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OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE   **B652/02**

PHYSICS B

Unit 2 Modules P4 P5 P6
(Higher Tier)

| Candidates answer on the question paper | **Tuesday 27 January 2009** |
| A calculator may be used for this paper | **Afternoon** |

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)

**Tuesday 27 January 2009
Afternoon**

Duration: 1 hour

| 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.
*   Do **not** write in the bar codes.
*   Write your answer to each question in the space provided, however additional paper may be used if necessary.

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

FOR EXAMINER'S USE

Section	Max.	Mark
A	20	
B	20	
C	20	
TOTAL	60	

OCR is an exempt Charity

Turn over

EQUATIONS

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

$$v = u + at$$

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

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

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

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

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

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

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

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

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

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

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

$$V_p I_p = V_s I_s$$

3

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Question 1 begins on page 4.

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Answer **all** the questions.

Section A – Module P4

1 **(a)** Nita rubs a rod with a duster.
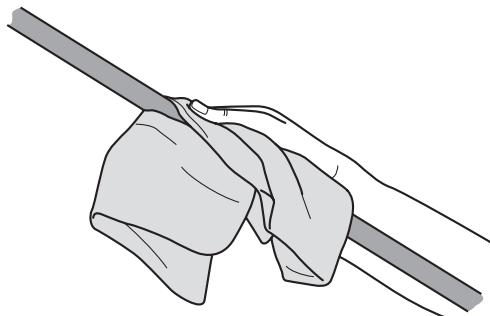
The rod is made from an insulating material.

The rod becomes charged with a negative charge.

Which statement, **A**, **B**, **C** or **D**, is true?

    A   The rod has **gained neutrons** from the cloth.

    B   The rod has **gained electrons** from the cloth.

    C   The rod has **gained protons** from the cloth.

    D   The rod has **lost electrons** to the cloth.

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

(b) Oliver uses electrostatics to help him spray paint a car.

charged car   charged paint droplets   paint gun
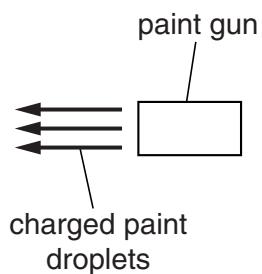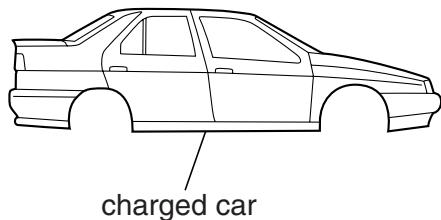
Describe how electrostatics help him spray paint the car.

In your answer write about

- electrostatic charges

- the paint droplets

- the reasons for using electrostatics in paint spraying.

....

....

....

....

.... **[3]**

[Total: 4]

Turn over

2 Phil makes the following circuit.
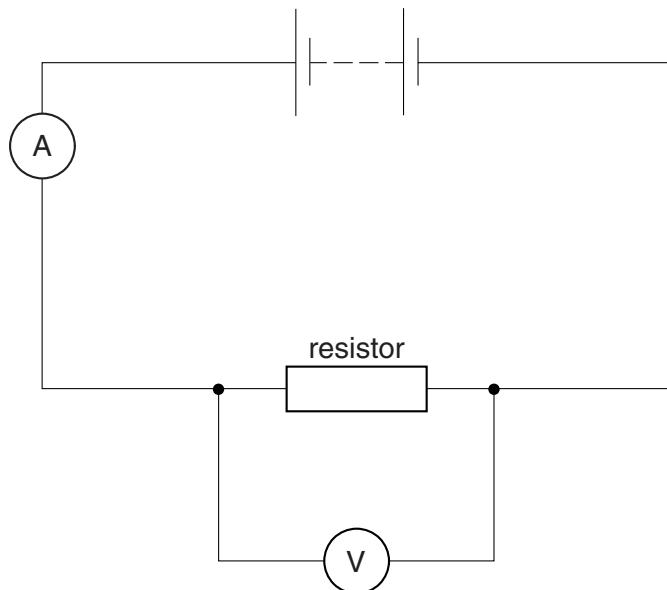
(a) An electric current flows through the resistor.

The voltmeter reading is 10 V.

The ammeter reading is 3 A.

Calculate the **resistance** of the resistor.

The equations on page 2 may help you.

....

....

....

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

 (b) Phil has a kettle and a hairdryer.

 Both have a wire fuse in the plug.

 Complete the following sentences.

 If the .... becomes too large the wire fuse .... This breaks the circuit. **[2]**

 (c) The hairdryer does **not** have an earth wire.

 It is **double insulated**.
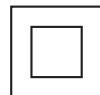
 Explain why a double insulated appliance does **not** need earthing.

 ....

 ....

 ....

 .... **[2]**

 [Total: 6]

3 Ultrasound is a **longitudinal** wave.

(a) **P** is a particle in a longitudinal wave.

Look at the diagram.

•   •   •   • • • **P**   •   •   •
                            •

How does **P** move in the longitudinal wave?

Put a (ring) around the correct answer.

↕   ↔   ↑   →   ↓   ←
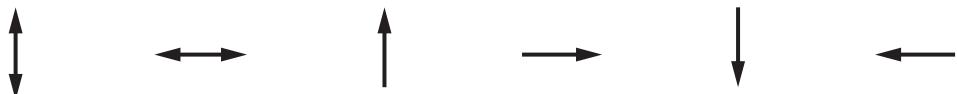
[1]

(b) Ultrasound is sometimes used for scans rather than X-rays.

Give **two** reasons for using ultrasound rather than X-rays.

1 ....

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

[Total: 3]

4 Americium (Am) is a radioactive element.

It gives off an alpha particle ($^4_2\alpha$) when it decays.

A new element **X** is produced when americium decays.

(a) Complete the table for the new element **X**.

	americium	**new element X**
mass number	241	
atomic number	95	
number of neutrons	146	

[3]

(b) This simple equation represents the beta decay of carbon 14 into nitrogen (N).

$$^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}\beta$$
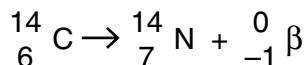
Construct a simple equation to represent the alpha decay of americium into element **X**.

.... [1]

[Total: 4]

Turn over

5 Energy is released in a nuclear reactor in a power station.

(a) Write down the name of the process that gives out energy in a nuclear reactor.

Choose from:

absorption

combustion

explosion

fission

fusion

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

(b) A reaction takes place when a particle hits a uranium atom.

What is the name of this particle?

Choose from:

atom

electron

ion

neutron

proton

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

(c) Nuclear reactions must be controlled in a reactor.

How do scientists control these reactions?

....

.... **[1]**

[Total: 3]

Section B – Module P5

6 This question is about satellites.

Look at the diagram.

satellite in polar orbit
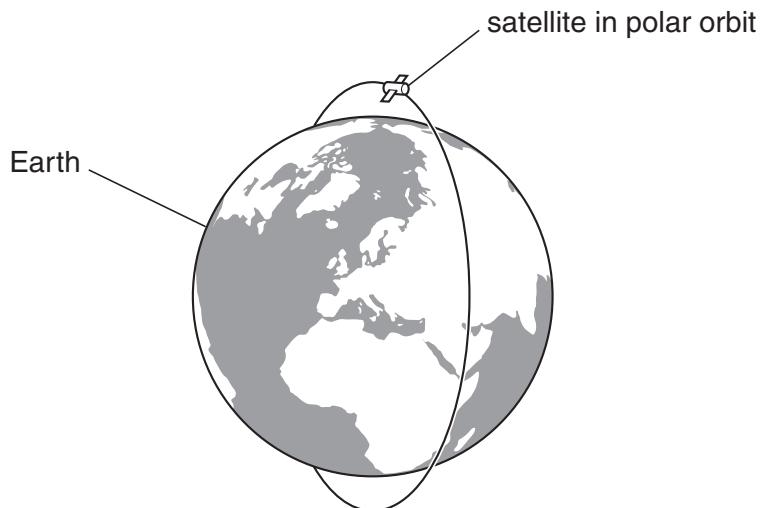
Earth

This type of satellite is used for weather forecasting.

(a) Complete these sentences about this type of satellite.

Satellites used for weather forecasting orbit the Earth around the ………………………………

in a ……………………………… polar orbit. They travel at ……………………………… speed.

The time to orbit the Earth is only a few ……………………………… . Eventually the satellites

send back images of the entire Earth's surface. **[3]**

(b) The other type of artificial satellite is a **geostationary** satellite.

How long does a geostationary satellite take to orbit the Earth?

.... **[1]**

[Total: 4]

Turn over

7 Look at the diagram of two cars. They are moving in the same direction.

car **X**   car **Y**

speed = 12 metres per second   speed = 5 metres per second
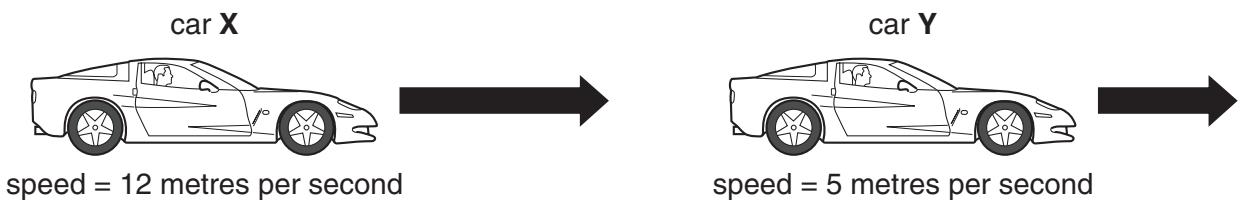
(a) What is the **relative** speed of the cars?

....

answer .... metres per second   **[1]**

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

It accelerates uniformly to a new speed of 15 metres per second.

This takes 30 seconds.

Calculate the distance travelled in this time.

The equations on page 2 may help you.

....

....

....

answer .... metres   **[2]**

(c) The driver of car **Y** drives the car very fast.

The car hits a crash barrier and stops very quickly.

Describe why the driver is injured.

....

....

.... **[2]**

[Total: 5]

8 James kicks a football in the air.

It travels in a curve.

This is an example of a **projectile**.
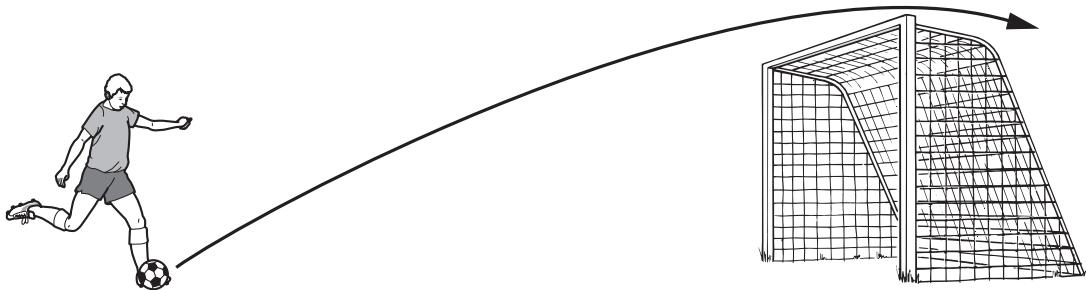
(a) The football travels at a velocity of 20 metres per second.

The mass of the football is 0.5 kilograms.

Calculate the **momentum** of the football.

The equations on page 2 may help you.

....

....

....

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

(b) The football travels in a curved path.

Explain why.

In your answer use ideas about

- the vertical velocity of the football

- the horizontal velocity of the football.

....

....

....

.... **[2]**

[Total: 4]

9 Four properties of electromagnetic (e.m.) waves are

- reflection

- polarisation

- diffraction

- interference.

Look at the boxes below.

Draw a line from each **property** to the correct **statement** about it.

One has been done for you.

property	statement
reflection	evidence for e.m. radiation travelling in waves
polarisation	helps transmit long wave radio waves around hills
diffraction	this can happen because e.m. waves are transverse
interference	used to transmit radio waves using the ionosphere
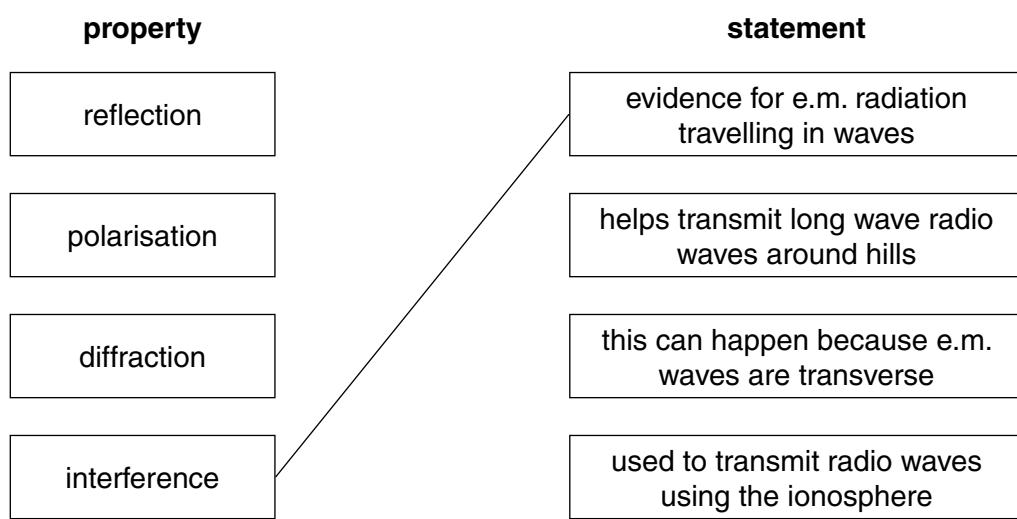
[2]

[Total: 2]

10 This question is about waves.

Look at the sentences about waves.

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

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

✓ or ✗

|	
Greatest diffraction happens when the gap size = the wavelength of the wave.	☐
Destructive interference happens when the path difference = an even number of half wavelengths.	☐
Light waves vibrating in any plane can pass through Polaroid sunglasses.	☐
Different colours of light travel at different speeds in glass causing dispersion.	☐

[2]

[Total: 2]

Turn over

11 This question is about how a convex lens forms a **real** image.

(a) Look at the ray diagram. It is incomplete.
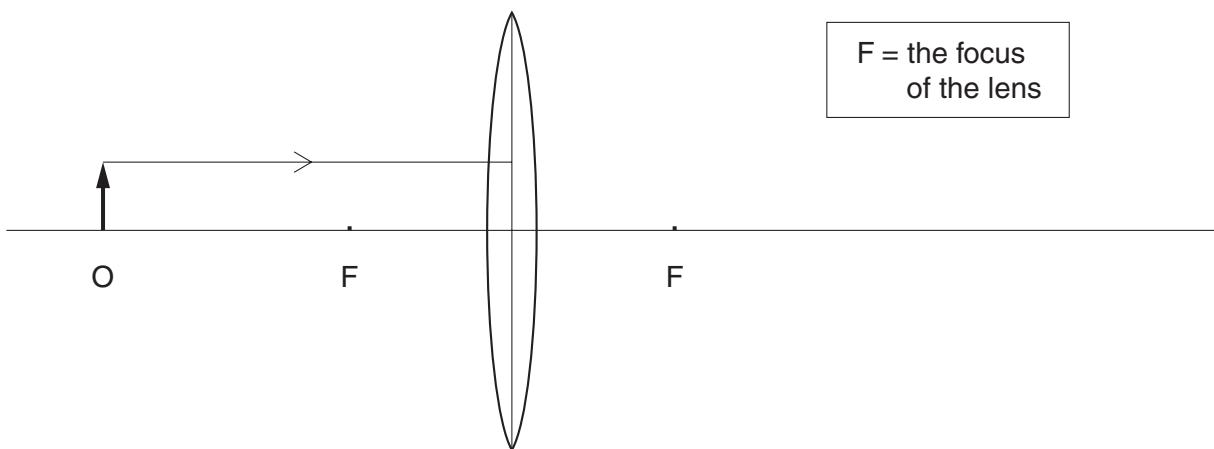
F = the focus
of the lens

O   F   F

Complete the path of the ray shown in the diagram.

Draw one **other** ray from the object to show how the image is produced.

Label the image. **[2]**

(b) How can you **show** that the image produced is a real image?

....

.... **[1]**

[Total: 3]

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Section C begins on page 18.

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Section C – Module P6

12 Sally does some experiments with electricity.

(a) Look at the diagram. It shows a variable resistor controlling a bulb.
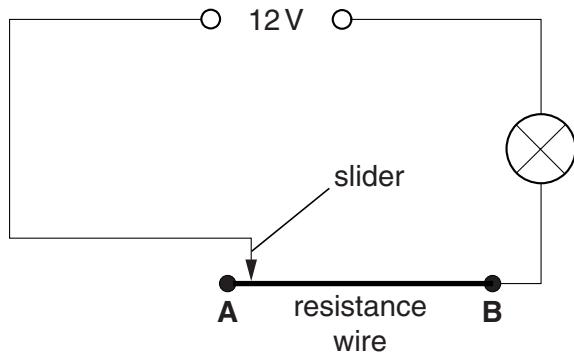
Sally puts the slider at position **A**. The bulb lights up.

She moves the slider from position **A** to position **B**.

**(i)** What happens to the **resistance** of the circuit?

.... **[1]**

(ii) What happens to the **brightness** of the bulb?

.... **[1]**

(b) Sally increases the voltage of the power supply.

This changes the current in the bulb.

Look at the graph of her results.
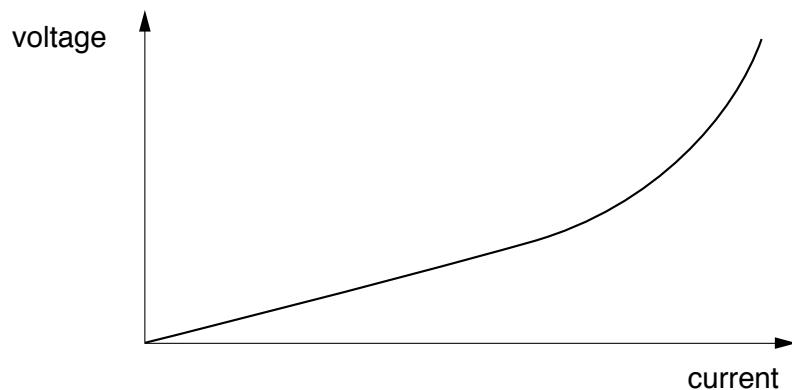
She expects a straight line graph.

The graph is curved.

Suggest a reason why.

.... **[1]**

[Total: 3]

13 Dan builds some circuits.

(a) He builds a circuit using a **thermistor**.

Look at the diagram.
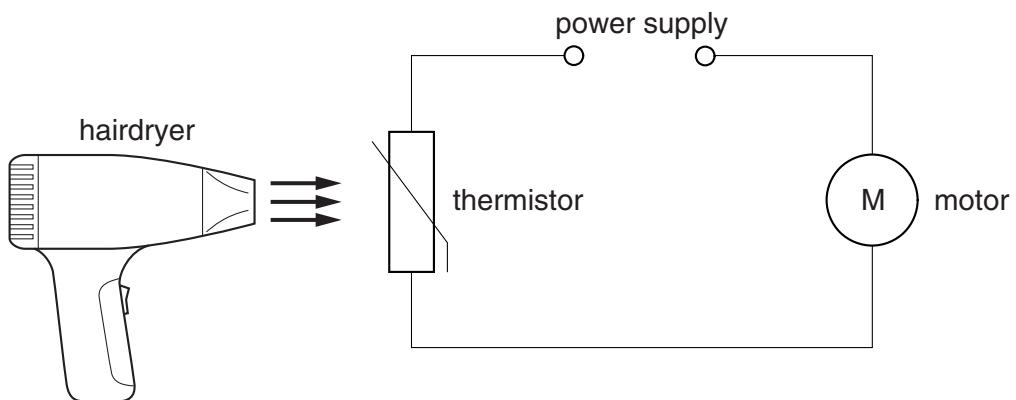
He uses a hair dryer to heat up the thermistor.

(i) What happens to the **resistance** of the thermistor?

.... **[1]**

(ii) What happens to the **speed** of the motor in the circuit?

.... **[1]**

(b) Dan builds another circuit using an **LDR**.

Look at the diagram.

power supply

torch

M) motor

LDR
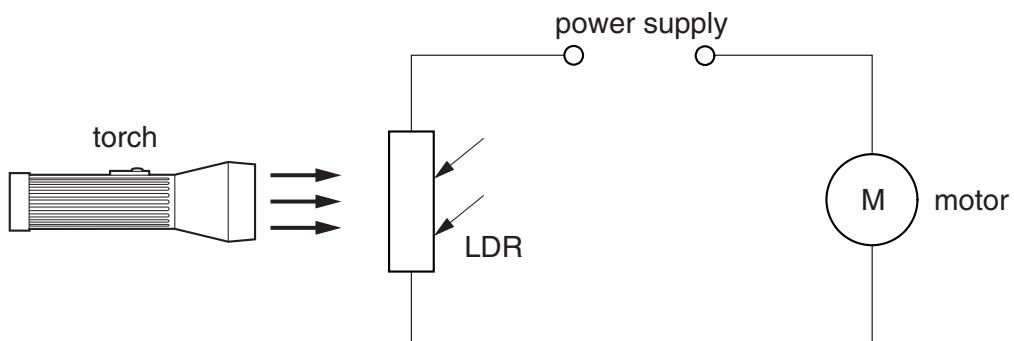
He uses a torch.

The torch shines **more light** onto the LDR.

(i) What happens to the **resistance** of the LDR?

.... **[1]**

(ii) What happens to the **speed** of the motor?

.... **[1]**

Turn over for the remainder of question 13

(c) Dan uses a potential divider in a circuit.

Look at the information in the diagram.

V_{in} ─────────┐
│
┌─┴─┐
│   │ $R_1 = 12$ ohms
│   │
└─┬─┘
●──────────── V_{out}
┌─┴─┐
│   │ $R_2 = 36$ ohms
│   │
└─┬─┘
$0\,V$ ───────●────────── $0\,V$
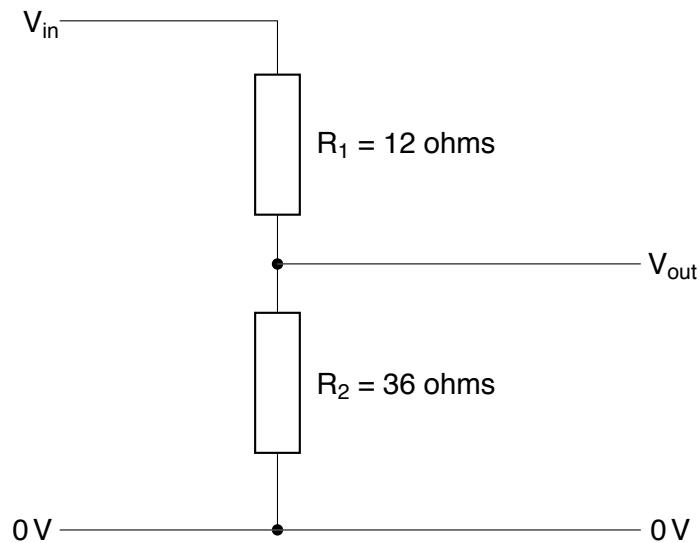
The input voltage, V_{in} is 5 V.

Calculate the output voltage.

The equations on page 2 may help you.

....

....

....

answer .... V **[2]**

[Total: 6]

14 Declan has some electrical appliances in his house.

(a) Look at the diagram of an electric motor.
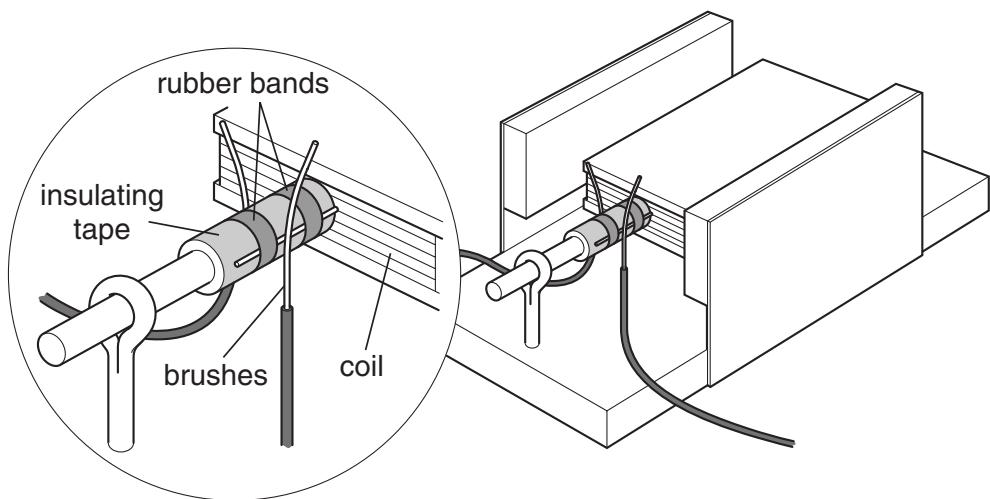
Declan connects the motor to the power supply. It spins round.

(i) Declan passes **more current** through the motor.

What happens to the motor?

.... **[1]**

(ii) He puts **stronger magnets** in the motor.

What happens to the motor?

.... **[1]**

(iii) Declan now uses a coil with **fewer turns**.

What happens to the motor?

.... **[1]**

(iv) He changes the direction of the **current**.

What happens to the motor?

.... **[1]**

Turn over for the remainder of question 14

(b) Declan has an electric razor.

He plugs it into a special socket in the bathroom.

This socket contains an **isolating transformer**.

(i) Why does he use an isolating transformer?

....

.... **[1]**

(ii) Transformers have a primary coil and a secondary coil.

What is special about the primary and secondary **coils** in an isolating transformer?

....

.... **[1]**

[Total: 6]

15 Bill has a programmable washing machine.

The control circuit is electronic and uses logic gates.

A logic gate switches on the washing machine.

The washing machine runs on 230 V mains electricity.

Explain how the logic gate can switch on a mains circuit.

In your answer write about

- the name of the device used

- why this device is needed.

....

....

....

....

.... **[3]**

[Total: 3]

16 Look at the diagram of an AC generator.

slip rings

brushes
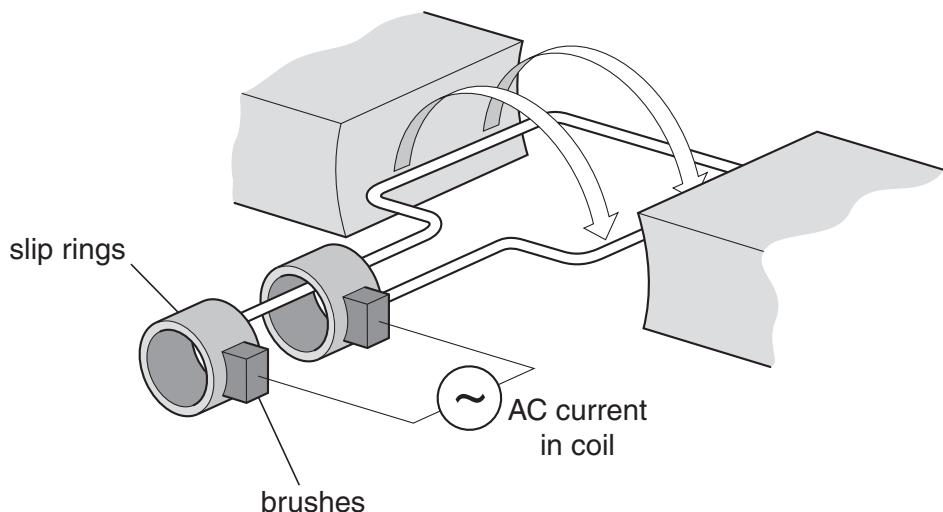
AC current
in coil

The coil spins and cuts the magnetic field. This produces an AC current.

Explain what the brushes and slip rings do.

Complete the sentences.

The brushes ....

....

The slip rings ....

.... **[2]**

[Total: 2]

END OF QUESTION PAPER

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