# Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

COMBINED SCIENCE 0653/23

Paper 2 (Core) **May/June 2016**
1 hour 15 minutes

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 20.

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.

This document consists of **20** printed pages.

International Examinations

[Turn over

1 Fig. 1.1 shows some parts of the human alimentary canal and its associated organs.
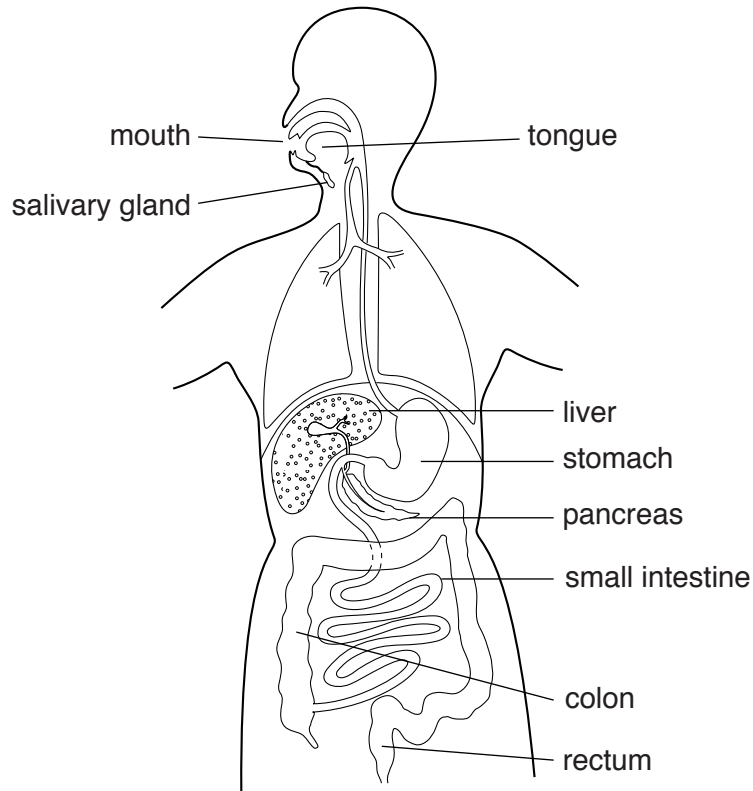
Fig. 1.1

(a) Use the labels in Fig. 1.1 to complete Table 1.1.

Table 1.1

function	name of organ(s)
ingestion	....
absorption of digested food	....
secrete digestive enzymes	stomach and .... and ....

[4]

(b) After the absorption of digested food, the blood takes the nutrients to the body cells.

State the part of the blood that transports dissolved nutrients.

.... [1]

3

(c) Fig. 1.2 shows a section of a capillary next to some body cells.
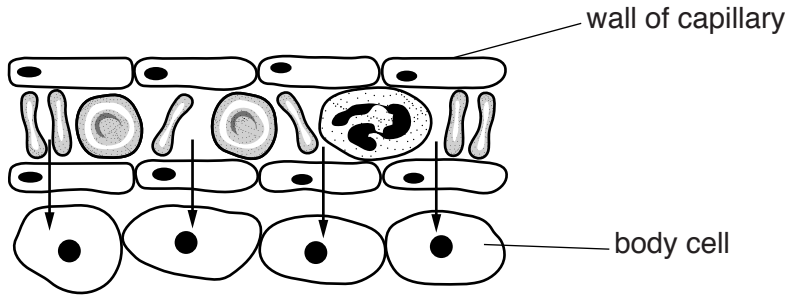
Fig. 1.2

Describe the process by which glucose moves in the direction shown by the arrows.

....

....

.... [2]

(d) Fig. 1.3 shows the effect of pH on the activity of an enzyme which is secreted into the food in the stomach. The environment in the stomach has a low pH because of the presence of hydrochloric acid.
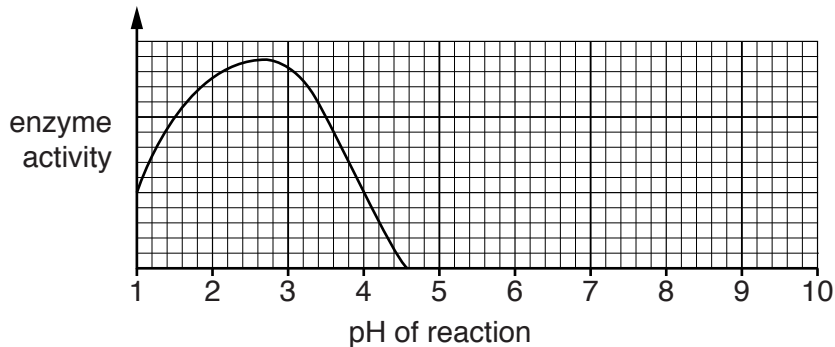

Fig. 1.3

(i) State the optimum pH for this enzyme.

.... [1]

(ii) The stomach contents enter the duodenum. The pH in the duodenum is approximately 8.

Suggest what happens to the activity of the enzyme when it enters the duodenum. Explain your answer.

....

....

....

.... [2]

2 **(a)** Lead bromide can be broken down into its elements using the apparatus shown in Fig. 2.1.

d.c. power supply

electrode **A**

molten lead bromide
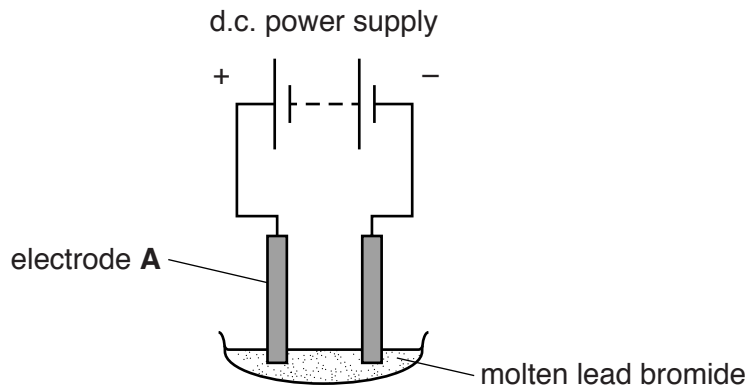
Fig. 2.1

(i) Name the process shown in Fig. 2.1.

.... [1]

(ii) Name the element produced at electrode **A** and state the colour of this element.

name ....

colour ....
[2]

(b) In a similar process, copper chloride is broken down into a metal and chlorine.

Write the word equation for this reaction.

.... [1]

(c) (i) Describe the trend in the boiling points of the elements going down Group VII of the Periodic Table, from chlorine to iodine.

.... [1]

(ii) Fluorine is another element in Group VII. Fig. 2.2 shows an atom of fluorine.

....

....

....
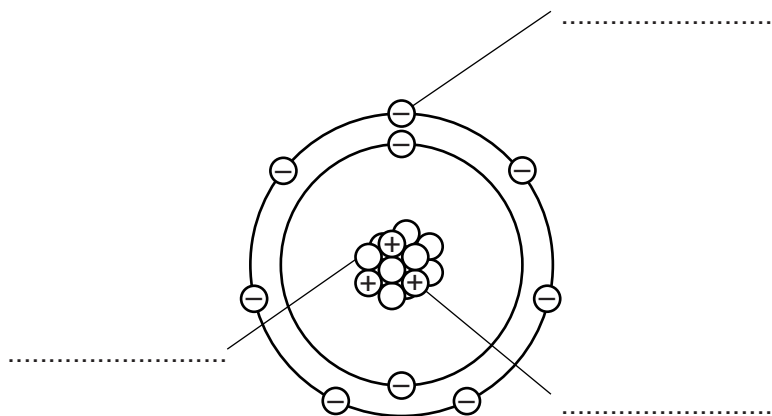
Fig. 2.2

Not all of the particles present in the atom of fluorine are shown.

Label the particles shown in Fig. 2.2. [3]

(iii) State what is meant by the term *nucleon number*.

....

.... [1]

3 Fig. 3.1 shows a small cart on 4 wheels with no engine. The cart runs down a sloping track steered by a driver.
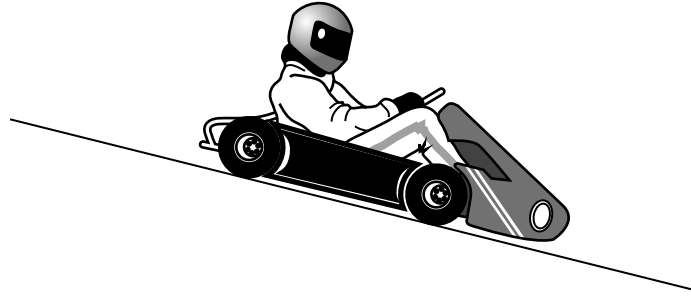
Fig. 3.1

(a) Name the force that causes the cart to move down the slope.

.... [1]

(b) Fig. 3.2 shows the track becoming horizontal at the bottom of the slope.
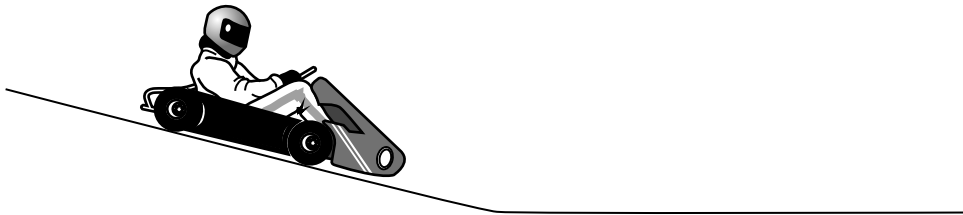
Fig. 3.2

(i) The force in part **(a)** may change the motion of the cart along the horizontal track.

Tick the box alongside the statement that describes the effect of this force.

Give a reason for your choice.

It increases the speed of the cart. ☐

It does not affect the speed of the cart. ☐

It decreases the speed of the cart. ☐

....

.... [1]

(ii) The cart moves along the horizontal track at an average speed of 8 m / s for a distance of 20 m before the driver applies the brakes.

Calculate the time taken to travel this distance.

State the formula you use, and show your working.

formula

working

time = ... s [2]

(iii) After applying the brakes, the cart comes to a stop in 10 m.

On the axes in Fig. 3.3, sketch the speed / time graph for the journey of the cart from the start of the horizontal track until it stops. (Scales and numbers are NOT required).

speed

time
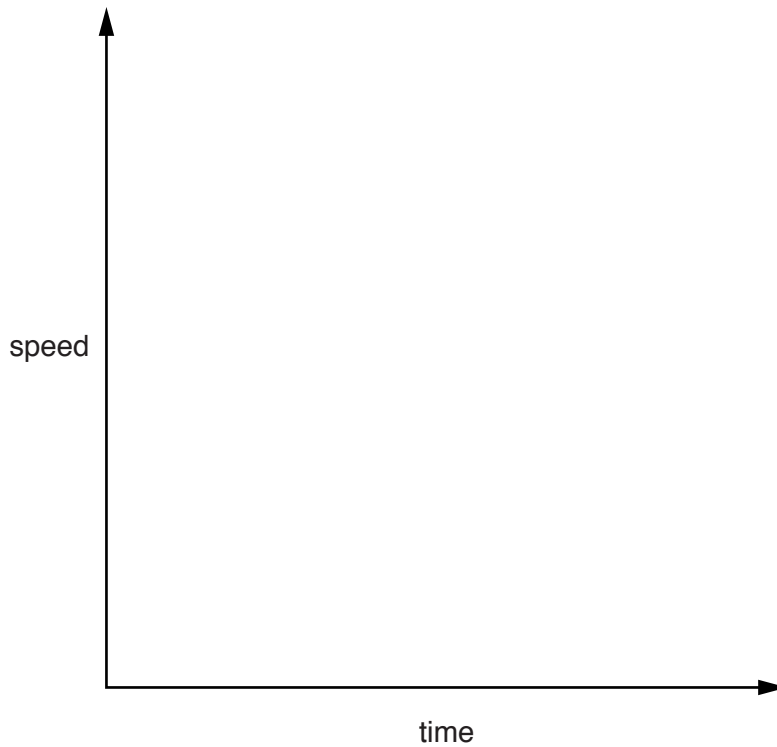
Fig. 3.3

[2]

(c) Complete the energy transfers that take place while the cart is moving.

From .... energy at the top of the slope

to .... *kinetic* .... energy on the track

to .... energy as the cart stops.

[2]

 [Turn over

4   Fig. 4.1 shows a germinating seed and a diagram of one of the root hair cells.

soil particles

root hair area
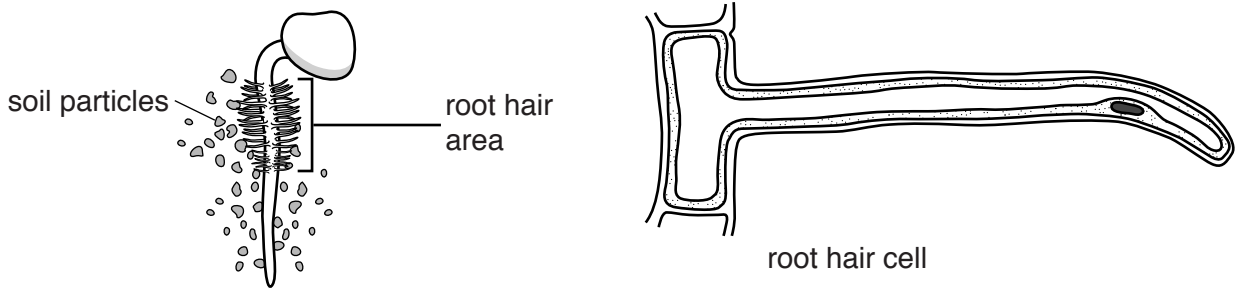
root hair cell

Fig. 4.1

(a) Use the following terms to complete the sentences.

You may use each term once, more than once, or not at all.

amino acids   cell membrane   cell wall   ions   nucleus

phloem   photosynthesis   respiration   transpiration   xylem

The root hair cell has a .... to control what enters and

leaves the cell. The main function of this cell is to absorb water and

.... Water goes from the root hair cell to the

.... to be taken to the rest of the plant. Water

evaporates from the plant by ....   [4]

(b) Study the germinating seed in Fig. 4.1.

Suggest why the root hair cells constantly have to be replaced as the root grows.

....

....

.... [1]

(c) A few days later the germinated seed in Fig. 4.1 develops leaves above ground and starts to photosynthesise.

(i) Write the word equation for photosynthesis.

.... [2]

(ii) List **two** conditions needed for photosynthesis.

1. ....

2. ....
[2]

5   Petroleum is a mixture of hydrocarbons. Fig. 5.1 shows how it is separated into useful products.
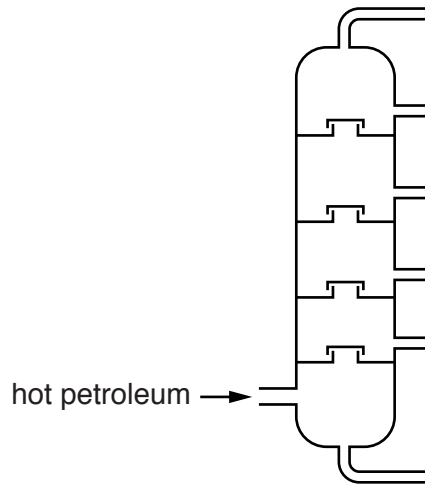
hot petroleum →

Fig. 5.1

(a) (i)   Name the process shown in Fig. 5.1.

.... [1]

(ii)   State what is meant by a *hydrocarbon*.

....

.... [2]

(b) Natural gas is often found with petroleum when it is extracted from the Earth's crust. It burns in air.

(i)   Name the main constituent of natural gas.

.... [1]

(ii)   Name the gas in air that reacts with natural gas when it burns.

.... [1]

(c) Ethanol, C_2H_5OH, is a compound made from petroleum.

    (i) Complete the diagram to show the structure of one molecule of ethanol.

$$-\overset{\displaystyle |}{\underset{\displaystyle |}{C}}-O$$
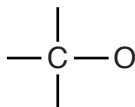
[2]

    (ii) Ethanol and hydrocarbons burn to form the same products.

        Name the two substances formed during the complete combustion of ethanol.

        1. ....

        2. ....

[2]

6 Global warming causes ice caps to melt. This causes a rise in sea level.

(a) Warming of the water in the oceans causes the sea level to rise for a different reason.

Explain this reason.

....

.... [1]

(b) Global warming causes more water from the sea to move into the atmosphere.

(i) Name the process that causes this movement.

.... [1]

(ii) In the process named in **(b)(i)**, the more energetic water molecules escape from the surface of the sea.

Suggest the effect this will have on

1. the energy of the molecules remaining in the sea water.

....

2. the temperature of the sea water.

....
[2]

(c) Global warming happens when more of the energy coming from the Sun is trapped in the Earth's surface and atmosphere.

(i) State the form of energy transfer between the Sun and the Earth.

.... [1]

(ii) Table 6.1 shows part of the electromagnetic spectrum.

Table 6.1

gamma rays	X-rays					radio waves

In Table 6.1, write in the correct boxes

1. the name of the part of the spectrum often involved in thermal energy transfer.
Circle your answer.

2. the name of the part of the spectrum that enables you to read this question.
Do not circle your answer.
[4]

**7** Fig. 7.1 shows the members of a food chain in a habitat.
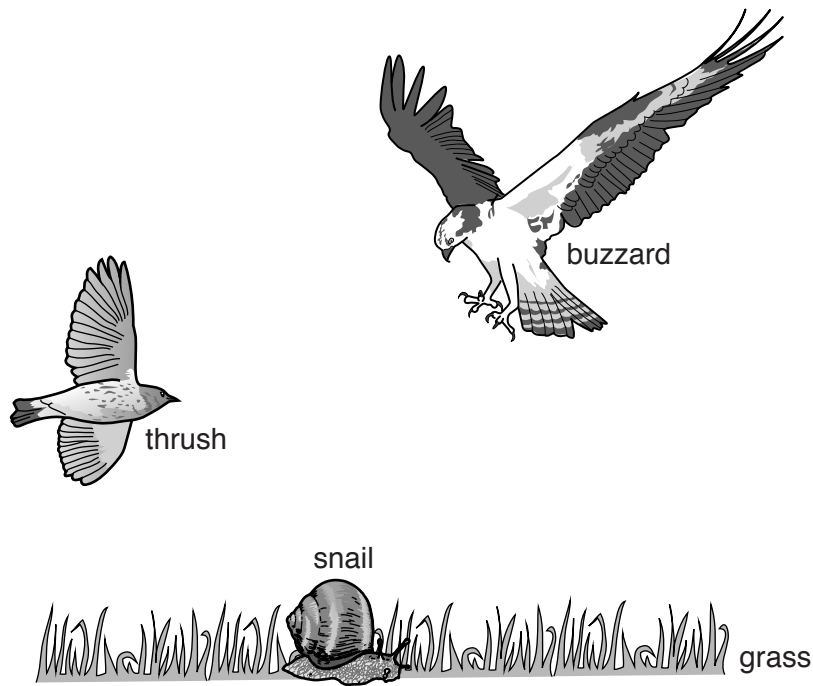
Fig. 7.1

The buzzard eats the thrush. The snail eats grass and the thrush is the snail's predator.

(a) (i) Complete each row of Table 7.1 by ticking the boxes that apply to each organism. One has been done for you.

Table 7.1

| organism	producer	consumer	herbivore	carnivore
buzzard				
grass				
snail				
thrush		✓		✓

[3]

(ii) Construct a food chain showing **all** of the organisms in Fig. 7.1.

[2]

(b) The activities of humans can cause air pollution by gases such as methane.

(i) State one large-scale activity of humans that adds methane to the atmosphere.

....

.... [1]

(ii) Explain why large amounts of methane in the atmosphere are harmful.

....

....

.... [2]

 [Turn over

8   Four metals are added to a dilute acid. Fig. 8.1 shows the pieces of metal before they are added to the acid.
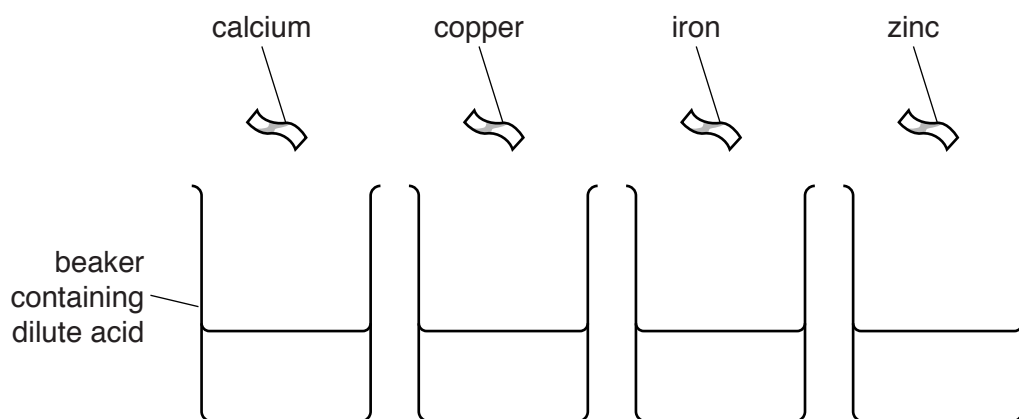
Fig. 8.1

(a) (i)   Place the four metals named in Fig. 8.1 in order of reactivity.

most reactive   ....

....

....

least reactive   ....

[1]

(ii) The pieces of metal are added to the acid in the beakers.

Describe what is seen in the beakers where a reaction takes place.

....

.... [1]

(b) One student thinks that iron reacts to form iron(II) ions. Another student thinks that iron reacts to form iron(III) ions.

Suggest a test for iron(II) ions and iron(III) ions, and state the observations for each.

test   ....

iron(II) ions   ....

iron(III) ions   ....

[3]

(c) Fig. 8.2 shows a piece of sodium added to water in a beaker.
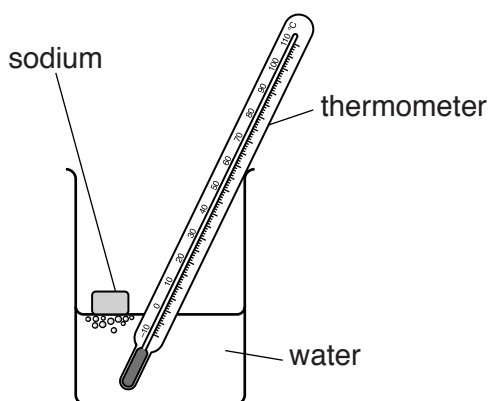

Fig. 8.2

The thermometer is used to measure the temperature of the water before and during the reaction.

The temperature of the water increases.

The equation for the reaction is

sodium + water ➔ sodium hydroxide + hydrogen.

(i) State the type of chemical reaction that causes an increase in temperature.

.... [1]

(ii) In this reaction sodium atoms turn into sodium ions.

State the charge of a sodium ion.

.... [1]

(iii) Describe how sodium ions are formed from sodium atoms.

....

.... [1]

9 A student investigates the current through an electric buzzer. He designs the circuit in Fig. 9.1 to use in his investigation.
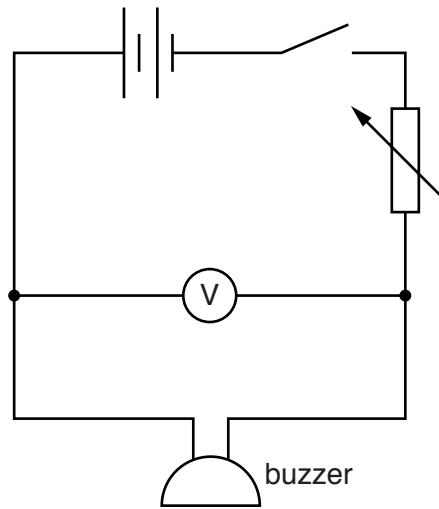
Fig. 9.1

(a) (i) Name the component represented by this symbol.
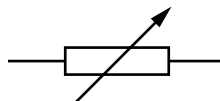
.... [1]

(ii) State and explain why the student includes this component in his circuit.

....

....

....

.... [2]

(iii) The student has left out an important component from his circuit that is needed to measure the current.

On Fig. 9.2 complete the circuit diagram and include the symbol for this missing component in its correct place.

Fig. 9.2

[3]

 [Turn over
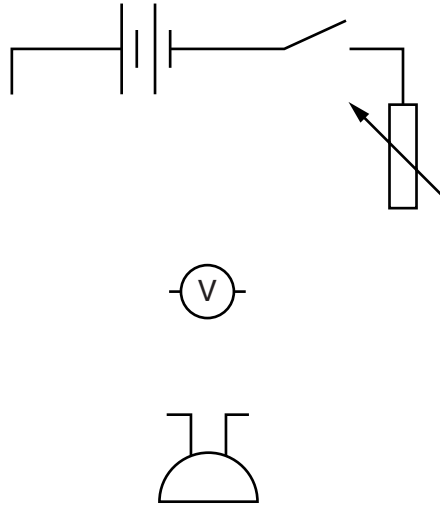
(b) The student used the correct circuit for his experiment. Fig. 9.3 shows his results plotted as a graph.
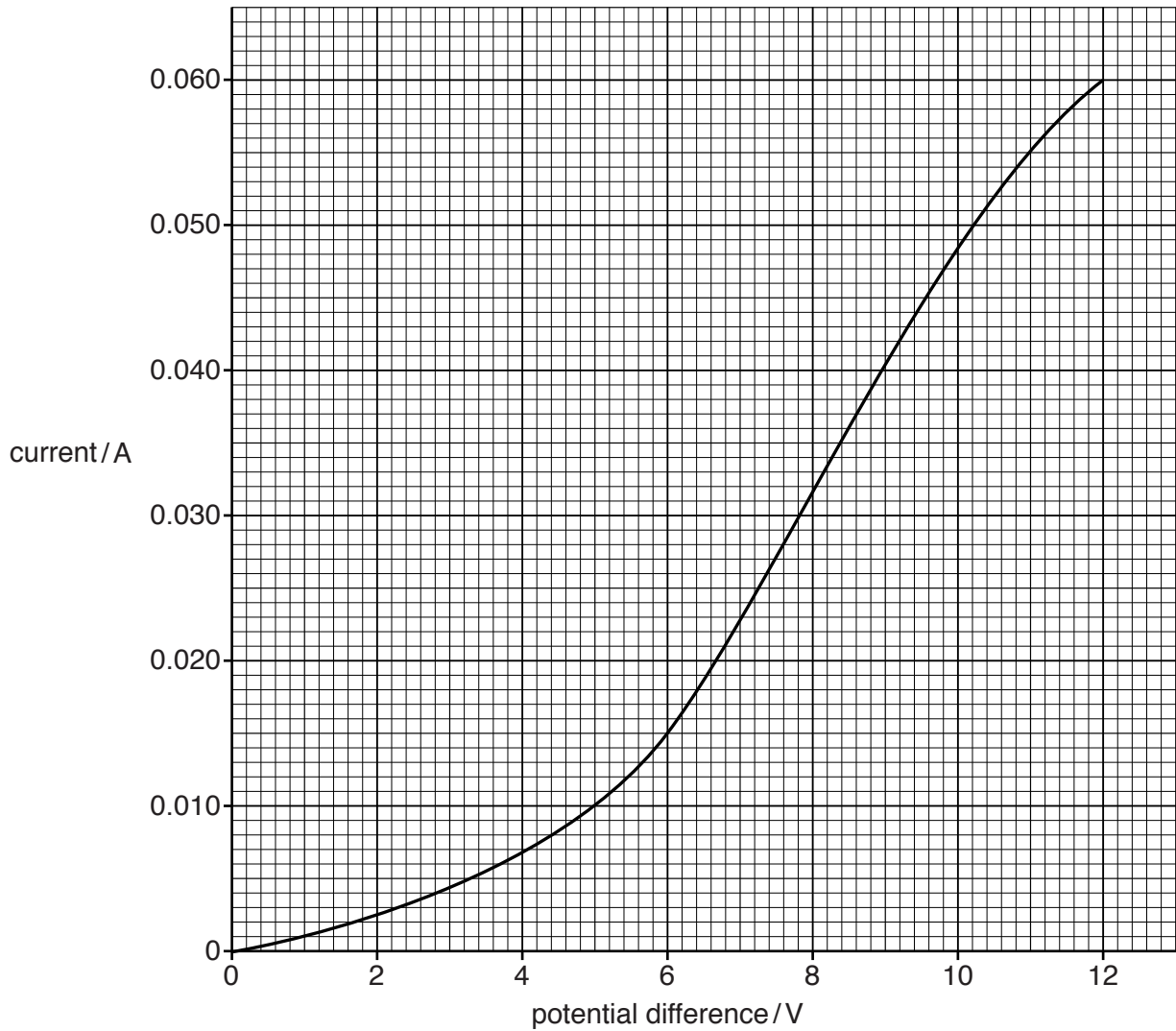
Fig. 9.3

The resistance of the buzzer is given by the formula

$$\text{resistance} = \frac{\text{potential difference (p.d.)}}{\text{current}}$$

The student says that the resistance of the buzzer is lower when the p.d. is 12V than when the p.d. is 6V. The resistance at 12V is 200Ω.

Use the graph in Fig. 9.3 to calculate the resistance at 6V to show that he was correct.

resistance at 6V = ...Ω [2]

(c) As the current increases the sound emitted by the buzzer becomes louder but has the same pitch.

State what happens to

the frequency of the sound waves,

....

the amplitude of the sound waves.

....
[2]

The Periodic Table of Elements

Group

Key

atomic number
atomic symbol
name
relative atomic mass

I	II													III	IV	V	VI	VII	VIII
								1 H hydrogen 1											2 He helium 4
3 Li lithium 7	4 Be beryllium 9													5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24													13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65			31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112			49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201			81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –				114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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