

Wednesday 15 June 2016 – Afternoon

**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 | |
|-----------------------|--|----------------------|--|

| | | | | | | | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|
| 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 bar codes.

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 **28** pages. Any blank pages are indicated.

EQUATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\text{GPE} = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$l_e = l_b + l_c$$

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

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

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

$$V_p I_p = V_s I_s$$

3
BLANK PAGE

Question 1 begins on page 4
PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

SECTION A – Module P1

1 Scientists from the British Antarctic Survey (BAS) have been measuring the amount of ozone in the atmosphere since 1957.

In the 1970s they became concerned about the ozone levels over Antarctica.

(a) They discovered a hole in the ozone layer.

(i) What advice did scientists and governments give to industry in response to this discovery?

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

(ii) What advice did scientists and governments give to the general population in response to this discovery?

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

(b) (i) Other scientists were surprised by these results. Suggest how the BAS scientists verified their measurements.

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

(ii) BAS scientists are now more confident that their explanations of these results are correct. Suggest why they now have more confidence in their explanations.

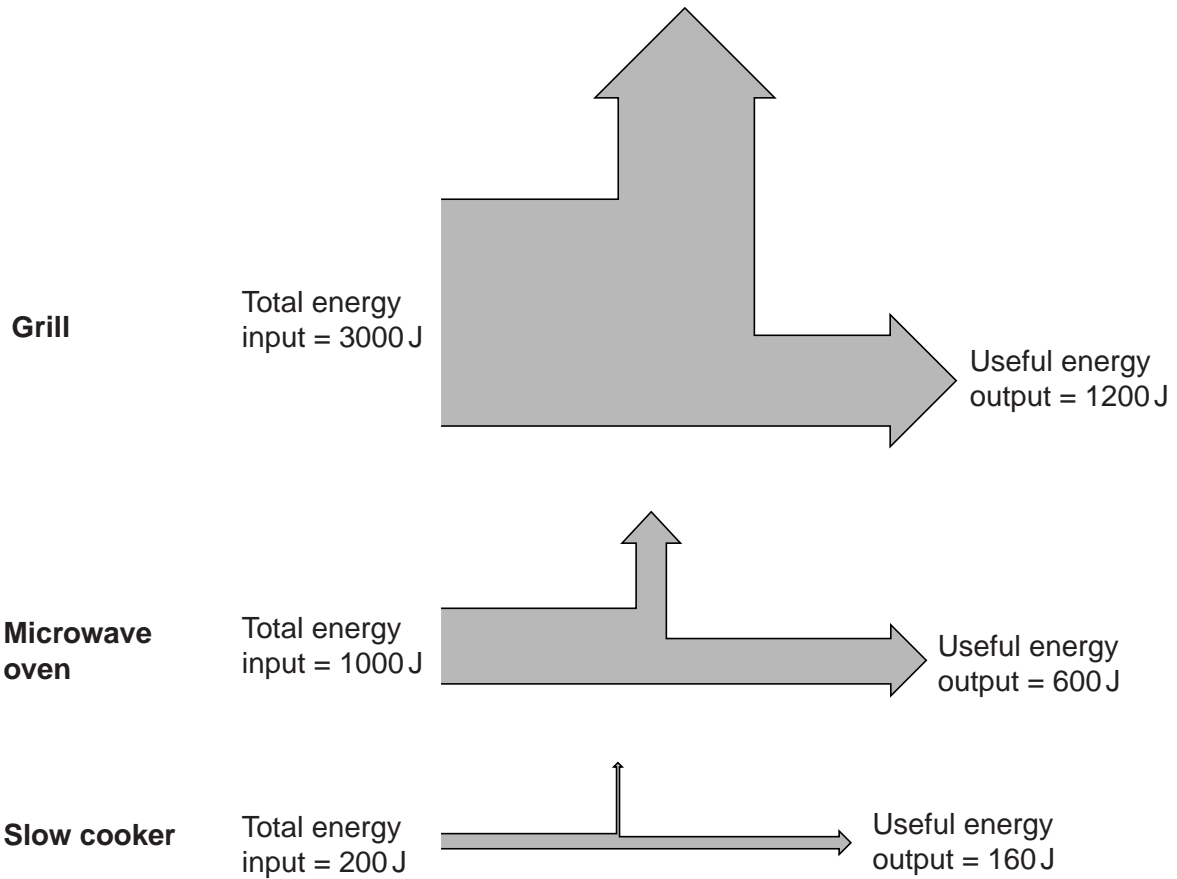
.....
..... [1]

[Total: 4]

2 Radhika has many appliances in her kitchen.

She compares the efficiency of the appliances by looking at these Sankey diagrams.

Each diagram shows the energy transferred in 1 second.



(a) Look at the Sankey diagram for the grill.

Calculate the wasted energy for the grill.

.....

Answer J [1]

(b) Calculate the efficiency of the microwave oven.

.....

.....

Answer [2]

(c) The slow cooker takes the **longest time** to cook food.

However, it is the **most efficient**.

Use the data on page 5 to explain both these statements.

.....

.....

.....

.....

..... [3]

[Total: 6]

- 3 Ivy wants to insulate her house.

Look at the information on different types of house insulation.

| Type of insulation | Cost to fit insulation in £ | Money saved each year in heating bills in £ |
|------------------------|-----------------------------|---|
| Cavity wall insulation | 840 | 210 |
| Double glazing | 4000 | 160 |
| Draught proofing | 120 | 72 |
| Loft insulation | 360 | 120 |

- (a) Ivy decides against fitting double glazing.

One reason is because it costs a lot to fit.

Use the information in the table to suggest other reasons why she has made this decision.

Do a calculation to explain your answer.

.....

.....

.....

..... [2]

(b) Ivy has an energy survey done on her house.

An engineer takes a thermogram photo of Ivy's house on a cold day.

The thermogram shows where heat escapes from her house.

Look at the black and white copy of the thermogram.



Explain what useful information Ivy can gain from the different colours on this thermogram.

.....

.....

.....

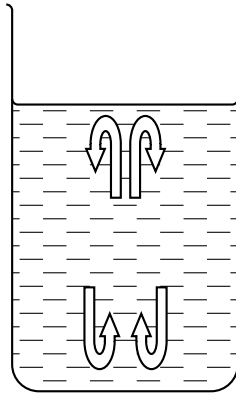
..... [2]

4 Alvin heats some water in a plastic beaker using a microwave oven.

This causes convection currents in the water.

(a) Alvin draws a diagram showing how he thinks convection currents are set up in the water.

Look at his diagram.



Explain how convection currents are caused in liquids.

.....

.....

.....

..... [2]

- (b) The plastic beaker has a mass of 0.2kg and the specific heat capacity of the plastic is 1680J/kg °C.

The water has a mass of 0.6kg and its specific heat capacity is 4200J/kg °C.

The energy from the microwaves is initially absorbed by the water which then heats the plastic beaker.

The plastic beaker and water experience different temperature rises.

The plastic beaker gains 13440J and the water gains 151200J.

- (i) Calculate the temperature rise of the water and the temperature rise of the plastic beaker.

water

.....

temperature rise of water °C

plastic beaker

.....

temperature rise of plastic beaker °C

[2]

- (ii) Heating the plastic beaker in the **microwave oven** results in the plastic having a lower temperature rise than the water.

Suggest a reason why.

.....

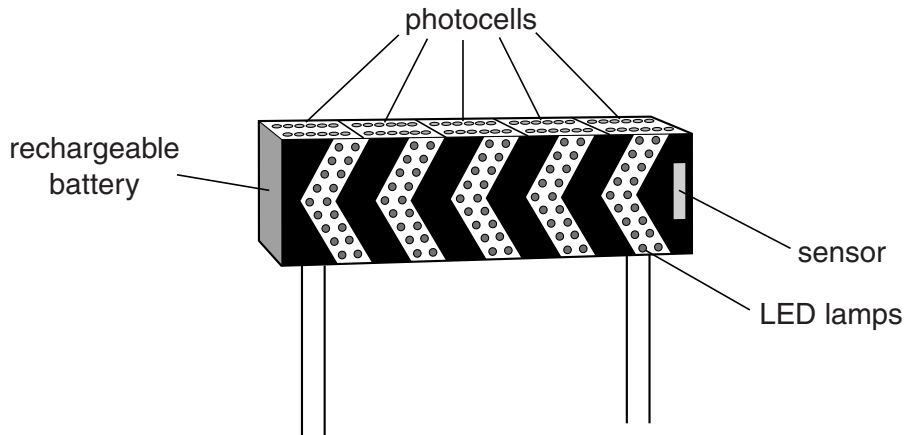
..... [1]

[Total: 5]

SECTION B – Module P2

5 Photocells can be used to supply electricity for road signs.

Look at the diagram of a road sign below.



This road sign is in the countryside. It is not connected to mains electricity.

When the sensor detects a car approaching, the LEDs in the road sign light up and flash.

(a) One advantage of using photocells is that they are able to power this road sign even in a remote location.

Write down **two** other advantages of using photocells for this road sign.

1

2

[1]

(b) Describe how the light produces electricity in the photocells.

.....

.....

..... [2]

(c) The photocells are fixed on the top of the road sign.

The photocells cannot move to point in the direction of the Sun.

Instead of using photocells which move, the road sign has a large area of photocells.

Explain why there needs to be a large area of photocells.

.....

.....

.....

..... [2]

[Total: 5]

Question 6 begins on page 14

6 The three main greenhouse gases are water vapour, carbon dioxide and methane.

(a) Where do these three greenhouse gases **mainly** come from?

Water vapour

.....

Carbon dioxide

.....

Methane

.....

[3]

(b) Infrared radiation travels from the Sun to the Earth.

Explain how the Earth's atmosphere can affect this infrared radiation.

.....

..... [1]

(c) Scientists study the average temperature of the Earth.

The average temperature has been rising. This is called global warming.

Anita does not believe in global warming.



Write about Anita's observations and conclusion and explain why she may be wrong.

.....

.....

.....

.....

[2]

(d) Human activity causes global warming.

Natural phenomena can also cause global warming.

Write about one **natural** cause of global warming.

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

[Total: 7]

Question 7 begins on page 16

7 Elin has some electrical appliances in her home.

She switches them on and measures how long they are used for.

She records some information about four appliances.

Look at the table.

| Appliance | Average power in watts | Voltage in volts | Current in amps | Time appliance used in hours |
|----------------|------------------------|------------------|-----------------|------------------------------|
| Grill | 1500 | 230 | | 0.5 |
| Oven | 1800 | 230 | | 5 |
| Laptop charger | 100 | 20 | | 1 |
| Slow cooker | 460 | 230 | | 4 |

(a) Which appliance uses the highest current?

Appliance.....

Calculate the current for this appliance.

.....

Answer (to two decimal places) A

[3]

(b) Elin buys her electricity from an energy company.

This company charges 18 pence per kWh unit for electricity.

What is the cost of using the grill for 20 hours?

.....

Answer pence

[2]

(c) Elin's mains supply is 230V.

The electricity company transmits electricity through the National Grid at a higher voltage of 400 000V.

This reduces energy waste for the company.

Explain why.

.....

.....

..... [2]

[Total: 7]

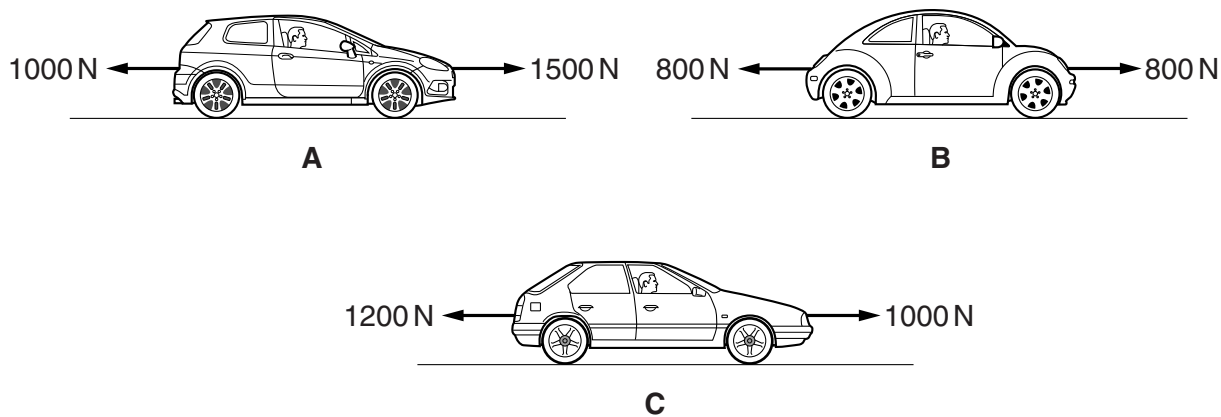
Question 8 begins on page 18

19
BLANK PAGE

Question 9 begins on page 20
PLEASE DO NOT WRITE ON THIS PAGE

SECTION C – Module P3

- 9 Look at the drawings showing forces acting on cars **A**, **B** and **C** travelling from left to right.



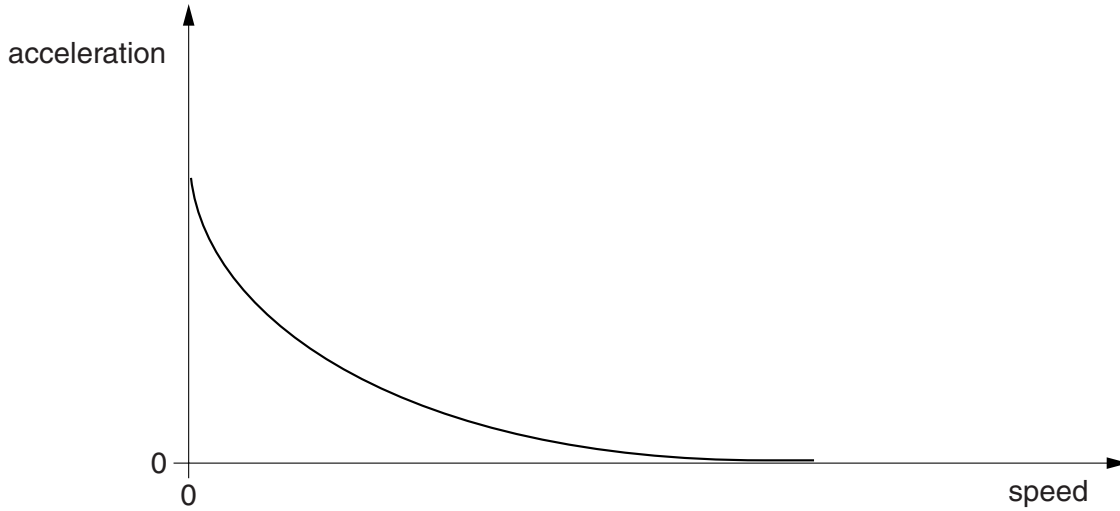
- (a) Put a tick (✓) in the correct box in the table below to show if each car is moving at a steady speed, increasing speed or decreasing speed.

| | steady speed | increasing speed | decreasing speed |
|----------|--------------|------------------|------------------|
| A | | | |
| B | | | |
| C | | | |

[2]

- (b) Amy accelerates her remote controlled car on a flat, straight test track with a constant driving force.

Look at the acceleration–speed graph for the car.



The acceleration changes as the speed changes.

- (i) Describe how the acceleration changes as the speed increases.

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

- (ii) Explain how the forces on the car cause the acceleration to change in this way.

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

[Total: 5]

10 Very old cars did not have seat belts.

The first seat belts were only fastened across the lap of the driver.

Modern seat belts pass over the shoulder and lap of all passengers.

This is one example of how the design of seat belts has been developed for cars.

(a) Describe how scientists could collect data to compare and improve the design of seat belts.

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

(b) Seat belts reduce injuries in a crash.

Explain how.

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

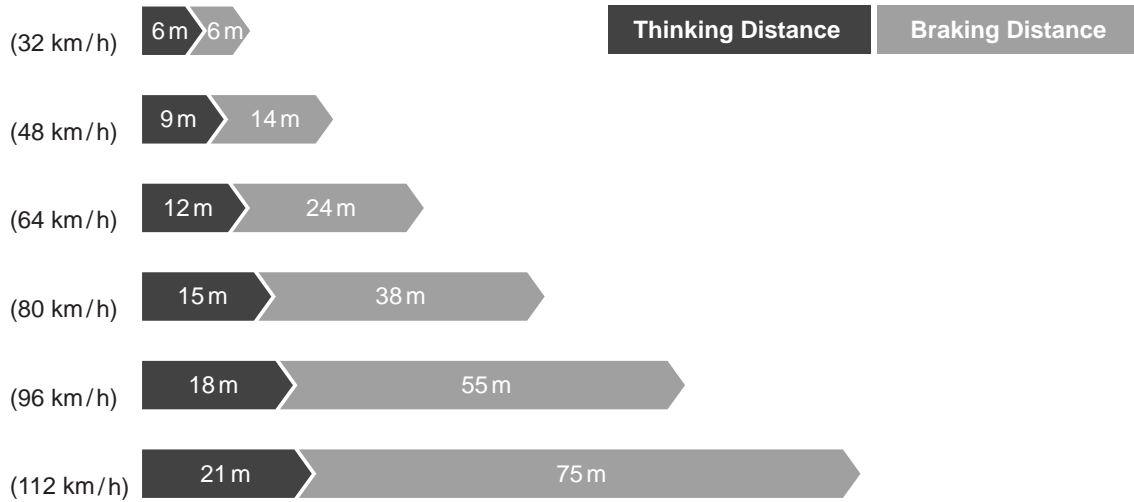
(c) There are other safety features in modern cars that reduce injuries. They work in a similar way to seat belts.

Write down two **other** safety features of modern cars that work in a similar way to seat belts.

1

2 [1]

(d) (i) Look at the data about stopping distances.



Ben says that “doubling the driving speed doubles the thinking distance”.

Chloe says “so, if I double the speed of my car, this will double the stopping distance”.

Is Chloe correct?

.....

Explain your answer.

.....

 [2]

(ii) One factor which increases the **braking** distance of the car is higher speed.

Write down two other factors that increase braking distance.

1

2

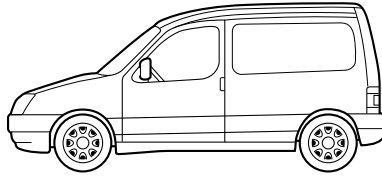
[1]

[Total: 8]

Question 12 begins on page 26

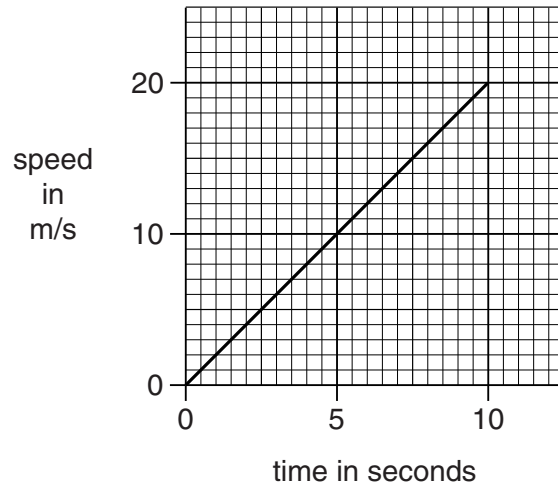
PLEASE DO NOT WRITE ON THIS PAGE

12 Emily has a van.



The van has a mass of 1400 kg.

Look at the speed–time graph for the first 10 seconds of her journey in the van.



(a) Calculate the acceleration of the van in the first 10 seconds.

.....

Choose your answer from:

0.5 m/s²

2 m/s²

10 m/s²

100 m/s²

200 m/s²

answer m/s²

[1]

(b) The accelerating force on the van is 2800 N.

Use this force and information from the graph on page 26 to calculate the work done to accelerate the van in the first 10 seconds.

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

answer J **[3]**

(c) The van now travels at a steady speed of 20 m/s.

Use the force given in **(b)** to calculate the power developed by the engine when travelling at this speed.

.....
.....

answer W **[2]**

[Total: 6]

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 margins.

A large rectangular area with a vertical solid line on the left side and horizontal dotted lines across the page, providing space for writing answers.



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.