

**Tuesday 18 June 2013 – 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.

**Duration:** 1 hour 30 minutes

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**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 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.

## EQUATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\text{GPE} = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$l_e = l_b + l_c$$

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

$$\frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

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

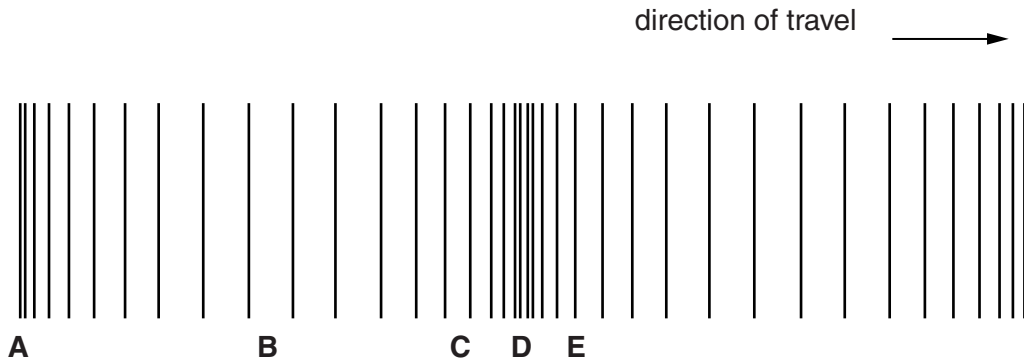
$$V_p I_p = V_s I_s$$

Answer **all** the questions.

**SECTION A – Module P4**

**1** Ultrasound is a longitudinal wave.

**(a)** Look at the diagram of a longitudinal wave.

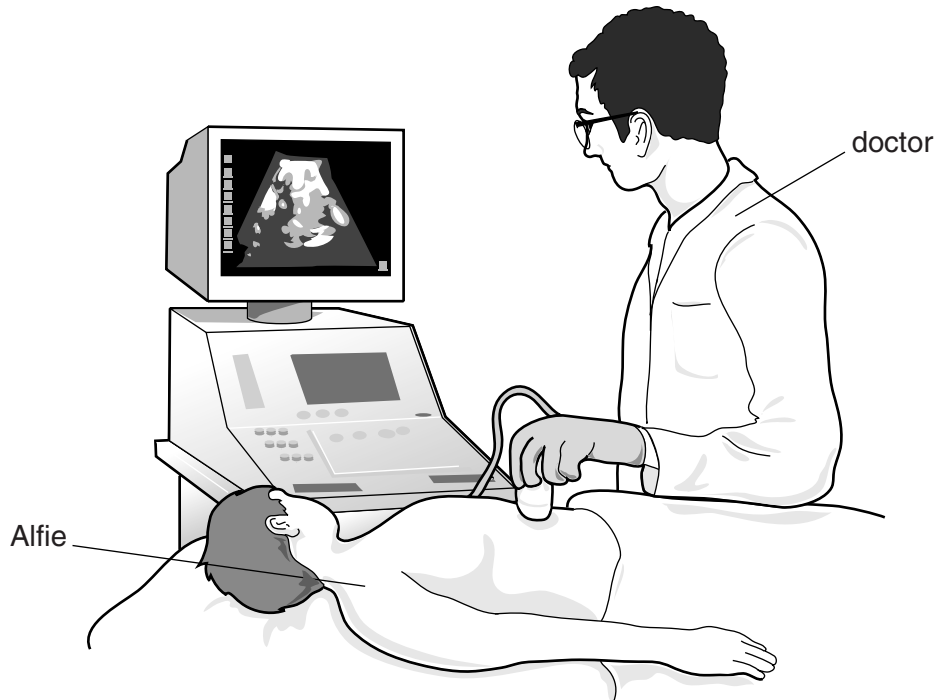


Choose from **A, B, C, D** or **E** to complete the following sentences.

- (i)** The wavelength is the distance between letter ..... and letter ..... [1]
- (ii)** A rarefaction is shown by letter ..... [1]

(b) Alfie has stones in his kidney.

The doctor uses an ultrasound machine.



(i) Suggest why doctors use ultrasound before they operate.

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

(ii) Write down another use of ultrasound.

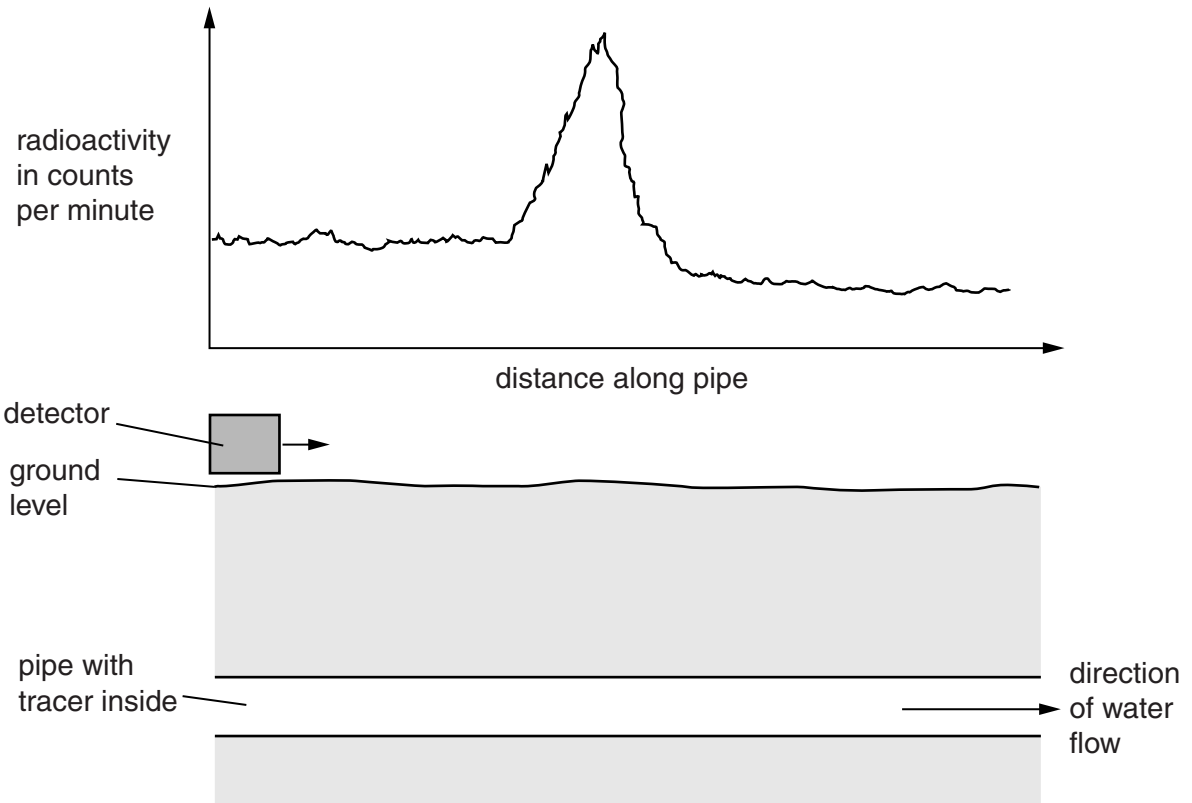
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..... [1]

[Total: 4]


2 A radioactive tracer is put into an underground water pipe.

A detector above the ground measures the radioactivity.

The graph shows the amount of radioactivity detected along the length of the pipe.



Describe the patterns in the graph and explain how this information can be useful.

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

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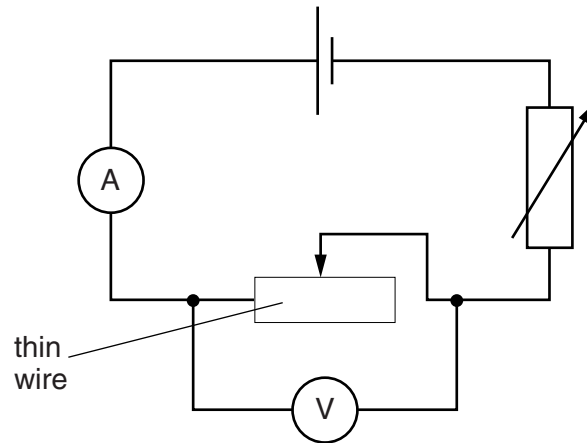
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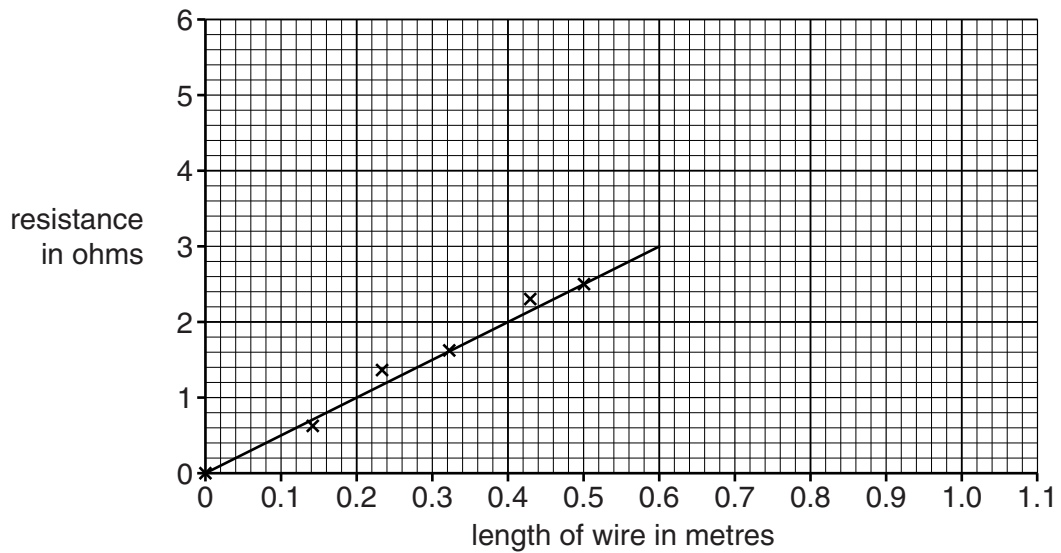
**[Total: 6]**  
**Turn over**

3 Ronin and Kiri use an electric circuit to investigate the resistance of a thin wire.



(a) Ronin changes the length of the wire. He calculates the resistance for each length.

He plots a graph of his results.



(i) Use the graph to estimate the resistance when the length of the wire is 1.0 metres.

.....  
 .....

resistance ..... ohms [2]

(ii) Ronin repeats the investigation with a **thicker** wire.

Here are his results.

Length of wire = 1.0 metre.

Reading on voltmeter = 0.25V.

Reading on ammeter = 0.40 A.

What is the resistance?

Put a **ring** around the correct answer.

- 0.10 ohms**                      **0.25 ohms**                      **0.63 ohms**                      **1.60 ohms**                      [1]

(iii) Kiri writes a two-sentence conclusion.

Sentence 1 **As the wire gets thicker the resistance decreases.**

Sentence 2 **This is because there is less current flowing through the wire.**

Is Kiri's conclusion correct?

Explain your answer.

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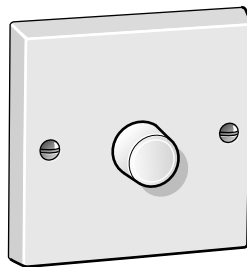
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..... [2]

(b) A dimmer switch can be used to control the brightness of a light in a room.



One type of dimmer switch contains a variable resistor.

Describe how the variable resistor in this dimmer switch can reduce the brightness of the light.

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..... [2]

[Total: 7]

4 This question is about nuclear energy.

(a) Complete the crossword.

One answer has been done for you.

**Across**

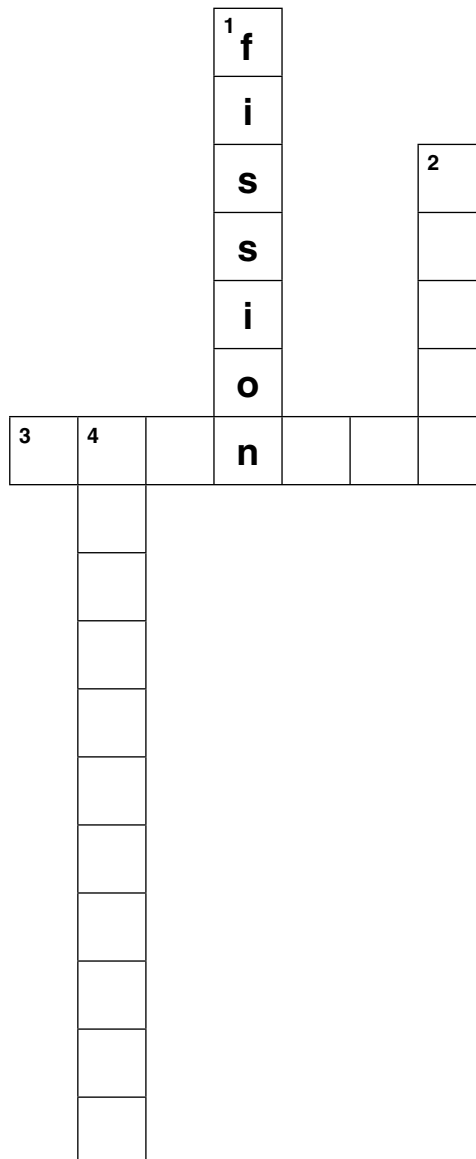
3 A fuel used in a nuclear power station is \_\_\_\_\_.

**Down**

1 The process that gives out energy in a nuclear reactor is nuclear **f i s s i o n**.

2 Energy from the reactor is used to heat water turning it into \_\_\_\_\_.

4 The waste produced by the nuclear reaction is \_\_\_\_\_.

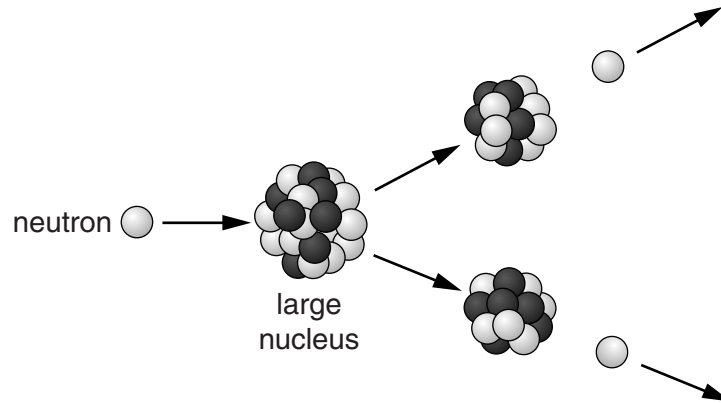


[2]



(b) Scientific ideas can be shown by models.

Look at a simple model for **nuclear fission**.



Describe the process of nuclear fission using this simple model.

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..... [2]

[Total: 4]

5 Tanida jumps up and down on a trampoline.

The jumping surface of the trampoline is an insulating material.  
Tanida is wearing synthetic socks.



When Tanida gets off the trampoline she gets an electrostatic shock as she touches the ground.

(a) Explain why Tanida gets an electrostatic shock.

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.....

.....

..... [2]

(b) Tanida’s parents want to reduce her risk of an electrostatic shock.

Look at the information they find on the internet.

How to reduce risk	Probability of an electrostatic shock
jump barefoot	32%
wear cotton clothing	46%
only use the trampoline when there is moisture in the air	24%

Suggest which change they should make to reduce the risk the most.

Describe how this method works.

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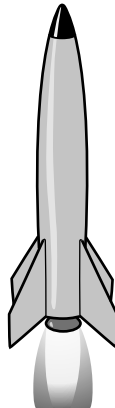
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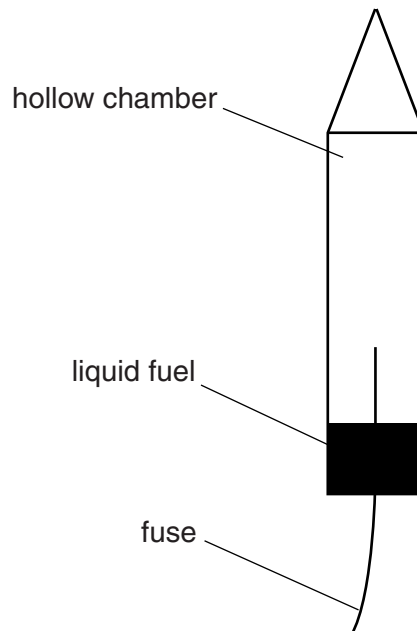
[Total: 4]

SECTION B – Module P5

6 Rockets use hot gases to make them move.



Look at the diagram of a simple rocket.



Denise lights the fuse of the rocket. The fuel in the rocket ignites.

A very fast chemical reaction takes place which creates a large amount of hot gas.

(a) Explain what happens to the hot gas and how this makes the rocket move.

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[2]

(b) Denise re-uses the rocket. This time she puts in more fuel than before.

Suggest what happens to the acceleration of the rocket.

Explain your answer.

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

(c) Rockets carry satellites into space.

(i) These satellites are kept in orbit around a planet by a force.

What is the name of this force?

..... [1]

(ii) Write down the name of a natural satellite and describe how it is different from an artificial satellite.

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

(d) A rocket was sent to Mars.

The rocket carried a vehicle called the Mars Rover.



The Mars Rover has a mass of 185 kg.

Its wheels are designed to carry a total weight of up to 1800 N.

The gravitational field strength ( $g$ ) on Mars is 3.8 N/kg.

This means a mass of 1 kg on Mars weighs 3.8 N.

(i) Calculate the weight of the Rover vehicle on Mars.

.....  
.....

answer ..... N [2]

(ii) Look at the table showing how gravitational field strength varies.

Place	Gravitational field strength in N/kg
Moon	1.6
Earth	10.0
Mars	3.8

Scientists are happy for the Rover to be used on the Moon or Mars.

They are very careful when using the Rover on Earth.

Use the data and information about the Rover to explain why.

.....

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..... [2]

[Total: 11]

7 This question is about lenses.

(a) Harry uses a projector lens to produce a magnified image of an object.

The size of the object is 25 mm and the size of the image is 200 mm.

Calculate the magnification.

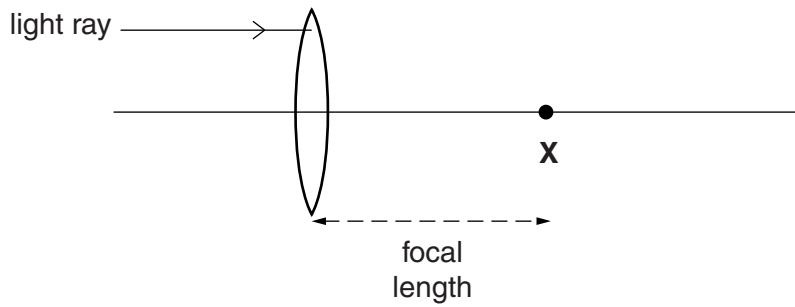
Choose from

- 0.125      8      175      225      5000

answer ..... [1]

(b) Harry draws a ray diagram for a convex lens.

Look at the diagram.



(i) Continue the path of the light ray on the diagram after it leaves the lens. [1]

(ii) Write down the name of X.

..... [1]

(iii) Harry uses two different convex lenses. One is thick and the other is thin.



How does the thickness affect the focal length of the lens?

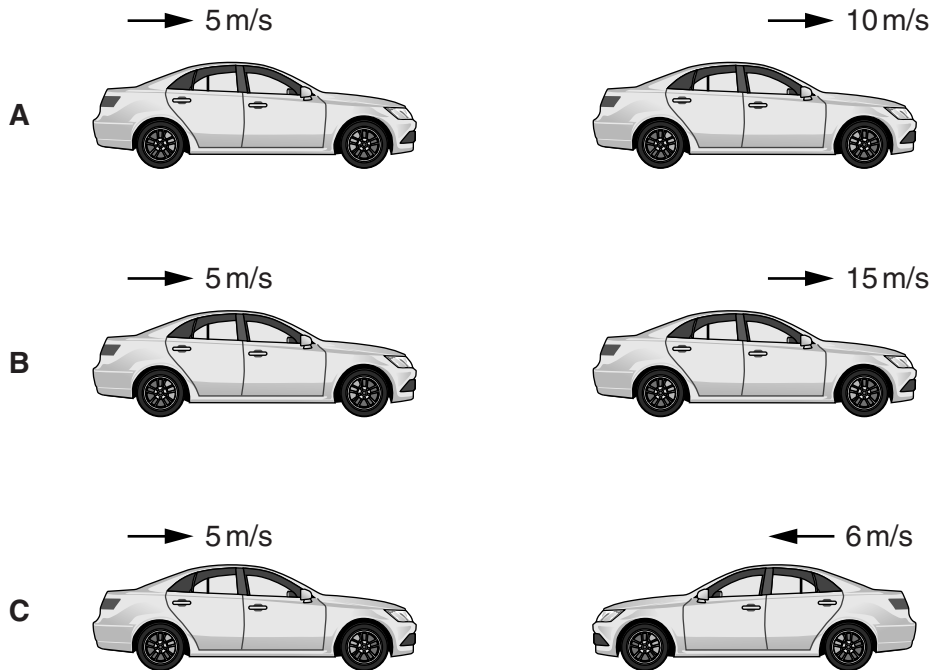
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[Total: 4]



8 Look at the diagrams of the three pairs of cars **A**, **B** and **C**.

The arrows show the direction and speed (velocity) of each car.



The two cars shown in **C** have the highest relative speed.

Explain why.

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..... [2]

[Total: 2]

- 9 Electromagnetic waves used for communication can be transmitted long distances around the Earth by different methods.

The communication method depends on the wavelength and frequency of the electromagnetic wave used.

Describe these different methods of communication.

Labelled diagrams may help your answer.



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

..... [6]

**[Total: 6]**

10 Many years ago, scientists tried to find out about light.

Some scientists, such as Newton, described light using a particle model.

Other scientists, such as Huygens, described light using a wave model.

Put ticks (✓) in the boxes to show which properties of light can be explained by each model.

Model	Property	
	Reflection	Interference
particle model		
wave model		

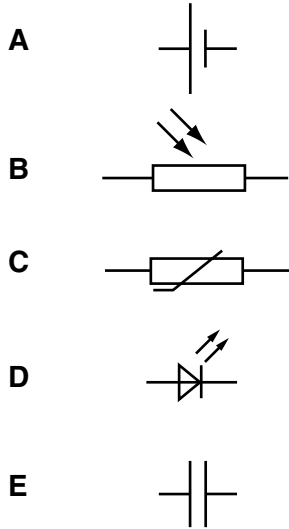
[2]

[Total: 2]

## SECTION C – Module P6

11 This question is about electronic components and circuits.

(a) Look at the symbols.



(i) Which symbol shows a **thermistor**?

Choose from **A**, **B**, **C**, **D** or **E**.

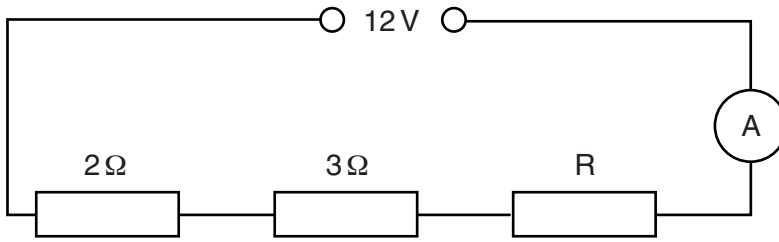
answer ..... [1]

(ii) Which symbol shows a **capacitor**?

Choose from **A**, **B**, **C**, **D** or **E**.

answer ..... [1]

(b) Pat connects three resistors in a circuit.



The supply voltage is 12V.

The reading on the ammeter is 1.5A.

(i) Calculate the total resistance in the circuit.

.....  
.....  
.....

answer .....  $\Omega$  [2]

(ii) Calculate the value of R.

.....  
.....  
.....

answer .....  $\Omega$  [1]

[Total: 5]

12 Electric motors are used in many everyday appliances.

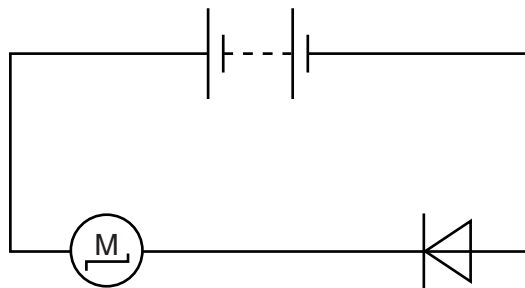
(a) Look at the list of appliances.

<b>cd player</b>	
<b>kettle</b>	
<b>lamp</b>	
<b>radio</b>	
<b>washing machine</b>	

Put a tick (✓) next to the appliances which have an electric motor.

[1]

(b) Rob puts a motor in a circuit.



The motor does not turn.

Explain why.

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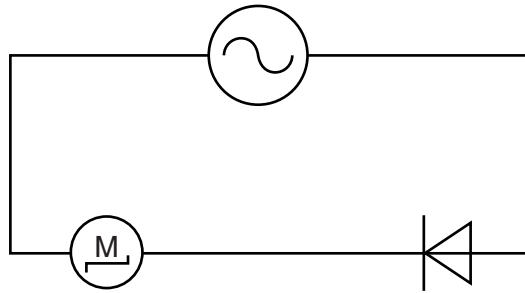
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..... [2]

(c) Rob replaces the battery with an ac supply.

The motor now turns, but not smoothly.



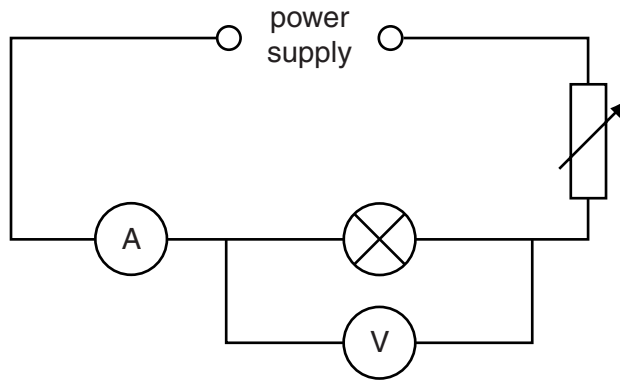
Explain why.

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..... [1]

[Total: 4]

13 Sue connects a circuit containing a variable resistor and a lamp.



Sue changes the resistance of the variable resistor.

She measures the current through the lamp and the voltage across the lamp.

She calculates the resistance of the lamp.

Look at the table of her results.

Voltage in volts	Current in amps	Resistance in ohms
1	1	1
4	2	2
12	3	4

Describe how the resistance of the lamp changes. Use a model of atomic structure to explain why the lamp has resistance and why the resistance changes.



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

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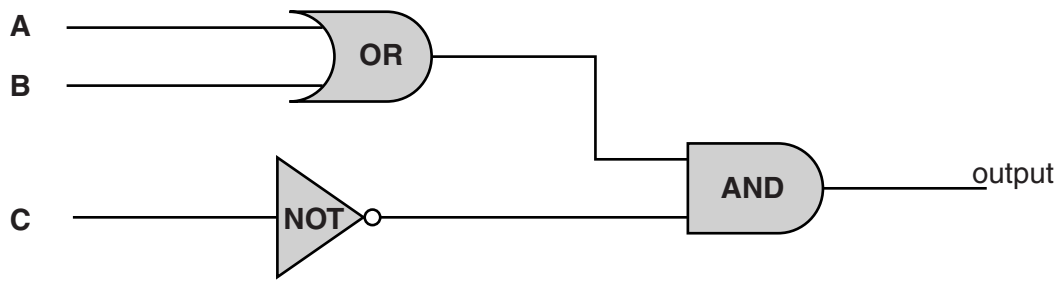
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..... [6]

[Total: 6]



14 Look at the logic circuit.



(a) Complete the truth table for the logic circuit.

A	B	C	Output
0	0	0	0
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	
1	0	1	
0	1	1	
1	1	1	

[1]

(b) The circuit is used by a gardener in his greenhouse to control a fan.

**A** is a temperature sensor      hot = 1

**B** is a moisture sensor          wet = 1

**C** is a light sensor              light = 1

What conditions are needed for the fan to operate?

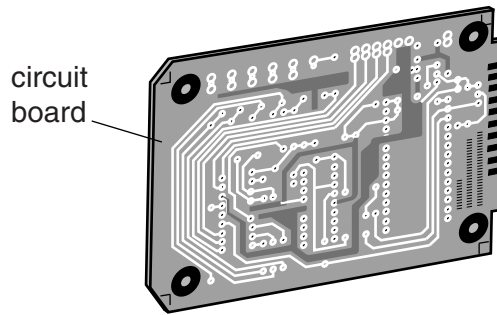
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..... [2]

- (c) A microchip manufacturer has been asked to make electronic components for a new communications satellite.



The manufacturer must make these components as small and as light as possible.

Write about the difficulties for the manufacturer in making very small components for the satellite.

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..... [2]

[Total: 5]

15 This question is about electrical devices.

(a) Look at the information about five different transformers.

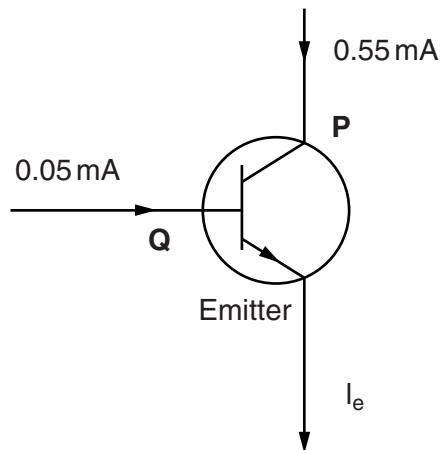
Put a tick (✓) in the correct column to identify each type of transformer.

The first one has been done for you.

Input voltage	Output voltage	Step up	Step down	Isolating
12	240	✓		
500	10			
230	230			
240	80			
1000	10 000			

[2]

(b) Look at the diagram of an NPN transistor.



(i) Write down the names of the terminals **P** and **Q**.

**P** is the .....

**Q** is the .....

[1]

(ii) Calculate the current flowing from the emitter,  $I_e$ .

.....  
 .....

answer ..... mA [1]

(iii) Complete this sentence.

Transistors can be connected together to make ..... [1]

[Total: 5]

SECTION D

16 NCAP is an organisation that tests the safety of all new cars.

(a) Look at the data about some cars.

Each safety category is scored as a percentage (%).

The maximum safety score is 100%.

Car	Safety star rating 5* – good 1* – poor	Safety categories				Average safety score
		Adult passenger safety	Child passenger safety	Pedestrian safety	Car safety features	
Q3	*****	94%	85%	52%	86%	79%
Captiva	*****	88%	82%	48%	71%	72%
Freemont	*****	83%	82%	50%	71%	72%
Ranger	*****	96%	86%	81%	71%	84%
Veloster	*****	96%	89%	49%	71%	76%
Voyager	****	79%	67%	47%	71%	.....
M-Class	*****	96%	75%	60%	86%	79%
Astra	*****	91%	79%	50%	71%	73%
Yaris	*****	89%	81%	60%	86%	79%

(i) Which three cars have the **highest** adult passenger safety % score?

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

(ii) Which car is safest for child passengers?

..... [1]

(iii) The Voyager has the lowest safety star rating.

Calculate the average safety score for the Voyager and explain why it only has a 4\* safety rating.

average safety score = ..... %

explanation .....  
 ..... [2]

(b) Car tyres grip the road when braking.

Tyres have a tread that wears away slowly with use.

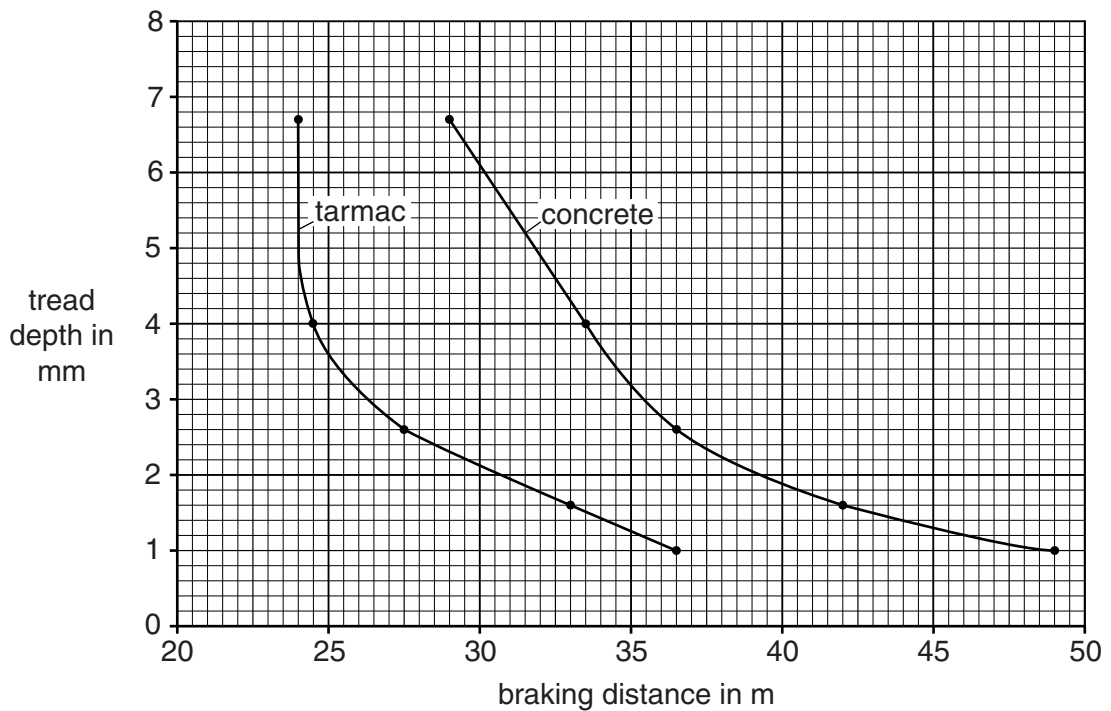
New tyres have a tread that is 9 mm deep.

The tread helps to move water away from the tyre when the road is wet.

This increases friction forces and improves braking.

Look at the graph. It shows braking distances for tyres of different tread depths.

The data is for two different road surfaces on a wet day.



What conclusions can you make from the graph?

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..... [2]

(c) The minimum legal tread depth is 1.6 mm in the UK.

Manjit has some tyres that have a tread depth of 6.7 mm.

The garage tells her that, for normal driving, the tread should wear by 0.17 mm per 1000 km.

(i) Calculate how many kilometres she can expect to travel before the tyres are illegal.

.....  
.....  
.....

answer ..... km [3]

(ii) It is unwise for Manjit to use the tyres for the distance calculated before replacing them.  
Use the graph to explain why.

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

[Total: 10]

**END OF QUESTION PAPER**

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