OCR
Oxford Cambridge and RSA

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Wednesday 21 June 2017 – Morning

GCSE GATEWAY SCIENCE
PHYSICS B

B752/01 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

* B 7 5 2 0 1 *

* 6 7 5 4 5 1 9 0 8 2 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The 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 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 **28** pages. Any blank pages are indicated.

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

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

momentum = mass × velocity

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

GPE = mgh

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

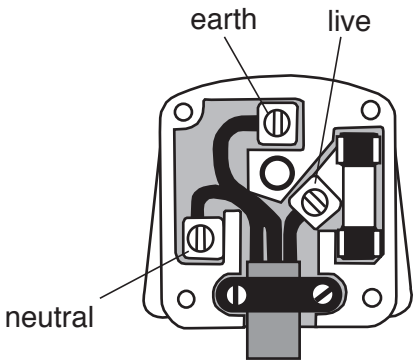
power loss = (current)^2 × resistance

$$V_pI_p = V_sI_s$$

Answer **all** the questions.

SECTION A – Module P4

1 Look at the diagram of a plug for an appliance.



(a) Complete the table.

Wire	Colour	Function
earth	green/yellow	.....
live	.....	carries the high voltage
neutral	.....	completes the circuit

[3]

(b) Some appliances are double insulated.

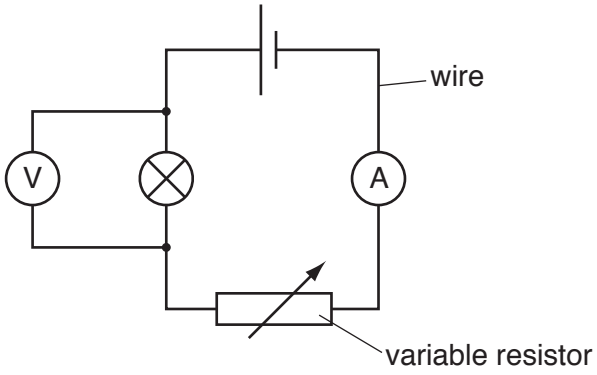
They have only two wires.

Write down the names of these two wires.

..... and .....

[1]

(c) Riya connects an electrical circuit.



The voltmeter reading is 3.0 V.

The ammeter reading is 1.5 A.

(i) Calculate the resistance of the lamp.

.....

.....

answer ..... ohms **[2]**

(ii) Riya wants to increase the current in the circuit.

She **cannot** change the voltage.

Describe **two** changes she could make to this electrical circuit to increase the current.

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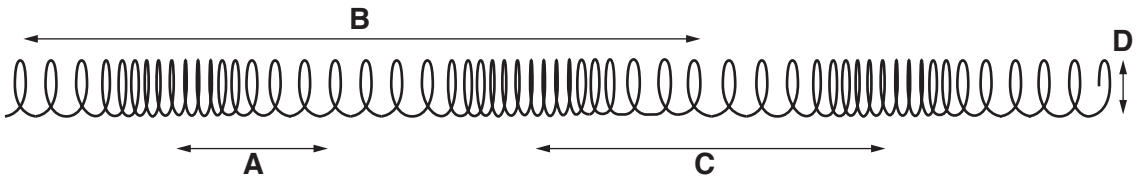
..... **[2]**

2 Ultrasound is a longitudinal wave.

(a) Look at the longitudinal wave in a slinky spring.



(i) Which arrow shows the **wavelength** of this slinky spring?

Choose from **A** **B** **C** **D**

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

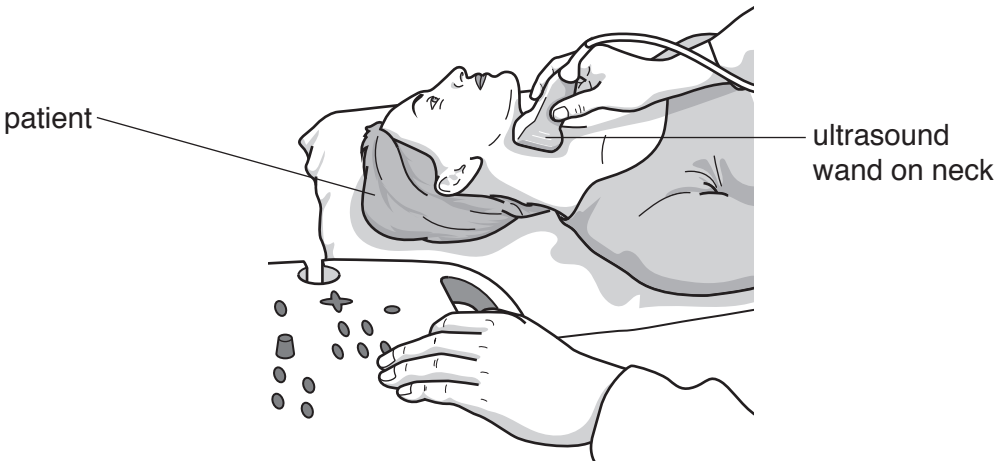
(ii) We can observe the wave moving in the slinky spring and calculate its frequency.

Why is it **not** possible to use this method to find the frequency of an ultrasound wave?

.....

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

(b) Ultrasound is used on a patient.



Ultrasound is used to measure the speed of blood in her neck.

Explain **two** advantages of using ultrasound to do this.

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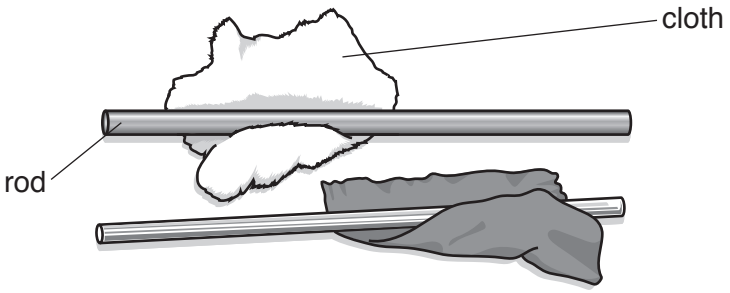
..... **[2]**

3 Carlos investigates static electricity.

He rubs rods with different cloths.



Carlos then uses the rods to pick up small pieces of paper.

Look at his results.

Rod material	Cloth material	Does it pick up paper?
plastic	nylon	yes
nylon	silk	yes
glass	artificial fur	yes
copper	steel wool	no

Explain his results and use these to describe why static electricity can be useful or a nuisance.

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

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

4 Radioisotopes are used in hospitals and in industry.

(a) Describe how radioisotopes are made.

Choose from

by placing materials in a nuclear reactor

by sterilising equipment

by using ultrasound

by using X-rays

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

(b) Emily collects information about different substances used in hospitals.

Substance	Passes through skin	Used to treat cancer	Harmful to healthy cells
A	yes	yes	very harmful
B	yes	no	not harmful
C	yes	yes	harmful
D	no	yes	harmful
E	no	no	not harmful

(i) Which **two** substances emit gamma radiation?

Explain your answer.

.....

.....

.....

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

(ii) A radiographer uses substances that emit gamma radiation.

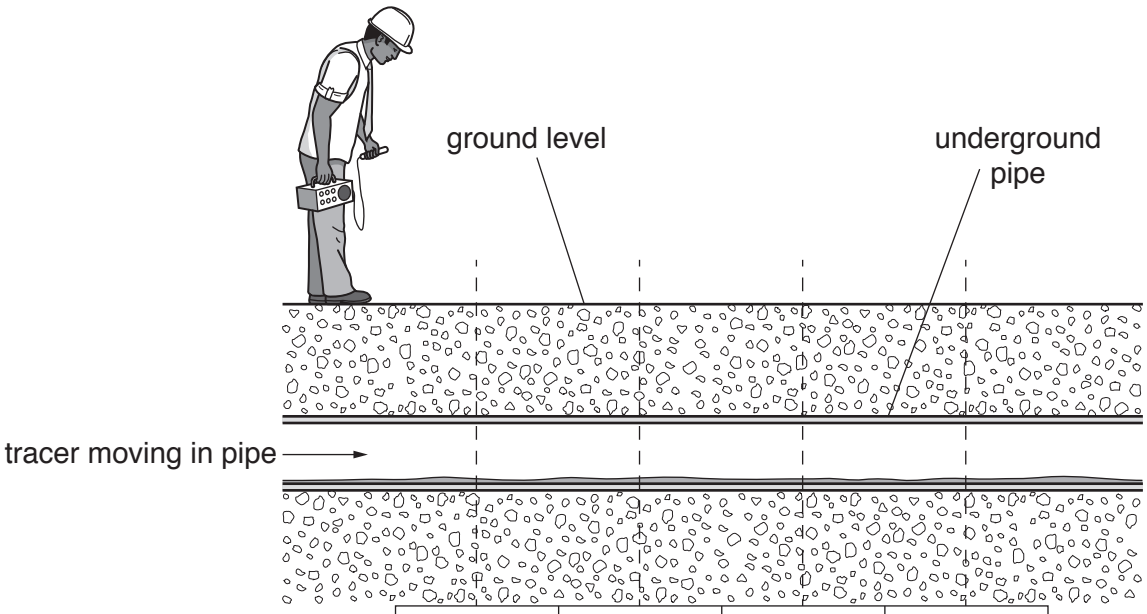
Write down **one** safety precaution the radiographer must take.

.....

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

(c) Radioisotopes can be used as tracers in industry.

They can be used to find a blockage in an underground pipe.



	area A	area B	area C	area D
	28	31	37	4
	30	21	29	5
	23	35	36	3
mean	**27**	**29**		

The table shows the amount of radiation in each area.

There are three readings for each area.

Just before the blockage the amount of radiation from the tracer **increases**.

Calculate the mean readings in areas **C** and **D and** use this information to find the blockage.

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

SECTION B – Module P5

5 Satellites orbit larger objects in space.

(a) The Moon is a natural satellite of the Earth. It has a circular orbit.

Explain why the Moon remains in orbit around the Earth.

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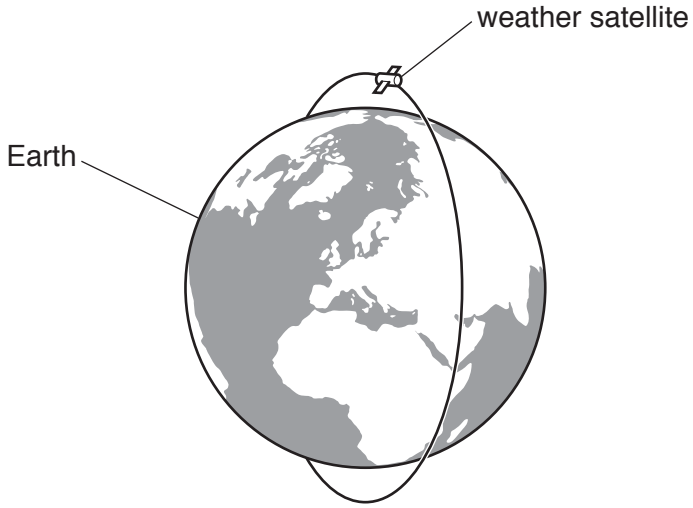
..... **[2]**

(b) Artificial satellites are used for weather forecasting.

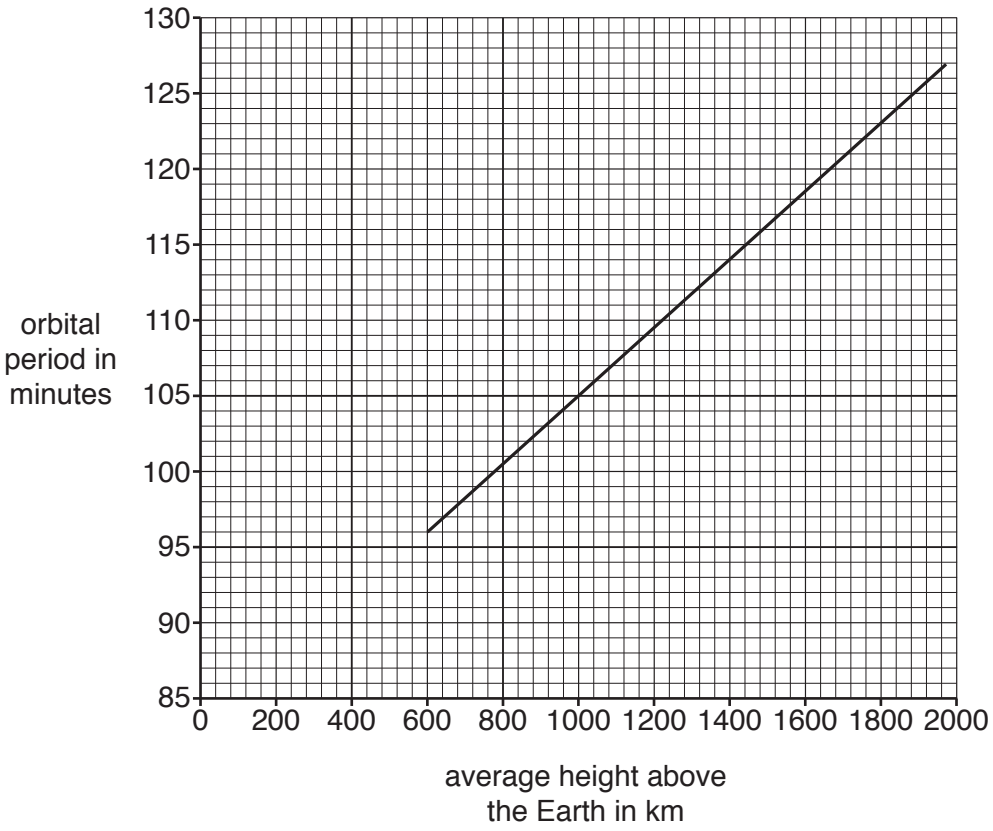


Write down one **other** use of artificial satellites.

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

(c) Weather forecasting satellites are in a low orbit.

The average height of a satellite above the Earth is linked to its orbital period.



(i) A scientist suggests that doubling the height above the Earth from 1000 km to 2000 km will double the time period.

Is he correct?

Use calculations in your answer.

.....

.....

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

(ii) Write down one **advantage** of a low orbit for weather satellites.

.....

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

(d) Low orbit satellites and geostationary satellites communicate with Earth.

Look at the information about different waves.

Wave	Frequency in MHz	Wave information
A	more than 30 000	radio waves and microwaves can pass through the atmosphere but are absorbed by rain and dust
B	less than 30	radio waves with long wavelengths are reflected by the upper atmosphere
C	30 to 30 000	microwaves and some radio waves pass through the atmosphere

Which wave is best for communicating with

- low orbit satellites
- geostationary satellites?

Explain your answers.

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

6 Speed and velocity are measurements.

(a) Tick (✓) the **two** correct sentences about speed and velocity.

Direction is **not** important when measuring speed.	☐
Relative speed does **not** depend on the direction of movement.	☐
Speed and velocity are vector quantities.	☐
Speed is a scalar quantity.	☐
Velocity is always higher than speed.	☐

[2]

(b) The diagram shows a car accelerating.

The car accelerates at 0.6 m/s^2 for 10 s.

The car has a final velocity of 11 m/s.

Calculate the starting velocity.

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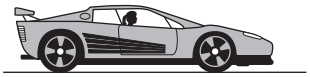
.....

answer ..... m/s **[2]**

(c) The car stops accelerating when it reaches the final velocity of 11 m/s.



The car crashes into a tree.

(i) Describe what happens to the motion of the car **and** the tree during the collision.

.....

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

(ii) What type of forces act on the car and the tree during the collision?

Choose from

forces are equal and in the same direction

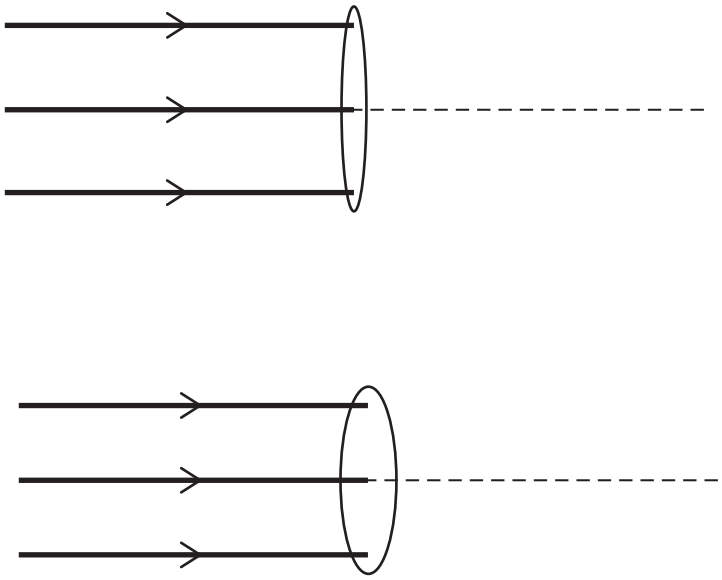
forces are equal and in opposite directions

forces are unequal and in the same direction

forces are unequal and in opposite directions

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

7 Anya compares two different convex lenses.



The light rays pass through the lenses.

Label and complete the ray diagrams to show the path the rays take.

Use your completed diagrams to describe how convex lenses produce a real image.

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

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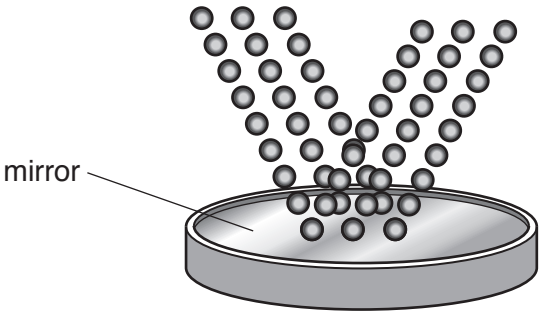
..... **[6]**

8 Models are useful in physics.

(a) There are two different models for the nature of light.

(i) Newton described light as particles.

Look at a model showing light as particles.



Use the model to describe **one** of the properties of light.

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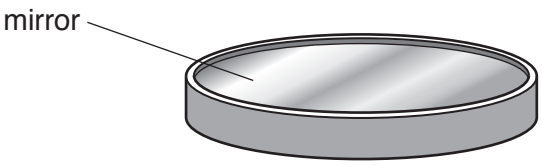
..... **[1]**

(ii) Huygens described light as a wave.

Redraw the model showing light as a wave.

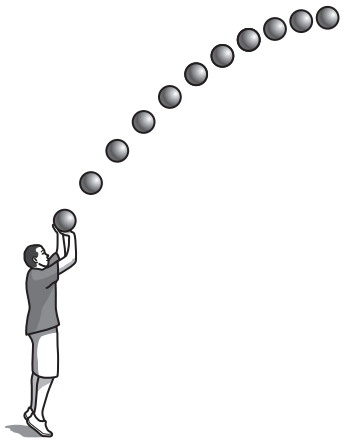


[1]

(b) Motion can also be shown with a model.

Eric throws **one** ball.

Look at the picture.



Eric has only used **one** ball.

Describe the type of motion **and** how the picture is made.

You may draw on the picture to explain your answer.

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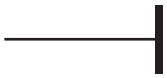
.....

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

SECTION C – Module P6

9 Dev investigates using a capacitor in an electrical circuit.

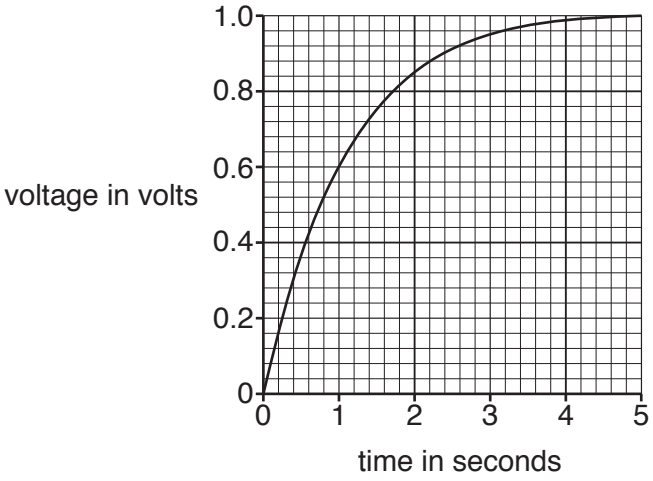
(a) Complete his circuit symbol of a capacitor.



[1]

(b) Dev connects the capacitor into a circuit.

He draws a graph of the voltage across the capacitor against time.



(i) The function of the capacitor is to store charge.

The capacitor is uncharged before he connects the electrical circuit.

Describe how the graph shows the capacitor is uncharged.

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

(ii) Compare the changes in voltage across the capacitor from 0 to 2.5 seconds **and** from 2.5 to 5 seconds.

Use information from the graph in your answer.

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

(c) Space probes are transported a long distance to Mars.

Glass capacitors are used to 'wake up' space probes when they reach Mars.

Space probes need large voltages for their electrical components to work.

Describe the risks of using capacitors in space probes.

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

10 (a) There are three types of transformers

- isolating transformer
- step-down transformer
- step-up transformer.

Which type is used in a bathroom shaver socket?

Explain your answer.

.....

.....

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

(b) Tick (✓) the **two** correct sentences about transformers.

Step-down transformers are used in mobile phone chargers.	☐
Step-up transformers are used in laptops.	☐
Transformers change AC to DC.	☐
Transformers only work with AC.	☐
Transformers only work with DC.	☐

[2]

(c) Clive finds information about voltages across the National Grid.

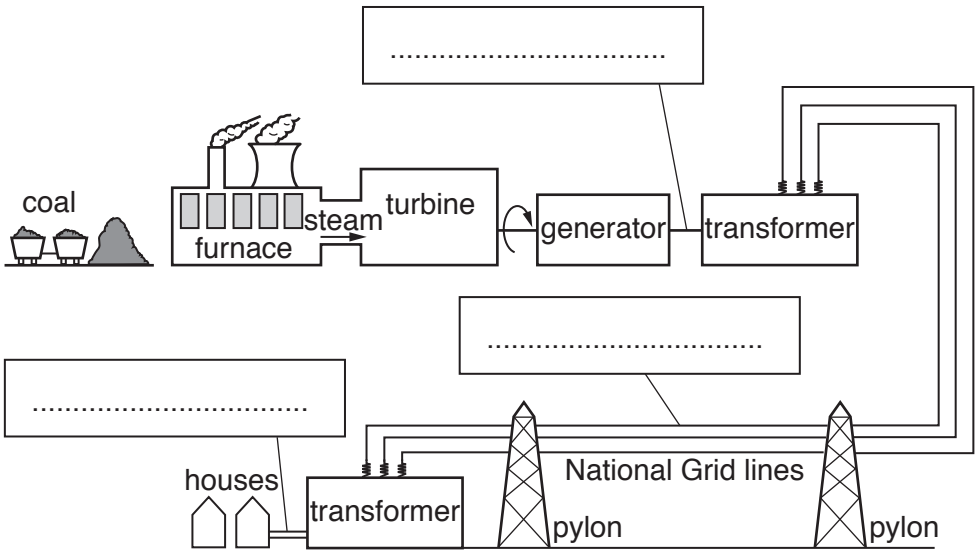
Here are the voltages:

25 000 V

230 V

275 000 V

Look at the diagram of a power station connected to the National Grid.



(i) Write the correct voltages in the boxes on the diagram. **[1]**

(ii) Describe how different transformers are used in the National Grid.

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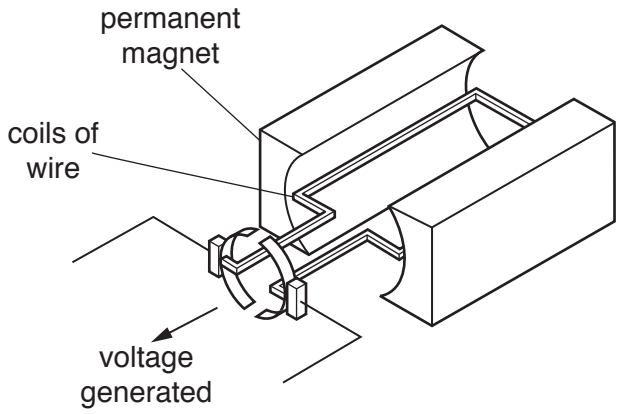
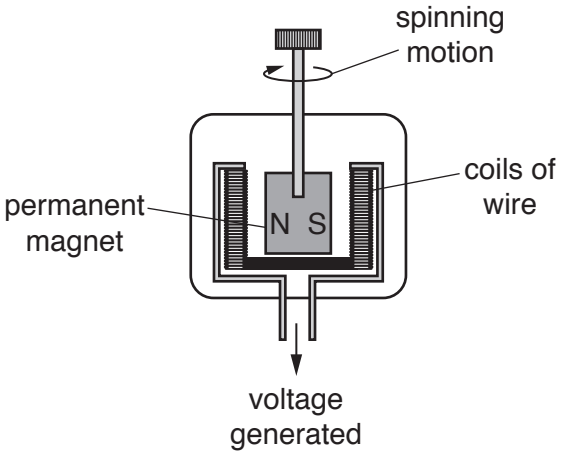
..... **[2]**

11 Tanya compares two generators

- a simple generator
- a generator in a power station.



simple generator



generator in a power station

Write about the similarities and differences in the way the two generators work.

Describe how the **size** of the voltage generated can be changed in the two generators.

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

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

12 Kate designs a moving robot that detects changes in **light** and **warmth**.

(a) Which **two** components must she use?

Choose from

diode

lamp

LED

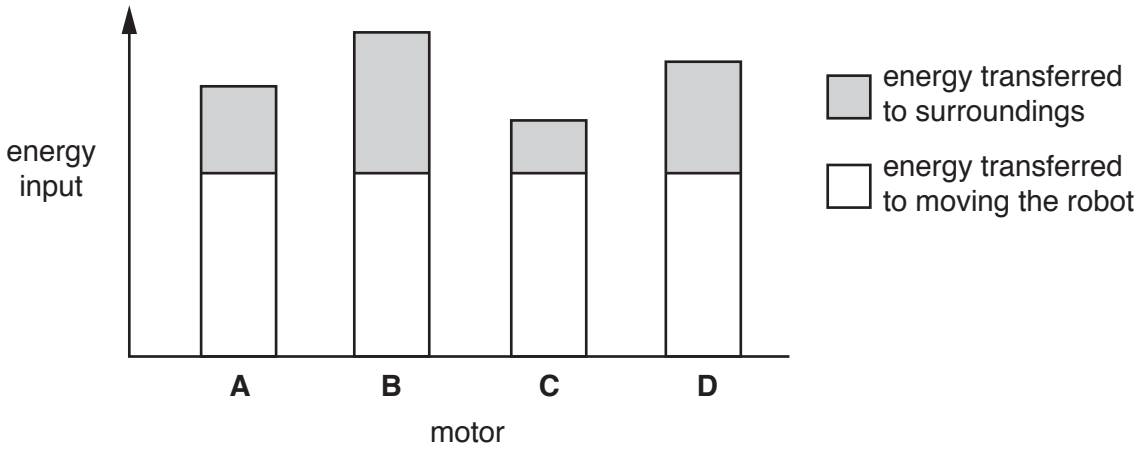
LDR

thermistor

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

(b) The robot has a motor to make it move.

Kate finds information about motors **A**, **B**, **C** and **D**.



Kate says 'the best motor to use is **C**'.

Explain why she is correct.

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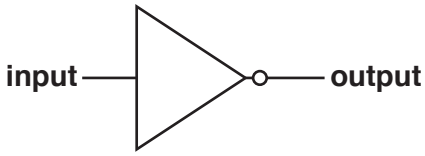
..... **[2]**

(c) The robot has a NOT gate in one of its electronic circuits.



The robot moves using the motor when the **output** to the NOT gate is 0.

When the robot bumps into an object the **input** changes to 1.

Describe how the NOT gate circuit helps to reduce damage to the robot.

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

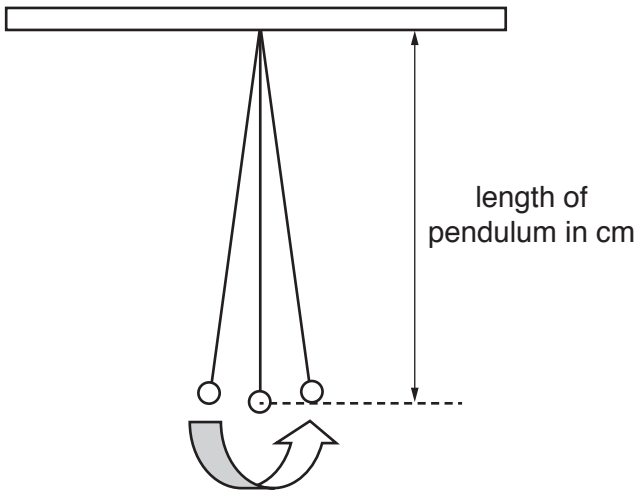
SECTION D

13 Helen investigates children's swings.

She models the swings in the laboratory using weights attached to string.

This type of swing is called a **pendulum**.

She sets up a pendulum and makes it swing.



(a) Helen uses a pendulum that has a length of 50 cm.

She measures the time it takes the pendulum to complete 10 swings.

She repeats this three times, **A**, **B** and **C**.

Look at her results.

Length of pendulum in cm	**Time for 10 swings in s**			
	A	**B**	**C**	**Mean (average)**
50	14.62	14.78	14.40	

Calculate the mean (average) time for 10 swings.

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

(b) Helen changes the length of the pendulum to 60 cm.

She takes three more measurements and calculates the mean.

Look at her results.

Length of pendulum in cm	Time for 10 swings in s			
	A	**B**	**C**	**Mean (average)**
60	16.35		15.65	16.00

The results table is incomplete.

Use the data to calculate the missing value **B**.

answer ..... s **[2]**

(c) Helen changes the length of the pendulum to 70 cm.

She takes more measurements and calculates the mean.

Look at her results.

Length of pendulum in cm	Time for 10 swings in s				Mean (average) time for one swing in s
	A	**B**	**C**	**Mean (average)**	
70	17.55	17.65	17.32	17.50666	

Use the data to calculate the mean time for one swing.

Give your answer to 2 decimal places.

answer ..... s **[2]**

(d) Helen wants to find out about real swings, like those used by children.

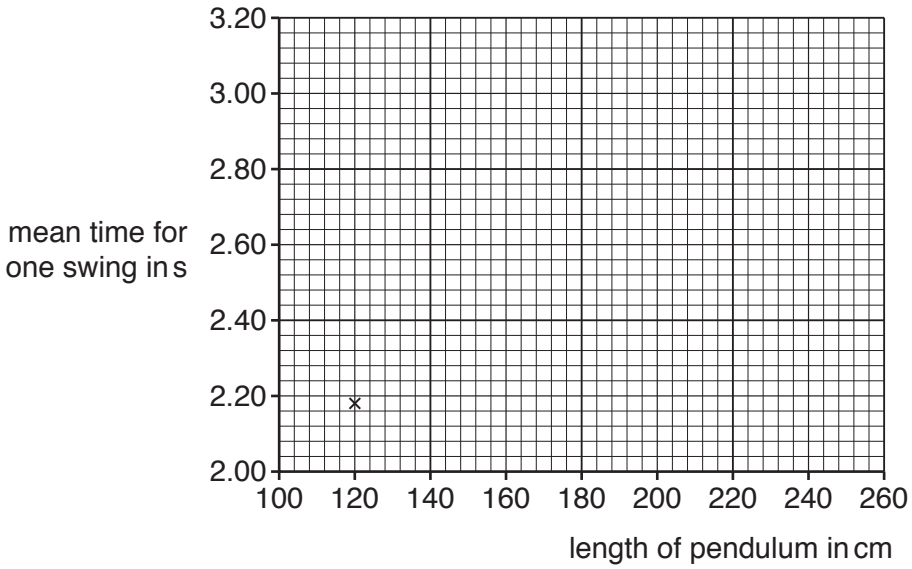
She uses longer pendulums and investigates the effect of changing the length.

Look at the summary of her results.

Length of pendulum in cm	Mean (average) time for one swing in s
100	2.00
120	2.18
150	2.43
190	2.74

(i) Plot Helen's results onto the graph. One has been plotted for you.

Draw a line of best fit.



[2]

(ii) Describe the pattern shown by the graph.

.....

.....

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

(iii) Helen wants to make a pendulum that takes 3 s for one complete swing.

Predict the length of this pendulum.

Show your working on the graph.

answer ..... cm **[2]**

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).