OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

PHYSICS B

B752/01

Unit B752: Physics modules P4, P5, P6 (Foundation Tier)

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)

Duration: 1 hour 30 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- The number of marks for each question is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **85**.
- This document consists of **32** pages. Any blank pages are indicated.

Examiner's Use Only:			
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	
Total			

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

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

distance = average speed × time

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

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

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

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

power = force × speed

$$KE = \tfrac{1}{2}\, mv^2$$

momentum = mass × velocity

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

GPE = mgh

$$mgh = \tfrac{1}{2}\, mv^2$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

power loss = (current)^2 × resistance

$$V_pI_p = V_sI_s$$

Answer **all** the questions.

Section A – Module P4

1 This question is about electricity.

(a) Colin is wiring a plug connected to a fridge.

The earth wire is connected to the conducting metal casing of the fridge.

Colin thinks that the **brown** wire should be connected to the earth connection.

Is he correct?

answer .....

Explain what will happen as a result of Colin's wiring.

.....

.....

.....

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

(b) Sally's electric hairdryer is double insulated.

It has only two wires.

Which **two** wires are connected to the hairdryer?

Choose from

blue and brown

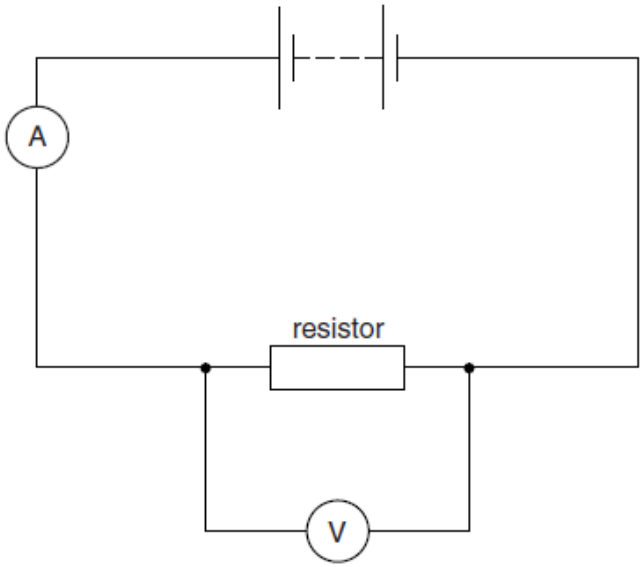
blue and green/yellow

brown and green/yellow

brown and red

answer ..... **[1]**

(c) (i) Phil makes the following circuit.



Phil adds a second resistor to the circuit. The resistance is doubled.

The voltage is kept constant.

What happens to the current?

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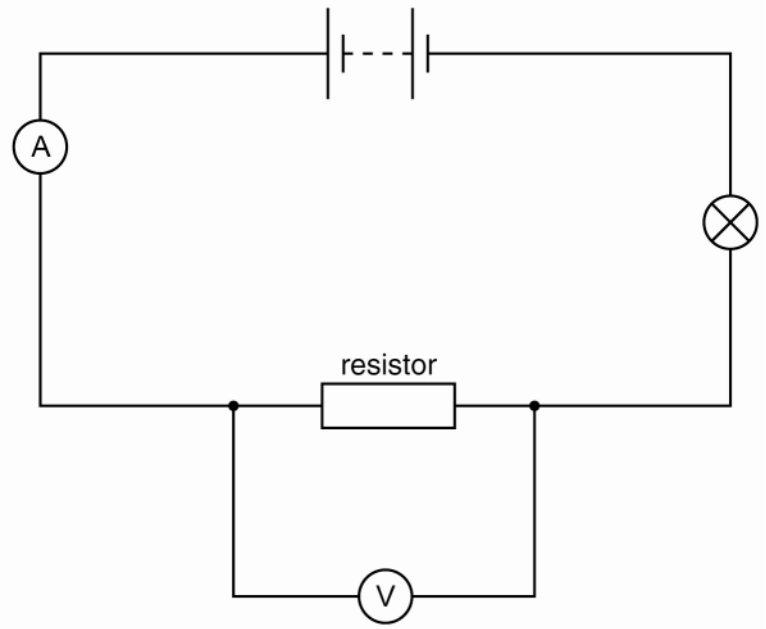
..... **[1]**

(ii) Phil adds a bulb to his circuit.



He wants to change the brightness of the bulb but he needs to make sure the bulb is not damaged.

He could do this by changing or adding components.

Describe the components he could change or add. Explain how this makes a difference.

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.....

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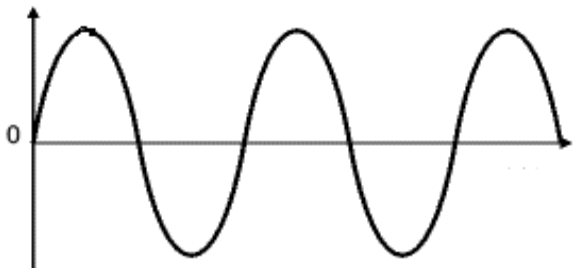
..... **[3]**

[Total: 7]

2 **(a)** Ultrasound is a longitudinal wave.

Look at the diagram of an ultrasound wave.



The wavelength of the wave is made shorter but the amplitude remains the same.

Draw a diagram of this wave.

[1]

(b) Ultrasound is used in **medicine**.

Write about **one** use for ultrasound and why it is used.

.....

.....

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

(c) Technetium-99 is a radioactive material. It is used as a medical tracer.

Technetium-99 emits gamma radiation and has a half-life of a few hours.

Give **two** reasons why technetium is a suitable medical tracer.

.....

.....

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

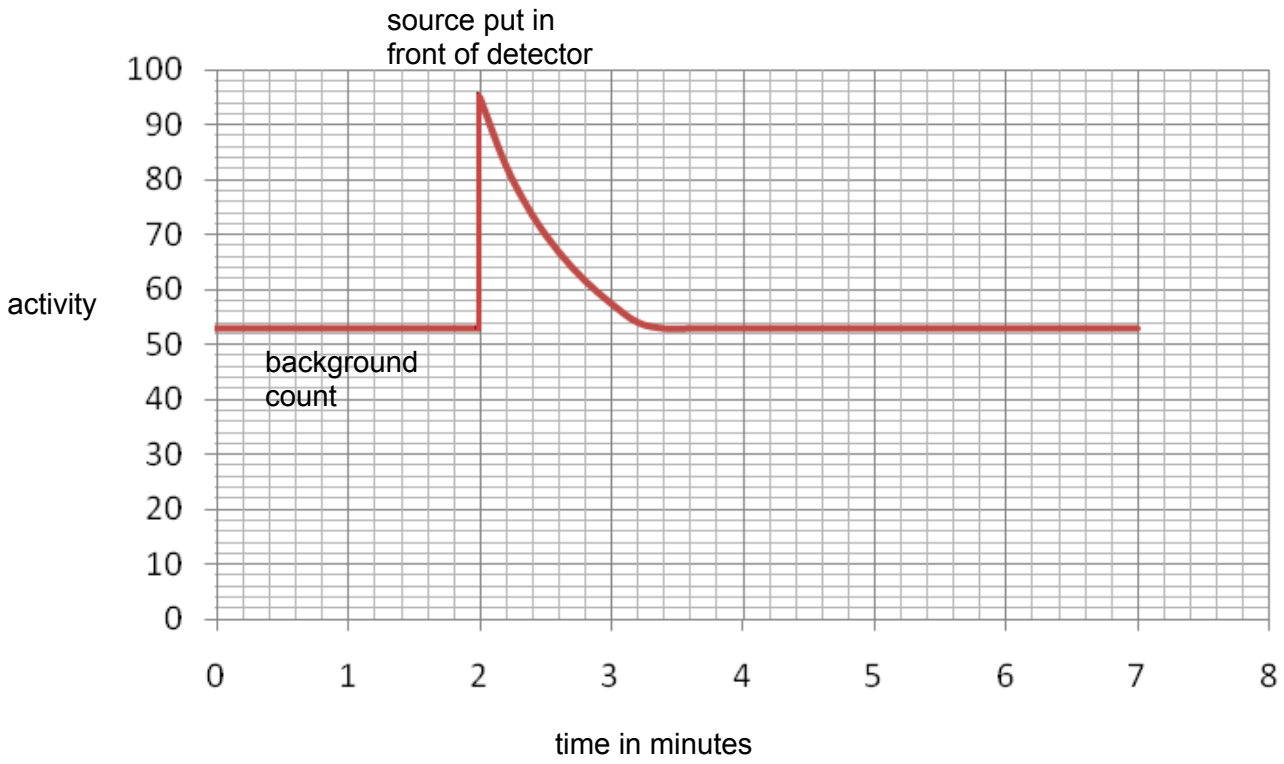
[Total: 5]

3 This question is about nuclear radiation and radioactivity.

Riswan is doing an experiment to see how the radioactivity of a source changes over time.

He wants to measure the half-life of the radioactive source.

Look at the graph of his data.



(a) What does the activity measure?

.....

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

(b) Write down **one** possible source of the background count on the graph.

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

(c) Riswan is trying to measure the half-life.

(i) What is meant by the half-life?

.....

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

(ii) Can Riswan use his data to find out the half-life of the source? Explain your answer.

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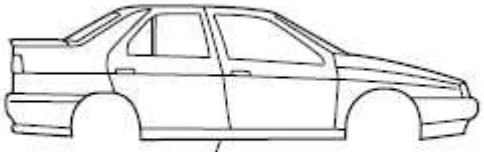
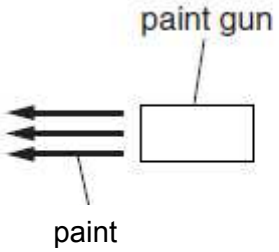
..... **[2]**

[Total: 5]

4 Electrostatics is used in the car manufacturing industry to spray paint cars.





The paint travels to the car.

Explain how electrostatic charge is useful in spray painting **and** suggest how the manufacturers can reduce potential dangers to the workers doing the spray painting.

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

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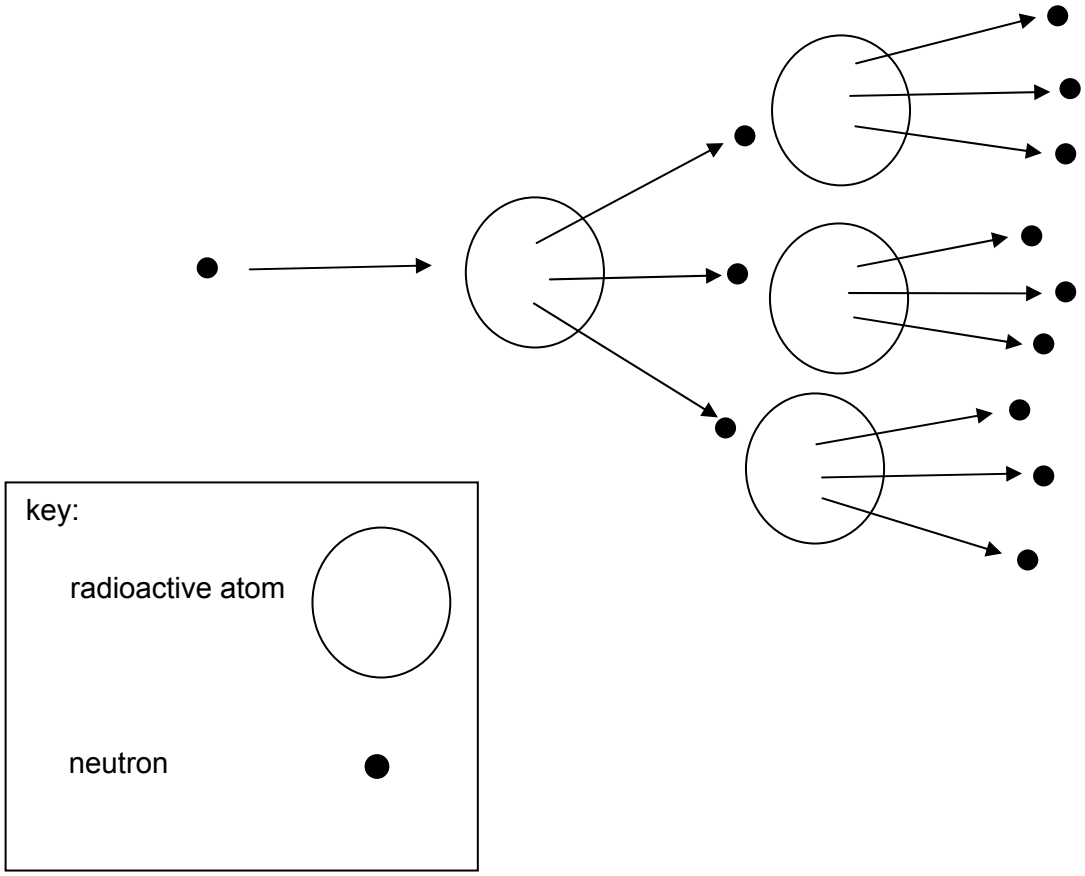
..... **[6]**

[Total: 6]

5 Nuclear power stations and nuclear bombs use a type of nuclear reaction.

Look at the diagram which represents a possible reaction.



Describe the type of reaction **and** explain how the reactions are different in a power station and a nuclear bomb.

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

[Total: 2]

Section B – Module P5

6 Artificial satellites orbit the Earth and send back information.

Satellites have many different uses. The choice of orbit for the satellite depends on what the satellite is used for.

Describe how different types of satellite orbit the Earth. Give examples of different uses of satellites and explain what type of orbit should be used and why.

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

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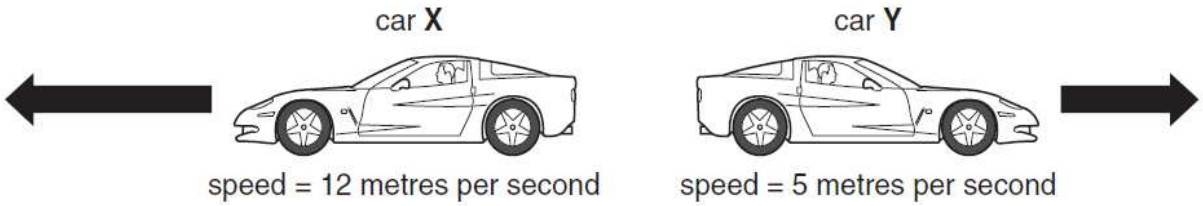
..... **[6]**

[Total: 6]

7 Look at the diagram of two cars.

Car **X** moves in the **opposite** direction to car **Y**.



(a) They then move in the same direction.

Look at the diagram below.

What happens to the **relative** speed of the cars? Explain why.

.....

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

(b) (i) Car **Y** moves at a speed of 5 metres per second.

It accelerates steadily to a new speed of 15 metres per second. This takes 30 seconds.

Calculate the distance travelled in this time.

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.....

.....

answer ..... m **[2]**

(ii) Car **X** is following 10 metres behind car **Y**.

Car **X** stays at a speed of 12 m/s.

How far does car **X** travel in the 30 seconds? Using your answer to part **(i)**, explain whether car **X** overtakes car **Y**.

.....

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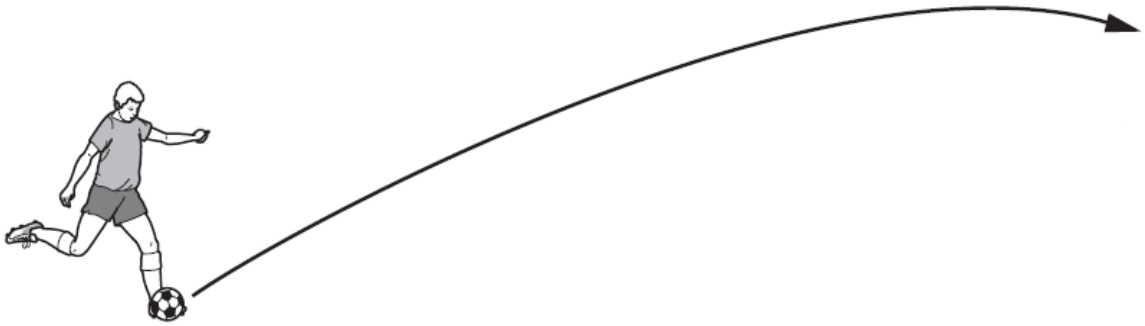
..... **[1]**

[Total: 5]

8 Fred is practising his goal kicks.



Fred thinks that increasing the angle above the ground will increase the range of his kick.

He tests his prediction.

Look at the table of his results.

angle in °	max height in m	range in m
10	4	27
25	21	61
40	50	79
55	80	75
70	106	51

Is Fred's prediction correct?

Use the data and your own knowledge to explain why you reached your conclusion.

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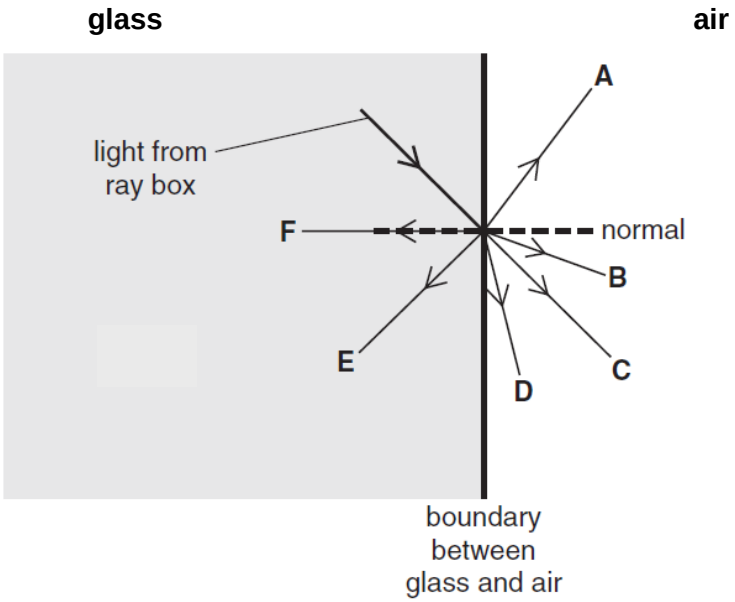
..... **[3]**

[Total: 3]

9 **(a)** Danny shines a ray of light from a ray box through a glass block.

He looks at the paths of light **after** it hits the boundary.



Which path shows the two rays he sees?

Choose **two** from **A**, **B**, **C**, **D**, **E** and **F**

answer .....and ..... **[1]**

(b) What happens to light, at a boundary, as it passes **from** glass to air?

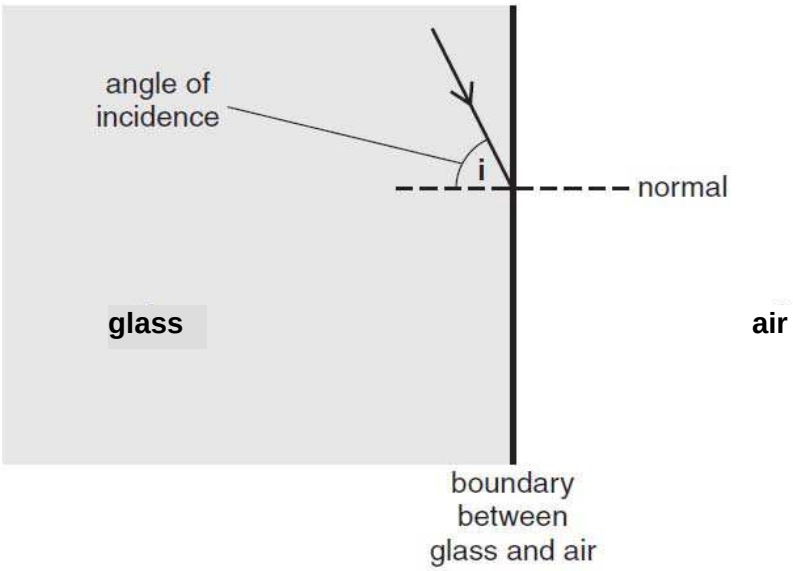
Put a tick (✓) in the box next to the correct answer

light is absorbed	☐
light is radiated	☐
light is reflected	☐
light is refracted	☐

[1]

(c) Danny moves the ray box.

The angle of incidence, **i**, is larger than the critical angle.



Complete the diagram **accurately** to show what happens to the ray of light. **[1]**

[Total: 3]

10 This question is about waves.

(a) Look at the sentences about waves.

Put a tick (✓) in the box beside the sentence if it is true.

Put a cross (✗) in the box if the sentence is false.

One has been done for you.

	✓ or ✗
Eclipses happen because light travels in straight lines.	✓
Light can never 'bend'.	
Electromagnetic waves are longitudinal.	

[1]

(b) Bharat's science teacher is explaining interference using two loudspeakers.

The loudspeakers are producing identical sound waves.

Bharat walks along a line in front of the speakers as shown

Describe what Bharat hears as he walks along the line and why the sound waves produce this effect.

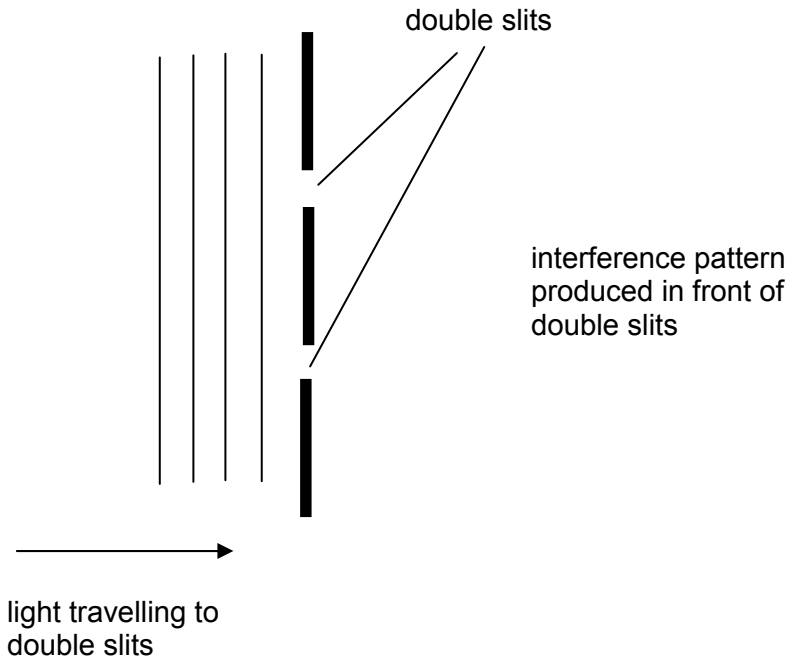
.....

.....

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

(c) Bharat's teacher then shows his class an experiment with light.

When the experiment was first performed many years ago it altered scientists' views about the properties of light.



Bharat's teacher explains that this famous experiment provided evidence for the wave nature of light.

Explain how the interference pattern provided this evidence.

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

(d) Radio waves can be used to communicate with satellites beyond the Earth's atmosphere.

Look at the table.

radio wave	frequency
A	25 MHz
B	40 GHz
C	10 GHz

One of these radio waves can be used to communicate with a satellite beyond the Earth's atmosphere.

Bharat thinks radio wave **B** can be used.

Is he correct?

Explain your answer.

.....

.....

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

[Total: 8]

Section C – Module P6

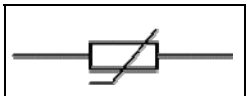
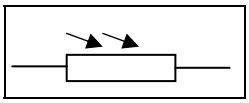
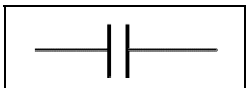
11 (a) Sally does some experiments about electricity in a physics lesson.

Sally's teacher gives her some cards to help her understand what some electrical components are used for. There are three sets of cards:

name of component	**component symbol**	**description of what the component does**

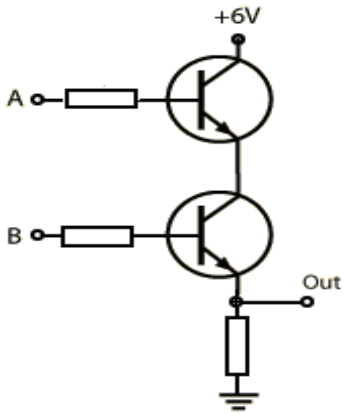
Draw straight lines to join each **name** to the correct **symbol**.

Draw straight lines from each **symbol** to the correct **description**.

name	**symbol**	**description**
capacitor		stores charge
thermistor		responds to a change in light
LDR		responds to a change in temperature

[2]

(b) (i) Look at the diagram of a logic gate.



What type of logic gate is shown in the diagram?

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

(ii) Describe how the inputs at **A** and **B** affect the behaviour of the two transistors, and the output of the logic gate.

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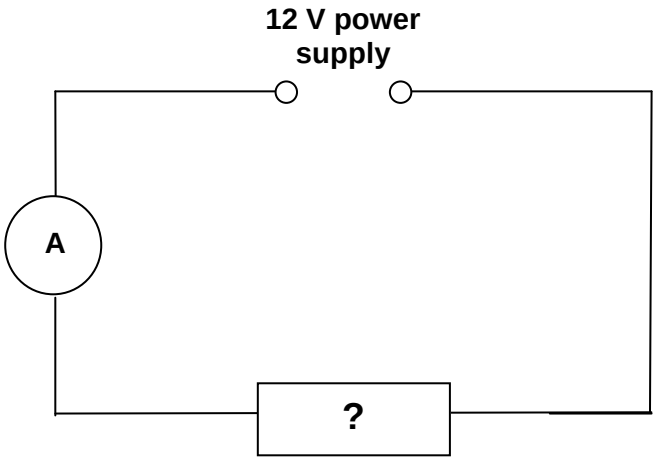
..... **[3]**

[Total: 6]

12 (a) Sally is investigating an unknown electrical component.

She builds a circuit and measures the current.

Look at the diagram.



She exposes the component to different temperature and light levels.

She records the current each time. Here are her results.

temperature in ^{o}C	light level	current in amps
0	normal	0.08
20	normal	0.12
75	normal	0.36
0	high	0.08
20	high	0.12

Use the data in the table to suggest what the unknown component could be.

Explain your answer.

.....

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..... **[4]**

(b) (i) Sally replaces the unknown component with a bulb.

She switches the circuit on for a short time.

A current of 3.0 A passes through the bulb.

Calculate the **resistance** of the bulb.

.....

.....

.....

answer …….. unit ..... **[2]**

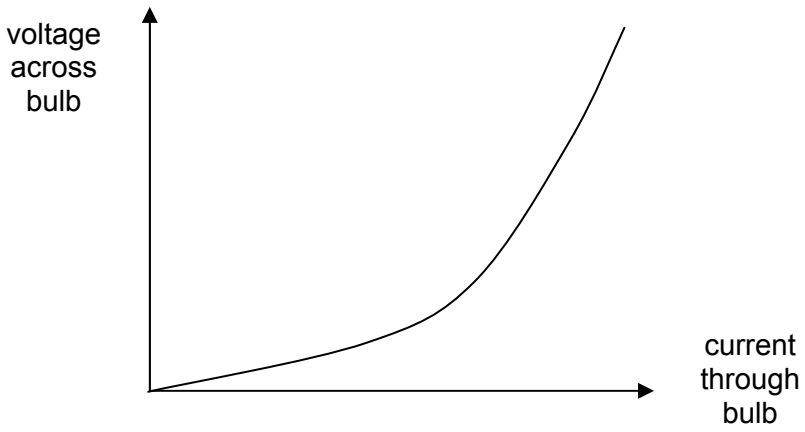
(ii) Sally switches the circuit back on.

She varies the voltage of the power supply.

She records the values of voltage and current for the bulb.

For each result she leaves the circuit switched on for a long time.

Look at the graph of her results.



What is happening to the resistance of the bulb and how is this shown by the graph?

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

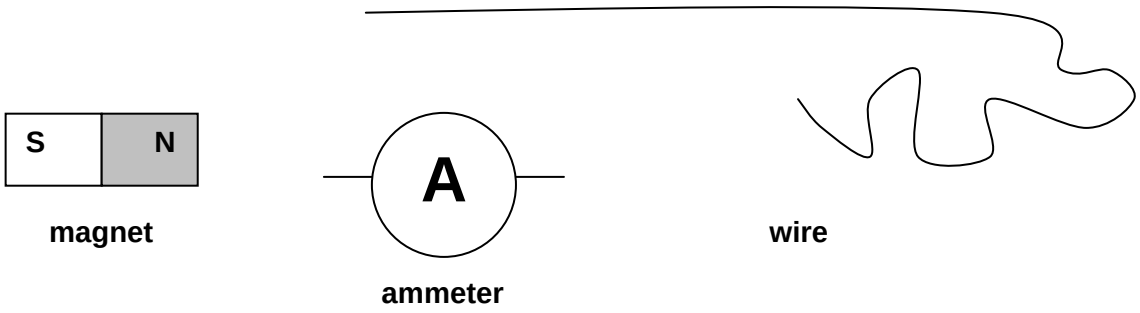
[Total: 8]

13 This question is about generating electricity.

(a) Dave has some scientific equipment.

He wants to **generate** electricity.

Look at the equipment.



Explain how he uses this equipment to generate a current and how he would know that a current is generated.

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.....

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

(b) Electricity is generated in power stations.

It is supplied to homes through cables and transformers in the National Grid.

Before it can be used in houses the voltage must be reduced.

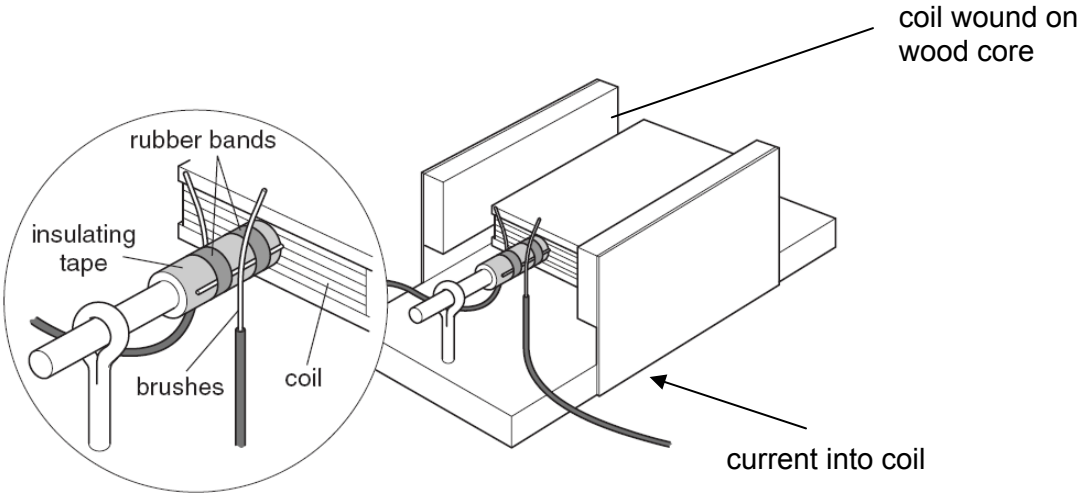
What is used to **reduce** the voltage?

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

[Total: 3]

14 Declan builds an electric motor.

Look at the diagram of his electric motor.



Declan connects the motor to a DC power supply.

It spins round slowly. Declan wants to make the motor spin **faster** in the **opposite** direction.

Explain how the forces on the current-carrying coil in the magnetic field cause the coil to rotate and how Declan could make the motor spin faster **and** in the opposite direction.

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

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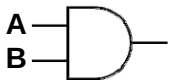
..... **[6]**

[Total: 6]

15 Gates are used to control electronic devices.

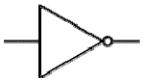
Here are the logic tables for two types of logic gate.

AND gate logic table



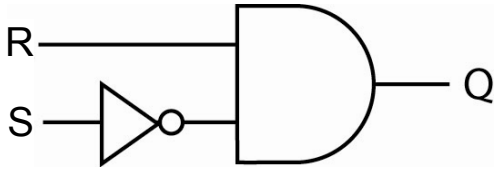
Input A	Input B	Output
0	0	0
0	1	0
1	0	0
1	1	1

NOT gate logic table



Input	Output
0	1
1	0

Logic gates can be combined to create new logic tables. For example, a **NOT** gate and an **AND** gate can be combined like this.



Complete the logic table for this combination. The first two rows have been done for you.

Input R	Input S	Output Q
0	0	0
0	1	0
1	0	
1	1	

[2]

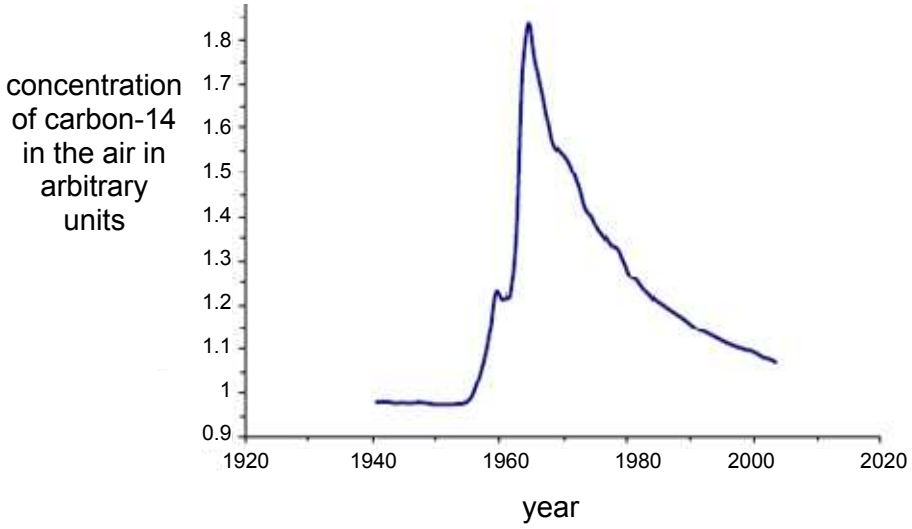
[Total: 2]

Section D

16 (a) Carbon-14 is a radioactive isotope of carbon.

It occurs naturally in small amounts.

Scientists have plotted the concentration of carbon-14 in the air since 1940.



Testing of nuclear bombs started in 1955. The testing was banned in 1963.

Scientists have used this graph to conclude that testing nuclear bombs increased the background radiation level.

How does the graph support this conclusion?

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

(b) Teeth trap small amounts of carbon-14 when they are formed.

Scientists use the amount of carbon-14 trapped in a tooth to estimate when it was formed.

Ian's tooth contains the equivalent of 1.05 arbitrary units of carbon-14.

The graph in **(a)** suggests that the year Ian's tooth was formed was 1957.

Fred's tooth contains the equivalent of 1.22 arbitrary units of carbon-14.

Use the graph to suggest why it is harder to estimate when Fred's tooth was formed.

.....

.....

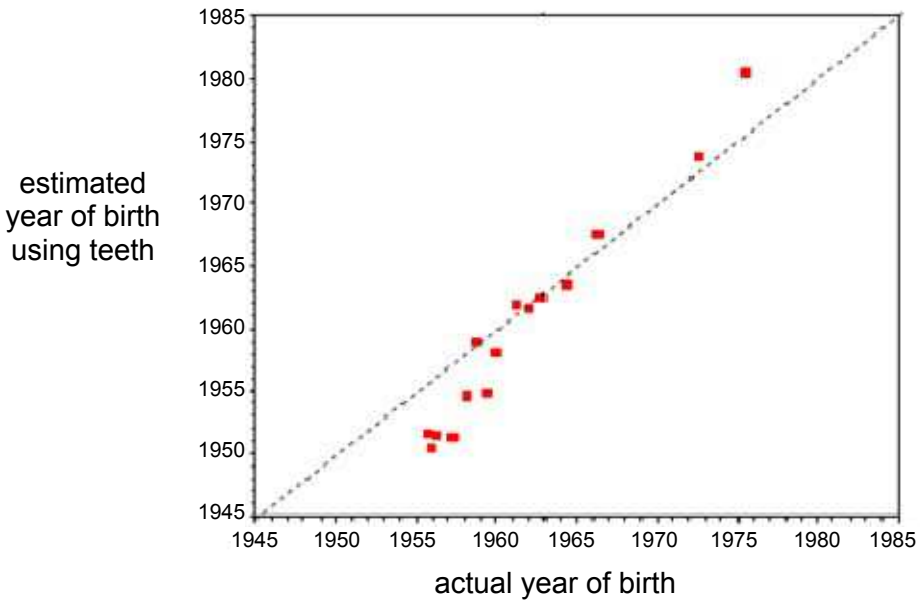
..... **[2]**

(c) The concentration of carbon-14 can be used to estimate the dates of birth of people.

Scientists have used this method on teeth from people of different ages.

They have plotted their results on a graph.

Look at the graph.



(i) How can you tell that more than 10 teeth were tested?

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

(ii) What does the graph show about the scientists' estimates?

.....

.....

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

(iii) How could the scientists improve their estimates?

Put a tick (✓) in the box next to the best answer.

test more teeth from older people	☐
test more teeth from people of different ages	☐
plot the dates in months not years	☐

Explain your answer.

.....

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

[Total: 10]

[Paper Total: 85]

END OF QUESTION PAPER

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