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)

TUESDAY 29 JANUARY 2008

Afternoon
Time: 1 hour

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

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

CUP/T45743

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.
- Do **not** write outside the box bordering each page.
- 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.
- 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 **23** printed pages and **1** blank page.

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

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

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

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

$$V_p I_p = V_s I_s$$

BLANK PAGE

Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module P4

1 This question is about static electricity.

(a) Sam rubs a balloon on his sweater.

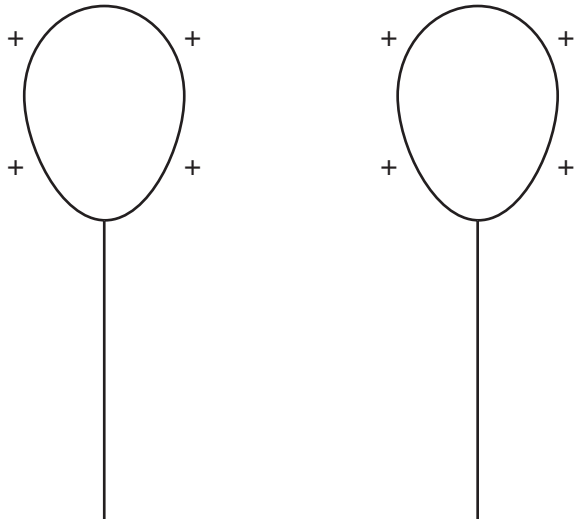
The balloon becomes charged.

(i) Write down the name of the charged particles that move between his jumper and the balloon.

..... [1]

(ii) He charges a second balloon the same way.

Look at the diagram.



What happens to the balloons when he tries to put them together?

.....

..... [1]

(b) Static electricity is useful in spray-painting cars.

Explain how.

In your answer write about

- electrostatic charge
- electrostatic force
- why it is used.

.....

.....

.....

.....

..... [3]

[Total: 5]

2 Electrostatic charges can be dangerous in hospitals.

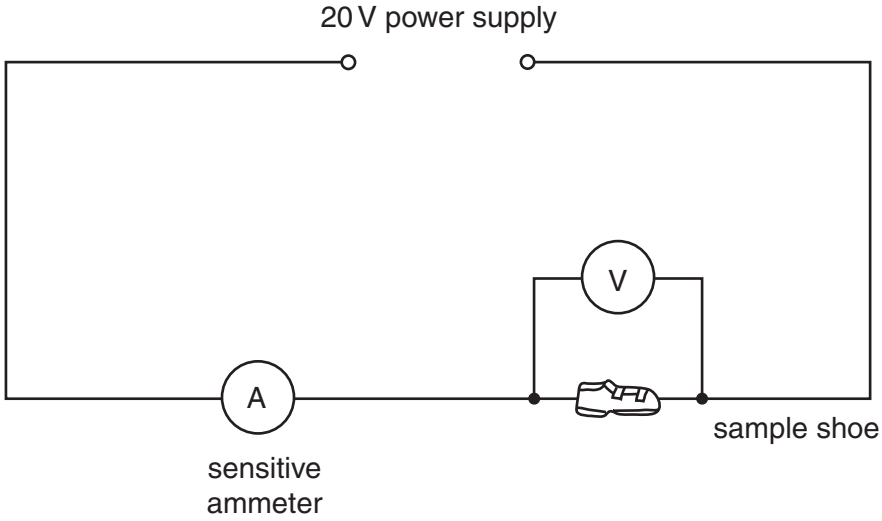
Doctors in operating theatres have to be careful not to become charged.

They wear shoes that conduct electricity.

The shoe manufacturer says that the resistance of the shoe is 15 000 ohms.

Tracey checks this in the laboratory.

She uses this circuit.



(a) The voltage is 20 volts.

What does she expect the current in the shoe to be?

Choose from: **0.0007 A** **0.0010 A** **0.0013 A** **0.0015 A**

You **must** show your working to gain full marks.

.....

.....

.....

answer ..... A [2]

(b) All the metal surfaces and electrical equipment in an operating theatre are earthed.

Suggest a reason why.

.....

..... [1]

[Total: 3]

3 This question is about **longitudinal** waves.

(a) Ultrasound and sound are examples of longitudinal waves.

Describe how ultrasound is different from sound.

.....

.....

..... [2]

(b) Doctors often use ultrasound rather than X-rays to get images of the inside of the body.

Give two reasons why.

1 .....

.....

2 .....

..... [2]

[Total: 4]

4 Nuclear radiation is used in hospitals.

(a) There are three types of nuclear radiation.

One type is stopped by skin.

Which type of nuclear radiation is stopped by skin?

..... [1]

(b) Uranium is used as a fuel in a nuclear reactor.

When the reactor is working there is a **chain reaction**.

What is a chain reaction?

.....

.....

..... [2]

(c) Radioactive substances that emit gamma rays are used as tracers to find blockages in underground pipes.

(i) Alpha or beta sources are not used.

Why are **only** gamma sources used?

.....

..... [1]

(ii) How does the gamma source show where the blockage is?

.....

..... [1]

[Total: 5]

5 Strontium-90 is radioactive and gives out beta particles from its nucleus.

(a) What is a beta particle?

.....

..... [2]

(b) The nucleus of strontium-90 contains 38 protons and 52 neutrons.

It emits a beta particle when it decays.

How many neutrons and protons are there in the nucleus of the **new** atom?

number of neutrons .....

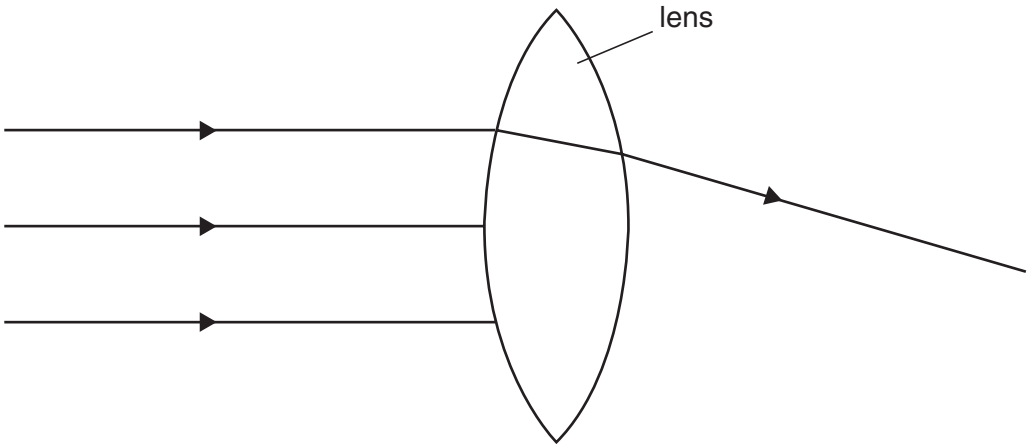
number of protons ..... [1]

[Total: 3]

Section B – Module P5

6 **(a)** The diagram shows three rays of light shining towards a lens.

One ray is shown passing through the lens.



Draw the paths of the other **two** rays as they pass through the lens. [2]

(b) David uses a camera to take a close-up picture of a butterfly.

He then takes a picture of a distant mountain range with the same camera.

He wants the picture of the mountains to be in focus.

What must he do to the distance between the lens and the film?

..... [1]

(c) David's camera produces a **real** image on the film.

David sees an image of a butterfly when he looks through a magnifying glass.

The magnifying glass image and the film image are different.

Write down **two** ways the magnifying glass image is different from the film image.

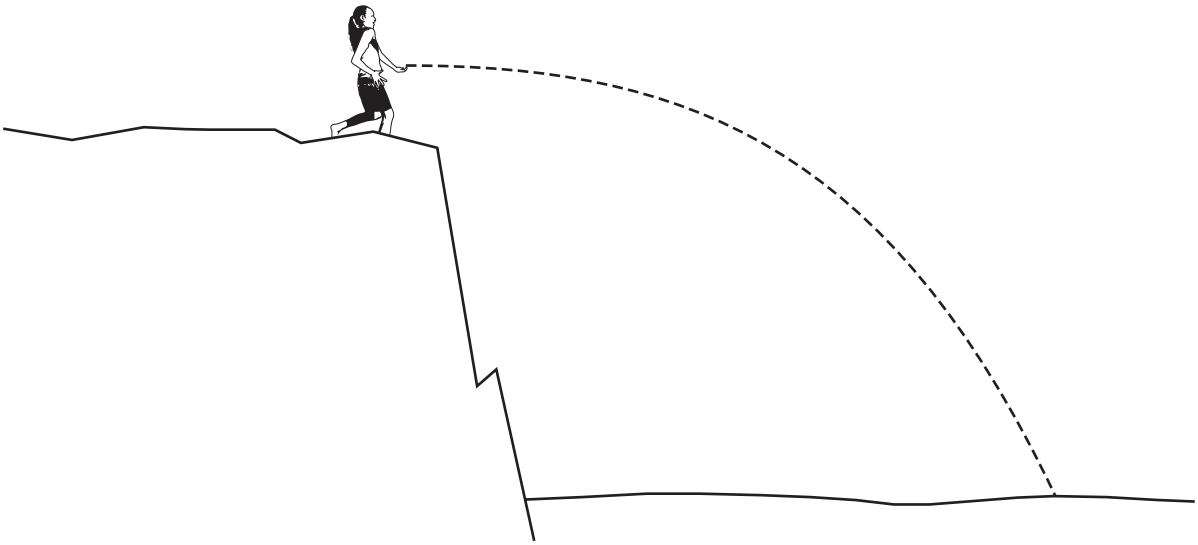
1 .....

2 ..... [2]

[Total: 5]

7 Sophie throws a stone into the sea.

She throws it horizontally with a speed of 25 m/s.



(a) Here are four sentences about how the stone behaves after it leaves her hand.

Ignore the effects of air resistance.

Only one of the statements is correct.

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

The stone speeds up horizontally.	☐
The stone has a constant horizontal velocity.	☐
The stone is called a trajectory.	☐
The stone has a constant vertical velocity.	☐

[1]

(b) The stone travels for 1.5 s before it goes into the sea.

How far in front of Sophie does the stone go into the sea?

.....

.....

answer ..... m [2]

(c) Sophie can run at 5 m/s.

If she was running at 5 m/s when she threw the stone forwards at 25 m/s, what would be the stone's horizontal velocity relative to the ground as she threw it?

.....

.....

answer ..... m/s [1]

[Total: 4]

8 **(a)** This question is about the properties of waves.

Describe an experiment to demonstrate interference of waves.

Your answer should include

- the type of wave
- how the wave is produced
- how the interference is caused.

You may draw a diagram to help you answer the question.

.....

.....

.....

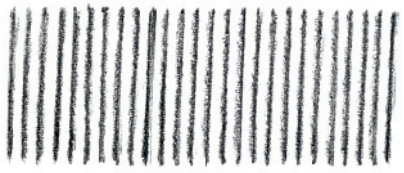
.....

.....

..... [3]

(b) The illustration shows an interference pattern produced by light.

The pattern consists of dark and light bands.



(i) Explain the reasons for the **dark** bands.

.....

..... [1]

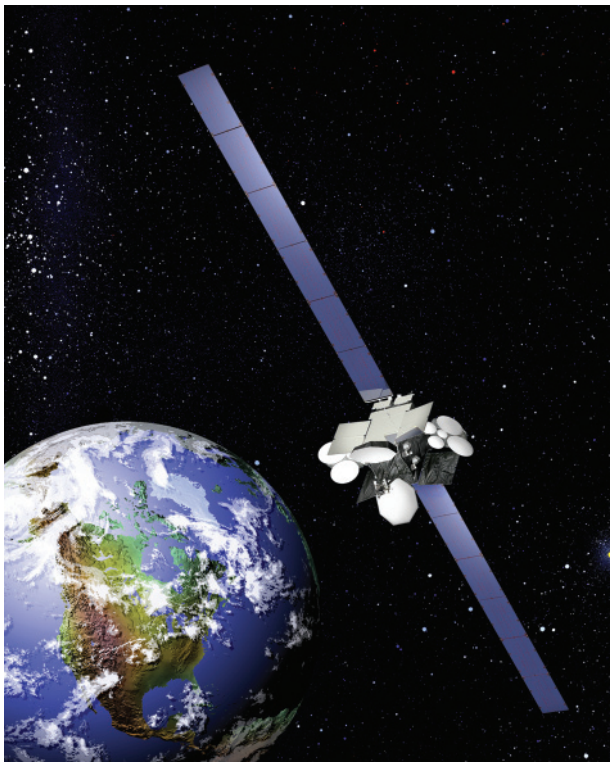
(ii) Explain the reasons for the **light** bands.

.....

..... [1]

[Total: 5]

9 Anik is an artificial satellite. It orbits around the Earth.



(a) Anik is a communications satellite. It orbits the Earth above the equator in **geostationary** orbit.

(i) How long does it take Anik to orbit the Earth?

answer ..... hours [1]

(ii) Explain what is meant by a **geostationary** orbit.

.....

.....

..... [2]

(b) NOAA is a **weather** satellite in orbit above the poles. It takes 100 minutes to orbit the Earth.

(i) How does the height of NOAA above the Earth's surface compare with the height of Anik?

..... [1]

(ii) Why is NOAA designed to orbit the Earth in such a short time?

.....

.....

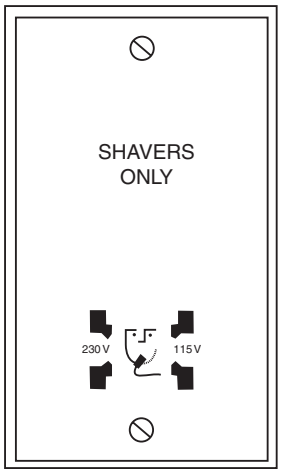
..... [2]

[Total: 6]

Section C – Module P6

10 Transformers are normally used to change the size of an AC voltage.

(a) A shaving socket has two outputs, 230V and 115V.



The input to the transformer is 230V. There are 10000 turns on the primary coil of the transformer.

The output is 115V. How many turns are there on the secondary coil?

Use the equations on page 2 to help you.

.....

.....

number of turns on secondary coil = ... [2]

(b) An **isolating** transformer is used between the 230V mains supply and the 230V outlet.

Explain why there is an **isolating** transformer in a shaver socket.

.....

..... [1]

(c) Electricity is transmitted around the country at very high voltages.

Explain why.

.....

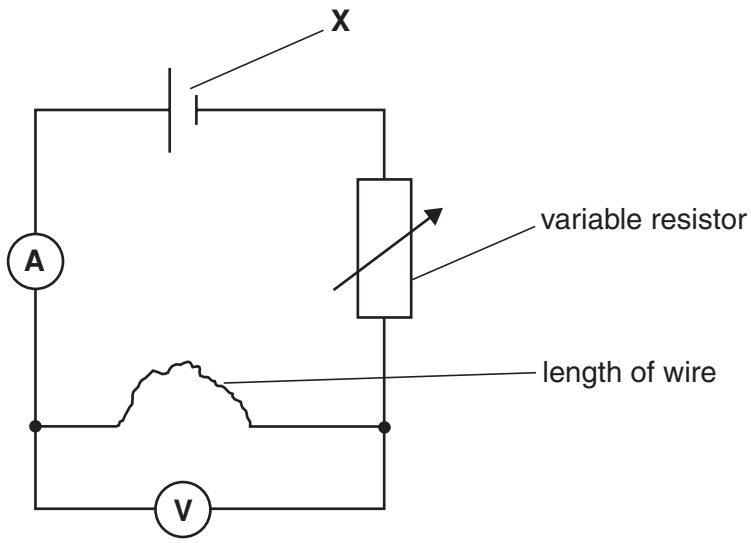
.....

..... [2]

[Total: 5]

11 Jenny wants to measure the resistance of a wire.

She uses this circuit.



(a) Jenny changes the variable resistor. The resistance gets less.

What happens to the current in the circuit when the resistance gets less?

..... [1]

(b) The reading on the ammeter is 0.5 A. The reading on the voltmeter is 1.5 V.

(i) Calculate the resistance of the wire.

Use the equations on page 2 to help you.

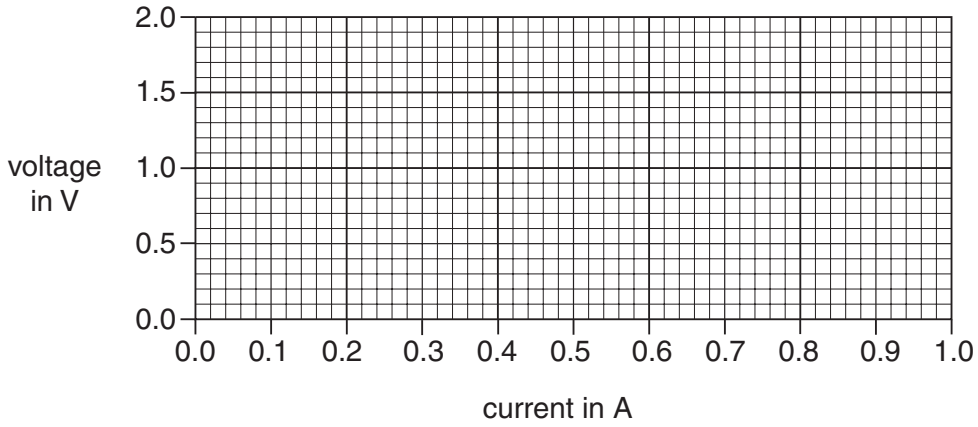
.....

.....

resistance of wire = ... Ω [2]

(ii) Jenny plots a graph to show how the voltage varies with current.

Use the axes to draw her graph.

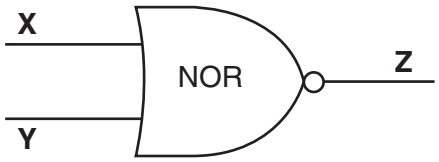


[3]

[Total: 6]

12 This question is about NOR gates.

(a) Complete the truth table for a NOR gate.



input **X**	input **Y**	output **Z**
0	0	

[2]

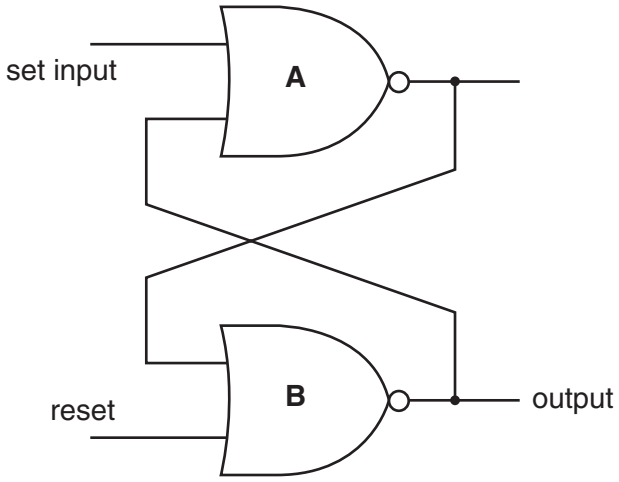
(b) A latch can be made from two NOR gates, **A** and **B**.

When a latch **input** becomes high

- the output becomes high
- the output stays high even when the input is disconnected.

The diagram shows a latch.

Explain how a latch works.



.....

.....

.....

.....

.....

..... [3]

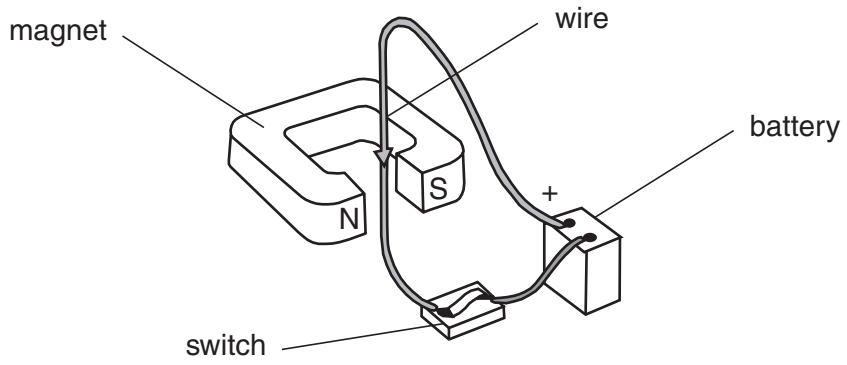
[Total: 5]

13 This question is about how electric motors work.

(a) Michael hangs a wire between the poles of a magnet.

He wants to find out what happens when a current passes through the wire.

When he switches on, the wire moves out of the gap between the poles of the magnet.

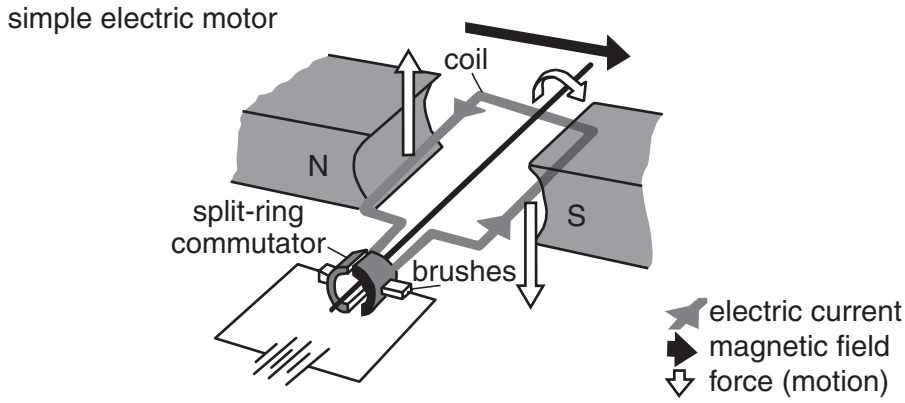


Michael reverses the direction of the current.

What difference does he see in the movement of the wire?

..... [1]

(b) The diagram shows a simple motor.



(i) The current in the motor is increased.

What happens to the speed of rotation of the motor?

..... [1]

(ii) How does the split-ring commutator keep the motor spinning in the same direction?

.....

.....

..... [2]

[Total: 4]

END OF QUESTION PAPER

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