OCR
RECOGNISING ACHIEVEMENT

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B652/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

PHYSICS B

Unit 2 Modules P4 P5 P6 (Higher Tier)

FRIDAY 20 JUNE 2008

Morning
Time: 1 hour

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T52629

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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.

FOR EXAMINER'S USE		
Section	**Max.**	**Mark**
A	**20**	
B	**20**	
C	**20**	
TOTAL	**60**	

This document consists of **20** printed pages and **4** blank pages.

[Turn over

EQUATIONS

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

$$v = u + at$$

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

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

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

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

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

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

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

i = incident angle
r = reflected 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 static electricity.

Olivia has a special type of dusting brush.

Look at the picture.

She shakes the brush and dusts the table.

The brush attracts dust from the table.

(a) Why does the brush now attract dust?

.....

.....[1]

(b) **(i)** Some lorries carry inflammable gases.

They need to be earthed before loading and unloading.

Explain why.

.....

.....

.....

.....[2]

(ii) Suggest **one other** way in which static electricity can be a nuisance.

.....

.....[1]

[Total: 4]

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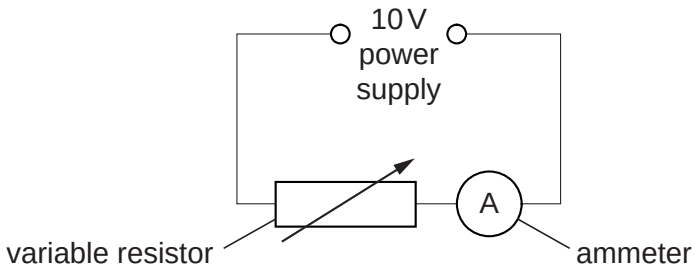
2 This question is about electricity.

Moira connects the following circuit.



She adjusts the variable resistor.

(a) The current decreases.

How did the resistance of the circuit change?

Choose from the list.

decreased **increased** **stayed the same**

answer .....[1]

(b) The reading on the ammeter is 2.5 A.

The voltage across the variable resistor is 10 V.

Calculate the resistance of the variable resistor.

The equations on page 2 may help you.

.....

.....

.....

answer .....ohms [2]

(c) Moira's washing machine has a fuse in the plug.

It also has an earth wire.

The fuse **and** earth wire work together to protect Moira.

Explain how.

.....

.....

.....[2]

[Total: 5]

3 There are three types of nuclear radiation.

(a) Which types of nuclear radiation can pass through the skin?

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

(b) Nuclear radiation is used to treat cancer.

The radiation can also damage healthy cells.

The damage to healthy cells is kept as low as possible.

Describe **two** ways of limiting the damage to healthy cells.

1 .....

.....

2 .....

.....[2]

[Total: 3]

4 This question is about radioactivity.

(a) Noel first measures the radiation in the environment.

(i) What do we call the radiation that is always present?

.....[1]

(ii) Where does this radiation in the environment come from?

.....[1]

(b) Noel investigates the decay of a radioactive material.

It gives out beta particles.

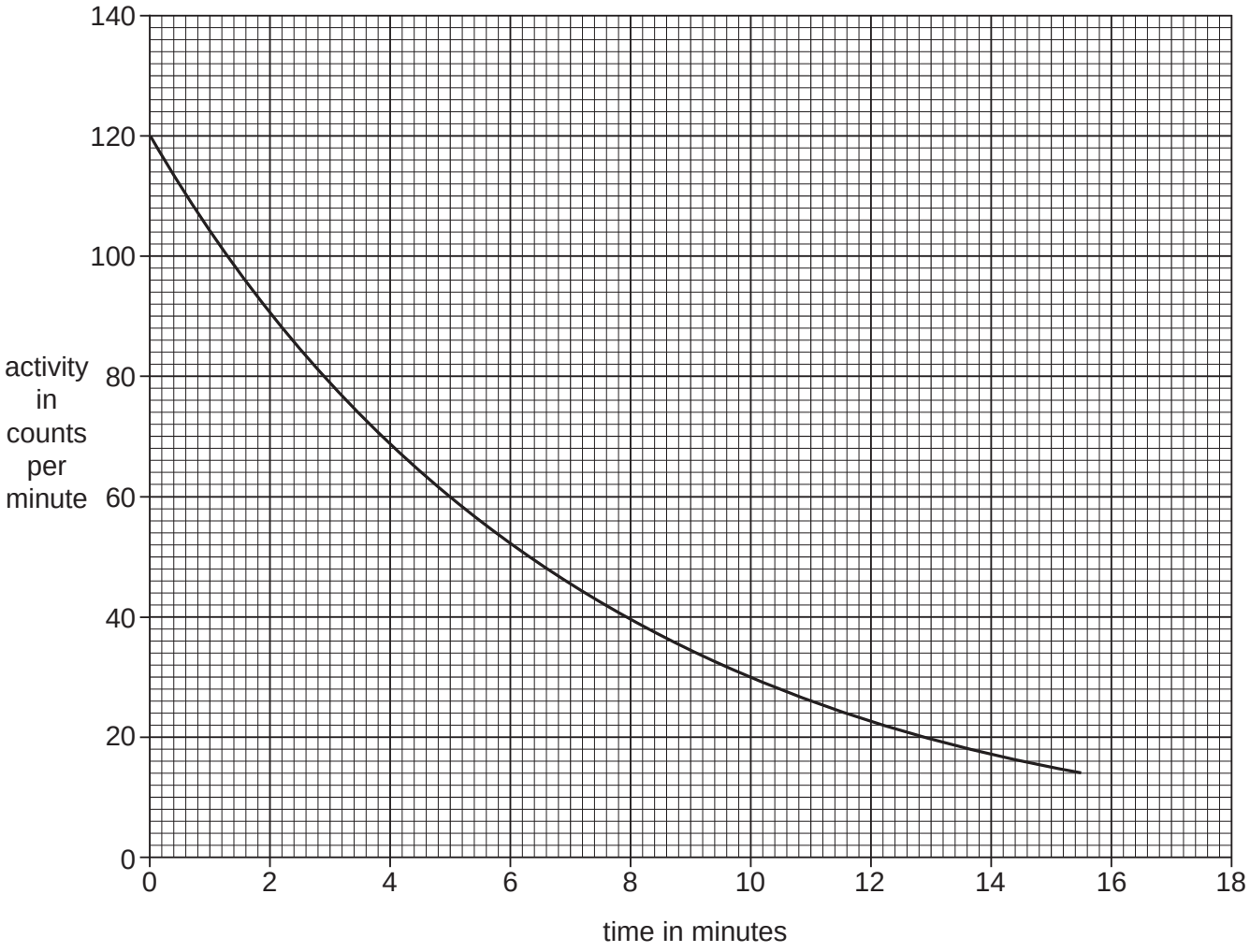
(i) What is a beta particle?

.....

.....[1]

(ii) Look at the graph.

It shows the results of Noel's experiment.



Use the graph to find the half-life of the radioactive material.

.....

.....

.....

answer .....minutes [1]

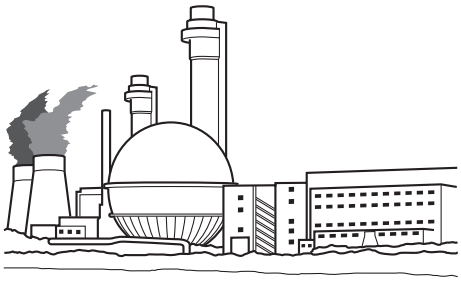
(iii) A second radioactive material also has a count rate of 120 counts per minute at the start.

It has a half-life of 3 minutes.

On the same axes, sketch a graph to show how this radioactive material decays. [2]

[Total: 6]

5 This question is about how electricity is generated in a nuclear power station.



Look at the list of stages. They are **not** in the correct order.

nuclear fuel put in reactor
nuclear reaction takes place
turbine turns
water boils
heat produced
electricity generated
steam produced
generator spins

Complete the table putting each stage in the correct place.

Three have been done for you.

nuclear fuel put in reactor
steam produced
electricity generated

[2]

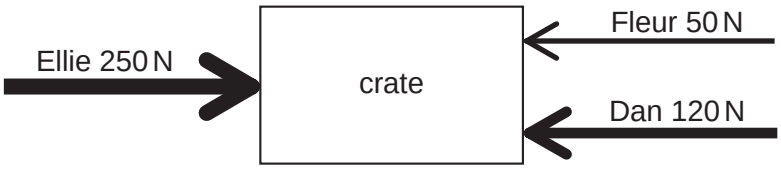
[Total: 2]

Section B – Module P5

6 This question is about vectors.

(a) Dan, Ellie and Fleur are pushing a large crate.

The diagram shows the size and direction of the forces they are using.



What is the resultant of these forces on the crate?

Put a tick (✓) in the box next to the correct answer.

170 N to the left ☐

250 N to the right ☐

420 N to the left ☐

420 N to the right ☐

80 N to the right ☐

[1]

[Turn over for the remainder of question 6

(b) (i) Sally walks at a constant **speed**.

Denise walks at a constant **velocity**.

The table shows three paths.

Put a tick (✓) in the table if the path could have been taken by **Sally**.

Put a tick (✓) in the table if the path could have been taken by **Denise**.

One tick has been done for you.

path taken	Sally at constant speed	Denise at constant velocity
	✓	
		
		

[3]

(ii) Sally now starts to run.

She accelerates at $2\,m/s^2$ for $2.5\,s$.

She starts from a speed of $2\,m/s$.

Calculate her final velocity.

The equations on page 2 may help you.

.....

.....

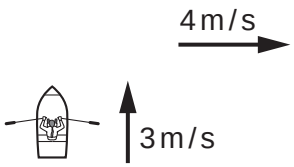
.....

final velocity = ...m/s [2]

(c) Denise rows across a river.

She rows at a steady velocity of 3 m/s.

The river is flowing at 4 m/s.



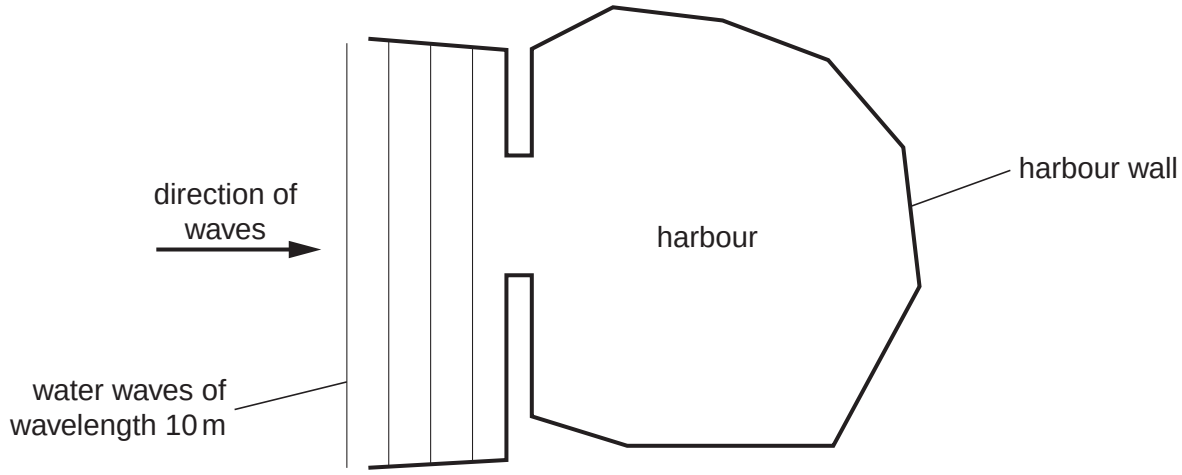
Find the **size** of her resultant velocity.

Use a calculation or a scale diagram.

size of resultant velocity = ...m/s [2]

[Total: 8]

7 Marie is watching water waves as they enter a harbour.



(a) The waves enter the harbour.

Draw on the diagram to show what happens to the waves. [2]

(b) **(i)** The size of the gap in the harbour entrance is reduced slightly.

Describe how this changes the diffraction of the waves.

.....

.....[1]

(ii) What size gap causes most diffraction?

.....

.....[1]

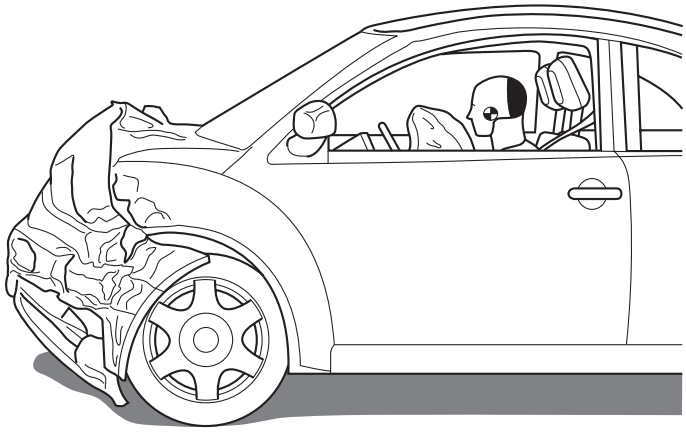
[Total: 4]

8 Crumple zones are designed to reduce injury to people in cars.

The picture shows what happened when a car collided with a wall.

The crumple zone was crushed.

This reduced the damage to the car interior.



Explain how crumple zones reduce injury.

In your answer, use ideas about **force**, **momentum** and **time**.

.....

.....

.....

.....[3]

[Total: 3]

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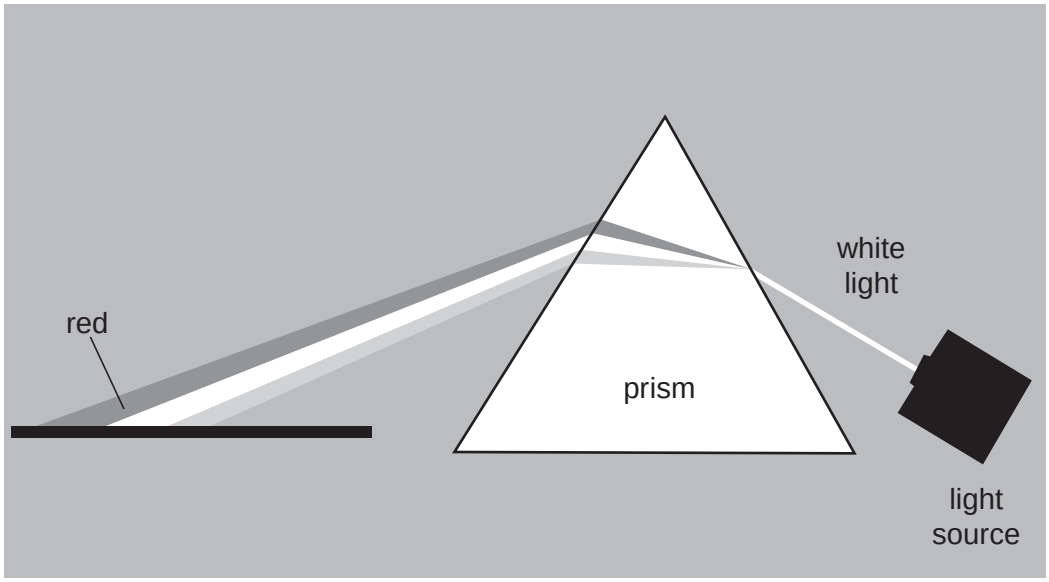
9 When white light passes through a glass prism, a spectrum is formed.



(a) Write down the spectral colours in **order**. The first one has been done for you.

red ; .....

.....[2]

(b) **(i)** Explain why different colours are deviated by different amounts.

.....

.....

(ii) Why is red light deviated **less** than any other colour?

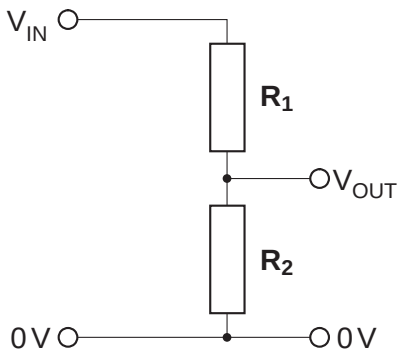
.....

.....[3]

[Total: 5]

Section C – Module P6

10 (a) The diagram shows a potential divider.



The resistance of $\mathbf{R_1}$ is 500 Ω.

The resistance of $\mathbf{R_2}$ is 1500 Ω.

The input voltage is 12 V.

Calculate the output voltage.

The equations on page 2 may help you.

.....

.....

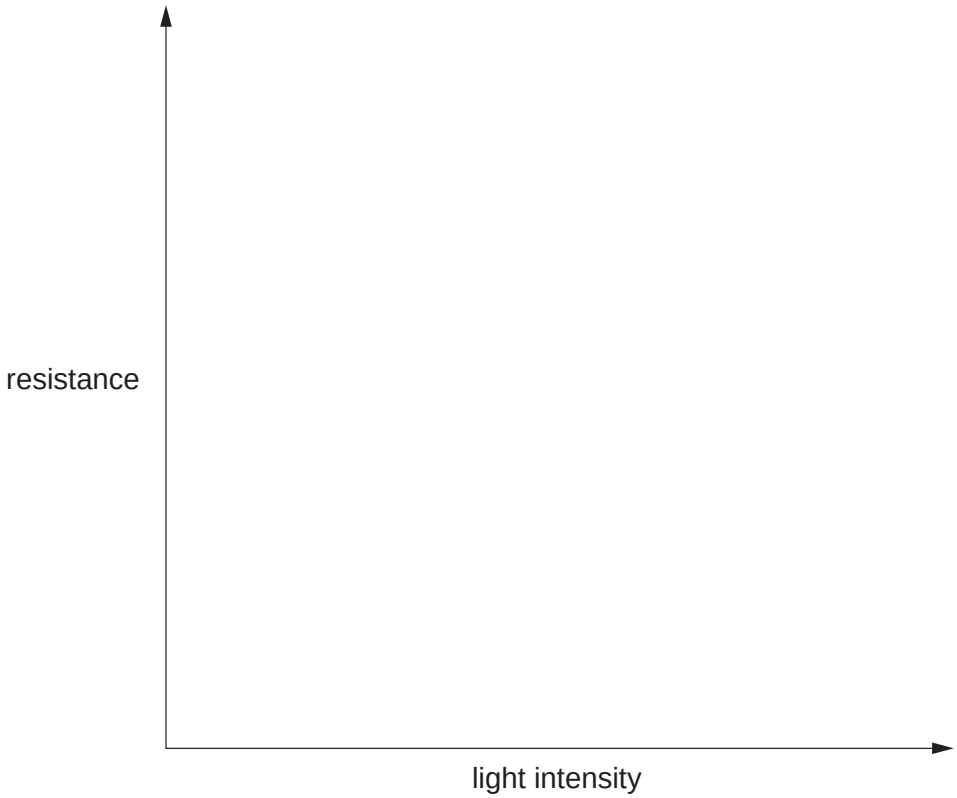
.....

answer .....V [2]

(b) An LDR can be used instead of one of the fixed resistors of a potential divider circuit.

Sketch a graph to show how the resistance of an **LDR** changes when the light intensity changes.

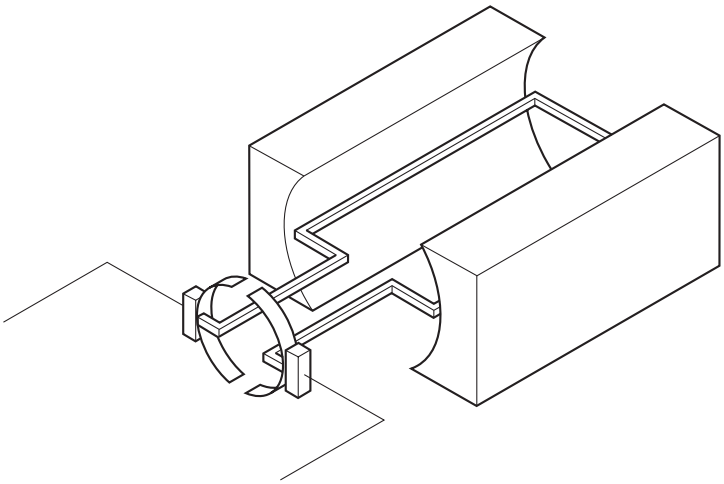
Use the axes below.



[2]

[Total: 4]

11 **(a)** Andy has made a model of a simple DC generator.



What must Andy do to make the generator produce a voltage?

.....[1]

(b) **(i)** How is electricity generated at a power station?

Put a tick (✓) in the box next to the correct answer.

A bar magnet rotates inside coils of wire.	☐
An electromagnet rotates around a permanent magnet.	☐
An electromagnet rotates inside coils of wire.	☐
Coils of wire rotate between the poles of a permanent magnet.	☐
Coils of wire rotate inside an electromagnet.	☐

[1]

(ii) Electricity is generated at a frequency of 50 Hz and a voltage of 20 000 V.

The generator spins faster.

What happens to the **frequency** and **voltage**?

.....

.....

.....[2]

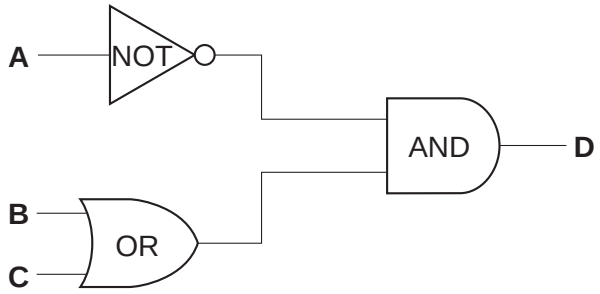
(iii) The number of turns on the generator is decreased.

What effect does this have on the **voltage**?

.....[1]

[Total: 5]

12 Sue builds a logic circuit using three gates.



(a) Sue starts to write the truth table for the circuit she has built.

Finish the truth table for the circuit she has built.

It has been started for you.

A	B	C	D
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

[2]

(b) Sue uses the output from the logic gates to switch on a motor.

The motor is powered by mains electricity (230V).

(i) What additional component must she use to switch on the motor?

.....[1]

(ii) Write down **two** reasons why this component is necessary.

1 .....

2 .....[2]

[Total: 5]

13 A silicon diode works because of the movement of **electrons** and **holes**.

(a) Explain what is meant by a hole.

Use ideas about electrons and charges.

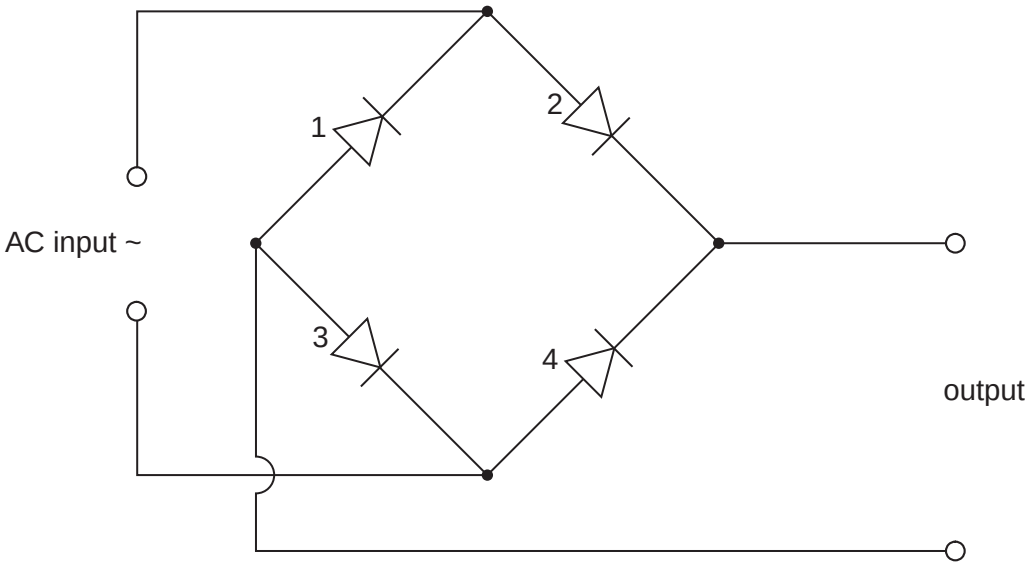
.....

.....

.....[2]

(b) **(i)** Four silicon diodes can be arranged in a bridge circuit to produce full wave rectification.

Look at the diagram.



An alternating supply is connected to the input.

Use the diagram to explain why the output produces full wave rectification.

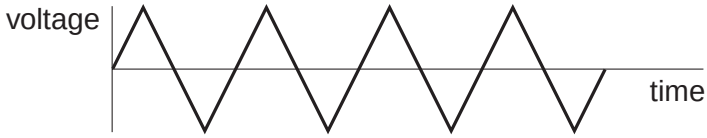
Drawing on the diagram may help your answer.

.....

.....

.....[2]

(ii) Here is an alternating voltage that is used as an input.



Draw on the axes below the **output** voltage.

[2]

[Total: 6]

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