OCR
RECOGNISING ACHIEVEMENT

F

Tuesday 22 January 2013 – Morning

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

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

• Your 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.

OCR is an exempt Charity

Turn over

2

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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

$V_pI_p = V_sI_s$

3

Answer **all** the questions.

SECTION A – Module P1

1 Grace researches methods of loft insulation for her house.

Look at the information she finds.

Insulating material	Recommended thickness of insulating material in mm
Phenolic foam	78
Rockwool	128
Polyurethane	76
Polystyrene	124
Spray foam	74
Sheep's wool	132

(a) Suggest which material is the best insulator and explain your answer.

....

....

.... **[2]**

(b) Grace thinks that she can improve her loft insulation.

She uses a layer of **shiny aluminium foil** under the insulating material.

Explain how shiny aluminium foil can **improve** her loft insulation.

....

.... **[1]**

[Total: 3]

2 This question is about waves.

(a) Wireless technology uses electromagnetic waves.

Look at the names of the waves in the electromagnetic spectrum.

radio	microwave	infrared	visible	ultraviolet	X-ray	gamma

(i) What can you say about the speed of these waves in a vacuum?

.... **[1]**

(ii) Write down **two uses** for infrared radiation.

1 ....

2 ....
                                                                                                              [2]

(iii) Wireless technology has no external wiring.

Write about other **advantages** of wireless technology.

....

....

.... **[2]**

(b) Surfers use water waves on the sea to move fast.

Look at the diagram of the water waves on the sea.
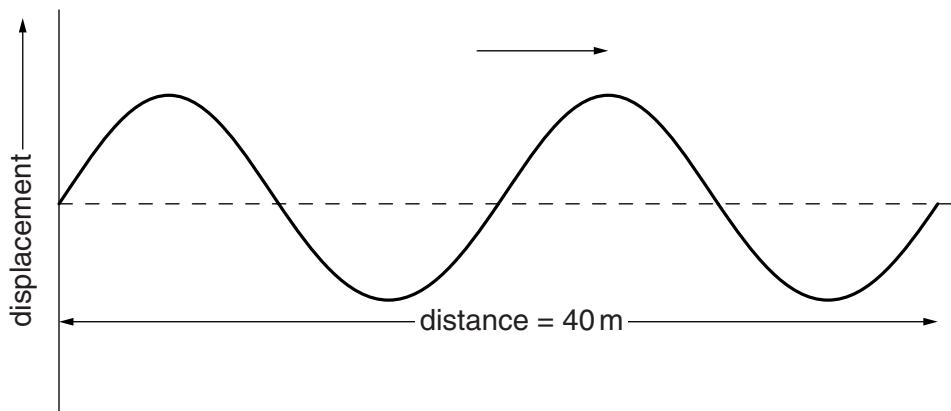
The surfer travels at the same speed as the water waves.

The water waves have a frequency of 0.25 Hz.

Use the information in the diagram to find the wavelength of the waves and calculate the speed of the surfer.

....

....

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

[Total: 7]

3 Dave experiments heating different materials.

(a) He needs to choose a heater to warm some water.

The table shows how much energy different heaters supply in 600 seconds.

Heater	Energy supplied in joules
A	5000
B	10 000
C	20 000
D	25 000
E	35 000

Dave needs to increase the temperature of 0.6 kg of water by 12 °C in 600 seconds.

Water has a specific heat capacity of 4200 J/kg °C.

Do a calculation to find out which heater Dave needs. Show your working.

....

....

.... J

The heater Dave needs for this is .... **[2]**

 (b) Dave needs to boil some ethanol. He uses an electrical heater.

Look at the diagram.
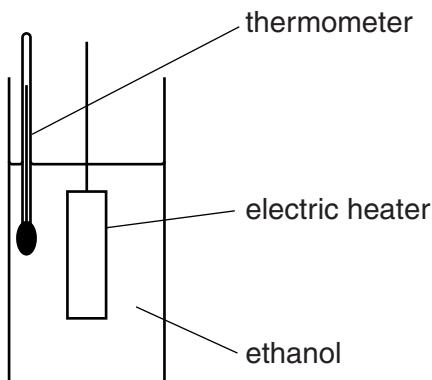
 (i) The ethanol is at its boiling point.

Dave measures the temperature of the ethanol as it boils.

What happens to the temperature of ethanol when it is boiling?

.... **[1]**

 (ii) The specific latent heat of ethanol is 850 J/g.

Calculate the energy needed to boil 12 g of ethanol.

....

....

answer .... J   **[2]**

 (iii) When Dave does this experiment he finds that he needs more energy to boil the ethanol than he expected.

Suggest reasons why.

....

....

.... **[2]**

[Total: 7]

4 Look at the information about the two gas heaters.

heater A – in front of the wall   **heater B – built into the wall**
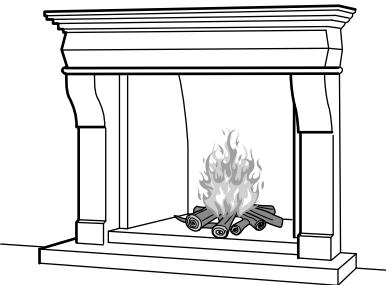
energy input from gas per second = **3 kJ**   energy input from gas per second = **4 kJ**

heat output to room per second = **2.4 kJ**   heat output to room per second = **2 kJ**

Compare the **efficiency** of the two heaters and explain why they have **different** heat outputs to the room.

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

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.... **[6]**

[Total: 6]

5 In 2011 there was a major earthquake in Japan. This was followed by a devastating tsunami.

   (a) Scientists did not predict the earthquake accurately.

   Immediately after the earthquake they did predict the tsunami.

   Explain why the tsunami was predictable.

   ....

   ....

   .... **[1]**

   (b) Scientists are getting better at making predictions.

   Suggest what scientists could do to improve their monitoring of earthquakes.

   ....

   ....

   .... **[1]**

   [Total: 2]

SECTION B – Module P2

6 Alec is looking at his electricity bills.

(a) Alec has a budget of £3 per day to spend on electricity.

When he calculates his daily electricity bill it is £1.72.

In the winter, Alec's house gets cold and he needs to turn on an extra heater.

The electric heater is 3 kW and Alec uses it for 4 hours. Electricity costs him 15p for each unit.

Will using the heater put Alec's daily bill above his budget of £3?

Do a calculation to find out the answer.

....

....

cost of using heater .... pence.

....

.... **[3]**

(b) Alec needs a new lawnmower. He looks at some information in the shop.

Look at the table.

Lawnmower model	Power in watts
Hovergreen	400
Hoverblue	350
Hoverwhite	450
Hovergold	
Hoverbronze	300

Alec likes the **Hovergold** mower but thinks it will be too costly to run.

This lawnmower uses a current of 1.2 A and plugs into a 230 V supply.

Calculate the **power** of the Hovergold mower.

....

....

answer .... W

What can you say about the **cost** of using the Hovergold mower compared to using the other mowers?

....

.... **[3]**

[Total: 6]

7 There are three types of nuclear radiation: alpha, beta and gamma.

The three types of radiation have different penetrating powers. They are stopped by different materials.

Mrs Brown shows a gamma source to her class. Her class are not convinced it is a gamma source. She needs to prove it emits gamma radiation only.

Explain how she can **safely** demonstrate to the class that it emits **gamma** radiation but not alpha or beta radiation.

You may draw a diagram to show your answer.

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

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.... **[6]**

[Total: 6]

8 Nuclear radiation is used in industry.

It is important that workers are kept safe when they are near radioactive sources.

(a) Look at the graph showing the activity at different distances from a radioactive material.

radiation in counts per minute

distance from radioactive material in cm
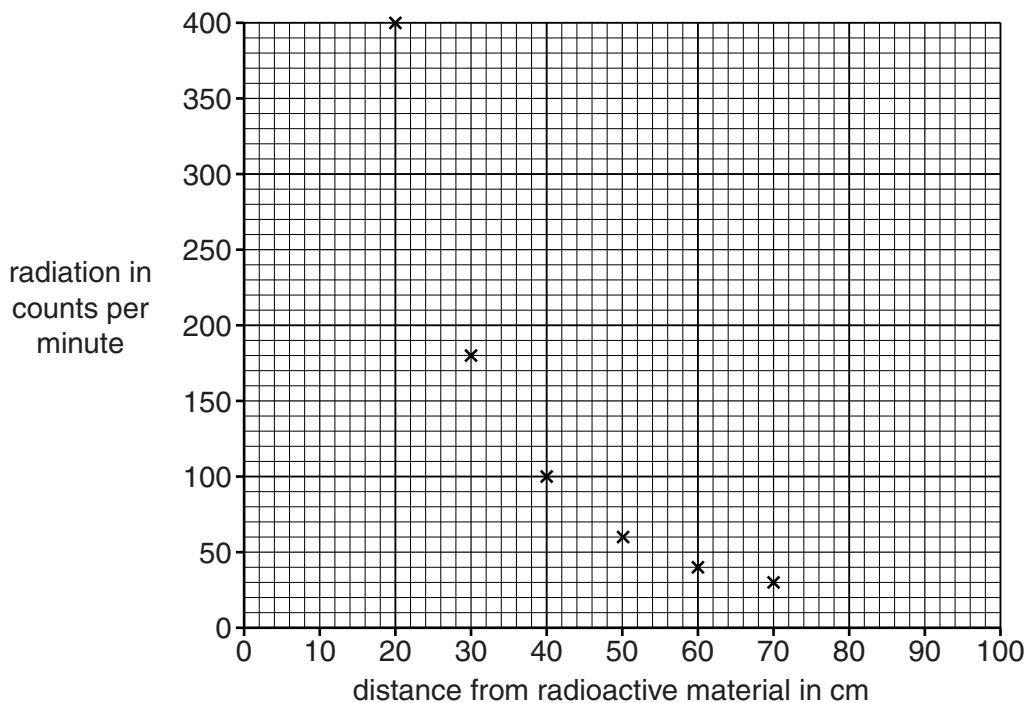
The workers are not allowed to be exposed to more than 10 counts per minute.

The supervisor asks them to work 80 cm from this radioactive material.

Are the workers safe at this distance?

....

Explain your answer.

....

....

.... **[2]**

Turn over for the remainder of question 8

14

(b) Radioactive waste can be harmful. Low level waste (from hospitals) and high level waste (from nuclear power stations) have to be disposed of differently.

Complete the sentences.

**Low level** waste is usually disposed of by ....

....

High level waste is disposed of by ....

....

[2]

[Total: 4]

9 There are many asteroids in our Solar System.

Asteroids have affected the Earth in the past.

They continue to be a risk to our planet.

(a) Describe how asteroids have affected the Earth and explain what evidence scientists have found to support this.

....

....

....

....

....

.... **[3]**

(b) Scientists track the paths of asteroids and publish their data.

Other scientists collect and review data on asteroids.

(i) Why is it important to collect more data on asteroids?

....

.... **[1]**

(ii) Why do other scientists review the data that these scientists produce?

....

.... **[1]**

[Total: 5]

10 Energy can be collected from the Sun in many ways.

Photocells transfer the energy in sunlight into electricity.

Megan does an experiment with a panel of photocells in the laboratory.

Look at the diagram.
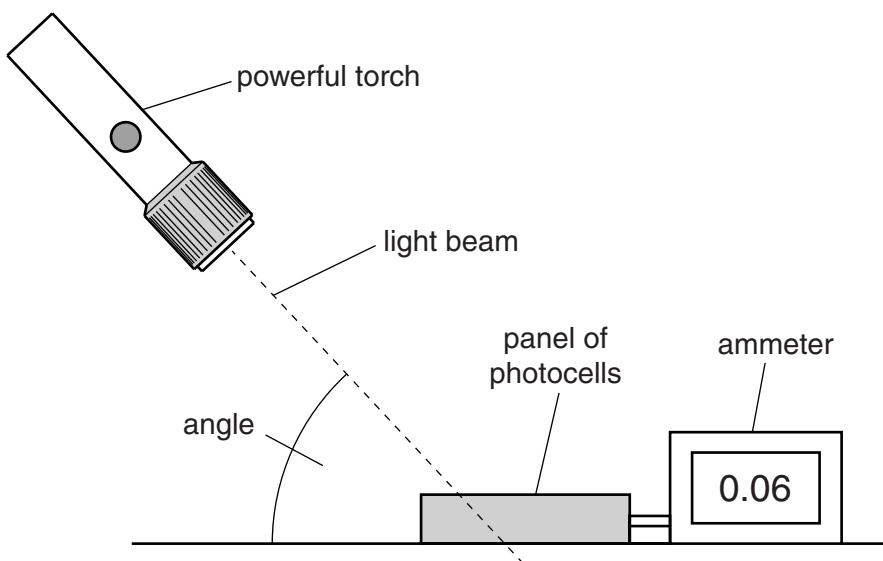
Megan shines the light on the photocell panel and records the current produced.

She changes the angle of the light beam and measures the current again.

Look at her results.

Angle of light beam in degrees	Current in mA
0	0.00
15	0.02
30	0.04
45	0.07
60	
75	0.16
90	0.22

(a) Megan has lost her result for 60°. Estimate the current for an angle of 60°.

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

(b) Describe how the current changes with increasing angle of light beam.

....

.... **[1]**

(c) Megan thinks she can get an output of 1.10 mA at 90° using 5 solar panels connected together.

Suggest why her prediction is sensible.

....

....

.... **[1]**

(d) The Sun in the UK is never at an angle of 90° to the Earth's surface.

The Sun appears to move across the sky during the day.

Suggest how the output of a single solar panel could be increased.

....

.... **[1]**

[Total: 4]

SECTION C – Module P3

11 Tall buildings often have lifts or elevators to transport people up and down.

Look at the drawing of the Taipei 101 Tower, one of the tallest buildings in the World.

top floor

approximate height between
101 floors = 442 m
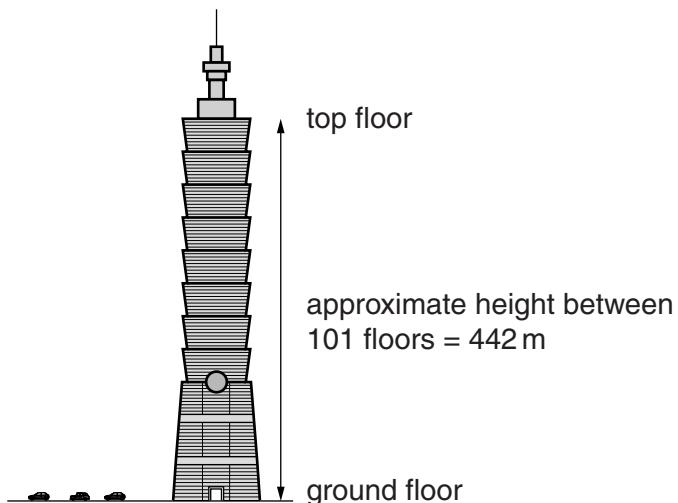
ground floor

(a) The lift takes 26.1 seconds to travel from the ground floor to the top floor.

The average speed of cars driving on the road past the tower is 15.7 m/s.

Is the average speed of the lift greater than the average speed of the cars?

Use a calculation in your answer.

...

....

....

speed of the lift (to 1 decimal place) .... m/s

comparison ....

.... **[3]**

(b) Ding Wei is a businessman. He travels up to the 40th floor for a meeting.

Look at the speed-time graph for his journey in the lift.
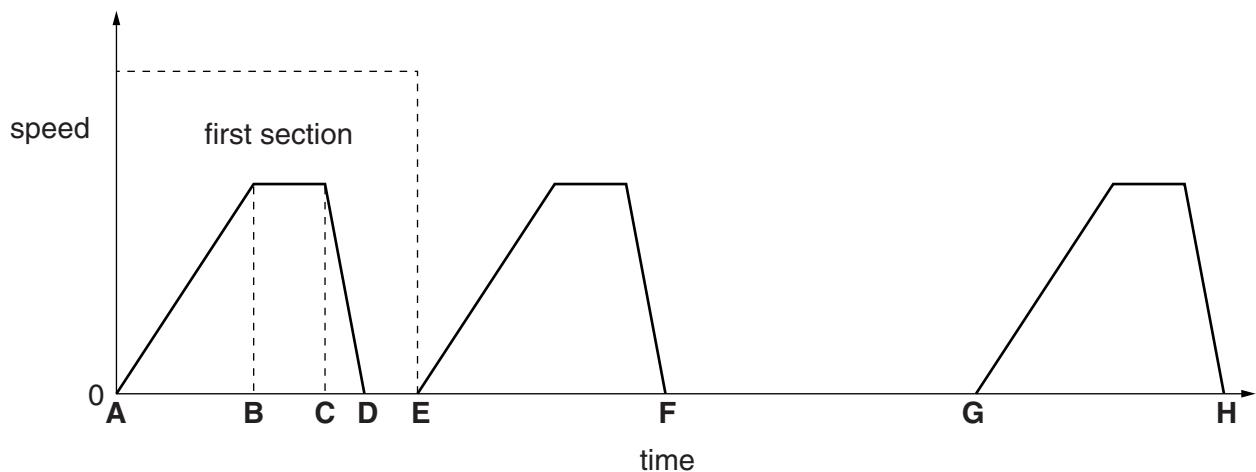
(i) In the first section of the graph, which part shows the lift **moving** at a **constant** speed?

Choose from

　　　　　A to **B**　　　　**B** to **C**　　　　**C** to **D**　　　　**D** to **E**

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

(ii) Suggest and explain what could be happening between D and E **and** between F and G on the graph.

....

....

....

....

.... **[3]**

　　　　　　　　　　　　　　　　　　Turn over for the remainder of question 11

(c) (i) When the lift is moving upwards work is done by the lift motors.

There are 8 people in the lift. The **average** weight of each person is 600 N.

They travel a distance of 30 m upwards from the first floor.

Calculate the work done in lifting the 8 people.

....

....

....

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

(ii) The lift now travels upwards a further 40 m with the 8 people inside.

Put a tick (✓) in the box which correctly completes the sentence about this second journey.

Compared with the first journey …

… more work is done in the second journey. ☐

… the same amount of work is done in the second journey. ☐

… less work is done in the second journey. ☐

[1]

[Total: 10]

12 Look at the extract from a newspaper article promoting electric cars.

> *Will electric cars take over our roads?*
>
> - *no need for fuel*
> - *no emissions*
> - *silent*
> - *economic to purchase*
> - *easy to charge batteries*

Electric cars could become more popular than petrol and diesel cars.

Use the points raised in the extract to identify the arguments **for** and **against** increasing the use of electric cars.

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

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.... **[6]**

[Total: 6]

13 Look at the graph. It shows the speed of a football dropped from a high cliff.
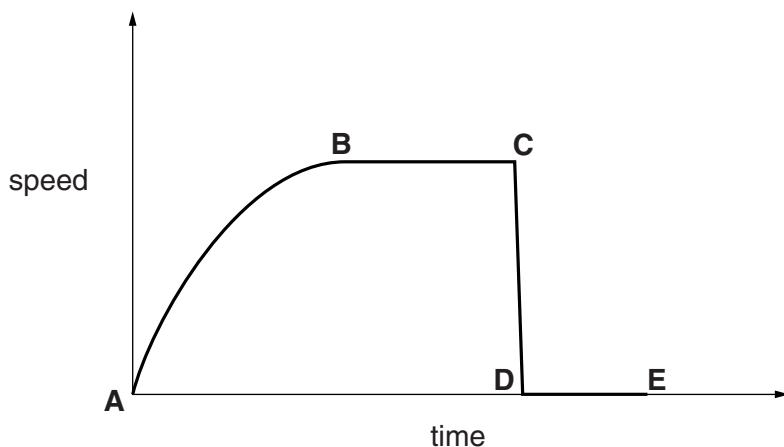
(a) Write down the name of the force causing the football to accelerate in part **AB** of the graph.

.... **[1]**

(b) Write down the name of the force acting against the movement of the football in part **AB** of the graph.

.... **[1]**

(c) **(i)** Which part of the graph shows the football **moving** at terminal speed?

Choose from

AB　　　　　BC　　　　　CD　　　　　DE

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

(ii) Why does the football reach a terminal speed?

....

.... **[1]**

(d) Look at the table below.

It shows different stones dropped from different heights.

Stone	Mass of stone in g	Height dropped from in m
V	100	20
W	100	40
X	200	20
Y	200	40

Which stone has the greatest gravitational potential energy (GPE) when it is dropped?

answer ....

Explain your answer.

....

....

....

.... **[3]**

[Total: 7]

14 ABS in cars is a design feature which reduces the chance of an accident.

Crumple zones are another safety feature.

Explain their purpose.

....

....

....

....

.... **[2]**

[Total: 2]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE