OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B652/02

PHYSICS B

Unit 2 Modules P4 P5 P6 (Higher Tier)

OCE/17802

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)

Monday 1 February 2010
Afternoon

Duration: 1 hour

B652/02

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.
- The total number of marks for this paper is **60**.
- A list of physics equations is printed on page two.
- This document consists of **24** pages. Any blank pages are indicated.

DC (SHW (SW)) 00507 6/09 17802/4

EQUATIONS

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

$$v = u + at$$

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

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

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

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

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

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

$$\text{refractive index} = n = \frac{\sin i}{\sin r}$$

i = incident angle
r = refracted angle

$$\sin c = \frac{n_r}{n_i}$$

c = critical angle
n_r = refractive index of less dense material
n_i = refractive index of more dense material

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

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

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

$$V_p I_p = V_s I_s$$

Answer **all** the questions.

Section A – Module P4

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

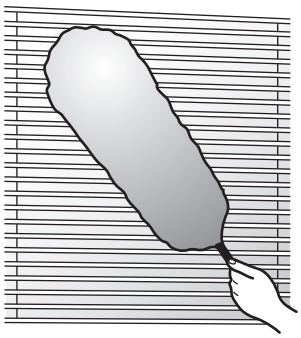
(a) Russell's window blinds are dusty.

Before he starts dusting, Russell rubs the duster with a plastic bag.

The duster becomes negatively charged.

Russell dusts the window blinds by moving the duster over the blinds.

Dust particles are attracted to the duster.



Explain how the duster gained a negative charge and why it attracts the dust.

.....

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.....

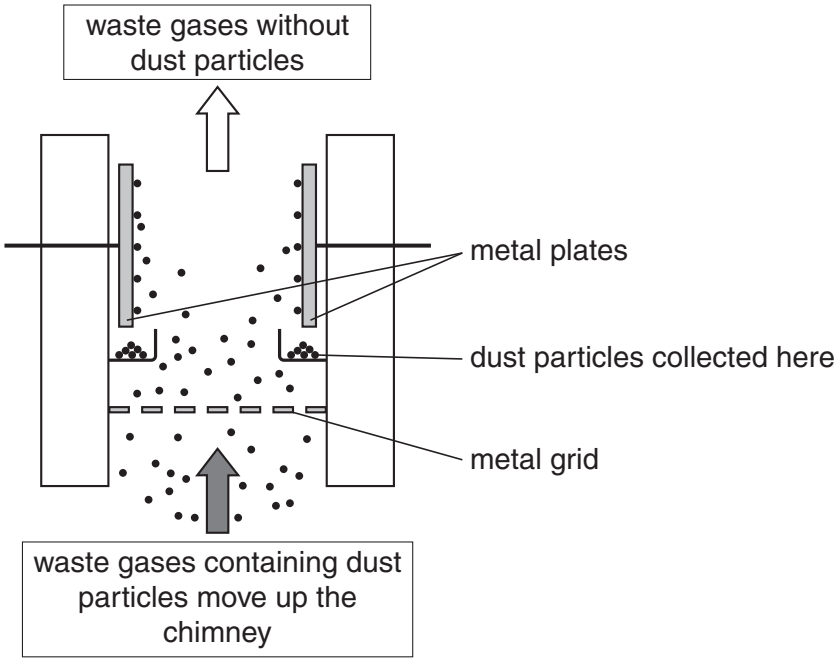
.....

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

Turn over for the remainder of question 1

(b) Dust particles can be removed from chimneys using an **electrostatic precipitator**.

The diagram shows an electrostatic precipitator.



Complete the following sentences explaining how the precipitator works.

Choose words from the list.

Each word can be used once, more than once or not at all.

attracted **charged** **conducted** **direct** **knocked**

negative **neutral** **positive**

The metal grid has a …… charge.

The metal plates have a …… charge.

The dust is charged by the metal grid.

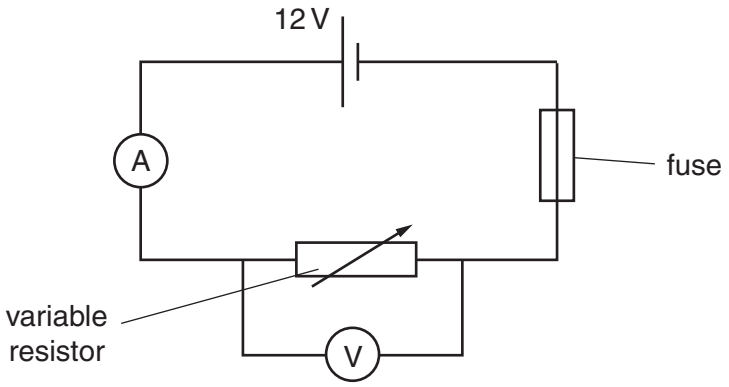
Then the dust is …… to the plates.

The plates are …… so the dust falls down and is collected. **[3]**

[Total: 6]

2 Harry is investigating electrical circuits.

He sets up the circuit shown in the diagram.



(a) Harry is investigating how the fuse works.

He adjusts the variable resistor.

The current increases to 1.5 A (amps).

The fuse blows.

Describe what happens to the circuit when the fuse blows.

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

(b) Harry measures the current and voltage for the variable resistor just before the fuse blows.

Look at his results.

current = 1.5 A

voltage = 12 V

Calculate the value of the **resistance**.

The equations on page 2 may help you.

.....

.....

.....

answer ..... Ω **[2]**

[Total: 3]

3 Daniel finds out about uses of physics in hospitals.

(a) Ultrasound is a longitudinal wave and is used in hospitals.

Daniel finds a picture of a doctor using ultrasound to treat a patient with kidney stones.

Complete the following sentences about the treatment.

The doctor sends ultrasound waves into the patient.

Ultrasound has a very high …… .

The waves cause the particles in the kidney stone to …… .

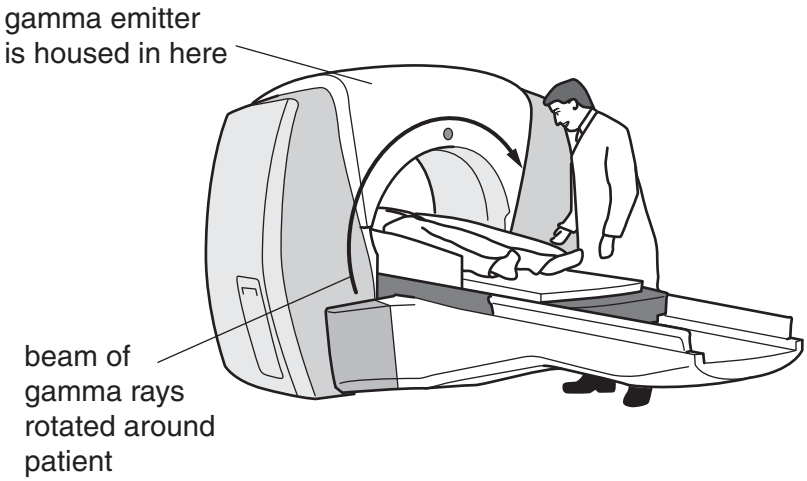
This causes the kidney stone to …… . **[3]**

(b) Daniel finds out that nuclear radiation is used in hospitals.

Gamma rays are one type of nuclear radiation.

Gamma rays are used to treat people who have a cancerous tumour.

Look at the diagram. It shows a patient about to be given treatment using a gamma emitter.



Daniel has made some notes about the treatment.

Complete the three sentences to explain the treatment.

1 The gamma rays are …… on the tumour.

2 The beam of gamma rays is rotated so that

…… .

3 This means that healthy tissue is not damaged

because ……

…… .

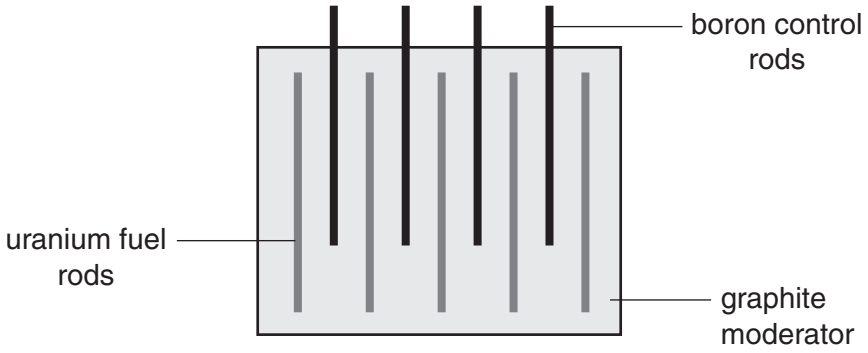
[2]

[Total: 5]

4 Nuclear power stations produce electricity.

Inside the power station a controlled nuclear chain reaction takes place in the **reactor**.

Look at the diagram of a nuclear reactor.



(a) Complete the flow diagram to show how the energy is released in a chain reaction.

A uranium ..... is hit by a	→	This causes the uranium ..... to split.	→	Energy is released.

[2]

(b) How do the control rods stop the nuclear chain reaction going out of control?

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

(c) What is the name of the process that gives out energy in this nuclear reactor?

Choose from

decay **fission** **fusion** **ionisation**

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

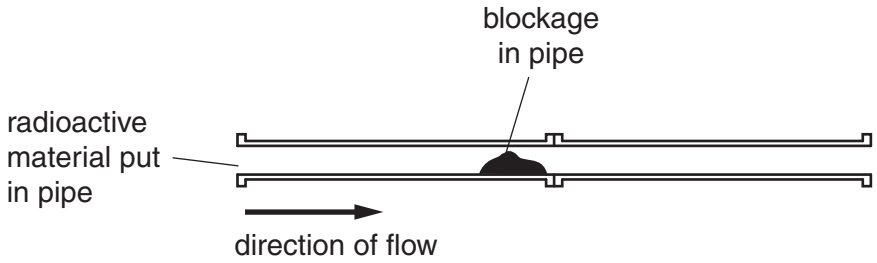
[Total: 4]

5 Engineers sometimes put radioactive materials into **underground** pipes carrying oil.

A gamma source is put into the pipe.

The gamma rays are detected at the surface using a Geiger counter.

The radiation is tracked so a blockage in the pipe can be found.



(a) Alpha and beta radiations are **not** used.

Why is gamma radiation used?

.....

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

(b) How do the engineers know where the blockage is?

.....

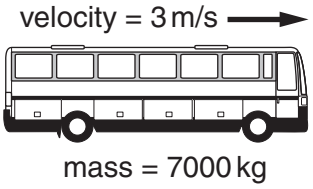
..... **[1]**

[Total: 2]

Section B – Module P5

6 This question is about velocity and momentum.

(a) A bus moves along the road. Look at the diagram.



(i) The mass of the bus is 7000 kg. Its velocity is 3 m/s.

Calculate the momentum of the bus.

The equations on page 2 may help you.

.....

.....

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

(ii) More passengers get on the bus.

The mass of the bus increases.

It moves again at 3 m/s.

How will this extra mass affect its momentum?

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

(b) A car accelerates. Look at the diagram.

The car accelerates at 1.5 m/s^2.

It takes 12 seconds to reach its final velocity.

Calculate the final velocity of the car.

The equations on page 2 may help you.

.....

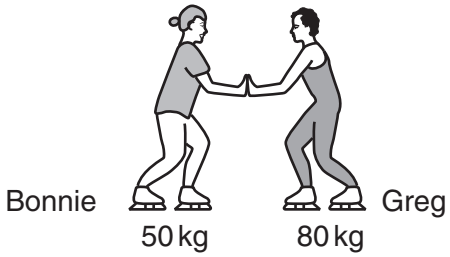
.....

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

(c) Bonnie and Greg are two ice skaters.

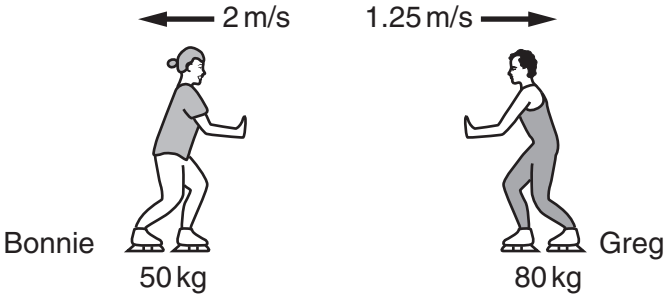
They are both stationary on the ice.

Look at the diagram.



Greg pushes Bonnie away from him.

Look at the diagram.



They both move in **opposite** directions at **different** speeds.

Explain why.

In your answer, use ideas about **momentum**.

The equations on page 2 may help you.

.....

.....

.....

.....

.....

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

[Total: 9]

7 This question is about natural and artificial satellites.

(a) The Moon is the Earth's only **natural** satellite.

not to scale

Gravity provides the force that keeps the Moon in orbit.

Complete the sentence.

Choose from

centrifugal

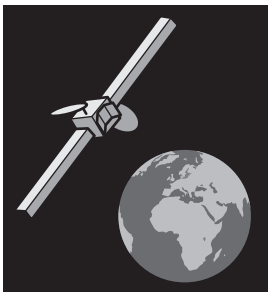
centripetal

magnetic

nuclear

The type of force that gravity provides is a ..... force. **[1]**

(b) Artificial satellites are put into orbit by rockets.



not to scale

One type of satellite has a **geostationary** orbit.

(i) Write down two reasons why a geostationary orbit is special.

1 .....

.....

2 .....

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

(ii) Geostationary satellites are useful for **satellite navigation** (SATNAV).

Why are geostationary satellites used for this?

.....

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

(c) Another type of satellite is a **polar orbiter**.

These low polar satellites travel at higher speeds than geostationary satellites.

Why do they need to travel at such high speeds?

.....

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

(d) Waves are transmitted from Earth up to satellites.

The satellites then transmit these waves back to Earth.

What type of wave is used?

Choose from

infrared **microwave** **radio** **ultraviolet**

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

[Total: 6]

8 **Polarising** sunglasses are used by skiers.

Light waves are **transverse**.

Some of the light waves reflected from snow surfaces cause glare.

Skiers wear polarising glasses to reduce the glare.

These glasses are **vertically** polarised.

Explain why.

.....

.....

.....

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

[Total: 2]

9 This question is about using waves for communication.

(a) Radio waves carry radio and TV signals.

Long wave radio waves can reach aerials behind hills.

Describe how they do this.

.....

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

(b) **Microwave** communications are sent as a thin beam.

Explain why.

.....

.....

.....

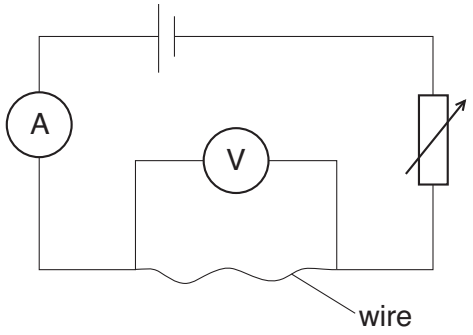
..... **[2]**

[Total: 3]

Section C – Module P6

10 This question is about current, voltage and resistance.

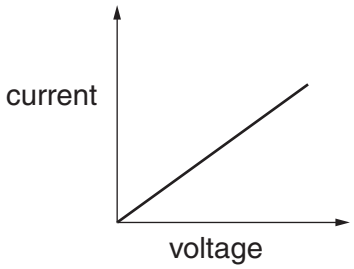
(a) Katy connects the following circuit.



She measures the voltage and current.

She draws a graph of her results.

Look at the graph.



Explain how she **uses the graph** to find the resistance of the wire.

.....

.....

.....

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

Turn over for the remainder of question 10

(b) Andrew builds a potential divider circuit using two **fixed** resistors.

Show how he sets up the circuit.

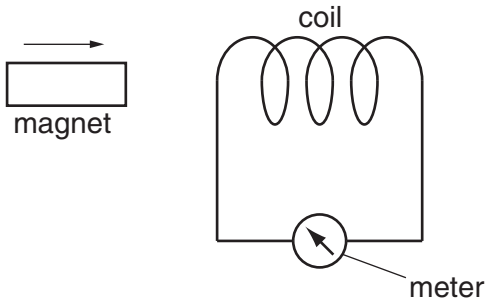
Your answer should include

- a diagram
- labels on the input terminals
- labels on the output terminals.

[2]

[Total: 4]

11 (a) Linda connects the following circuit.



She moves the magnet towards the coil.

The pointer on the meter moves to the **left**.

It shows the direction and size of the current.

Linda wants to change the direction of the current.

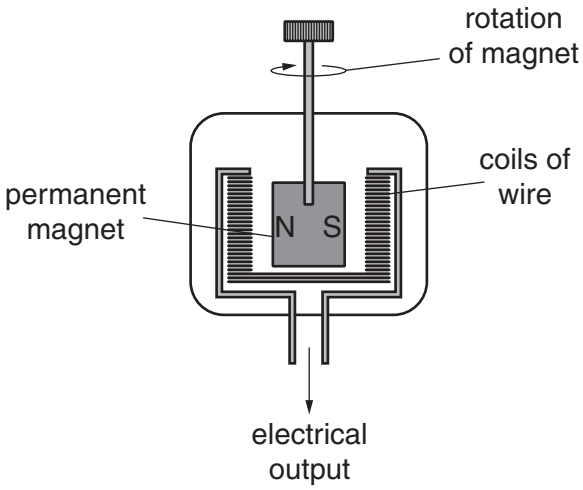
This would make the pointer move to the **right**.

Describe how she could do this.

.....

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

(b) In a power station a magnet rotates inside a coil of wire.



An alternating current (AC) is produced.

(i) The magnet spins faster.

Complete the sentence.

When the magnet spins faster, the size of the AC produced ……

and the frequency of the output …… . **[1]**

(ii) A stronger magnet is used.

Complete the sentence.

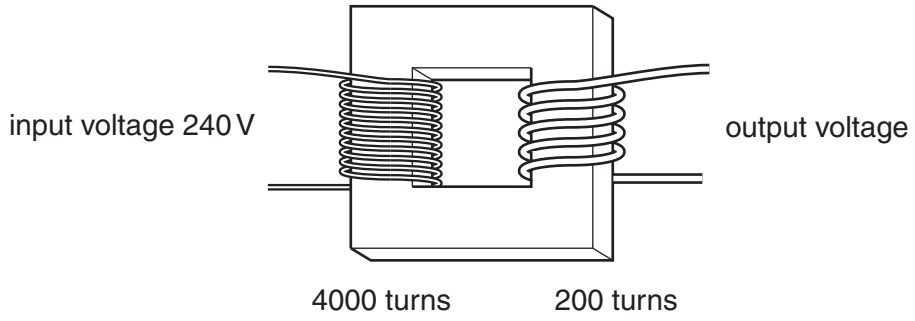
When the stronger magnet is used, the size of the AC produced ……

and the frequency of the output …… . **[1]**

[Total: 3]

12 This question is about transformers.

(a) The diagram shows a transformer.



The primary coil has 4000 turns.

The secondary coil has 200 turns.

The input voltage is 240 V.

Calculate the output voltage.

The equations on page 2 may help you.

.....

.....

.....

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

(b) Transformers will only work using alternating current (AC).

Explain why the supply must be AC and **not** DC.

In you answer write about

- magnetic fields
- electromagnetic induction.

.....

.....

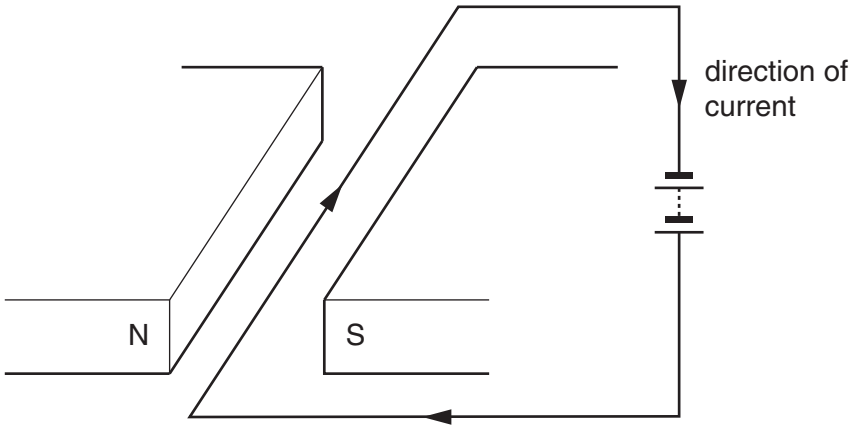
.....

.....

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

[Total: 5]

13 Look at the diagram of a wire passing through a magnetic field.



(a) When a current flows there is a force on the wire.

Use Fleming's Left Hand Rule to work out the direction of the force on the wire.

Choose from

downwards

towards N

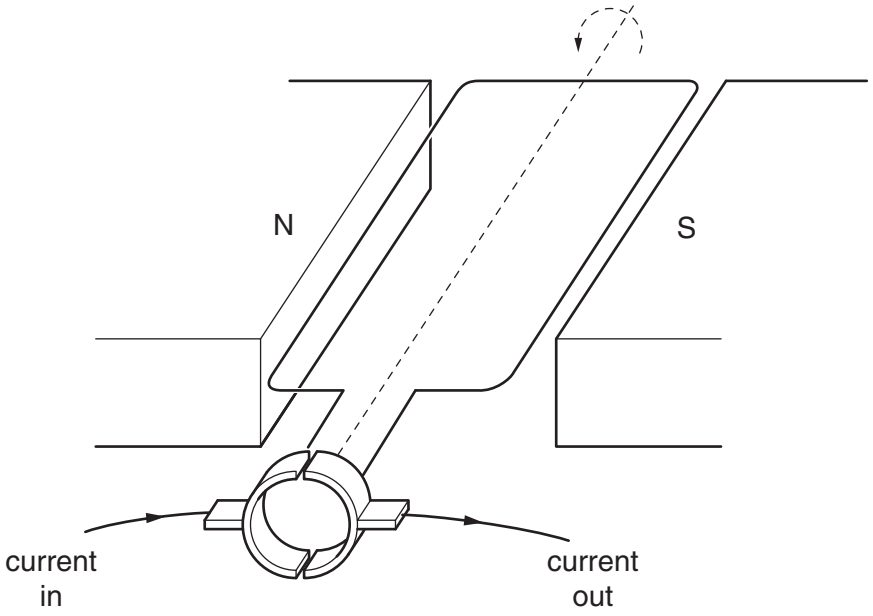
towards S

upwards

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

(b) In an electric motor a coil is placed in a magnetic field.

To keep an electric motor turning the force on the coil of wire must be in the same direction.



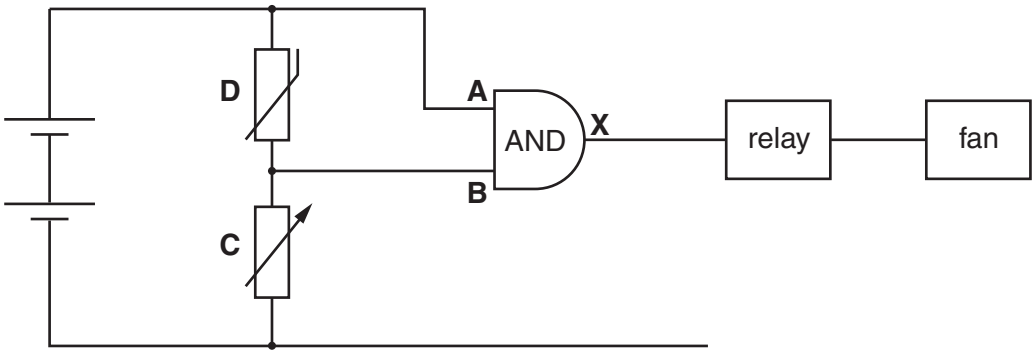
Which part of the motor keeps the force in the same direction?

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

[Total: 2]

14 This question is about using logic gates to control temperature.

Look at the circuit.



(a) Complete the truth table for the AND gate.

A	B	X
0	0	
0	1	
1	0	
1	1	

[1]

(b) The circuit controls a fan.

The logic gate cannot operate the fan directly.

It needs a connection through a relay.

Explain why.

.....

.....

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

(c) When the temperature increases, the fan switches on.

(i) Describe how the resistance of **D** changes as the temperature increases.

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

(ii) What happens to the input at **B** when the temperature increases?

.....

.....

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

(iii) Explain why a **variable** resistor **(C)** is used in this circuit.

.....

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

[Total: 6]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE