

Wednesday 14 June 2017 – Morning

**GCSE GATEWAY SCIENCE
PHYSICS B**

B751/02 Physics modules P1, P2, P3 (Higher Tier)

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)

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- 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 **75**.
- This document consists of **20** pages. Any blank pages are indicated.

EQUATIONS

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

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

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{power} = \text{force} \times \text{speed}$$

$$\text{KE} = \frac{1}{2}mv^2$$

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

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

$$\text{GPE} = mgh$$

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

$$v = u + at$$

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

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

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

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

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

$$l_e = l_b + l_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} =$$

$$\frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_p I_p = V_s I_s$$

Answer **all** the questions.

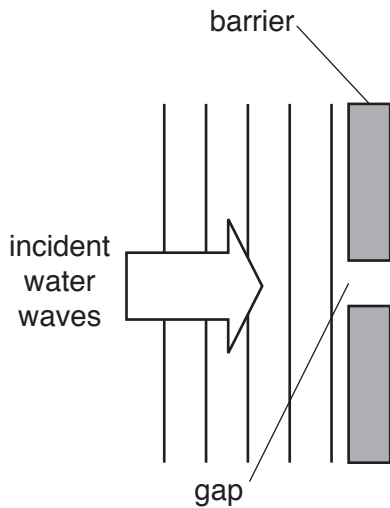
SECTION A – Module P1

1 Sami uses a ripple tank to investigate waves.

He makes water waves.

The waves have a similar wavelength to the size of the gap in the barrier.

Look at the diagram.



(a) Draw the diffraction pattern that Sami sees after the waves pass through the gap. [2]

(b) Describe how the pattern is different when the gap is **increased** in size.

.....

..... [1]

2 Ray investigates the U-values of different flooring materials.

The U-value is a measure of how good a material is as an insulator.

Good heat insulators have a low U-value.

Look at the table.

Flooring material	U-value in W/m^2
cork tiles	3.6
ceramic tiles	50.0
lino	20.0
wool carpet	0.7
oak wood	1.6

Ray chooses flooring materials for two rooms in his home.

- room **A** has underfloor heating
- room **B** does **not** have underfloor heating.

Explain which flooring materials Ray should choose for room **A** and for room **B**.



The quality of written communication will be assessed in your answer to this question.

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..... [6]

3 Light and infrared radiation are used for communication.

(a) (i) Describe how light is used to communicate using Morse code.

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

(ii) Explain why Morse code is a **digital** signal.

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

(b) Infrared radiation can travel along optical fibres.

Explain how infrared radiation travels along an optical fibre.

You may draw a diagram to show your answer.

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

(c) An infrared wave travels at 2.0×10^8 m/s along an optical fibre.

The wavelength of the infrared wave is 9.0×10^{-7} m.

Calculate the frequency of the infrared wave.

Give your answer to **two** significant figures.

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

Answer Hz [3]

4 Kate sometimes gets a poor signal on her mobile phone.

She knows that adverse weather can affect getting a good signal.

(a) Write down one **other** factor which could stop her getting a good signal.

..... [1]

(b) How can problems with signal loss be reduced?

..... [1]

(c) Some people are concerned that mobile phone masts may be dangerous.

Describe arguments for **and** against increasing the number of mobile phone masts in a built-up area.

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

5 (a) Calculate the energy needed to change the state of 3.5 kg of water into steam.

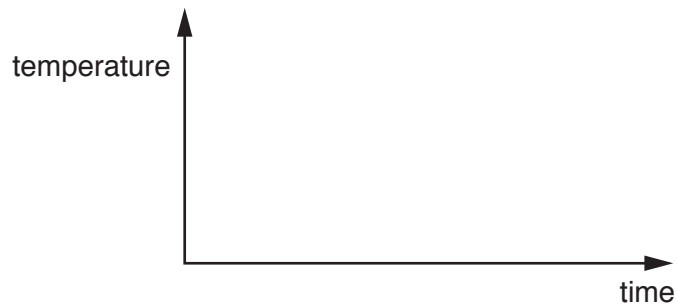
The specific latent heat for boiling water is 2 260 000 J/kg.

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

Answer J [2]

(b) This change of state from water into steam can be sketched on a temperature/time graph.

Sketch the line and describe what it shows.



..... [1]

SECTION B – Module P2

6 Tarak has a café.

He uses five appliances in his café.

He writes down the power of each appliance and the time it is used each day.

Look at the table.

Appliance	Power in kilowatts	Time used each day in hours
toaster	2.0	4.0
kettle	3.0	2.5
microwave	1.0	3.0
fridge	0.3	8.0
freezer	0.5	12.0

(a) Which appliance costs Tarak the **most** to use each day?

..... [1]

(b) Which appliance costs Tarak the **least** to use each day?

..... [1]

(c) Electricity costs 16p per kilowatt-hour.

Calculate the cost of using the freezer each day.

.....

Answer p [2]

- 7 (a) A power station has an efficiency of 30% and an energy input of 1 500 000 J.

Calculate the wasted energy in the power station.

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

Answer J [3]

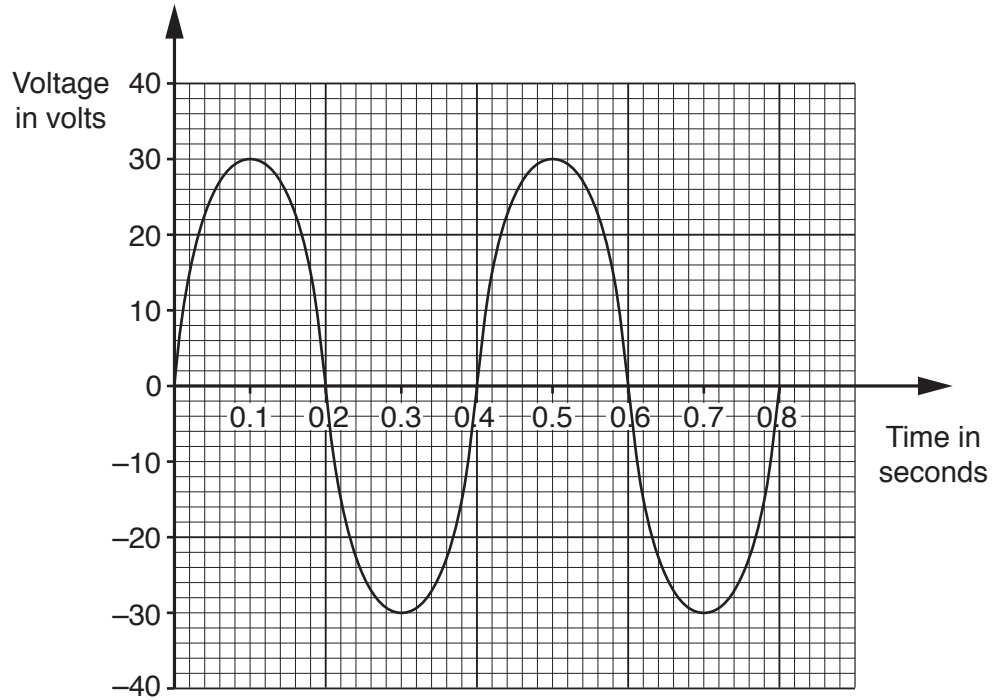
- (b) Transformers are used to **increase** the voltage of the electricity before it is transmitted to homes.

Explain why the voltage is increased.

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

(c) Generators in power stations produce alternating current (AC).

Look at the voltage/time graph for a model generator.



Use the graph to find:

(i) the **time period** of the alternating current

Answer

[1]

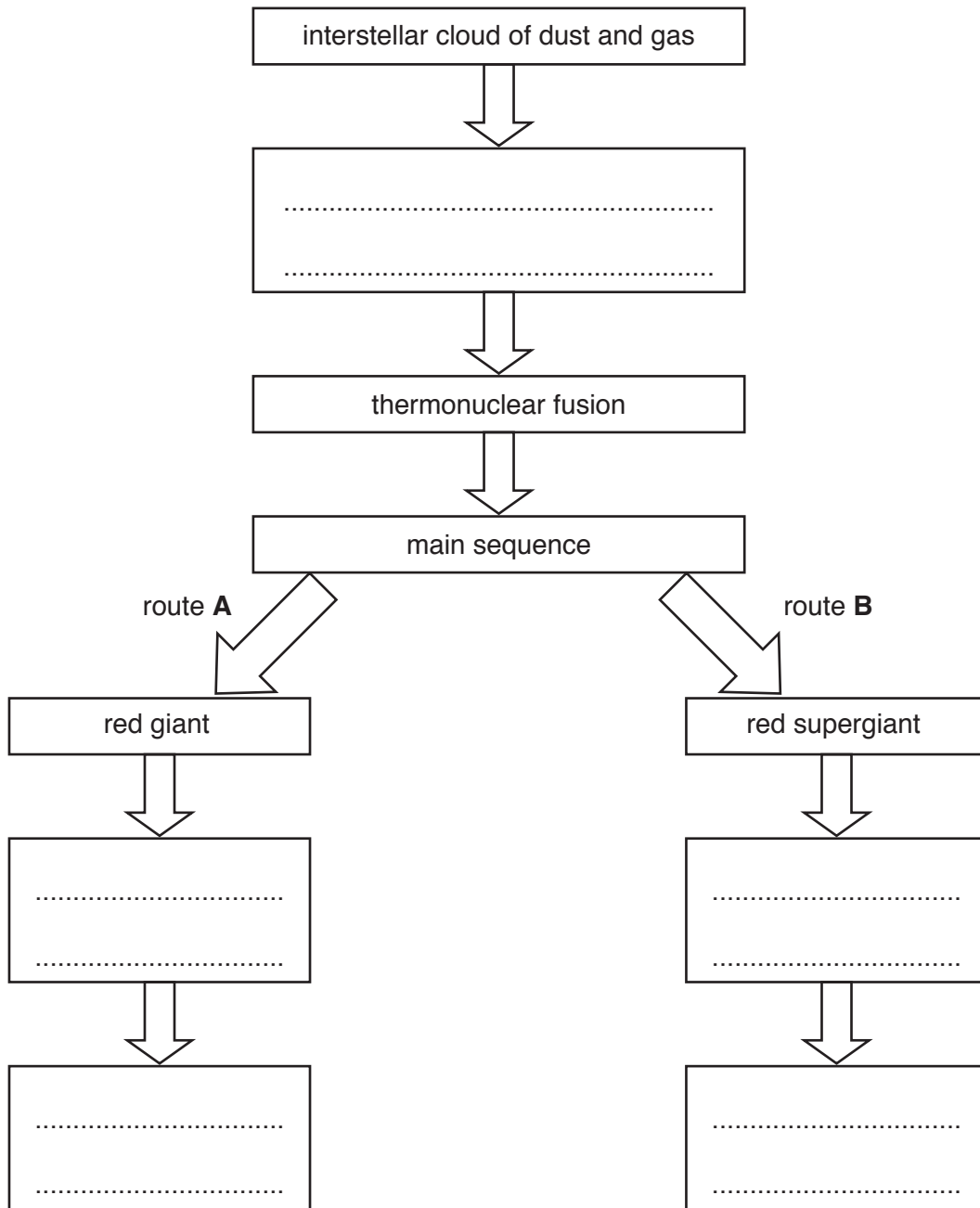
(ii) the **peak voltage** of the alternating current.

Answer

[1]

9 Chloe and Marcus draw a flow chart for the life-cycle of a star.

Look at their flow chart.



(a) (i) Their flow chart is incomplete.

Fill in the **five** missing parts of the life-cycle of a star.

Write your answers in the boxes on the flow chart.

[3]

(ii) Explain what determines whether a star follows route **A** or route **B** after the main sequence.

.....

[1]

(b) Chloe also completes a project on Near Earth Objects (NEOs).

Look at her project.

Near Earth Objects (NEOs)

NEOs are usually comets or asteroids.

NEOs are surveyed by telescopes or satellites.

Red shifts are used to track the speed of NEOs.

NEOs are objects on a possible collision course with Earth.

NEOs will be deflected by the ozone layer of the Earth.

The gravitational attraction of Jupiter will stop most NEOs reaching Earth.

Marcus checks her project and finds three mistakes.

Write down the **three** mistakes in her project.

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

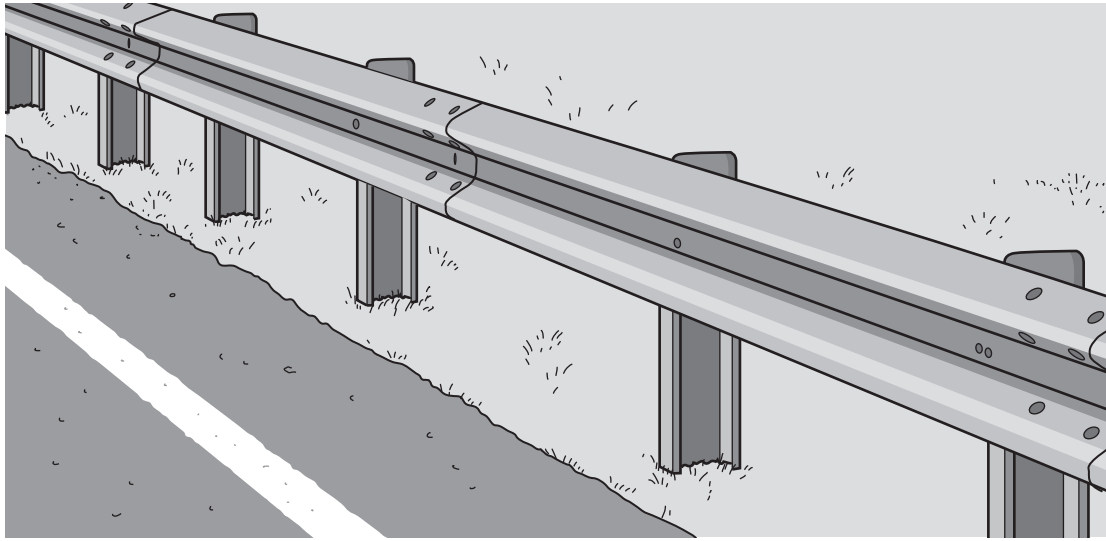
(c) A centripetal force is needed for circular motion.

What provides the centripetal force for the Moon orbiting the Earth?

..... [1]

SECTION C – Module P3

10 (a) Crash barriers are used at the side of motorways.



Explain how a crash barrier can reduce the force on the passengers in a car when the car crashes.

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

(b) Different factors can **increase** the thinking distance and the braking distance of a car.

(i) Write down one factor that increases **thinking distance**.

..... [1]

(ii) Write down one factor that increases **braking distance**.

..... [1]

(c) Explain what this warning means.

"you are driving inside the thinking distance of the car in front"

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

11 John wants to buy a new car.

He researches the performance of new cars.

Look at the table.

Car	Fuel used	Number of seats	Fuel consumption in km/litre	Carbon emissions in grams/km
A	petrol	2	4.1	150
B	petrol	4	4.0	172
C	petrol	5	3.6	177
D	diesel	5	5.2	129
E	diesel	7	4.1	149

(a) Describe the trends and patterns in the data.

.....

 [2]

(b) John wants to buy a car that is cheap to run.

Suggest and explain which car John should buy.

.....

 [2]

(c) People use data provided by car manufacturers to make decisions on which car to buy.

Why is it important that this data is accurate and independently checked?

.....

 [2]

13 (a) A bus has a momentum of 50 000 kg m/s.

It comes to a stop in 8 seconds.

Calculate the **braking force** of the bus.

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

Answer N [2]

(b) The bus has a mass of 5 000 kg.

Calculate the **acceleration** of the bus.

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

Answer m/s² [2]

14 (a) A ball is dropped from a cliff 20 m high.

Calculate the speed of the ball just before it hits the ground.

Acceleration due to gravity = 10 m/s².

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.....
.....

Answer m/s [2]

(b) Acceleration due to gravity varies slightly at different points on the Earth's surface.

Where, on the Earth, will acceleration due to gravity be different to its value at sea level?

..... [1]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large area of lined paper for writing, consisting of 25 horizontal dotted lines. A solid vertical line runs down the left side of the page, creating a margin. The rest of the page is blank, intended for the student to write their answer.

The page features a vertical solid line on the left side, extending from the top to the bottom of the main content area. To the right of this line, there are 20 horizontal dotted lines, evenly spaced, spanning the width of the page. This layout is typical for handwriting practice or for creating a simple ledger with one column.

A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



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