OCR
Oxford Cambridge and RSA

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Wednesday 15 June 2016 – Afternoon

GCSE GATEWAY SCIENCE
PHYSICS B

B751/01 Physics modules P1, P2, P3 (Foundation 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 1 *

* 1 2 5 2 4 3 7 2 3 8 *

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 **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 = $(\text{current})^2$ × resistance

$$V_pI_p = V_sI_s$$

Answer **all** the questions.

SECTION A – Module P1

1 People worry about spending too much time in the sun.

This is due to the harmful effects of ultraviolet (UV) radiation.

(a) Write about the problems caused by too much exposure to UV radiation.

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

(b) Write about different ways people can protect themselves from UV radiation.

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

(c) 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.

(i) What did the BAS scientists discover and how did they explain their measurements?

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

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

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

(iii) BAS scientists are now more confident that their explanations of these results are correct.

Suggest why they now have more confidence in their explanations.

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

[Total: 9]

2 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 wants to fit all four types of insulation in her house.

(i) How much money will Ivy save in heating bills each year if she fits all four types of insulation?

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.....

answer ..... **[1]**

(ii) Ivy only has £4100 to spend on insulating her house.

Is £4100 enough for her to fit **all four** types of insulation?

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Do a calculation to explain your answer.

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

(iii) 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.

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

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

An engineer takes a thermogram photo to show where heat escapes from Ivy's house.

He chooses a cold day to get the best results.

Look at the black and white copy of the thermogram.

Explain in detail how Ivy can use the thermogram to show where heat escapes from her house and suggest why a cold day gives the best results.

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

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..... **[6]**

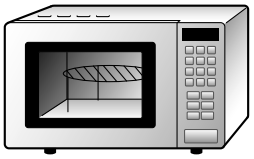
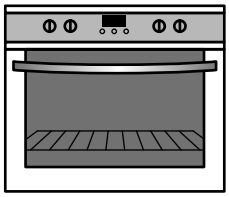
[Total: 10]

3 Stefan experiments with different ovens in his kitchen.

He compares a microwave oven and an infrared oven for heating beakers of milk to 80 °C.

He heats the milk in glass beakers in both ovens.

Look at his results.

			Time to heat milk to 80 °C in minutes	
Beaker	**Material**	**Colour**	 **Microwave oven**	 **Infrared oven**
A	glass	white	2	25
B	glass	black	2	20
C	glass	transparent	2	22

(a) Stefan makes sure his experiment is a fair test.

Suggest ways he can do this.

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

(b) How do microwaves heat the milk?

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

(c) The microwave oven takes the **same** time to heat the milk in the different beakers.

Explain why.

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

(d) Look at the information in the table about the infrared oven.

Explain why the different coloured beakers take different times to heat up the milk.

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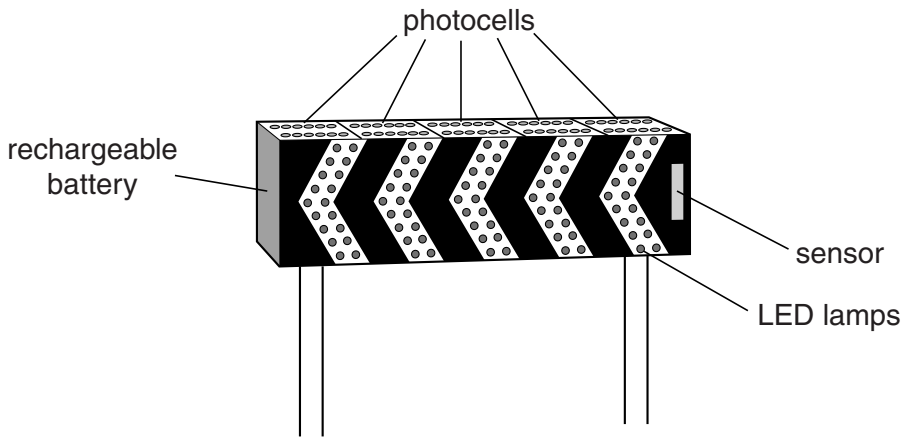
..... **[2]**

[Total: 6]

SECTION B – Module P2

4 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) The photocells are essential to make the road sign work.

What do the photocells do during daylight?

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

(b) Describe how the LED lamps are powered at night time.

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

(c) Write down an advantage of using photocells to power the road sign.

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

[Total: 5]

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

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

Water vapour .....

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Carbon dioxide .....

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Methane .....

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[3]

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

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

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..... **[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.

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

(d) Human activity causes global warming.

Natural phenomena can also cause global warming.

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

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

[Total: 7]

Question 6 begins on page 10

6 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	Time appliance used in hours
Grill	1500	230	0.5
Oven	2000	230	5
Phone charger	10	12	1
Slow cooker		230	4

(a) The slow cooker uses an average current of 2 A.

Calculate the average power for the slow cooker.

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Answer ..... W **[2]**

(b) Which appliance costs Elin the most to use?

Appliance.....

Use the data from the table to explain your answer.

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

(c) Elin's phone charger plugs into the 230 V mains.

The charger reduces the voltage to 12 V.

Name the device in the charger that is used to reduce the voltage.

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

[Total: 5]

7 Asteroids orbit the Sun.

What are asteroids and how have some asteroids damaged the Earth in the past?

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

[Total: 2]

Question 8 begins on page 12

8 Mrs Khan is doing some experiments using **radioactive** sources.

She wants to demonstrate the **three** different types of nuclear radiation to her class.

She asks the class about some of the **safety** precautions she should follow when using the radioactive sources.

Explain the safety precautions Mrs Khan should take and name the three different types of nuclear radiation.

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

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..... **[6]**

[Total: 6]

SECTION C – Module P3

9 Adrian runs a 100 m race.

It takes him 12 seconds to run the race.

(a) Calculate his average speed.

Give your answer to two significant figures.

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answer ..... m/s **[2]**

(b) At the start of the race it takes him 4 seconds to increase his speed by 10 m/s.

(i) Calculate his average acceleration.

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answer ..... units ..... **[3]**

(ii) Adrian has a mass of 60 kg.

Calculate the average force needed at the start of the race to cause this acceleration.

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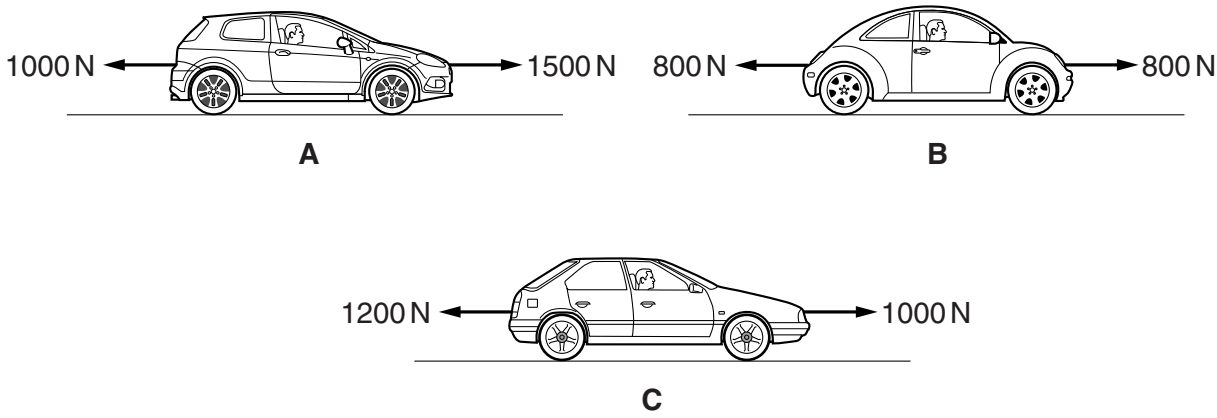
answer..... N **[2]**

[Total: 7]

10 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) Air resistance reduces the speed of cars.

Suggest ways of reducing air resistance.

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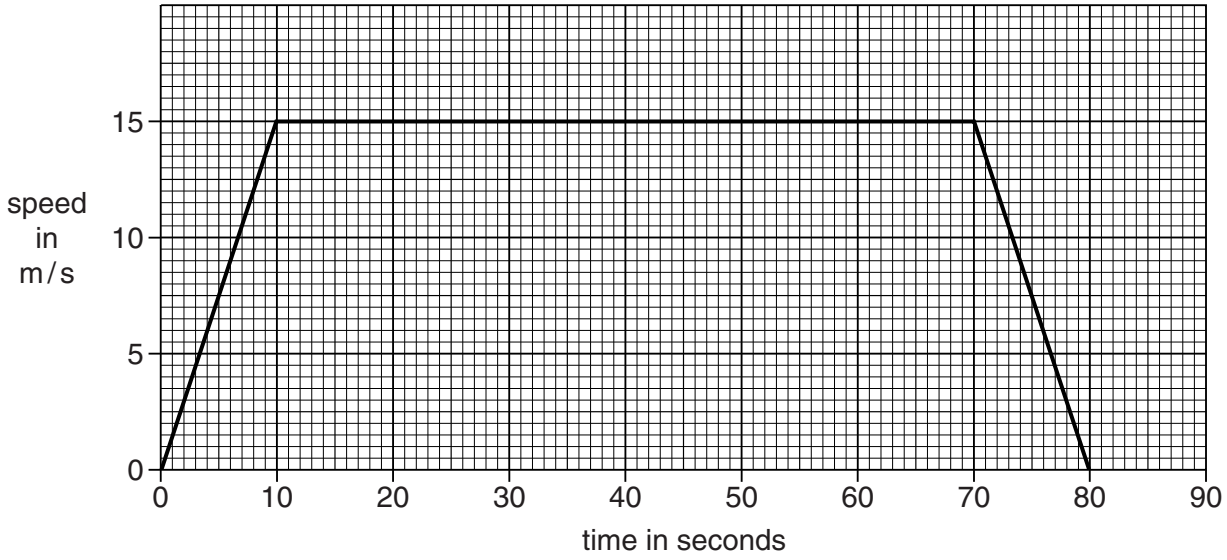
..... **[2]**

[Total: 4]

11 Beth catches a bus to school each day.

Look at the speed–time graph of her journey between two bus stops.



Describe in detail the journey shown by the graph in terms of speed and acceleration over time.

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

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..... **[6]**

[Total: 6]

12 (a) Look at the information about four athletes.

	Nick	**Steve**	**Sue**	**Julie**
mass in kg	85	80	60	55
height in metres	1.7	1.9	1.6	1.5

They all run at the same speed.

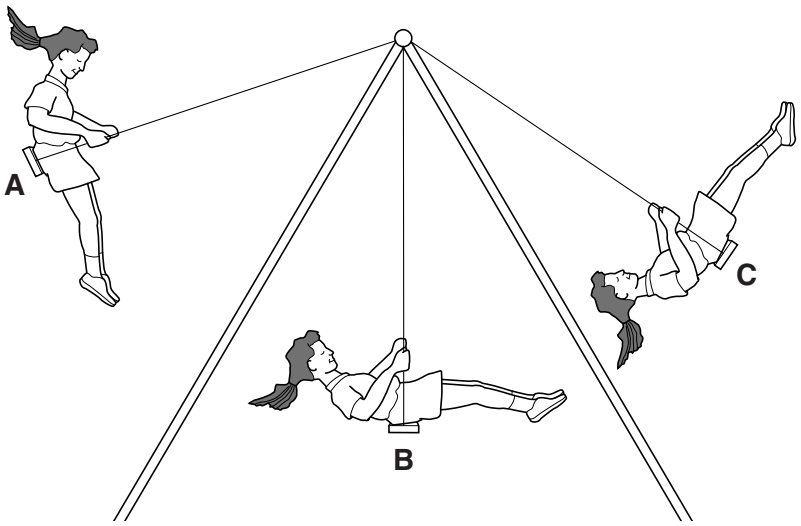
Which athlete has the **greatest** kinetic energy?

Choose from: **Nick** **Steve** **Sue** **Julie**

answer ..... **[1]**

(b) Julie uses the swing.

Look at the diagram showing different positions during the swing.



(i) Which position shows where Julie has the greatest kinetic energy?

Choose from: **A** **B** **C**

answer ..... **[1]**

(ii) Which position shows where Julie has the greatest gravitational potential energy?

Choose from: **A** **B** **C**

answer ..... **[1]**

[Total: 3]

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Question 13 begins on page 18

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13 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.

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

(b) Seat belts reduce injury by absorbing energy when the car stops suddenly.

Write about other safety features that absorb energy when the car stops suddenly.

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

(c) The seat belt exerts a force on the passenger when a car is stopping.

This force causes a change in momentum of the passenger.

Look at the table for four different passengers when their car stops.

Passenger	Change in momentum of passenger in kg m/s	Passenger stopping time in seconds
A	1440	4
B	1224	2
C	1200	3
D	1000	1

Which passenger experiences the greatest **force** from their seat belt?

Choose from: **A** **B** **C** **D**

answer ..... **[1]**

[Total: 5]

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.