

Wednesday 20 June 2012 – Morning

**GCSE GATEWAY SCIENCE
PHYSICS B**

B652/02 Unit 2 Modules P4 P5 P6 (Higher Tier)

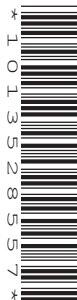
Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour



Candidate forename		Candidate surname	
Centre number		Candidate number	

MODIFIED LANGUAGE

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

- The number of marks is given in brackets [] at the end of each question or part question.
- A list of physics equations is printed on page two.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

EQUATIONS

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

$$v = u + at$$

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

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

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

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

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

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

$$\text{refractive index} = n = \frac{\sin i}{\sin r} \quad \begin{array}{l} i = \text{incident angle} \\ r = \text{refracted angle} \end{array}$$

$$\sin c = \frac{n_r}{n_i} \quad \begin{array}{l} c = \text{critical angle} \\ n_r = \text{refractive index of less dense material} \\ n_i = \text{refractive index of more dense material} \end{array}$$

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

$$V_{\text{out}} = V_{\text{in}} \times \frac{R_2}{(R_1 + R_2)}$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$V_p I_p = V_s I_s$$

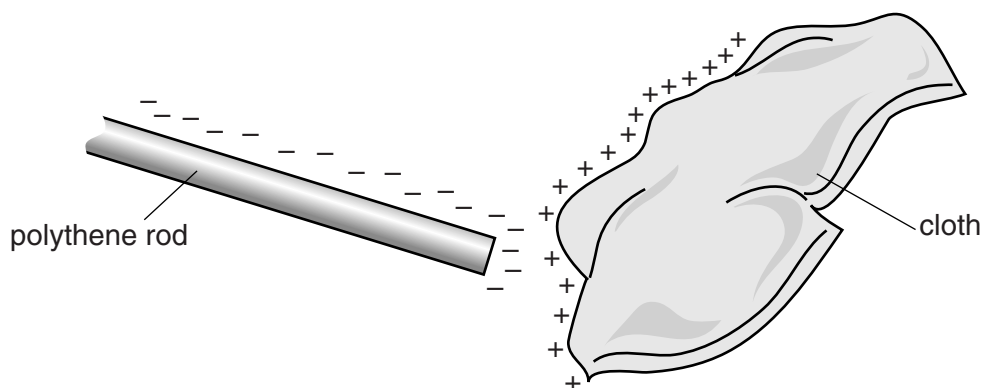
Answer **all** the questions.

Section A – Module P4

- 1 Steven experiments with electrostatics in a science lesson.

He rubs a polythene rod with a cloth.

The rod becomes negatively charged and the cloth becomes positively charged.



Describe what effect the cloth and the rod now have on each other.

Explain why the cloth has a net positive charge and the rod has a net negative charge.

.....

.....

.....

.....

..... [3]

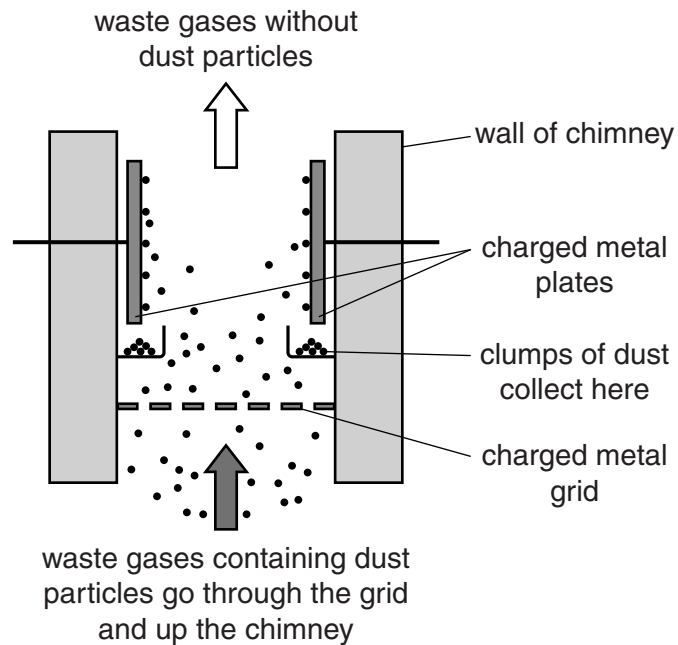
[Total: 3]

2 This question is about how static electricity can be useful.

One use is removing dust (smoke) particles from power station chimneys.

This is done using an **electrostatic precipitator**.

Look at the diagram of an electrostatic precipitator.



Look at the sentences opposite about how the electrostatic precipitator works.

They are **not** in the **correct order**.

Put numbers (2 to 6) in the correct order boxes to explain how the precipitator works.

Two sentences (1 and 7) have been done for you.

5

sentence

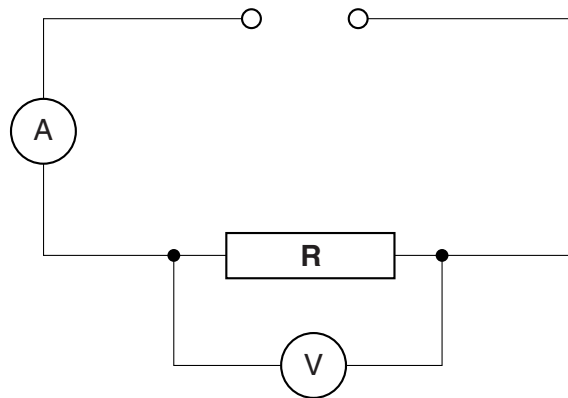
**correct
order**

Dust particles pass through the metal grid and become negatively charged.	
Dust particles are attracted to the metal plates.	
The metal grid is negatively charged and the metal plates are positively charged.	1
Plates are knocked so dust can fall and be collected.	
This is because opposite charges attract.	
Up to 99% of the dust in the smoke from the power station can be removed in this way.	7
Dust particles form larger clumps of dust on the metal plates.	

[3]

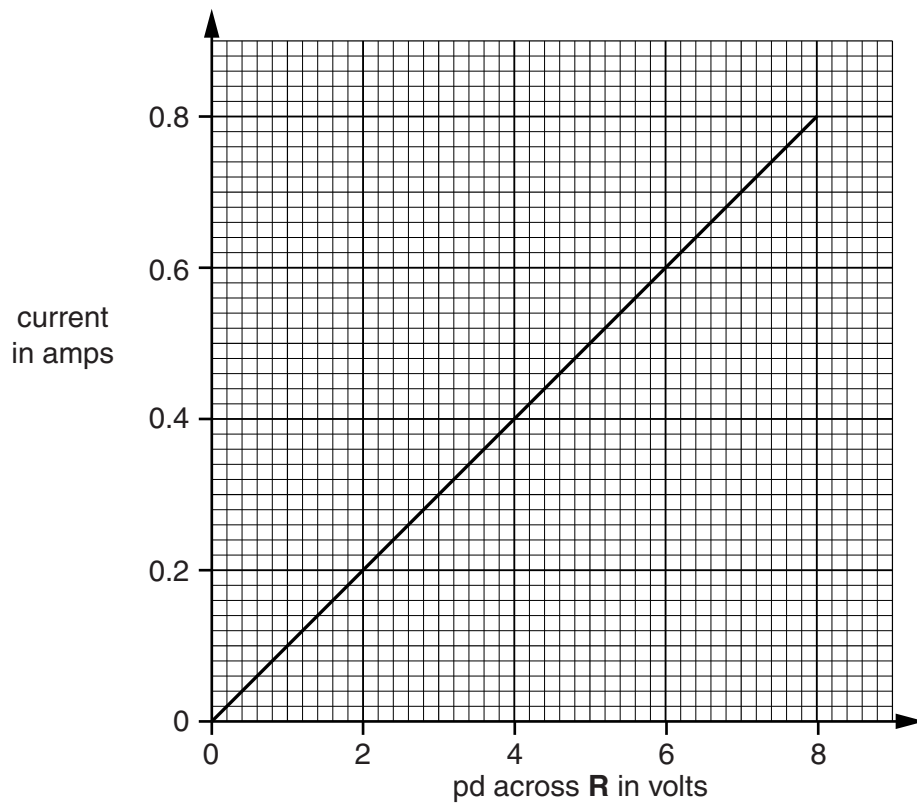
[Total: 3]

3 Thomas sets up this circuit.



He measures current and voltage (pd).

This is a graph of his results.



Calculate the resistance of **R**.

The equations on page 2 may help you.

.....

.....

.....

answerohms (Ω)

[3]

[Total: 3]

- 4 Doctors can **locate** kidney stones in a human body using an ultrasound scan.



- (a) Why is ultrasound used instead of X-rays to locate the kidney stones?

.....
 [1]

- (b) Doctors can break up the kidney stones using ultrasound.

How do the ultrasound waves break up the kidney stones?

.....
 [1]

- (c) Kidney stones can also be removed by conventional surgery.

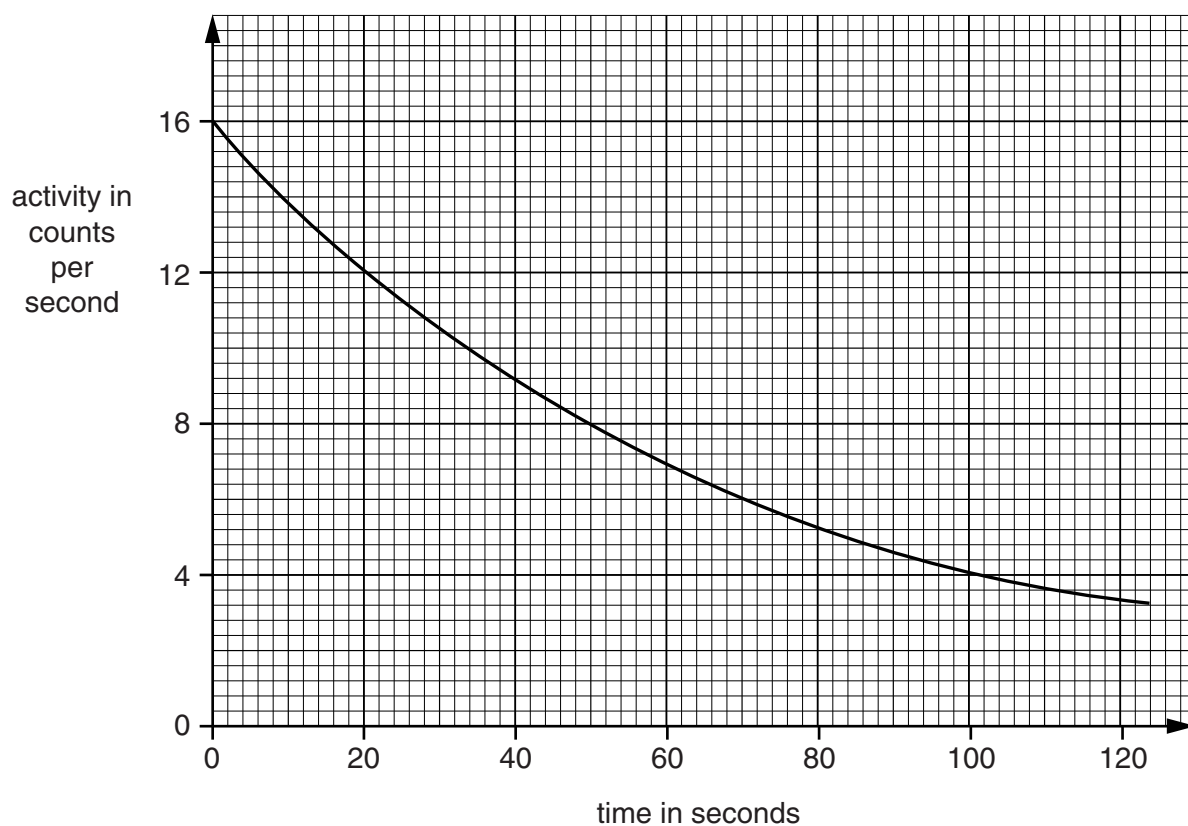
Suggest an advantage of using ultrasound.

.....
 [1]

[Total: 3]

- 5 A radioactive isotope decays by emitting beta (β) particles.

Look at the graph showing how the activity (radioactivity) of the isotope changes with time.



- (a) Explain what is meant by **half-life**.

.....

 [1]

- (b) **Use the graph** to determine the half-life of the isotope.

Show clearly on the graph **how** you work out the half-life.

.....

answer seconds

[2]

- (c) The activity of the isotope starts at 16 counts per second.

What would the activity of the isotope be after a period of **3 half-lives**?

Choose from

16 12 8 5.3 4 2 1

answer counts per second [1]

- (d) An atom of the isotope decays when a β particle is emitted from its nucleus.

Describe how the nucleus has changed by completing the sentence.

After a β particle has been emitted, the nucleus has **neutron**

and **proton**. [1]

[Total: 5]

- 6 The fuel used in most nuclear power stations is uranium.



The uranium is inside the nuclear reactor.

- (a) What **type** of **nuclear** reaction releases the energy from the uranium fuel?

..... [1]

- (b) Describe how the energy released in the reactor is used to generate electricity.

.....

 [2]

[Total: 3]

Section B – Module P5

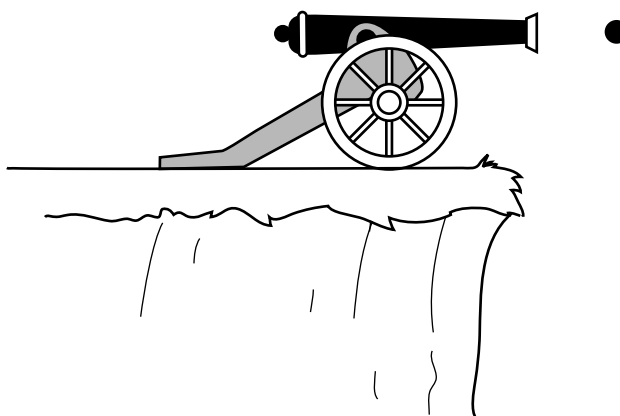
- 7 In this question ignore the effects of air resistance.

A cannon ball is fired **horizontally** from the top of a cliff.

The ball leaves the cannon. Its **horizontal** velocity is 30 m/s .

Its **vertical** velocity is 0 m/s .

The acceleration due to gravity (g) is 10 m/s^2 .



- (a) What is the horizontal velocity of the ball after 3 seconds?

.....
 [1]

- (b) Calculate the vertical velocity of the ball 3 seconds after it leaves the cannon.

The equations on page 2 may help you.

.....

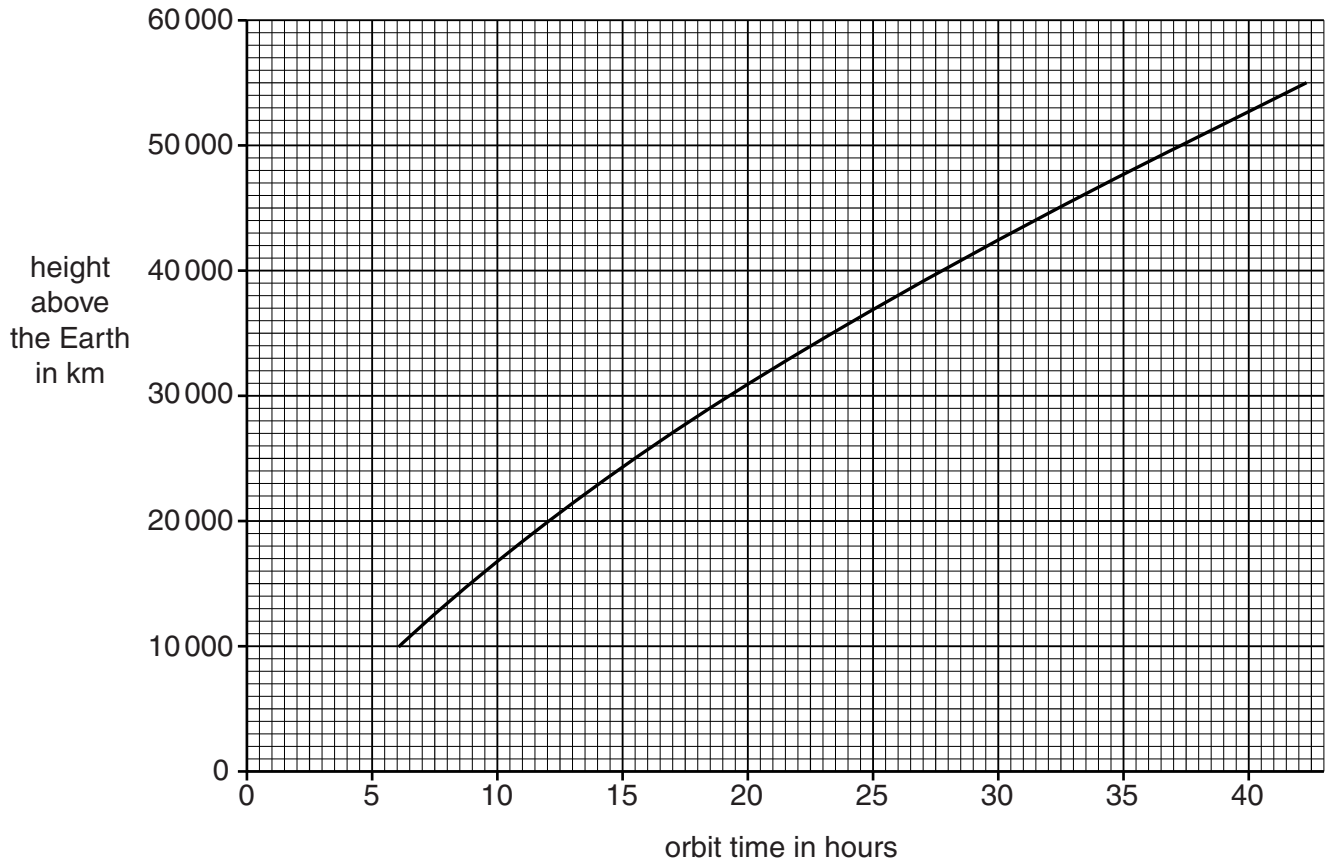
answer [2]

[Total: 3]

8 This question is about satellites.

Look at the graph.

It shows the orbit time of satellites at different heights above the Earth.



(a) Geostationary satellites are used for communication.

(i) How many hours does it take for a geostationary satellite to make one **orbit** of the Earth?

answerhrs [1]

(ii) Use the graph to complete the following sentence.

This geostationary satellite is approximatelykm above the Earth. [1]

(b) Satellites in a low orbit travel faster than those in a high orbit.

Explain why.

.....
 [1]

[Total: 3]

- 9 Look at the diagram of light entering a glass block.

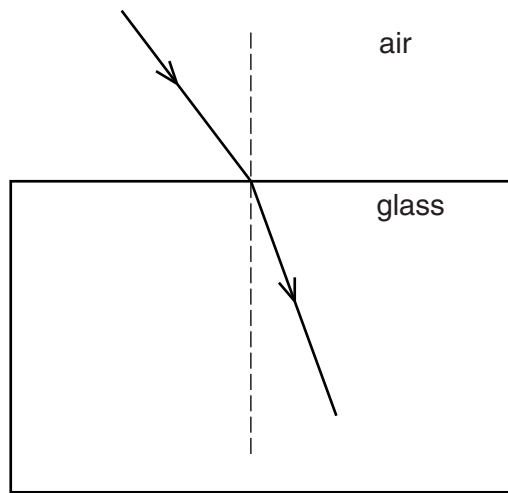


diagram not to scale

- (a) (i) The angle of incidence is 30° .

The refractive index of glass is 1.5.

Calculate the angle of refraction.

The equations on page 2 may help you.

.....

answer [2]

- (ii) The light bends towards the normal as it enters the glass.

Explain why the light changes direction in this way as it passes from air to glass.

.....

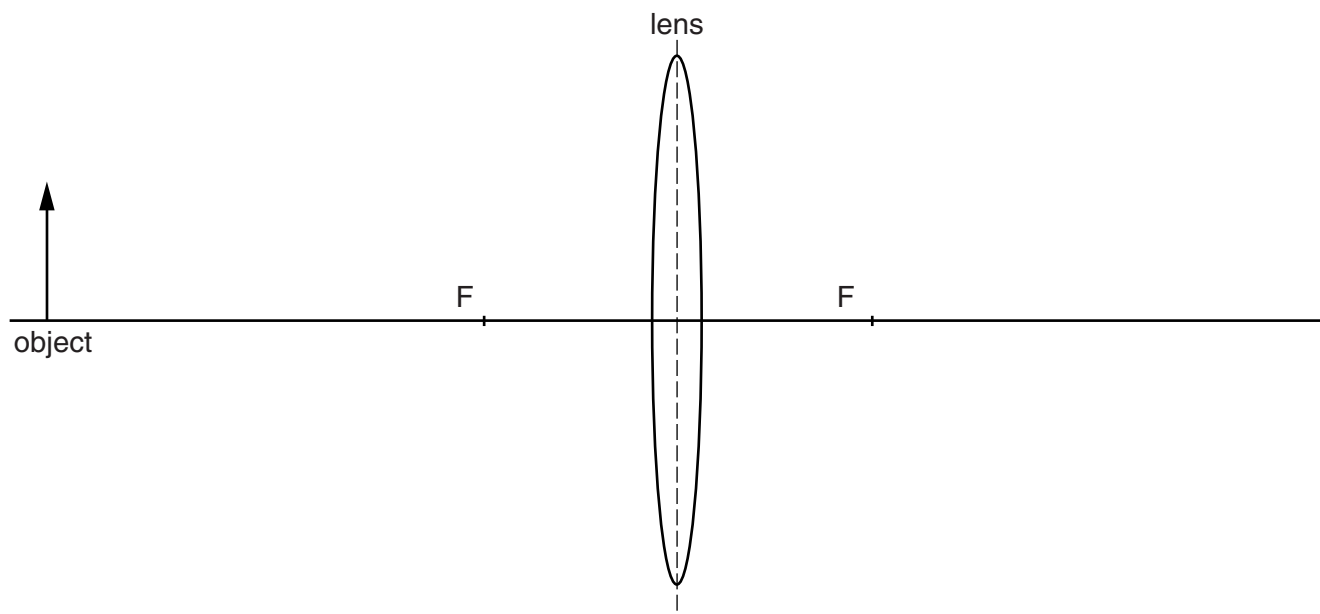
 [2]

(b) Convex lenses can be used in a camera to produce an image on the back of the camera.

Complete the ray diagram below to show how an image of the object is formed on the back of the camera. The focal points of the lens are labelled F.

You should

- use a ruler to draw two rays starting from the top of the object
- draw and label the image.



[2]

[Total: 6]

10 This question is about waves.

(a) Waves can undergo **interference**.

Explain what is meant by interference and describe how you could **demonstrate** the interference of one type of wave.

In your answer you should

- draw a diagram of how your equipment is set up
- name the type of wave being used
- explain how the demonstration works.

.....

.....

.....

.....

..... [3]

(b) **Light waves** can also be **polarised**.

(i) What is meant by polarised?

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

(ii) Suggest why sound waves can **not** be polarised.

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

[Total: 5]

11 When a car is in a collision the people inside the car may be injured.

(a) Use ideas about **motion** to explain why people may be injured in a collision.

.....
 [1]

(b) Some cars have crumple zones.

These can reduce injuries.

Explain how crumple zones can help to reduce some injuries.

Use ideas about momentum in your answer.

.....

 [2]

[Total: 3]

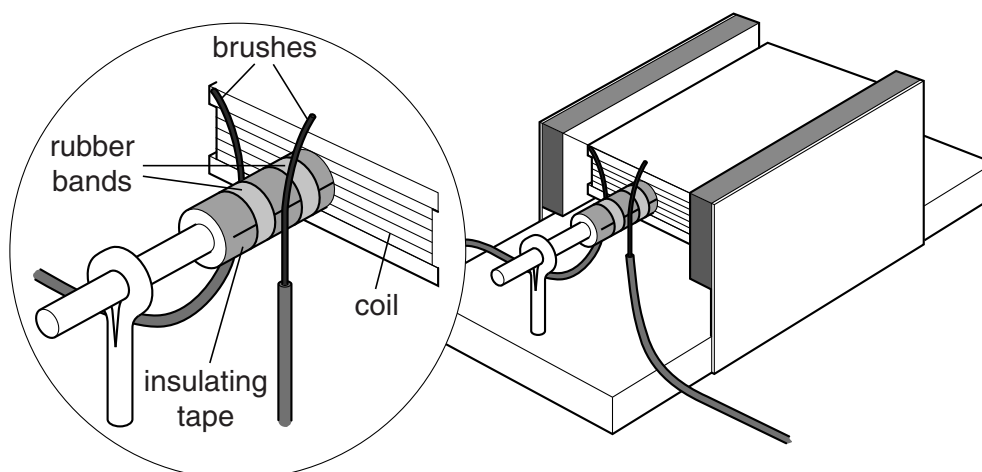
Section C – Module P6

12 Bob has electrical appliances in his home.

Some electrical appliances contain an **electric motor**.

(a) Look at the diagram of a model electric motor.

The brushes are making contact with the wire ends of the coil.



Bob connects the motor to the power supply. The coil spins round.

(i) Bob wants the motor to spin **faster**.

Describe **three** different ways to make **this** motor spin faster.

.....

.....

.....

..... [3]

(ii) Bob uses the power supply to change the direction of the **current**.

What happens to the motor?

..... [1]

(b) Motors in washing machines need to be **powerful**.

These motors have **radial** magnetic fields.

Describe how a radial field is produced and explain why it produces a more powerful motor effect.

You may want to draw a diagram to illustrate your answer.

.....

.....

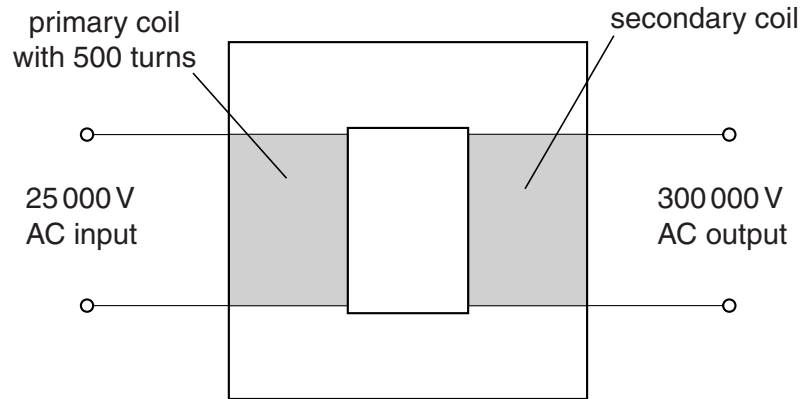
..... [2]

[Total: 6]

13 Electricity is generated in power stations.

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

(a) Look at the diagram of a transformer.



The **primary** coil has 500 turns.

Calculate the number of turns on the **secondary** coil.

The equations on page 2 may help you.

.....

answer turns **[2]**

(b) Electricity is transmitted at high voltages to improve the efficiency. Explain why.

You should use the appropriate equation from page 2 to explain your answer.

.....

 **[3]**

(c) Isolating transformers are used for shaver sockets in bathrooms.

(i) These isolating transformers are a safe way to use electrical sockets in bathrooms.

Explain why.

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

(ii) The **input** and **output** voltages for isolating transformers are the **same**.

Describe the relationship between the number of turns in the primary and secondary coils of an isolating transformer.



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

[Total: 7]

14 Kamrun experiments with electrical circuits.

(a) He builds a circuit and tests some resistors. He keeps the voltage fixed at 12V.

Look at his results for the two resistors.

resistor A	resistor B
	
current 2.5 A	current A
voltage 12 V	voltage 12 V
resistance Ω	resistance 8 Ω

Calculate the missing values to complete the results. Use this information to explain why there is a different current in each resistor.

You should use the appropriate equation from page 2 to explain your answer.

.....

.....

.....

.....

.....

.....

..... [3]

- (b) Gates are used to control electronic devices.

Kamrun has an alarm fitted to his car.

The alarm system has a series of gates and other electronic components.

One of the gates is an **AND** gate and the other is an **OR** gate.

Complete the tables using 0s and 1s.

AND gate		
input signal A	input signal B	output signal
0	0
0	1
1	0
1	1

OR gate		
input signal A	input signal B	output signal
0	0
0	1
1	0
1	1

[2]

- (c) The alarm system needs to work the car horn and the headlamps.

A **relay** is fitted to the output of the gates.

- (i) Describe what the relay does in the circuit.

.....

 [1]

- (ii) Describe why the relay is needed.

.....

 [1]

[Total: 7]

END OF QUESTION PAPER

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