UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7763852044

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	
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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).

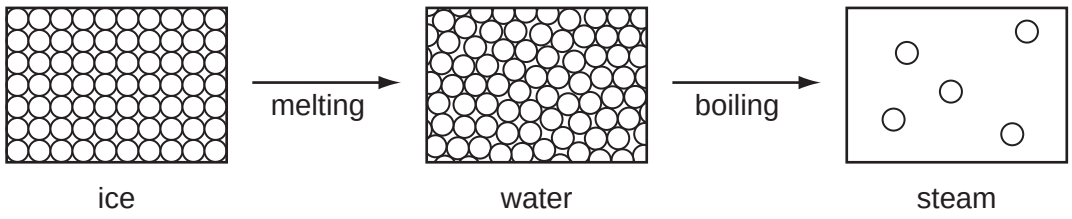


Fig. 1.1

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]

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

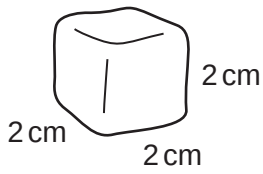


Fig. 1.2

Calculate the density of ice.

Show your working.

.....g / cm^3 [2]

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

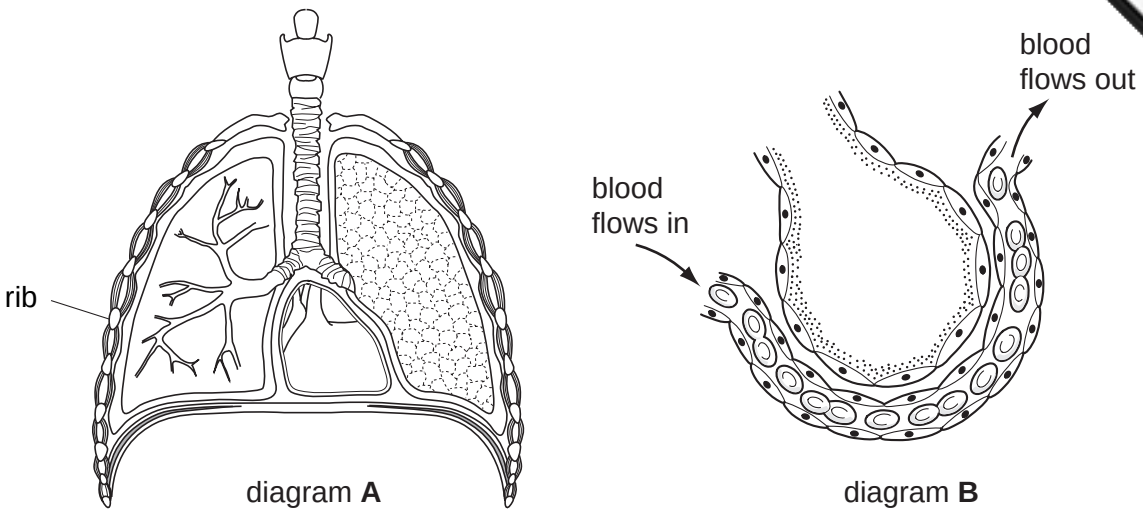


Fig. 2.1

(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 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.

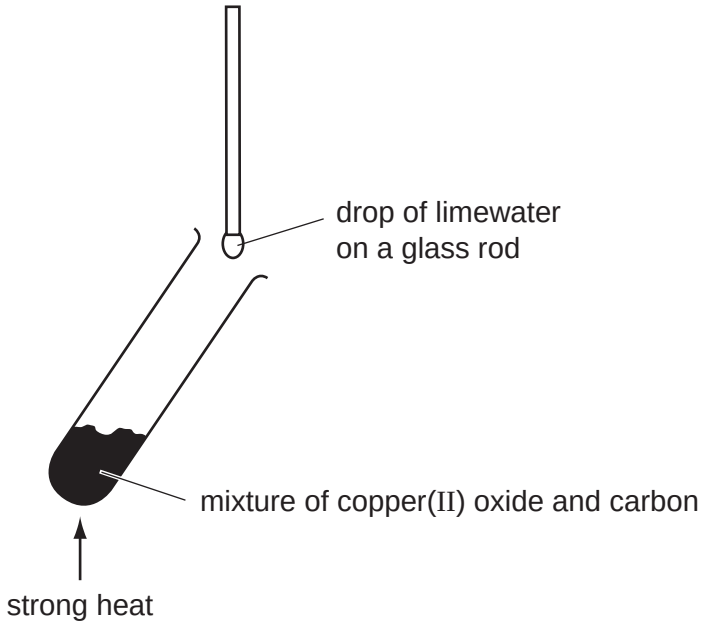


Fig. 3.1

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.

[ ] + [ ] → [ ] + [ ] [2]

(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.

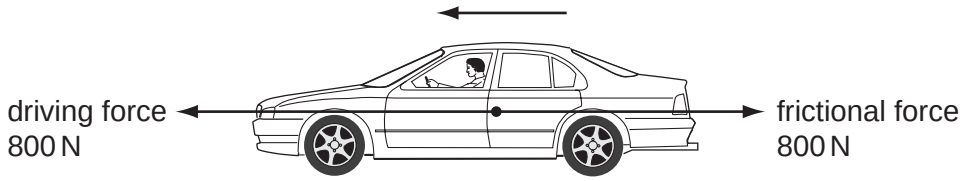


Fig. 4.1

(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 h speed of the car changes from the moment when the driver sees the pedestrian the car stops.

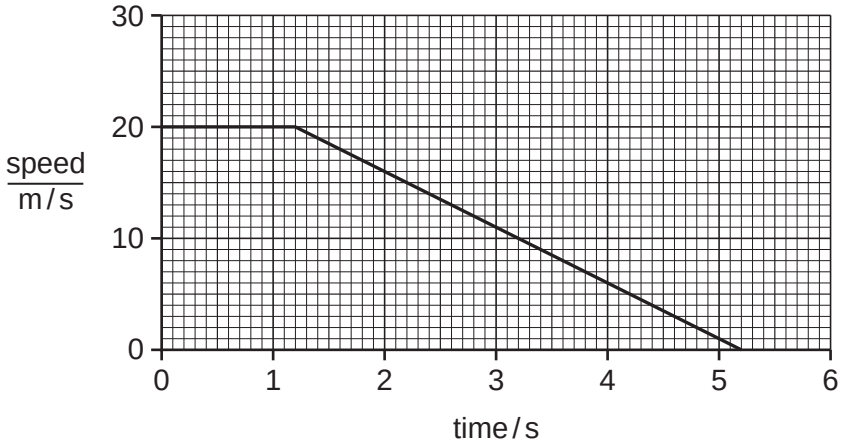


Fig. 4.2

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.

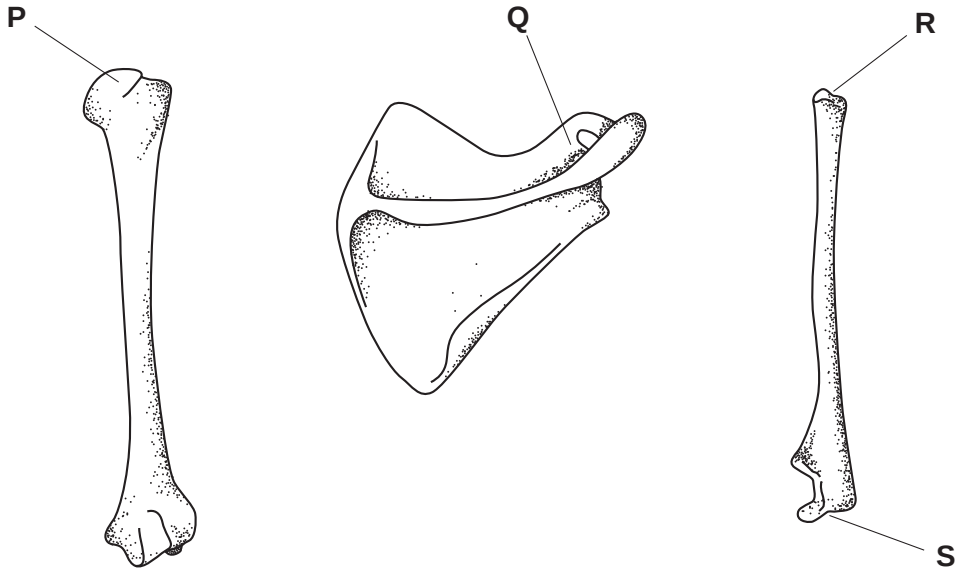
(i) State **one** property which all electromagnetic waves have in common.

..... [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.



bone **A** bone **B** bone **C**

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.

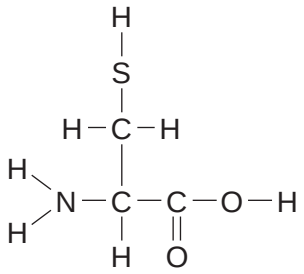


Fig. 6.1

(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 t 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.

.....

[1]

(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.

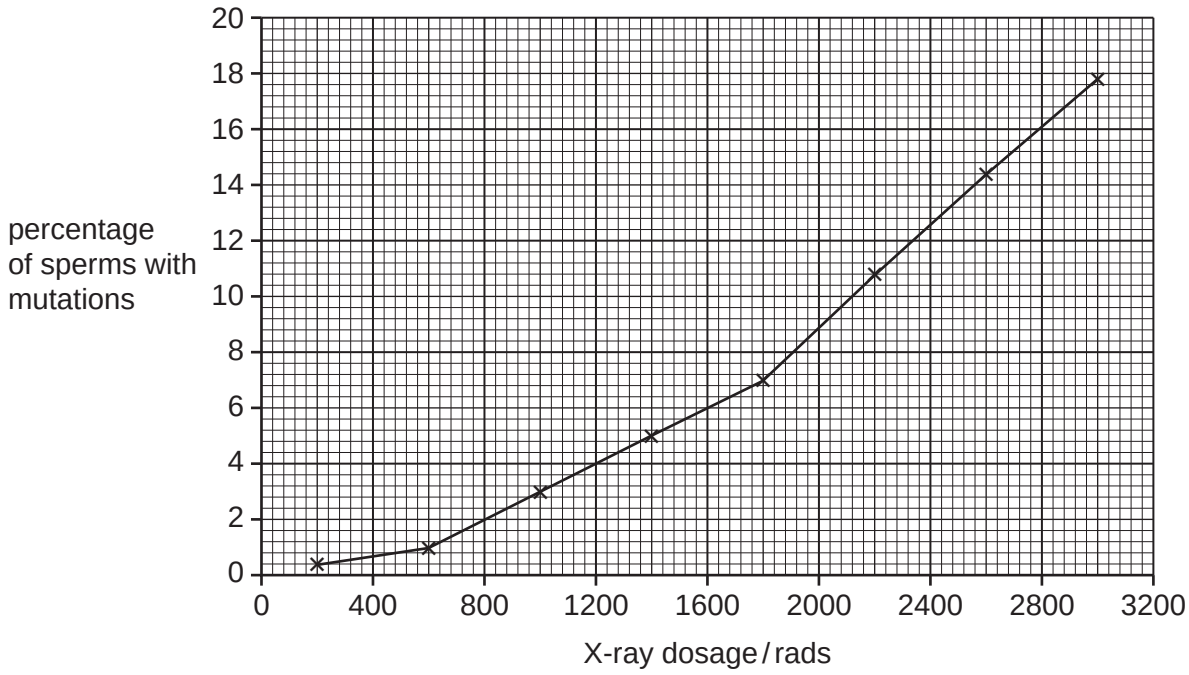


Fig. 8.1

(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 gr... 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]

(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 pot 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.

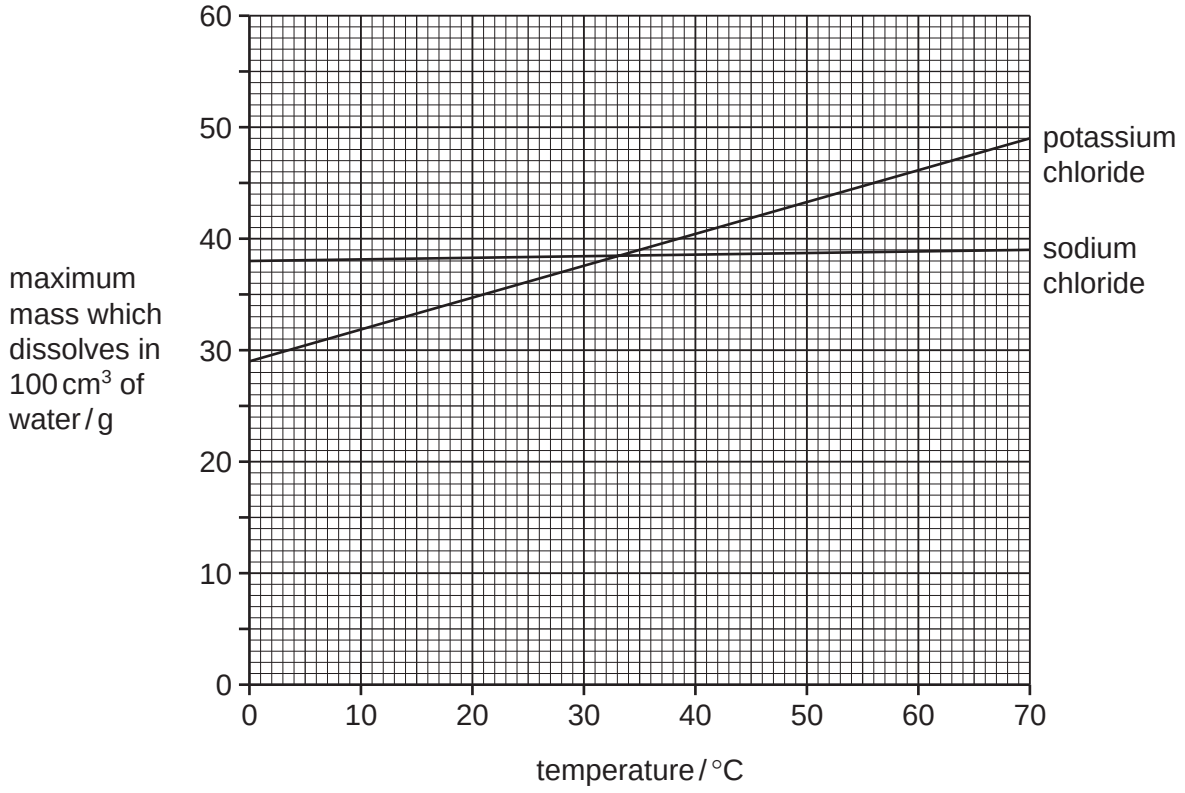


Fig. 9.1

(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, $\mathbf{A_1}$, $\mathbf{A_2}$, $\mathbf{A_3}$ and $\mathbf{A_4}$.

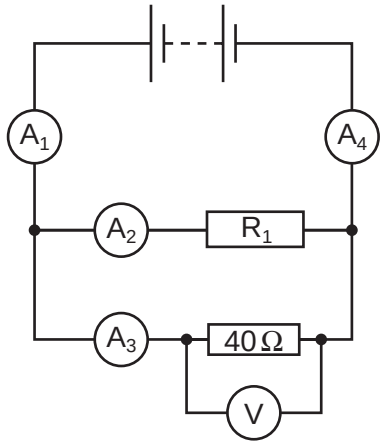


Fig. 10.1

Table 10.1 shows the readings on each ammeter.

Table 10.1

ammeter	reading on ammeter / amps
$\mathbf{A_1}$	0.5
$\mathbf{A_2}$	0.2
$\mathbf{A_3}$	0.3
$\mathbf{A_4}$	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 $\mathbf{R_1}$ in Fig. 10.1 is c
Tick the correct box.

The resistance of $\mathbf{R_1}$ is less than 40 Ω. ☐

The resistance of $\mathbf{R_1}$ is equal to 40 Ω. ☐

The resistance of $\mathbf{R_1}$ is greater than 40 Ω. ☐ [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.

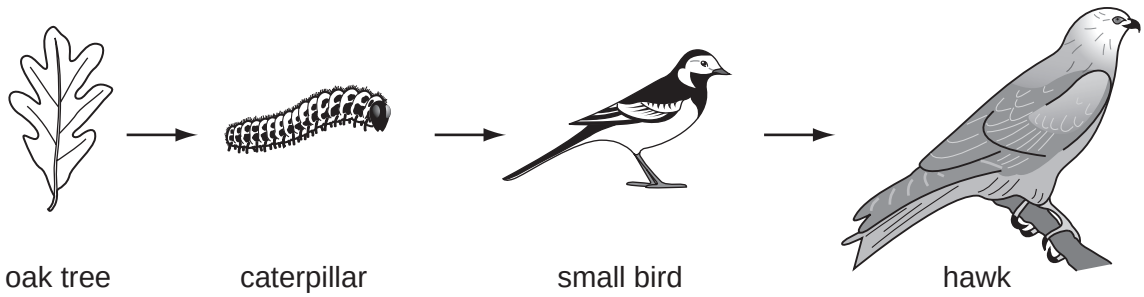
Show your working.

.....V [1]

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

.....V [1]

11 The diagram shows a food chain.



oak tree → caterpillar → small bird → hawk

(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	0
							1 **H** Hydrogen 1										4 **He** Helium 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
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulphur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
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	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
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**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
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **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	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

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

Key: a = relative atomic mass; **X** = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).