

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
GATEWAY SCIENCE
PHYSICS B**

B652/02

Unit 2 Modules P4 P5 P6 (Higher Tier)

**Friday 18 June 2010
Afternoon**

Duration: 1 hour

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)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

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 **20** pages. Any blank pages are indicated.

EQUATIONS

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

$$v = u + at$$

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

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

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

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

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

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

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

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

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

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

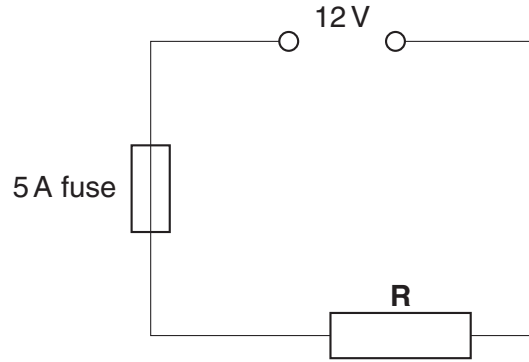
$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$V_p I_p = V_s I_s$$

Answer **all** the questions.

Section A – Module P4

1 Zak connects the following circuit.



He uses a fuse.

The fuse melts if the current is more than 5 amps.

Calculate the resistance in the circuit when the current is 5 amps.

The equations on page 2 may help you.

.....

.....

.....

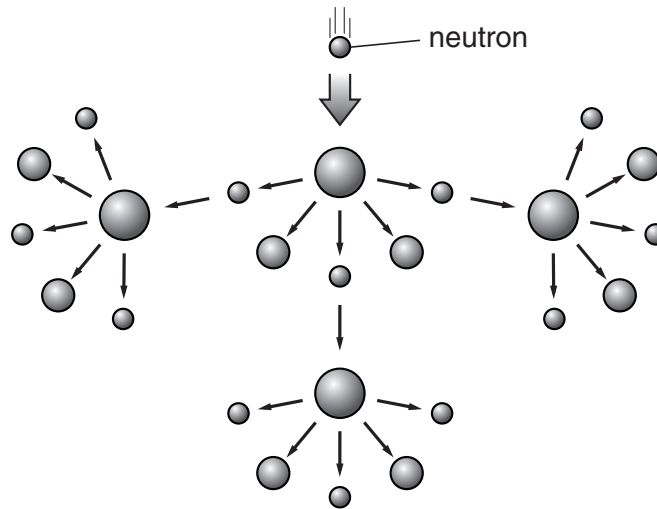
answer ohms

[2]

[Total: 2]

2 (a) (i) Nuclear power stations use uranium as a fuel in a reactor.

Energy is released when a uranium atom splits in a chain reaction.



Write down the name of the process producing this energy.

..... [1]

(ii) Some materials are put into the reactor. This makes them radioactive.

What do the materials absorb to make them radioactive?

.....
 [1]

(b) Some radioactive sources emit beta particles.

What is a beta particle?

In your answer write about

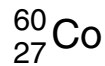
- what type of particle it is
- its movement.

.....

 [2]

- (c) Cobalt-60 has a mass number of 60.

Cobalt-60 has an atomic number of 27.



Cobalt-60 emits a beta particle.

- (i) What is the **mass** number of the new substance?

answer [1]

- (ii) What is the **atomic** number of the new substance?

answer [1]

[Total: 6]

- 3 Hospitals use beta and gamma emitters as tracers.

- (a) Suggest one reason why alpha emitters are **not** used as tracers in hospitals.

.....
 [1]

- (b) X-rays and gamma rays have similar **properties**.

They are both electromagnetic waves which come from atoms.

Write down another **property** they have in common.

.....
 [1]

[Total: 2]

4 Ultrasound is used in hospitals.

It is used to look inside people by scanning the body.

(a) Ultrasound **cannot** be heard.

Explain why.

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

(b) Ultrasound is a longitudinal wave.

The waves are made up of a series of compressions and rarefactions.

What is a compression?

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

[Total: 2]

5 This question is about carbon dating.

(a) Carbon dating measures the activity of one isotope of carbon.

Which radioactive isotope of carbon is used for carbon dating?

..... [1]

(b) The activity of this isotope in living trees has not changed for thousands of years.

The activity is less in dead wood than in living wood.

Explain why.

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

(c) Archaeologists excavate a large wooden monument.

The activity of 1 g of living wood is 20 counts per minute.

The activity of 1 g of wood from the monument is 5 counts per minute.

The half-life of radioactive carbon is 5700 years.

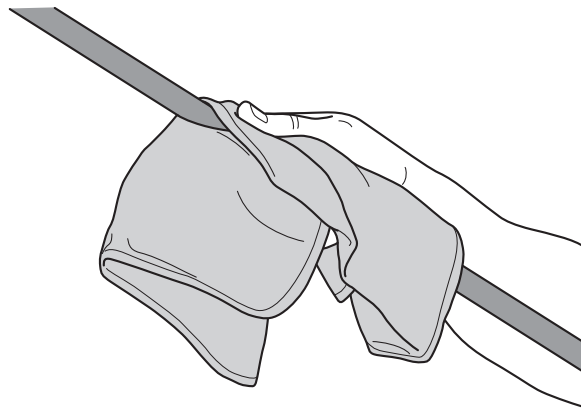
How old is the wooden monument?

.....
.....

answer years [2]

[Total: 6]

6 Wanda charges a plastic rod by rubbing it with a cloth.



The rod gets a positive charge.

Explain why.

.....

.....

.....

..... [2]

[Total: 2]

Section B – Module P5

7 A human cannonball is an example of a **projectile**.

Look at the picture of a man being fired as a human cannon ball.



(a) All projectiles have a downward vertical force acting on them.

Write down the name of this force.

..... [1]

(b) Assume air resistance has no effect.

The human cannonball has both a horizontal and a vertical velocity.

(i) What happens to the size of his horizontal velocity during his flight?

..... [1]

(ii) What happens to the size of his **downward** vertical velocity during his flight?

..... [1]

(c) At one particular moment, the human cannonball is moving with a horizontal velocity of 4 m/s and a vertical velocity of 3 m/s.

His resultant velocity is 5 m/s.

Explain how you could calculate this value.

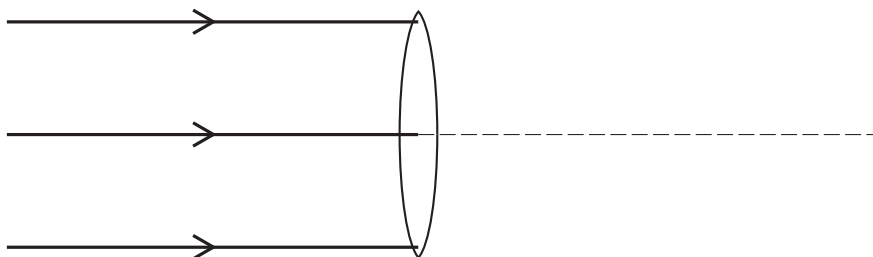
You may draw a diagram to help you answer.

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

[Total: 5]

Turn over

8 The diagram shows three parallel rays of light and a lens.



(a) The rays pass through the lens.

Finish the diagram by showing the paths they take.

[2]

(b) A convex lens can be used as a magnifying glass.

It can also be used in a slide projector.

The images produced in both cases are magnified.

(i) The images produced are different.

Write down **two** differences.

1

.....

2

..... [2]

(ii) The image on the screen from the projector is out of focus.

A teacher adjusts the lens at the front of the projector.

This brings the image into **focus**.

What happens to the **position** of the lens to bring the image into focus?

..... [1]

[Total: 5]

9 Microwaves are used for transmitting signals to satellites orbiting above the Earth.

They are not used for transmitting signals over long distances on Earth.

Finish the sentences by choosing the **best** words from this list.

diffract light radio reflect refract sound

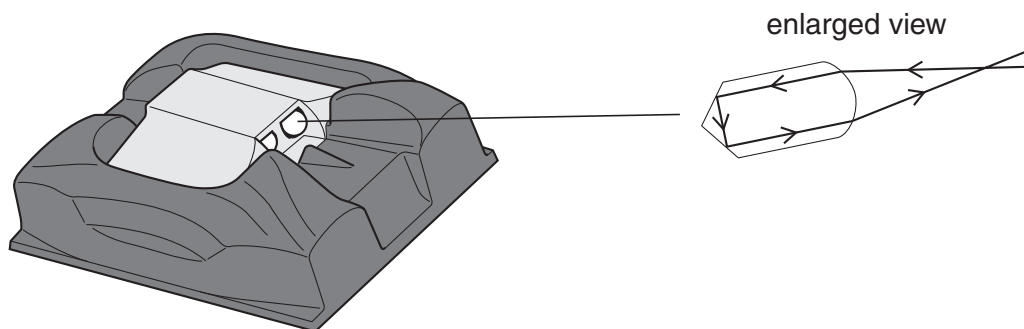
The best way to transmit signals long distances on Earth is using long wave waves.

These waves around hills and over the horizon. [2]

[Total: 2]

10 Cat's eyes are set into the surface of roads. They help drivers to see lane markings at night.

The inside of the cat's eye is made of a transparent plastic material.



Light from a car headlamp is totally internally reflected in the cat's eye.

(a) What two conditions are needed for this **total internal reflection** to occur?

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

(b) The refractive index of the plastic in the cat's eye is 1.5.

Light enters the plastic with an angle of incidence of 25° .

The light is refracted.

Calculate the angle of refraction.

The equations on page 2 may help you.

.....
.....
.....

answer $^\circ$ [3]

[Total: 5]

11 The Keirin is a sprint cycle race.



The cyclists follow a motorised cycle until they are travelling at a speed of 14 m/s.

The motorised cycle leaves the track.

The cyclists then accelerate from 14 m/s to 18 m/s at a steady rate.

This takes them 3 seconds.

(a) What distance do the cyclists travel during the 3 seconds?

The equations on page 2 may help you.

.....

answer m [2]

(b) The motorised cyclist leaves the track travelling at a **speed** of 14 m/s.

Speed is a scalar quantity.

Velocity is a vector quantity.

What is the difference between a **scalar** and a **vector** quantity?

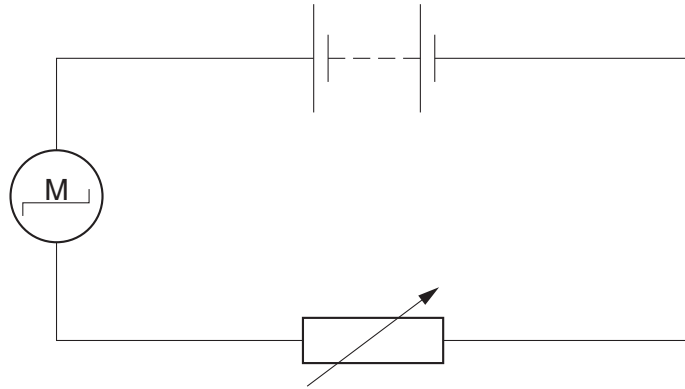
.....
 [1]

[Total: 3]

Section C – Module P6

12 Joe investigates variable resistors.

He makes this circuit.



(a) He adjusts the variable resistor.

The speed of the motor increases.

Explain why this happens.

In your answer use ideas about

- resistance
- current.

.....

.....

..... [2]

(b) Joe replaces the motor with a light bulb.

He adjusts the variable resistor. The bulb gets dimmer.

Which letter gives the correct explanation?

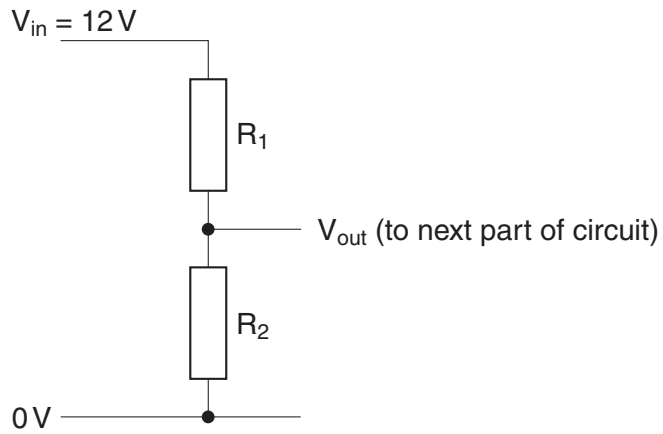
	resistance of variable resistor	current
A	greater	greater
B	greater	smaller
C	smaller	greater
D	smaller	smaller

answer

[1]

[Total: 3]

13 Look at the arrangement of two fixed resistors in series.



(a) The input voltage is fixed at 12V.

The output voltage needs to be variable.

Explain how you could do this.

.....

.....

..... [2]

(b) The value of R_1 is $70\ \Omega$.

The value of R_2 is $50\ \Omega$.

Calculate the output voltage (V_{out}).

The equations on page 2 may help you.

.....

.....

.....

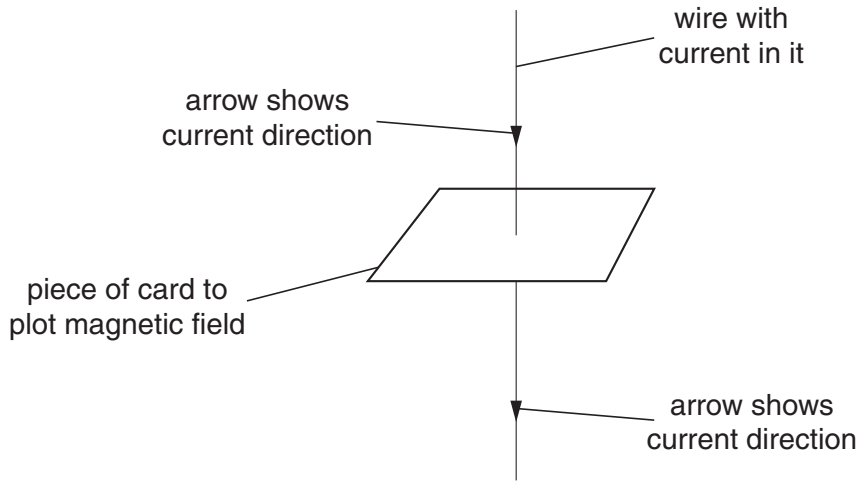
answer V [2]

[Total: 4]

14 Julia investigates the magnetic field produced by an electric current.

The current passes **down** a straight wire.

She plots the magnetic field around the wire.



(a) What **shape** is the magnetic field around the wire?

..... [1]

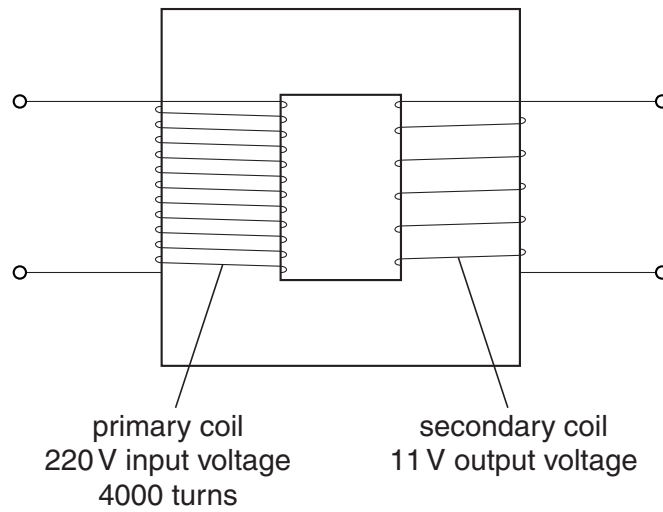
(b) Julia now makes the current pass **up** the wire.

What happens to the **direction** of the magnetic field?

..... [1]

[Total: 2]

15 Look at the diagram of a transformer.



(a) Calculate the number of turns in the secondary coil.

The equations on page 2 may help you.

.....

.....

.....

answer turns [2]

(b) The transformer in the diagram is a **step down** transformer.

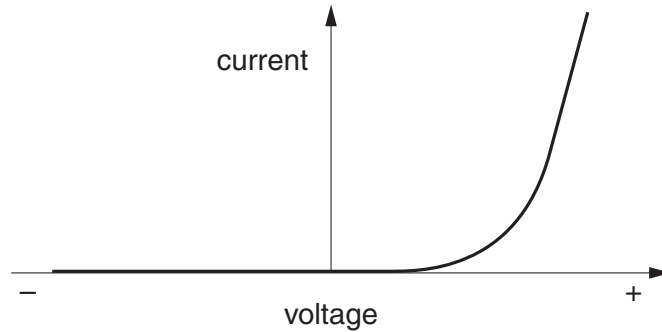
What is different in the construction of a **step up** transformer?

.....

..... [1]

[Total: 3]

16 Declan does an experiment with an electrical component.
He measures the current and voltage for the component.
He then draws a current-voltage graph.



(a) Look at the graph.

Complete the sentence.

The graph shows the current-voltage characteristics for a silicon [1]

(b) Explain the shape of the current-voltage graph.

In your answer write about the resistance of the component.

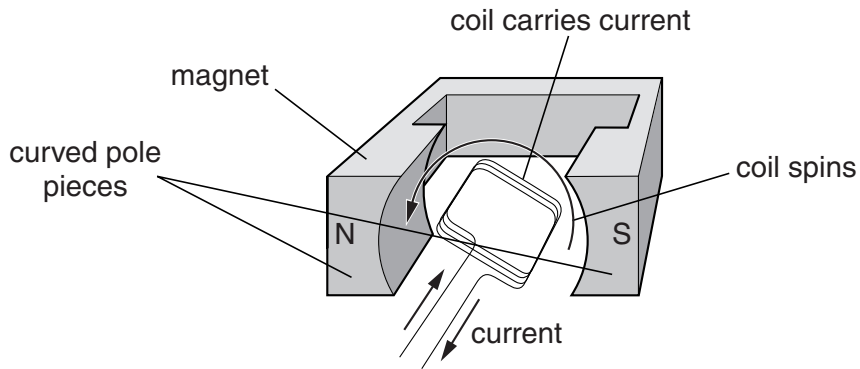
In the forward (+) direction.
.....
.....

In the reverse (-) direction.
..... [2]

[Total: 3]

17 Look at the diagram. It shows part of a DC (direct current) motor.

The coil spins when it carries a current.



(a) Every half turn the current in the coil is reversed.

Explain why.

.....
 [1]

(b) The motor has curved pole pieces.

These produce a **radial** magnetic field.

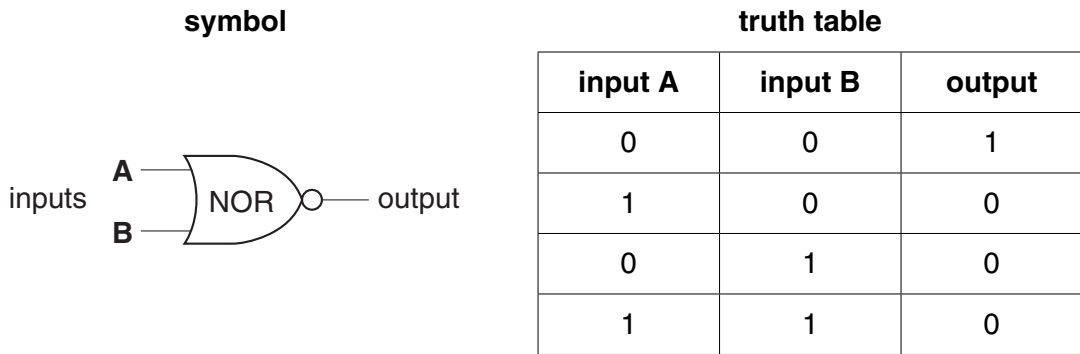
Why do practical motors have a radial magnetic field?

.....
 [1]

[Total: 2]

18 This question is about logic gates.

(a) Look at the **symbol** and **truth table** for a **NOR** gate.



Look at the truth table.

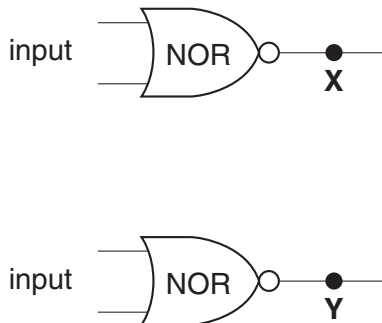
Explain why the output is only ON (output = 1) for the first row in the table.

.....

..... [1]

(b) Two NOR gates can be used to make a **bistable latch** circuit.

Draw lines from **X** and **Y** to complete the diagram of a bistable latch.



[2]

[Total: 3]

END OF QUESTION PAPER

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