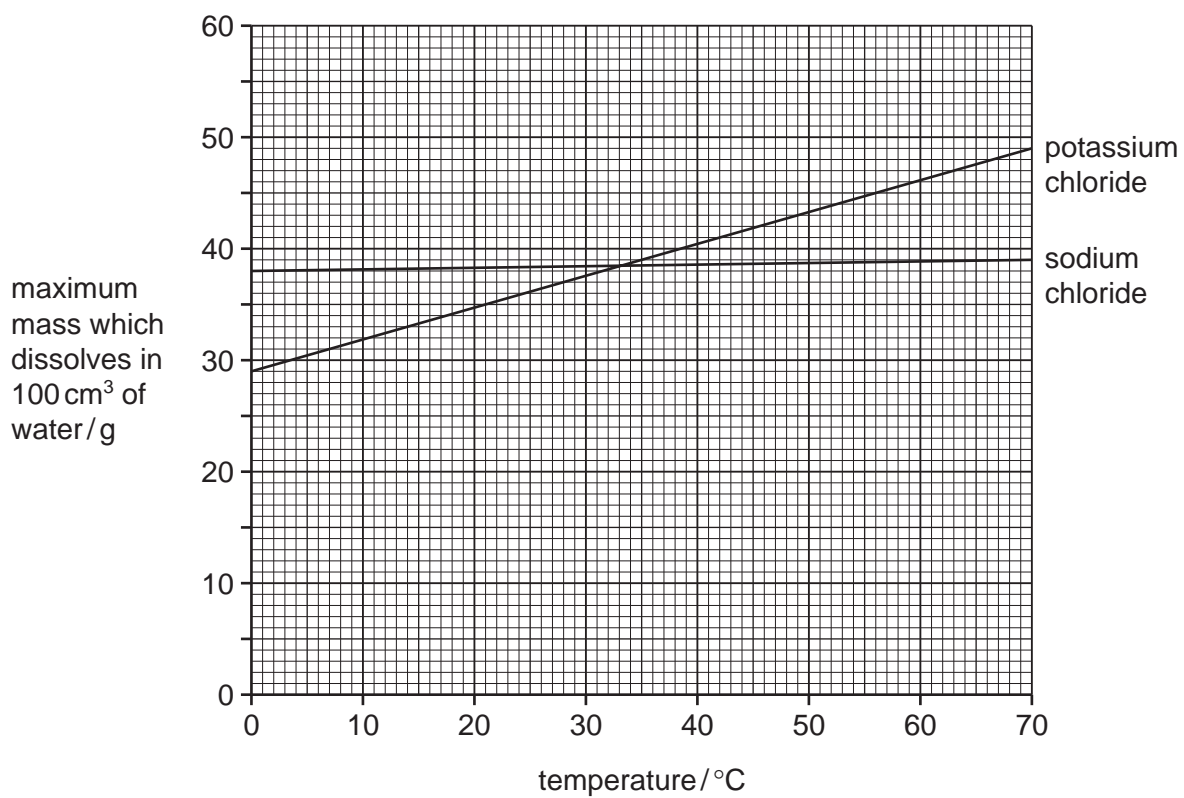


Fig. 9.1

(ii) What conclusions can be drawn from Fig. 9.1 about the effect of temperature on the solubilities of the two salts?

.....
.....
..... [2]

(iii) At what temperature do the salts have the same solubility?

..... °C [1]

10 Fig. 10.1 shows a circuit containing four ammeters, A_1 , A_2 , A_3 and A_4 .

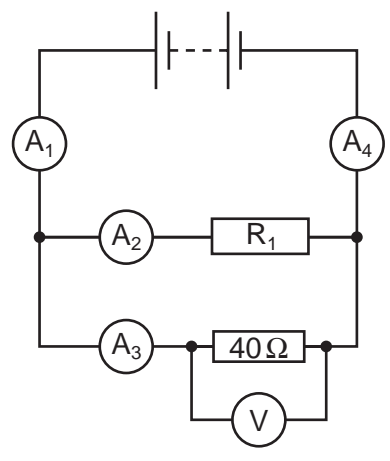


Fig. 10.1

Table 10.1 shows the readings on each ammeter.

Table 10.1

ammeter	reading on ammeter / amps
A_1	0.5
A_2	0.2
A_3	0.3
A_4	0.5

(a) Electric current is a flow of electrical charge.

(i) State the name of the particle that carries charge around an electrical circuit.

..... [1]

(ii) State the unit of electrical charge.

..... [1]

(b) (i) Which **one** of the following statements about the resistor R_1 in Fig. 10.1 is correct? Tick the correct box.

The resistance of R_1 is less than 40Ω .

The resistance of R_1 is equal to 40Ω .

The resistance of R_1 is greater than 40Ω .

[1]

(ii) Explain your answer.

..... [1]

(c) (i) Write down the equation connecting resistance R , potential difference V and current I .

..... [1]

(ii) Calculate the reading on the voltmeter.

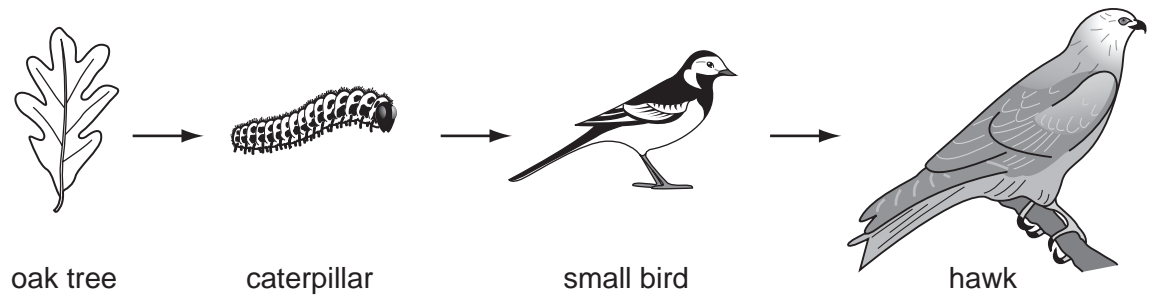
Show your working.

.....V [1]

(iii) State the potential difference across the power supply.

.....V [1]

11 The diagram shows a food chain.



(a) Name the primary consumer in this food chain.

..... [1]

(b) Explain **one** way in which hawks are adapted to be predators.

.....
.....
..... [2]

(c) The arrows in the food chain show the direction of energy flow.

(i) Name the process by which the oak tree transfers energy from sunlight into energy in glucose.

..... [1]

(ii) Name the green pigment that absorbs energy from sunlight.

..... [1]

(d) An oak tree can be many metres tall.

Describe and explain how water from the soil is transported up to the leaves at the top of the tree.

.....
.....
.....
.....
.....
..... [3]

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DATA SHEET
The Periodic Table of the Elements

		Group														
	I	II	III	IV	V	VI	VII	VIII	IX	X	0					
			1 H Hydrogen 1								4 He Helium 2					
7 Li Lithium 3	9 Be Beryllium 4										20 Ne Neon 10					
23 Na Sodium 11	24 Mg Magnesium 12		5 B Boron 5	11 Al Aluminium 13	12 C Carbon 6	14 N Nitrogen 7	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18	40 Ca Calcium 20					
39 K Potassium 19	40 Ca Calcium 20		11 B Boron 5	12 C Carbon 6	13 Si Silicon 14	14 N Nitrogen 7	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18	84 Kr Krypton 36					
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	56 Fe Iron 26	55 Mn Manganese 25	59 Co Cobalt 27	58 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36		
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	101 Ru Ruthenium 44	100 Tc Technetium 43	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	126 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54		
226 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89	190 Os Osmium 76	186 Re Rhenium 75	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	210 Rn Radon 86		
			140 Ce Cerium 58	141 Pr Praseodymium 59	142 Nd Neodymium 60	143 Pm Promethium 61	144 Sm Samarium 62	145 Eu Europium 63	146 Gd Gadolinium 64	147 Tb Terbium 65	148 Dy Dysprosium 66	149 Ho Holmium 67	150 Er Erbium 68	151 Tm Thulium 69	152 Yb Ytterbium 70	153 Lu Lutetium 71
			232 Th Thorium 90	231 Pa Protactinium 91	232 U Uranium 92	233 Np Neptunium 93	234 Pu Plutonium 94	235 Am Americium 95	236 Cm Curium 96	237 Bk Berkelium 97	238 Cf Californium 98	239 Es Einsteinium 99	240 Fm Fermium 100	241 Md Mendelevium 101	242 No Nobelium 102	243 Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

a	X
b	

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