OCR

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Tuesday 10 June 2014 – 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 1 6 2 7 3 0 0 5 1 *

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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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 **24** 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

$$V_pI_p = V_sI_s$$

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Question 1 begins on page 4

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Answer **all** the questions.

SECTION A – Module P1

1 **Lasers** have many uses.

(a) Lasers can be used in industry to cut materials.

Describe how properties of laser light allow materials to be cut.

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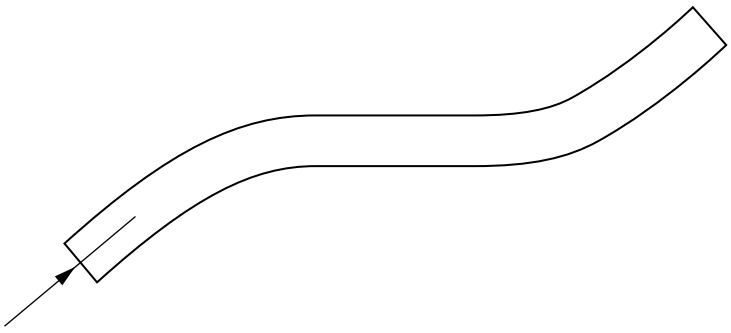
..... **[2]**

(b) Light from a laser travels along an optical fibre.

Look at the diagram.



Complete the path of the light to show how it travels along the optical fibre. **[1]**

(c) Write down two **other** uses of lasers.

1 .....

2 .....

[2]

[Total: 5]

2 Microwave ovens are used to heat food.

Chris looks at information about three microwave ovens.

Microwave oven	Energy input per second in joules	Energy absorbed by food each second in joules	Heating efficiency of the oven
Thermo-wave	1200	600	
Micro-fast	1400	700	
Quick-cook	1000	800	

(a) Calculate the heating efficiency of the Quick-cook oven.

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

(b) The Thermo-wave and Micro-fast ovens have the **same** heating efficiency.
How does the information in the table show this?

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

(c) Chris wants to compare the three ovens.
He wants to know which oven heats food the fastest.

Describe an experiment Chris could do to find this out.

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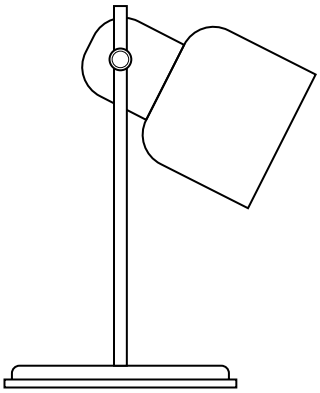
..... **[3]**

[Total: 6]

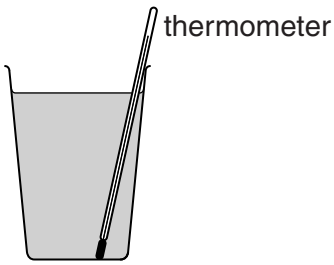
3 Alex wants to keep her drinks cool on a hot day.

She does this experiment to find out which cup is best to use.

Look at the diagram.



infrared lamp



100 g water

Alex uses the lamp to warm up 100 g of cold water in a cup.

She places the cup 20 cm from the lamp.

Alex measures the temperature of the water after 1 hour.

She repeats this experiment with three different cups.

Look at her results.

Cup	Material	Surface of cup	Starting temperature in °C	Finishing temperature in °C	Temperature rise in °C
A	polystyrene	shiny	15	23	
B	polystyrene	black	15	29	
C	expanded polystyrene (contains air bubbles)	shiny	15	17	
D	expanded polystyrene (contains air bubbles)	black	15	20	

Calculate the temperature rise for each cup and complete the table.

Which cup is the **best** for keeping drinks cool on hot sunny days?

Use information about the material and surface of the cups to explain your answer.

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

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

[Total: 6]

4 Ultraviolet (UV) light comes from the Sun.
UV light is also used in sunbeds.

Many doctors are worried about the dangers to people who are exposed to UV light.
Skin cancer has been linked to UV light.

(a) One type of skin cancer is called malignant melanoma.
Look at the table about patients that have this cancer.
It shows the percentage of malignant melanomas found in each body area.

Body area	Males	Females
Head and neck	23%	14%
Chest and back	41%	20%
Arms	18%	23%
Legs	13%	39%
Other	5%	4%

Tara looks at the information.
She suggests, 'Males have a higher percentage of malignant melanomas on their head and neck because, on average, males have shorter hair than females.'
Explain how shorter hair may increase the risk of malignant melanomas.

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

(b) Scientists are unsure whether exposure to the sun or sunbeds has the highest risk of causing skin cancers.

Suggest how scientists could gather evidence to find out which has the highest risk.

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

(c) Pale and darker skins can both be affected by UV light.

(i) Darker skins reduce the risk of skin cancer.
Explain why.

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

(ii) Look at the table. It shows information for different skin types.

Recommended safe time for being in the sun in hours			
Skin type A	**Skin type B**	**Skin type C**	**Skin type D**
1.0	0.4	0.7	0.2

If factor 10 sunscreen is used, which skin types will be safe for being in the sun for 5 hours?

Skin types ..... **[1]**

[Total: 6]

5 Look at the list of electromagnetic waves.

gamma

infrared

visible light

microwave

radio

ultraviolet

X-rays

Complete the table. Put the waves in order of **increasing** frequency. Four have been done for you.

radio	**increasing frequency** ↓
infrared	
ultraviolet	
gamma	

[2]

[Total: 2]

SECTION B – Module P2

6 Look at the table about electrical heaters.

Appliance	Voltage in volts	Current in amps	Power rating
Water heater	230	15	
Room heater	230	8	
Fish tank heater	10	20	

(a) Which heater has the highest power rating?

Use calculations to find out the answer and complete the sentences below.

The appliance with the highest power rating is ..... .

The highest power rating is ..... .

The unit for power is ..... . **[4]**

(b) The cost of using electricity depends on the power rating of the appliance used and the price charged for each unit of electricity.

What else affects the cost of using an electrical appliance?

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

[Total: 5]

7 Nuclear power stations have benefits and risks.

(a) Davinder is worried because he lives near a nuclear power station.

Write about **one risk** of living near a nuclear power station.

Explain how **this** risk is reduced for people living nearby.

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

(b) The nuclear power station produces electricity.

The electrical output of the power station is connected to transformers.

The outputs of these transformers are connected to the National Grid.

Why are these transformers used and how is this important for the National Grid?

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

[Total: 5]

8 People have been interested in space and the universe for many years.

It is only in the last 65 years that spacecraft have been sent into space.

(a) Suggest how scientists studied space before the launch of spacecraft.

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

(b) Manned spacecraft have visited the Moon.

Some scientists are also planning visits to Mars.

Why are the Moon and Mars the only places that have been considered for manned spacecraft missions?

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

(c) Scientists have **not** planned to send manned spacecraft close to black holes.

Suggest why.

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

(d) Spacecraft can be either manned or unmanned.

What extra resources must **manned** spacecraft carry?

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

[Total: 5]

9 Scientists study space.

They collect evidence to help develop theories.

(a) The **Big Bang** is a well-known theory.

What is the Big Bang theory?

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

(b) Asteroids are made of rock and they travel through space.

Asteroids have hit the Earth in the past and have left large craters.

Some scientists think that a large asteroid hitting the Earth led to the extinction of dinosaurs.

Explain how this collision could have led to the extinction of dinosaurs.

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

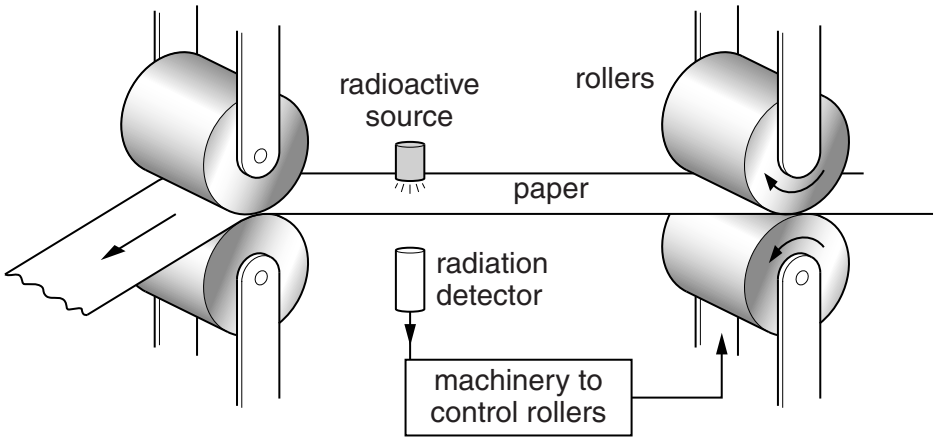
[Total: 4]

10 Beta radiation can be used to check the thickness of paper in factories.

A radioactive source emits beta radiation.

There is a detector for beta radiation directly underneath the paper.

Look at the diagram of the machine that is used.



The owners of the factory make sure that the workers are protected from too much exposure to the beta radiation.

Explain why beta radiation is used to check the thickness of paper, and how the workers can be protected from too much exposure to this radiation.

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

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

[Total: 6]

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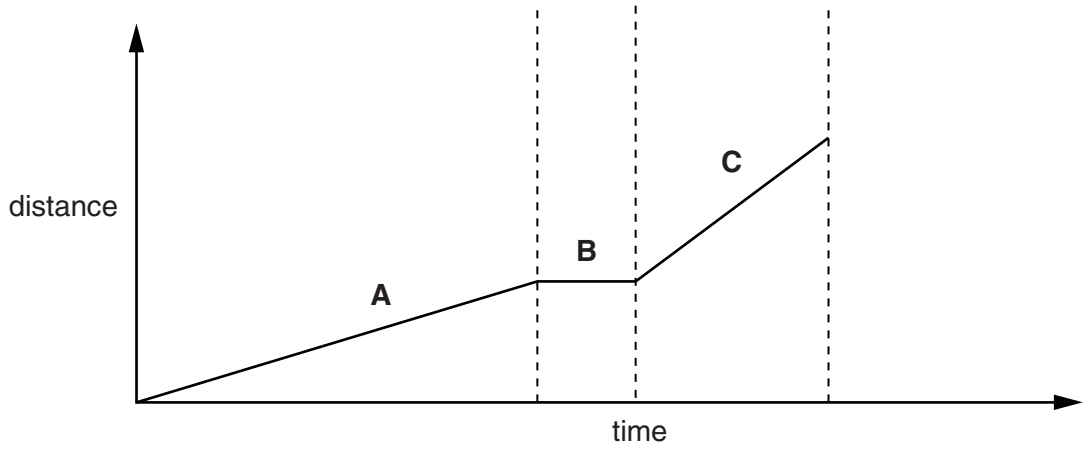
SECTION C – Module P3

11 Ben walks to school.

Look at the distance-time graph of his journey.



(a) Describe Ben's motion during each part of the graph.

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

(b) Ben's friends catch the bus to school.

The bus starts from rest. Its speed increases steadily to 15 m/s.

It takes the bus 10 seconds for this increase in speed.

Calculate the acceleration of the bus in m/s^2.

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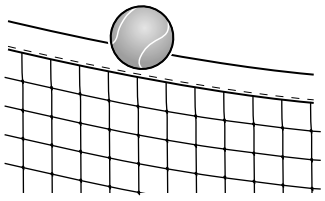
answer .....m/s^2 **[2]**

[Total: 5]

12 (a) Look at the diagram.

Anya and Yaj are watching a tennis match



Anya says, “I think that when the ball is going over the net it only has kinetic energy”.

Yaj says, “I think that when the ball is going over the net, it has kinetic energy and gravitational potential energy”.

Who is correct? .....

Explain your answer.

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

(b) Alice drops a pebble from the top of a high cliff.

(i) The mass of the pebble is 0.30 kg.

Calculate the momentum of the pebble when it is falling at a speed of 4.0 m/s.

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

(ii) It reaches a terminal speed before it hits the ground.

Explain why it travels at a terminal speed.

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

(iii) An astronaut does the same experiment as Alice, on the Moon.

In this experiment, the pebble falls, but does not reach a terminal speed.

Suggest why.

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

[Total: 7]

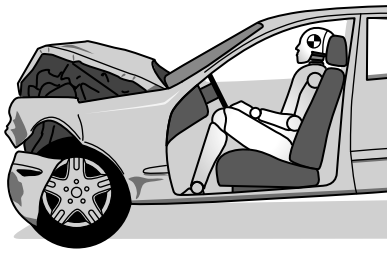
Question 13 begins on page 20

13 Scientists investigate the safety of seat belts.

They use two cars. Each car has an identical dummy in the driver's seat.

Both cars are crashed, at the same speed, into identical barriers.

In one car, the dummy is wearing a seat belt. In the other car, the dummy is not wearing a seat belt and hits the windscreen in the collision.



Look at the results.

	Crash with seat belt	**Crash without seat belt**
Mass of dummy	60 kg	60 kg
Distance travelled by dummy whilst stopping	60 cm after seat belt locked	20 cm after hitting windscreen
Time taken for dummy to stop moving	0.08 sec	0.03 sec
Deceleration	175 m/s^2	467 m/s^2
Stopping force	10500 N	

Calculate the missing data and use the information in the table to explain how seat belts reduce injury in a crash.

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

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

[Total: 6]

14 This question is about cars.

Look at the data about five cars.

Car	Engine size in cm^3	Maximum speed in km/h	Emission of CO_2 in g/km	Fuel used per 100 km in litres
A	1000	157	109	4.6
B	1000	157	110	4.7
C	1300	166	104	3.9
D	1400	214	148	6.3
E	2000	206	155	5.5

(a) The cars travel 50 km.

Which car produces the **least** carbon dioxide (CO_2) over the 50 km journey?

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

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

(b) Which car is the most economical to run over a 50 km journey?

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

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

(c) Two engineers, Clare and Kurt, are discussing the data in the table.

Clare suggests the engine size and maximum speed are clearly linked.

Kurt does not think there is a clear link.

Explain why they come to different conclusions about the data in the table.

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

[Total: 4]

15 (a) Chen has an electric car.

It is powered by an electric motor.

Describe how electricity can be supplied to power the electric motor.

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

(b) Electric cars are not always suitable for long journeys.

Suggest why.

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

[Total: 3]

END OF QUESTION PAPER

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