

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

B752/02
GATEWAY SCIENCE
PHYSICS B

Physics modules P4, P5, P6
(Higher Tier)

WEDNESDAY 17 JUNE 2015: Morning
DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	
-------------------------------	--	------------------------------	--

Centre number						Candidate number				
--------------------------	--	--	--	--	--	-----------------------------	--	--	--	--

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:
None

OTHER MATERIALS REQUIRED:
Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

The quality of written communication is assessed in questions marked with a pencil ().

A list of equations can be found on pages 4–6.

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

The total number of marks for this paper is 85.

Any blank pages are indicated.

BLANK PAGE

EQUATIONS

$$\text{energy} = \text{mass} \times \frac{\text{specific heat}}{\text{capacity}} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{power} = \text{force} \times \text{speed}$$

$$\text{KE} = \frac{1}{2}mv^2$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$\text{GPE} = mgh$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$I_e = I_b + I_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_p I_p = V_s I_s$$

BLANK PAGE

QUESTION 1 BEGINS ON PAGE 8

PLEASE DO NOT WRITE ON THIS PAGE

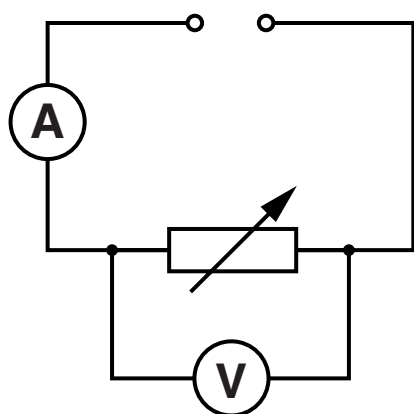
Answer ALL the questions.

SECTION A – Module P4

- 1 Ksenia and Eva investigate five different variable resistors.**

They set each variable resistor to the maximum resistance.

They keep the voltage the same and use this circuit to measure the current.



Look at their results.

Variable resistor	Reading on ammeter in amps
A	0.12
B	0.15
C	0.16
D	0.06
E	0.11

- (a) (i) The maximum resistance for variable resistor B is 4.79 ohms.

Calculate the voltage to 2 significant figures.

voltage _____ volts [2]

- (ii) During the measurements the voltage was kept constant for all the variable resistors.

Which variable resistor has the HIGHEST resistance?

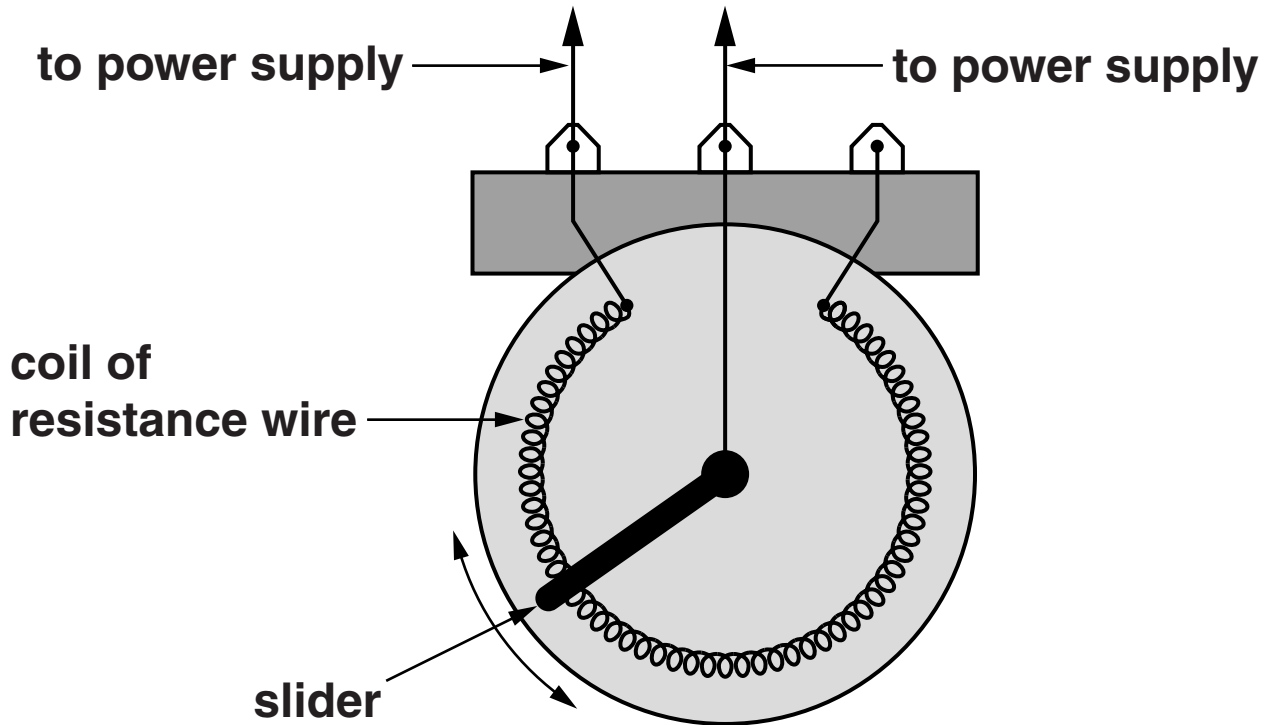
Choose from

A B C D E

_____ [1]

(b) Ksenia looks inside variable resistor A.

Look at the diagram.



The slider moves around and keeps in contact with the coil of resistance wire.

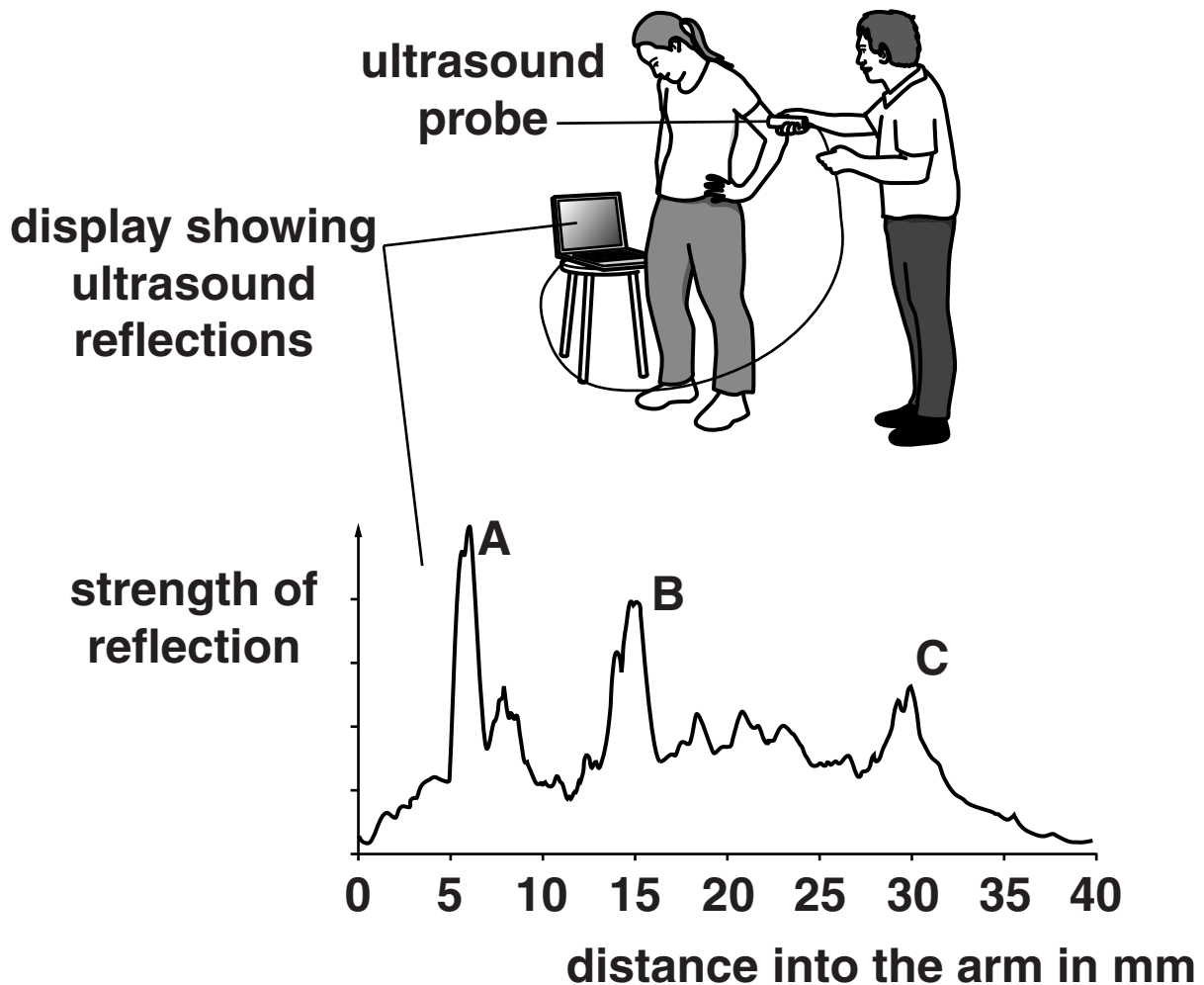
Explain how this variable resistor can be moved to increase AND decrease the current in a circuit.

[2]

BLANK PAGE

2 Ultrasound can be used on humans.

Becky has her body fat measured using ultrasound on her arm.



Ultrasound reflects strongly at different tissue layers inside the arm.

The body fat layer is just below the skin.

The different tissue layers in the arm are

fat-muscle layer

muscle-muscle layer

muscle-bone layer.

Why is ultrasound used rather than surgery or X-rays to measure body fat?

Explain what the display shows and how it can be used to find the thickness of body fat in Becky's arm.



The quality of written communication will be assessed in your answer to this question.

[6]

3 Scientists use several methods to find out when old plants lived.

(a) In the table opposite there is information about two methods.

Describe why scientists might use both methods to find out when old plants lived.

[2]

(b) Another method uses radioactive dating of rocks by calculating the ratio of two metals in the rocks.

One of the metals is uranium.

What is the name of the other metal?

Choose from

lead

potassium

rubidium

strontium

thorium

answer _____ [1]

	RELATIVE DATING	ABSOLUTE DATING
METHOD	Find out where plant fossils are in layers of rocks. Newer rocks are on top of older rocks. The method can be used in very old rocks.	This uses carbon dating. The amount of radioactive Carbon-14 can be measured in dead plants. This can be compared with the amount of Carbon-14 in living plants to find the age.
PROBLEMS	Cannot find the exact age of the plant fossils.	Cannot be used for very old dead plants as the amount of Carbon-14 is too low.

4 Radiation comes from the nucleus of an atom that is unstable.

(a) An alpha particle is a helium nucleus.

What is a beta particle?

Choose the BEST answer from

an electron

a fast moving electron

a proton

a fast moving proton

_____ **[1]**

(b) What happens to a nucleus when a beta particle is emitted?

Put ticks (✓) next to the TWO correct statements.

mass number is unchanged

☐

nucleus has one more neutron

☐

nucleus has one more proton

☐

atomic number decreases by one

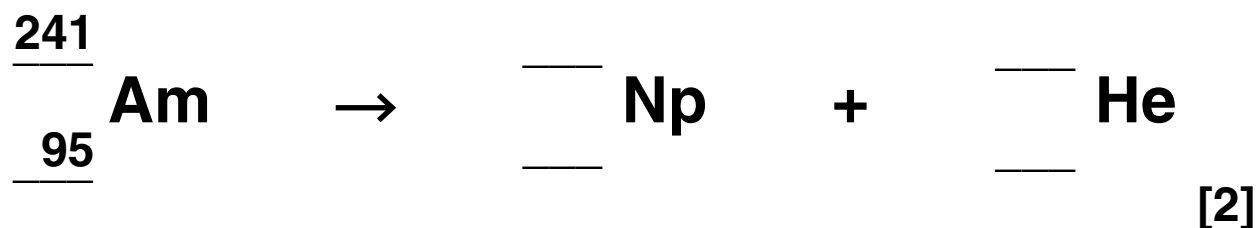
☐

[1]

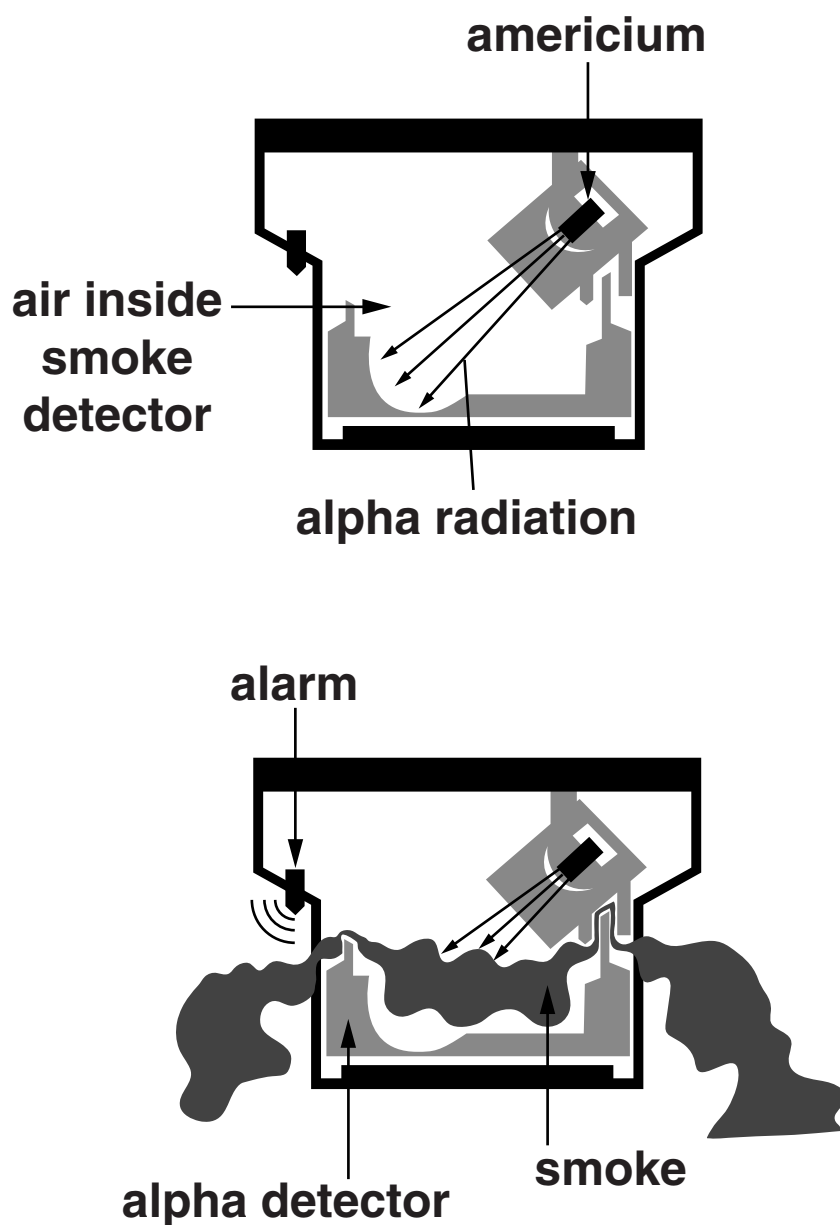
(c) Radioactive americium (Am) is used in smoke alarms.

(i) Complete the equation for alpha decay.

An alpha particle is a helium nucleus.



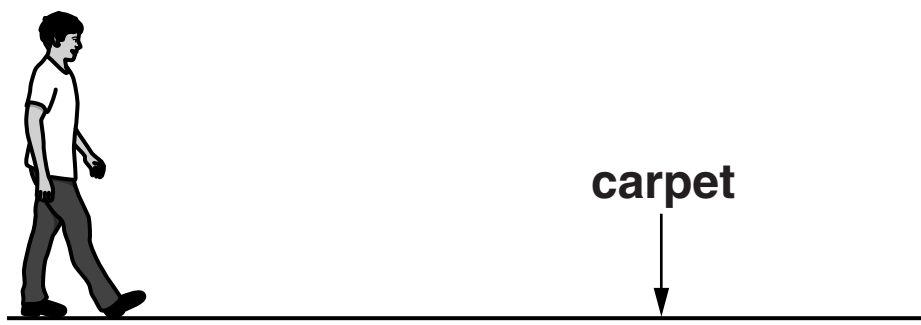
- (ii) Here are two diagrams showing how a smoke detector works.



Use the diagrams to describe how a smoke detector works.

[2]

5 Patrick walks on a nylon carpet.

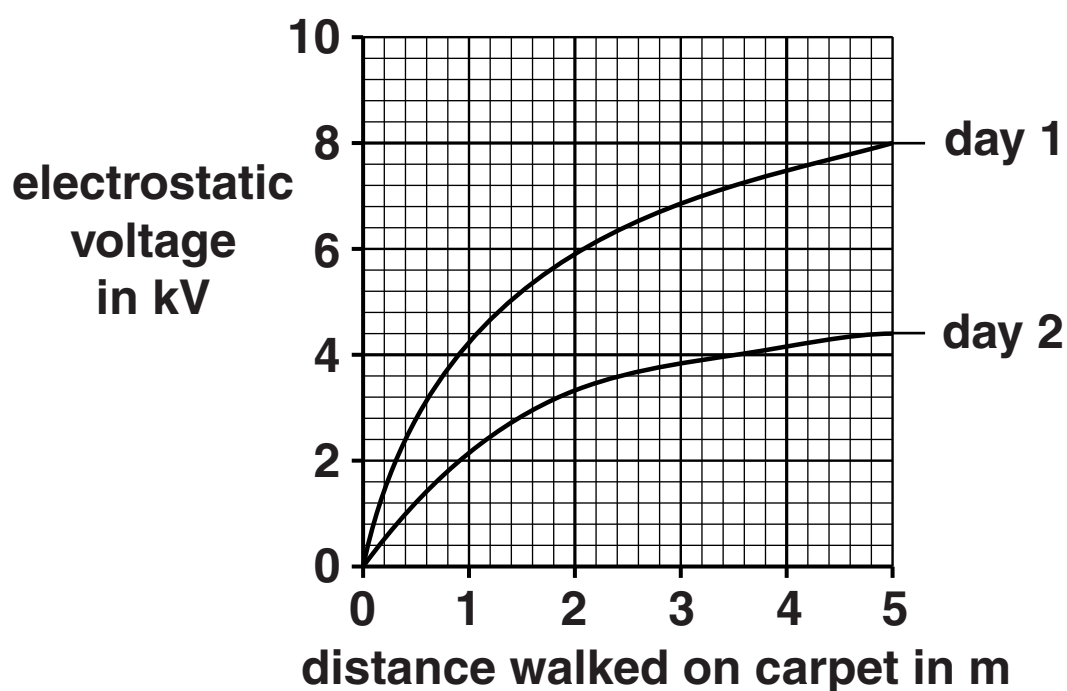


He becomes negatively charged.

(a) Describe how Patrick has become NEGATIVELY charged.

[2]

- (b) His electrostatic voltage is measured when he walks on the carpet on different days.



- (i) Use the graph to explain what happens on day 1.

[2]

- (ii) Suggest what is different on day 2.

[1]

SECTION B – Module P5

- 6 Artificial satellites are put into space for scientific research.**

The satellites are carried into space by rockets.

- (a) A rocket accelerates steadily from rest and reaches 8000 m/s after travelling $1\,680\,000 \text{ m}$. Calculate the time, in minutes, it takes the rocket to reach this speed.**

answer _____ **minutes** **[3]**

- (b) (i) The rocket is now in a stable orbit.
To keep the rocket in this orbit its speed needs to stay at 8000 m/s.
Suggest, by using ideas about gravitational and centripetal forces, why this speed needs to be maintained to keep it in this stable orbit.**

[3]

- (ii) The rocket re-enters the Earth's atmosphere safely.

In the final part of the descent its speed reduces steadily from 2000 m/s to 120 m/s just before touchdown. This takes place over a distance of 5×10^5 m.

Calculate the average DECELERATION over this distance.

answer _____ m/s² [3]

(c) The International Space Station (ISS) is an artificial satellite.

The astronauts on the ISS do scientific research. These astronauts are from different countries that work in teams and publish their results.

(i) Suggest why using teams of scientists on the ISS may be beneficial.

_____ [1]

(ii) Suggest why it is important for the scientists on the ISS to publish their results.

_____ [1]

7 This question is about using electromagnetic waves for communication.

- (a) Microwaves are used to communicate signals between Earth and satellites.
Sometimes when these signals are received they can be weak or of poor quality.**

Suggest what engineers can do to the microwave dish on Earth to improve communication with a satellite. Explain why the improvements work.

Suggestion 1 _____

Explanation _____

Suggestion 2 _____

Explanation _____

[4]

- (b) Electromagnetic waves are used for communication.
Look at the information about different waves.**

Wave	Wavelength	Frequency
A	3.3 m	90 MHz
B	15 m	20 MHz
C	0.006 m	50 GHz

- (i) Which wave is reflected by the ionosphere?**

answer _____

Explain why you chose this wave.

[2]

- (ii) Which wave can pass through the Earth's atmosphere but is reduced in strength because of absorption and scattering?**

answer _____

Explain why you chose this wave.

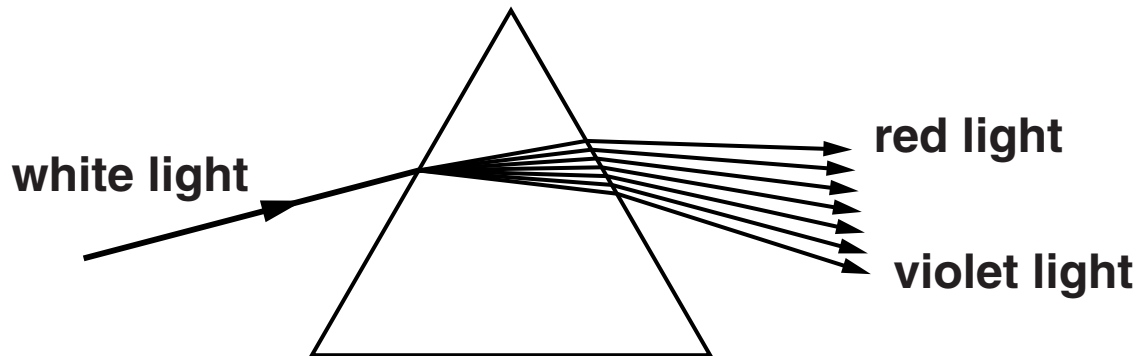
[2]

BLANK PAGE

8 Chantal does some experiments using light.

She shines a beam of white light through a prism.

Look at the diagram.



The white light disperses to produce a visible spectrum of colours.

Explain why the white light disperses and why the colours deviate by different amounts.

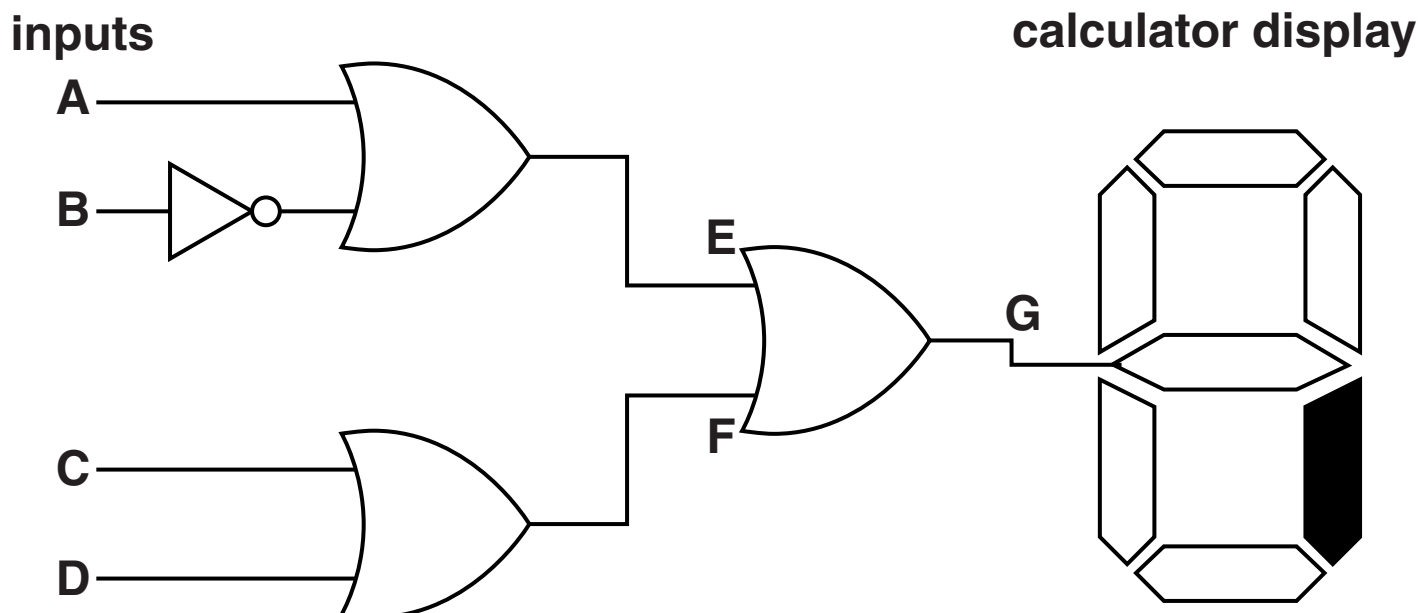


The quality of written communication will be assessed in your answer to this question. [6]

SECTION C – Module P6

9 Enzo connects logic gates together to make a logic system.

Look at the diagram.

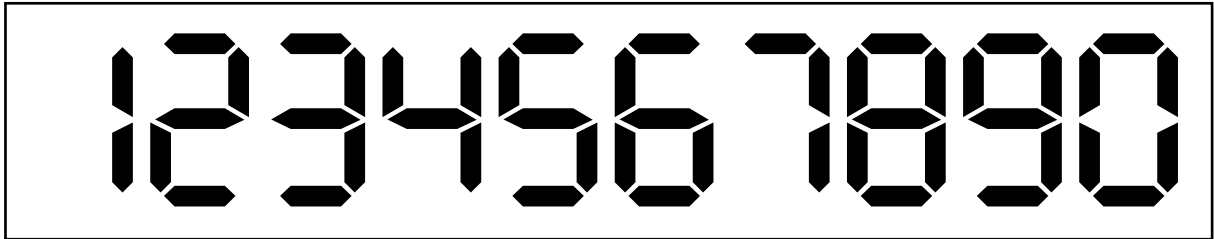


He completes part of the truth table. The output from the logic system switches the shaded segment on the calculator display on and off.

A	B	C	D	E	F	G
0	0	0	0	1	0	1
0	0	0	1	1	1	1
0	0	1	0	1	1	1
0	0	1	1			
0	1	0	0			
0	1	1	0			
1	0	0	1			
1	0	1	1	1	1	1
1	1	0	1	1	1	1
1	1	1	1	1	1	1

The shaded segment is switched on for most numbers.

calculator display



Complete Enzo's truth table and use it to describe how his logic system is used to display a segment of the numbers.

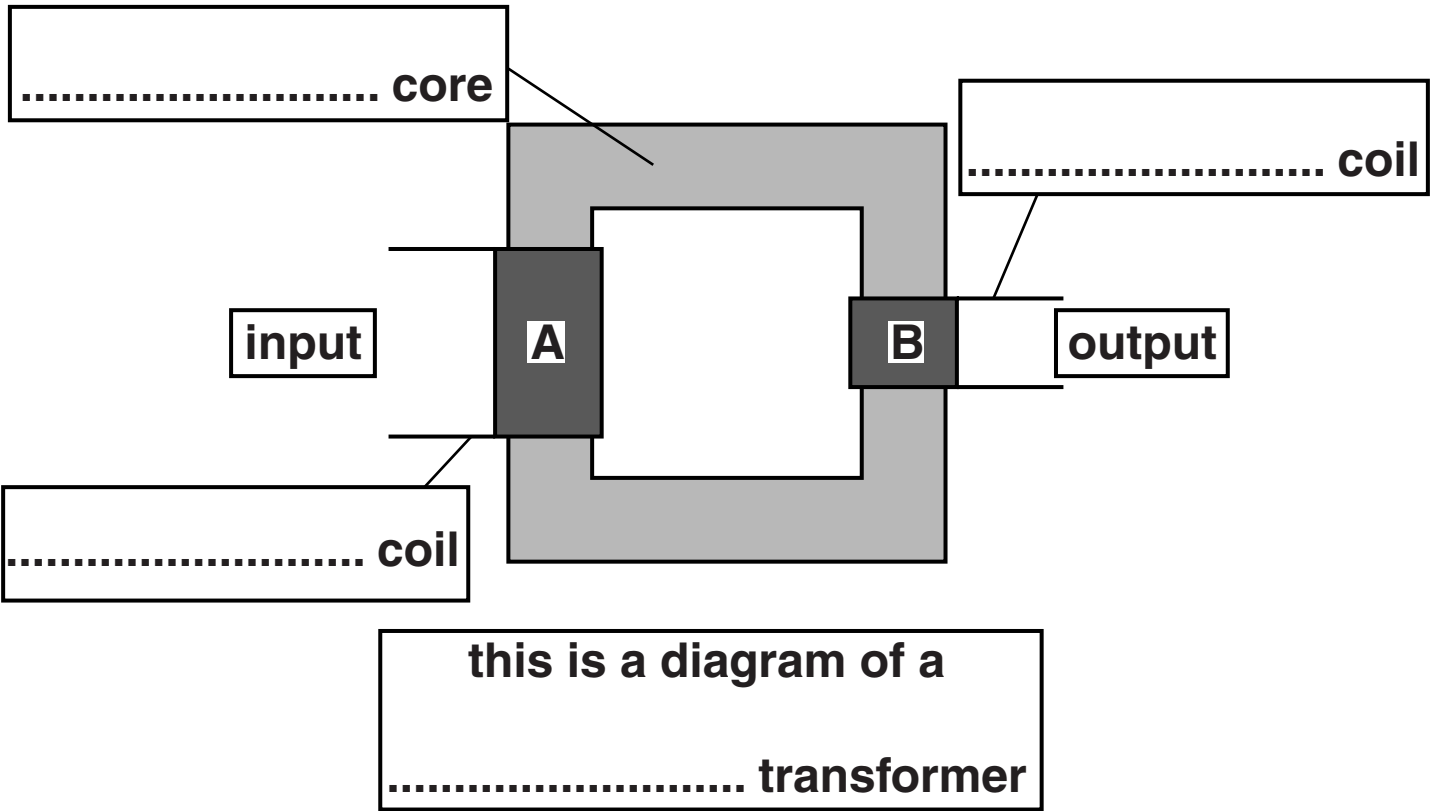
Explain your answer using numbers that have a 1 or 0 output at G.



The quality of written communication will be assessed in your answer to this question. [6]

10 Transformers are used in many different appliances.

(a) Look at the simple diagram of a transformer.



A has 4000 turns and B has 150 turns.

(i) Complete the FOUR labels on the diagram. [2]

(ii) The input voltage is 10 000V.

Calculate the output voltage.

output voltage _____ V [2]

(b) Transformers are devices that work with alternating current (AC).

Explain why transformers require AC.

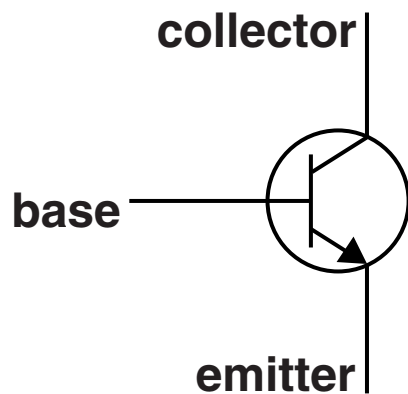
[2]

(c) ISOLATING transformers are an important technological advance.

How have these improved safety in the home?

[2]

11 The NPN transistor is the basic building block of electronic components.



The currents flowing through the transistor terminals are I_c I_b and I_e .

Here are the currents of different transistors.

I_b in mA	I_c in mA	I_e in mA
2	80	_____
4	100	_____
8	120	_____

(a) Calculate the THREE missing values for I_e and put your answers in the table.

[1]

(b) Look at the sizes of the currents I_b and I_c in the table.

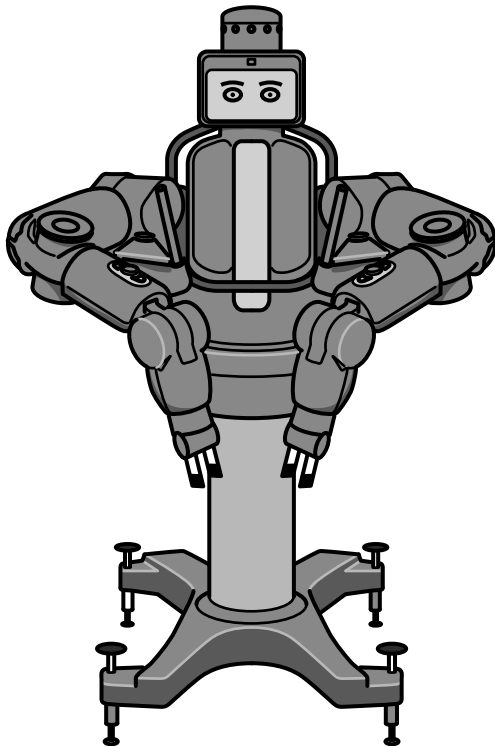
(i) Describe, in general, how I_b is different to I_c .

_____ **[1]**

(ii) Explain this difference.

_____ **[2]**

(c) Baxter is a new type of robot made by Rethink Robotics.



Baxter can carry out repetitive tasks in manufacturing.

It can work alongside humans.

Baxter is able to sense and react to its environment.

Its developers say it has 'common sense'.

Society needs to make choices about the acceptable uses of new technologies like Baxter.

Write about the advantages AND disadvantages of Baxter.

[3]

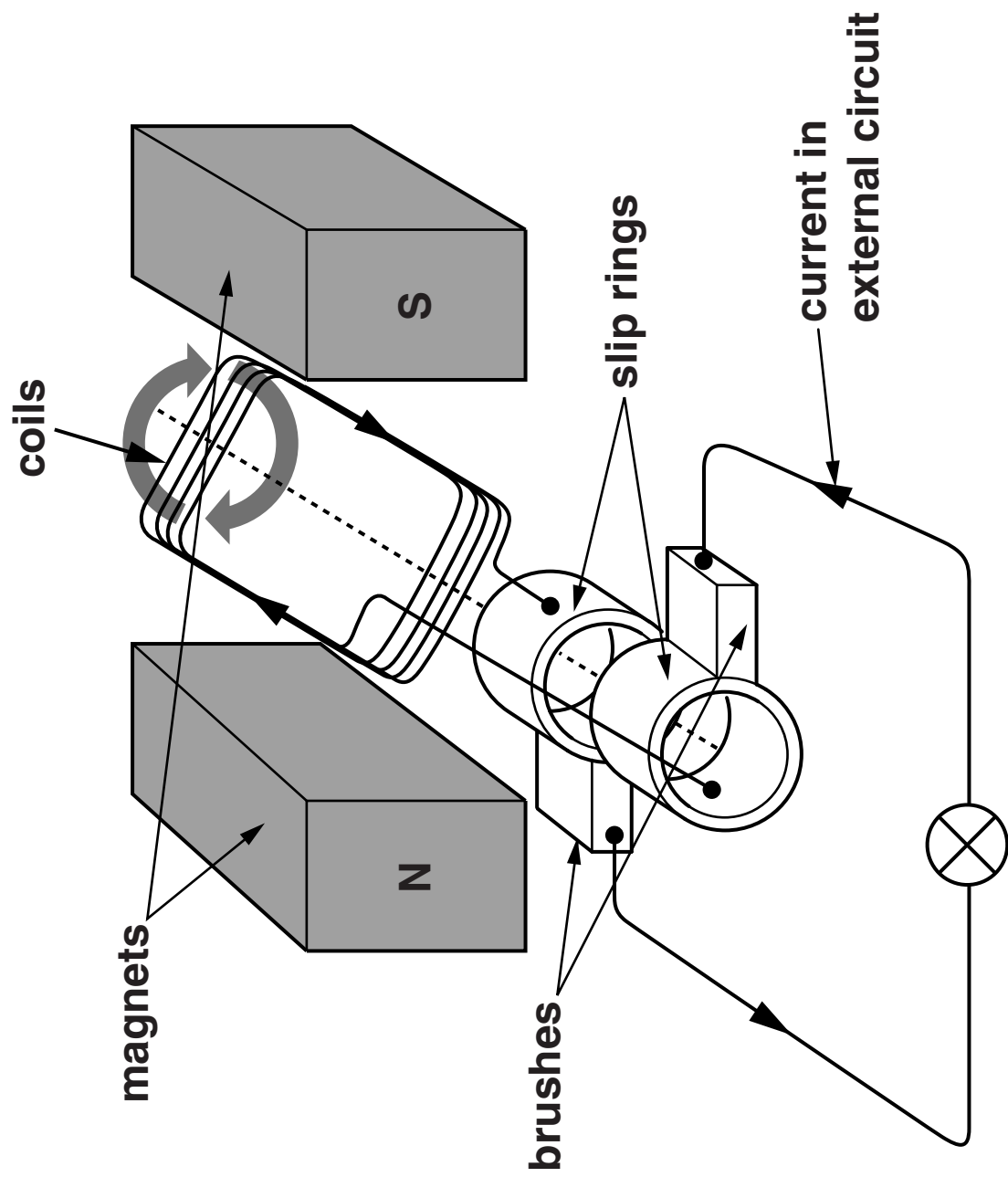
12 AC generators are used to generate electricity.

Opposite is a diagram of a small AC generator.

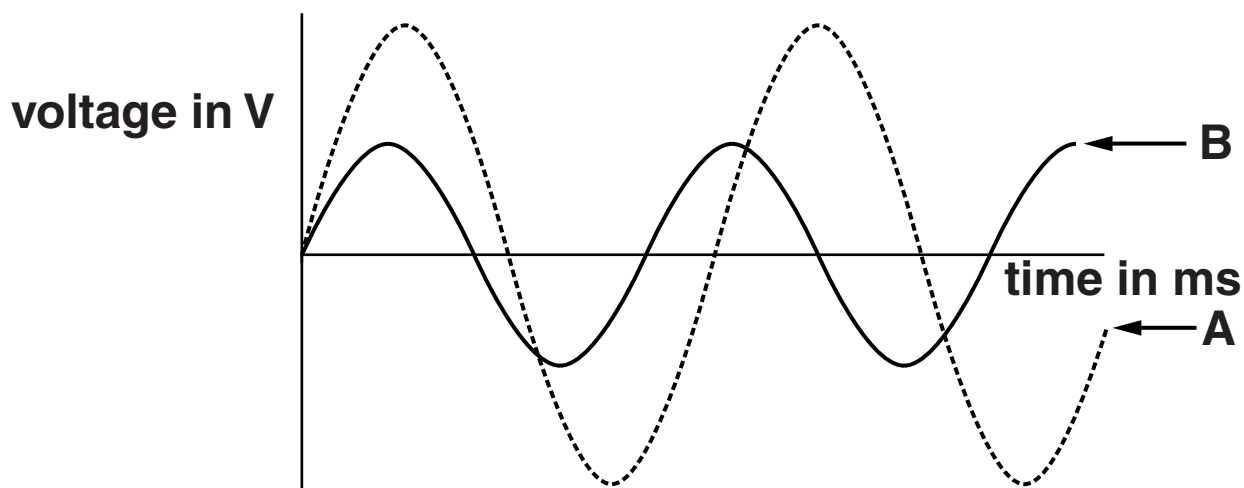
(a) Explain how this AC generator works.

Use ALL the labels in the diagram in your explanation.

[2]



(b) Look at the diagram.



Graph A shows the output from this small AC generator.

The generator can also produce the output shown by graph B.

Suggest what changes are needed to produce the output shown by graph B.

[2]

SECTION D

13 Rene researches the range of sounds that different people can hear.

(a) Rene's research shows that

'The average person has a hearing range from 20 Hz up to 20 000 Hz'.

**Rene tests the hearing range of a group of people.
Look at the data she collects.**

Person	Age	Lower frequency limit of hearing in Hz	Upper frequency limit of hearing in Hz	Frequency range of hearing in Hz
Jane	16	22	19 000	18 978
Alec	16	19	20 000	19 981
Dionne	16	24		
Niamh	16	16	21 000	20 984
Evangelos	16	15	20 000	19 985
average	16	19.2	19 800	19 780.8

- (i) Rene's original research showed a lower frequency limit of human hearing of 20 Hz. The data she collects shows an average lower frequency limit of 19.2 Hz. Suggest reasons for this difference.

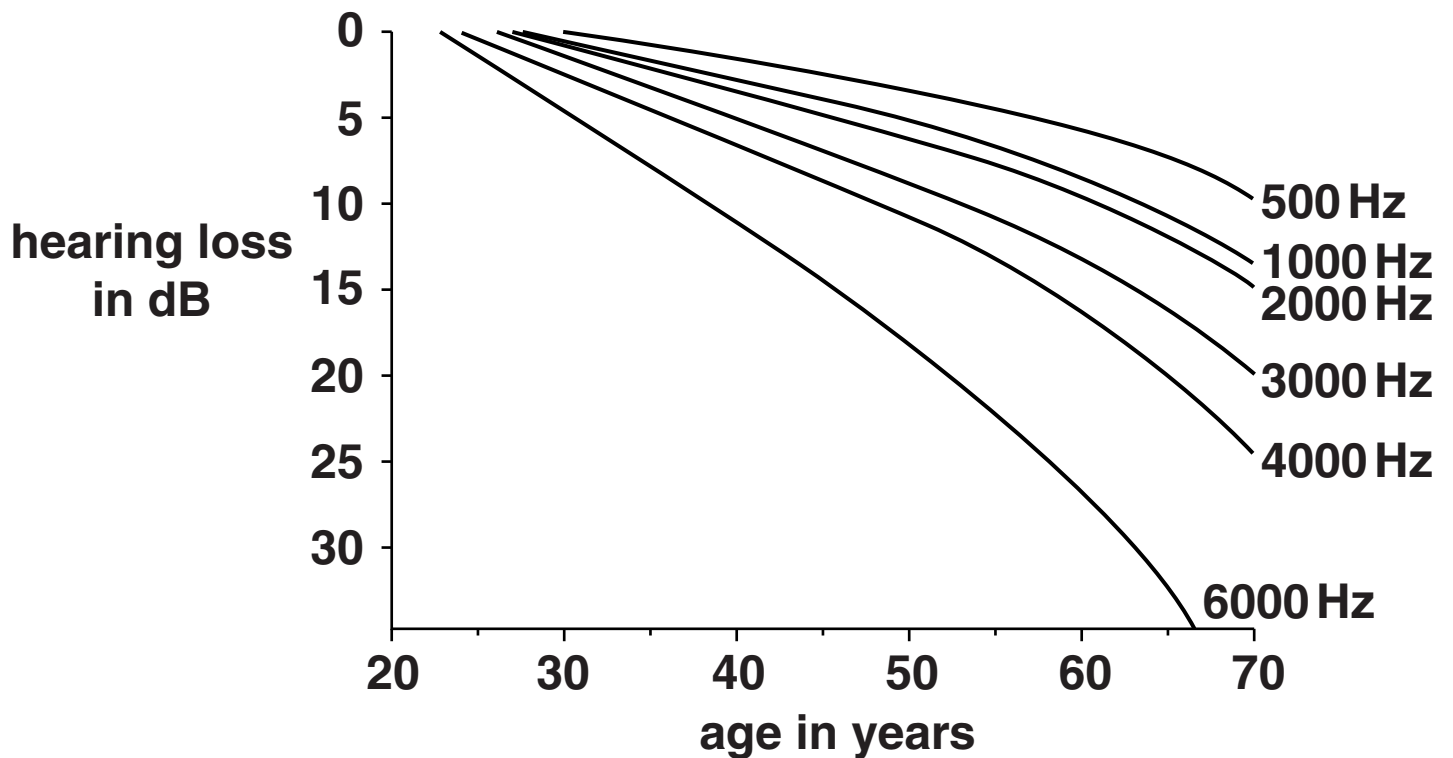
[3]

- (ii) Rene has not completed her table. She has lost some of her results. Calculate the upper frequency limit of hearing for Dionne.

answer _____ Hz [2]

(b) Look at the data on hearing level loss at different ages.

It shows the hearing loss in dB for different ages at six different frequencies.



(i) Describe the trends shown by the graph.

[2]

- (ii) Scientists are developing hearing aids to help people hear high frequency sounds. These hearing aids can detect sounds of frequency 6000 Hz and above and change them to sounds of half that frequency.

60 year olds can have difficulty hearing sounds above 6000 Hz.

Explain how these hearing aids can improve their hearing.

Use the data from the graph in your answer.

[3]

END OF QUESTION PAPER

BLANK PAPER

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

