OCR
Oxford Cambridge and RSA

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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

* B 7 5 1 0 2 *

* 6 7 5 4 4 8 2 4 6 9 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

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

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

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

distance = average speed × time

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

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

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

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

power = force × speed

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

momentum = mass × velocity

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

GPE = mgh

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

power loss = (current)^2 × resistance

$$V_pI_p = V_sI_s$$

Answer **all** the questions.

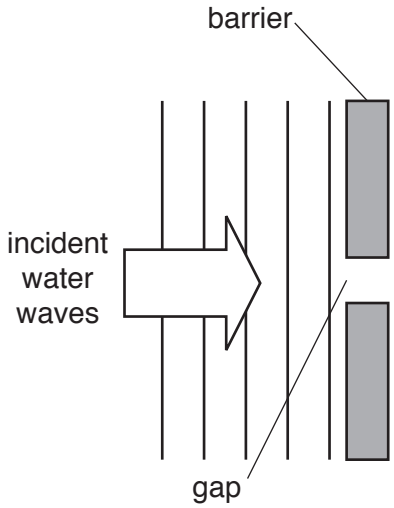
SECTION A – Module P1

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.

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..... **[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.

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

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

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..... **[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.

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..... **[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.

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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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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.

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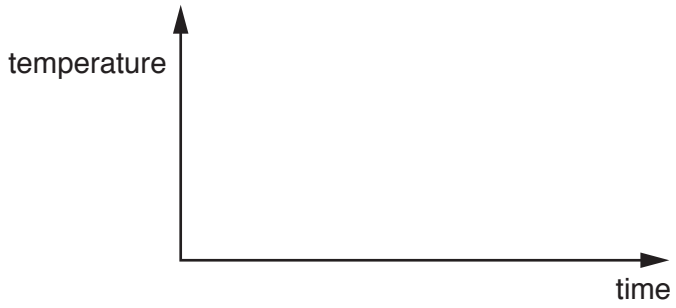
Answer ..... J **[2]**

(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.



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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.

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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.

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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.

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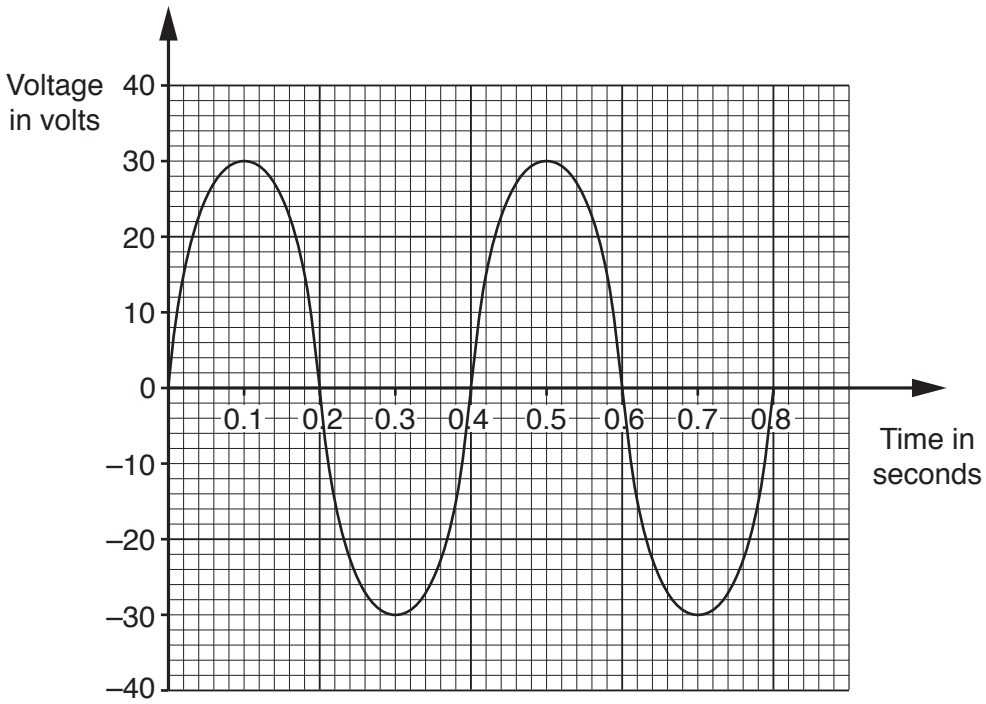
(c) Generators in power stations produce alternating current (AC).

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]**

8 Radiation is involved in passive solar heating and the greenhouse effect.

Compare the similarities and differences between passive solar heating and the greenhouse effect.

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

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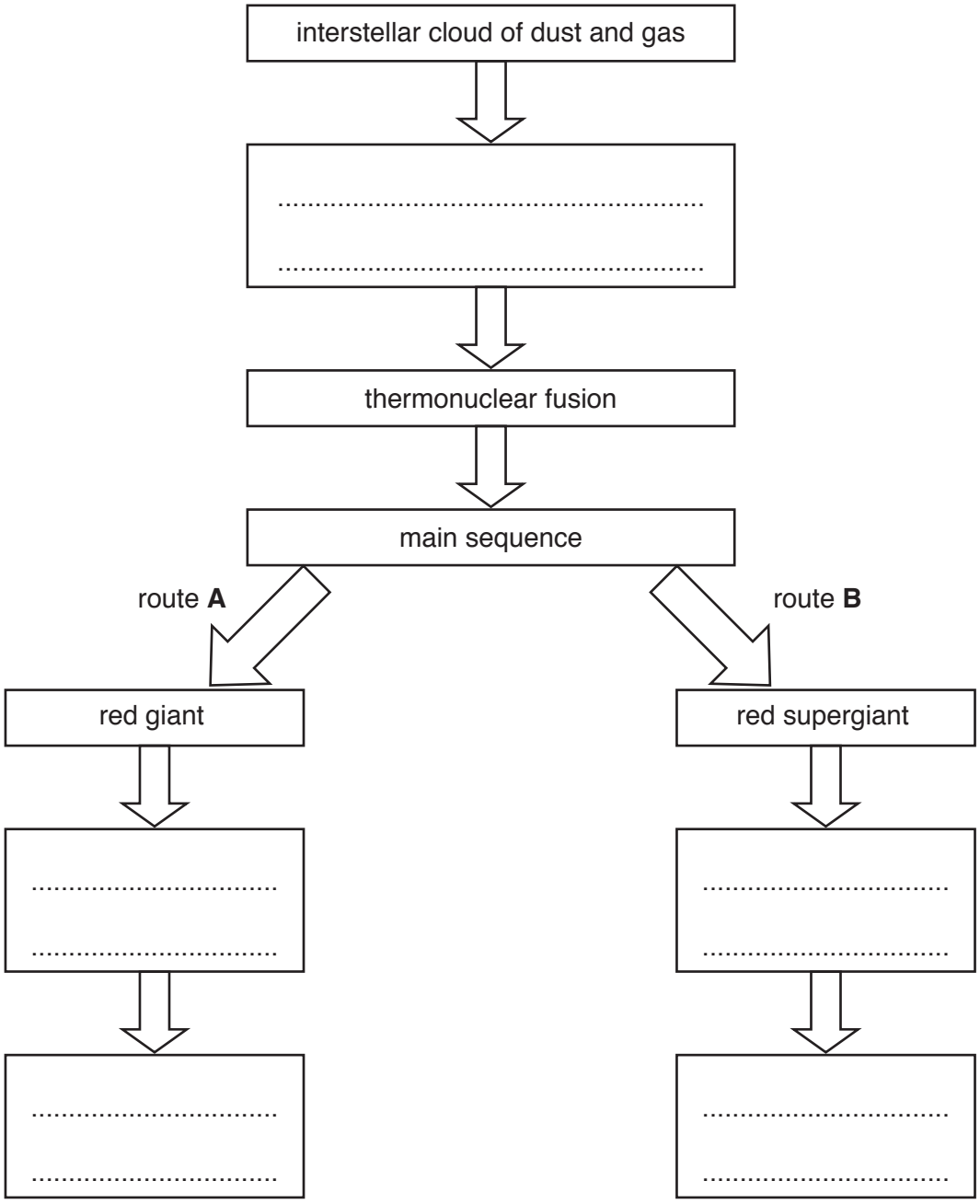
9 Chloe and Marcus draw a flow chart for the life-cycle of a star.

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.

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..... **[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]**

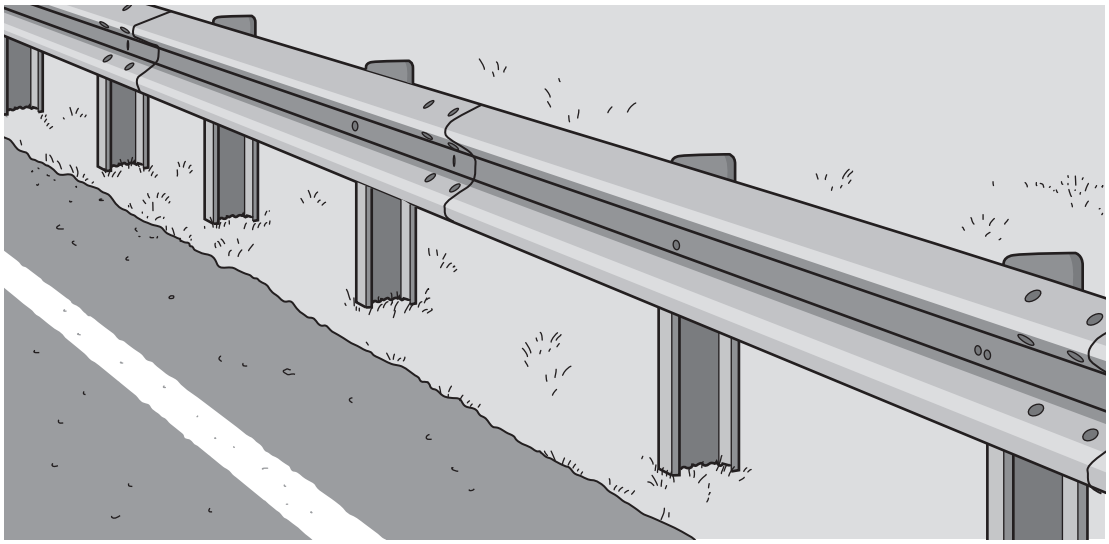
(c) A centripetal force is needed for circular motion.

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.

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(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"

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..... **[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.

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

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

Suggest and explain which car John should buy.

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..... **[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?

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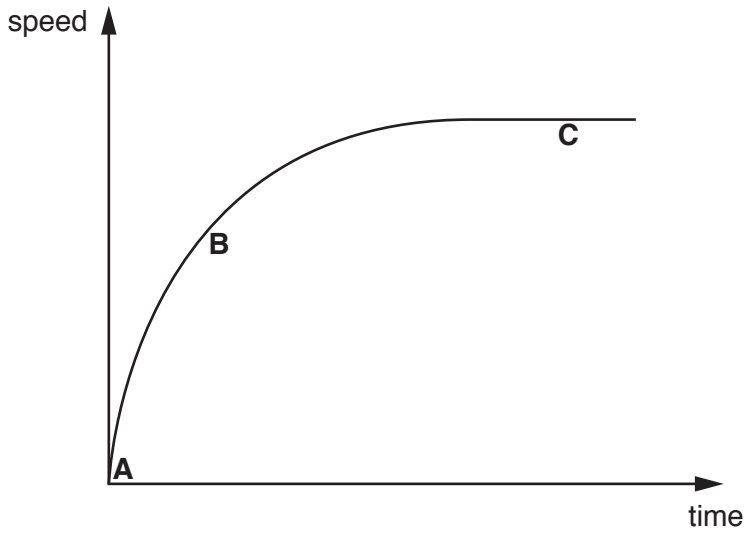
..... **[2]**

12 Mia investigates terminal velocity.

She drops an object and looks at its motion as it falls through the air.

Mia plots a graph of the speed of the object against time as it falls through the air.

Look at the graph.



Describe the motion of the object from being dropped until it reaches terminal velocity.

Include ideas about forces and acceleration in your answer.

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

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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.

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Answer ..... N **[2]**

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

Calculate the **acceleration** of the bus.

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Answer ..... m/s^2 **[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/s^2.

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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).