

Friday 20 January 2012 – 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.

Duration: 1 hour 15 minutes

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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 **28** pages. Any blank pages are indicated.

EQUATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\text{GPE} = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$l_e = l_b + l_c$$

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

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

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

$$V_p I_p = V_s I_s$$

Answer **all** the questions.

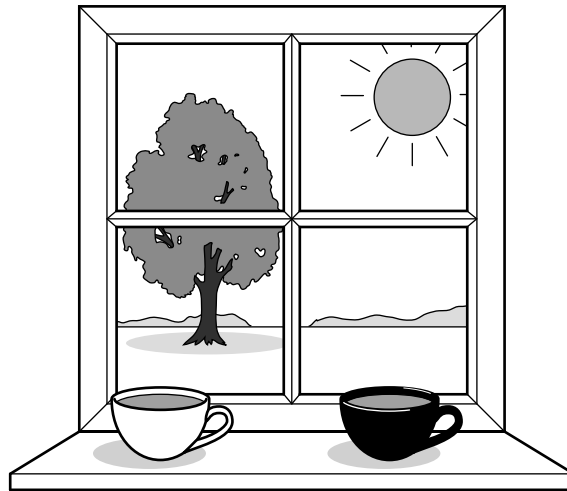
Section A – Module P1

1 This question is about heating up and cooling down.

(a) Dave puts his **cold** drink into two cups.

One cup is black the other cup is white.

He puts **both** cups near a **sunny** window.



The **black** cup heats up more quickly than the white cup. Suggest why.

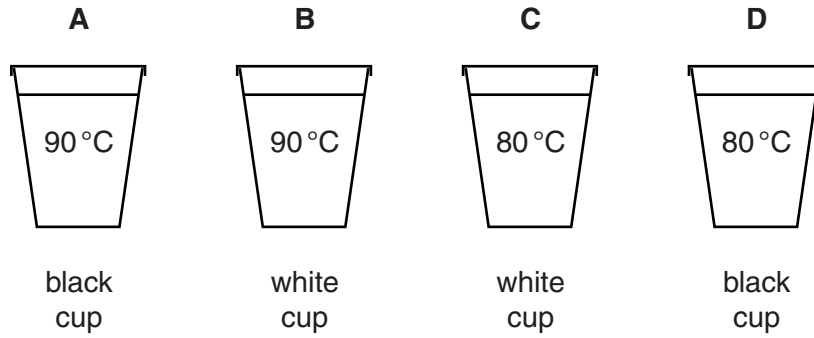
.....
..... [1]

(b) Dave tests how things cool down.

He puts equal amounts of hot water into four cups of the same type.

The cups have lids and are either black or white.

Look at the information in the diagrams.



He measures the temperature using a **thermogram**.

(i) How does a thermogram show different temperatures?

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

(ii) The water and cups cool down.

Which cup cools the quickest?

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

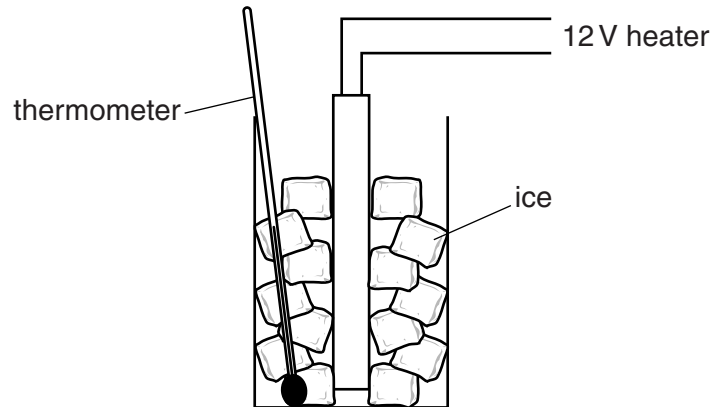
answer

Explain your answer.

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

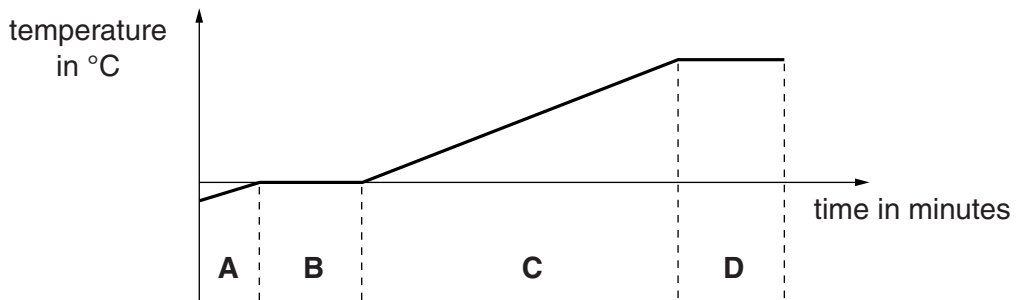
(c) Dave heats some ice in a beaker.

Look at the diagram.



He measures the temperature of the ice as it is heated.

Look at the sketch graph of his results.



Which parts of the graph show the ice melting and the water boiling?

Melting happens in part

Boiling happens in part

These parts show melting **and** boiling because

.....

 [2]

[Total: 7]

2 Earthquakes produce shock waves.

Scientists detect these shock waves.

(a) What equipment do they use to detect shock waves?

Choose from

- ammeter** **joulemeter** **multimeter**
seismometer **voltmeter**

answer [1]

(b) Scientists study shock waves.

Two types of shock wave are

- P waves
- S waves.

The P waves and S waves behave **differently** in rock.

There are two **states** of rock

- solid rock
- liquid rock.

(i) Which state(s) of rock do P and S waves go through?

Complete the table by putting ticks (✓) in the correct boxes.

	solid rock only	liquid rock only	solid and liquid rock
P waves			
S waves			

[2]

(ii) Which of these statements is correct?

- A** P waves travel faster than S waves
- B** P waves and S waves travel at the same speed
- C** S waves travel faster than P waves
- D** P waves and S waves are both transverse waves

Choose from **A, B, C** or **D**.

answer [1]

(c) S waves travel through the Earth.

The S waves have a wavelength of 45 m. Their frequency is 120 Hz.

Jack thinks that S waves travel **faster** than 6000 m/s.

Jill thinks they travel **slower** than 6000 m/s.

Who is correct?

Calculate the wave **speed** of the S waves to find out who is correct.

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.....

.....

.....

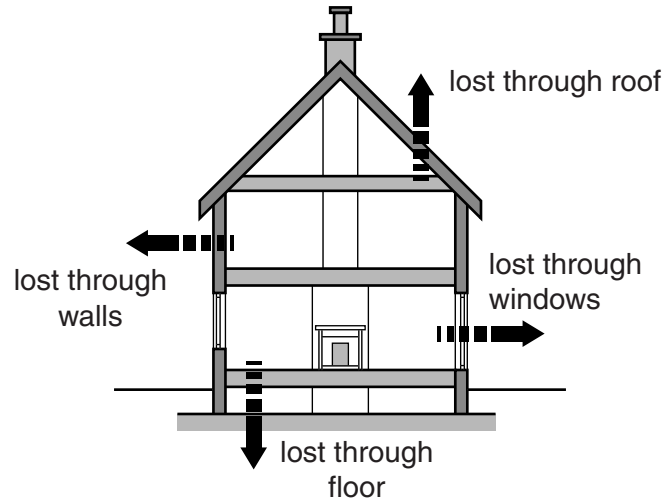
..... [2]

[Total: 6]

3 Bilhar has high fuel bills.

His house has poor insulation.

Look at the diagram of Bilhar's house. It shows where heat energy escapes through **conduction**, **convection** and **radiation**.



Bilhar wants to **improve** the insulation in his house.

Look at the costs of fitting insulation.

insulation	cost to fit	money saved each year	payback time
double glazing (for 6 windows)	£6000	£300	20 years
cavity wall foam	£700	£120	6 years
thick carpets	£1000	£100	10 years
loft insulation	£300	£150	2 years

4 Phone masts send and receive microwave signals for mobile phones.



(a) Some people are concerned about having a phone mast near to their house.

Suggest whether or not having a mast near someone's house can be dangerous. Explain your answer.

.....

.....

.....

.....

..... [2]

(b) It is difficult to make conclusions about the danger of microwaves to people using mobile phones.

Suggest reasons why.

.....

.....

..... [2]

[Total: 4]

5 Signals are used for communication.

There are **two** types of signal

- **analogue**
- **digital.**

Describe the **difference** between analogue and digital signals.

You may use a diagram in your answer.

.....

.....

..... [2]

[Total: 2]

Section B – Module P2

6 The Sun is a stable source of energy that provides heat and light.

We can use this heat or light as an energy source in the home.

(a) Complete the sentences.

Photocells transfer light into

The power of a photocell depends on the surface exposed to light.

[2]

(b) Describe **other** ways in which the Sun’s heat and light are harnessed in the home.

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

[Total: 4]

7 The **greenhouse effect** causes global warming.

(a) Which **gases** are the main cause of the greenhouse effect?

..... and [1]

(b) Evidence suggests that increased global warming has caused climate change.

Describe how human activity has added to global warming.

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

(c) Scientists collect data on global warming.

- It is difficult to measure and show global warming.
- Scientists share their data with other scientists.

Describe their difficulties and explain why they share the data.

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

8 Amrit spends a lot of money on her electricity bills.

Some appliances cost more to run than others.

Look at the table.

appliance	voltage in volts	power in watts
iron	230	1500
heater	230	3200
microwave	230	850
radio	9	8
TV	230	350
light	230	11

(a) All the appliances are switched on for 30 minutes.

Which appliance costs the most to use?

.....

Explain why.

.....

..... [1]

(b) Amrit uses the iron for 0.5 hours. Its power is 1.5 kW. Electricity costs 18 pence per unit.

Calculate the number of kilowatt hours used by the iron and how much this will cost.

.....

.....

number of kWh =

.....

cost of using the iron = pence

[3]

(c) The radio has a 9V rechargeable battery.

Amrit charges the battery using a battery charger.

She plugs the charger into the 230V mains supply.

(i) The battery charger decreases the voltage from the mains.

What is the name of the device that decreases the voltage?

..... [1]

(ii) The radio has a power rating of 8W.

Over a year the radio is more expensive to run than the 11 W light.

Suggest reasons why.

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

[Total: 7]

9 Nuclear radiation can be both **harmful** and **useful**.

Jim collects information about the three types of nuclear radiation.

Look at the information.

type of radiation	range in air in cm	range in glass in cm	range in soil in cm
beta	100	0.06	0.3
gamma	10 000	350	300
alpha	5	0.02	0.01

Jim says, 'Disposing of nuclear waste is easy. It's best just buried underground in the soil.'

(a) Suggest why Jim thinks that burying nuclear waste underground in soil is best.

.....
 [1]

(b) Explain why Jim may be **incorrect**.

.....

 [2]

[Total: 3]

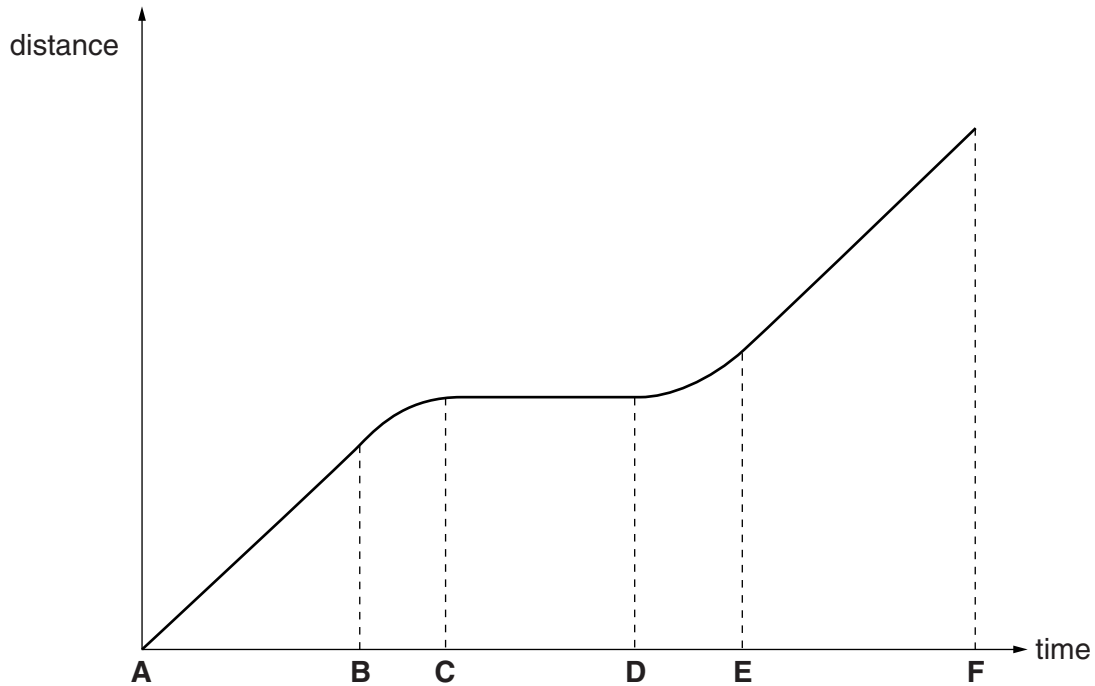
Section C – Module P3

10 Laura and Paul are learning about distance and time in a science lesson.

(a) Paul walks around the school sports field.

Laura measures the distance Paul walks and the time he takes.

Laura draws a graph showing the results for the different parts of Paul's walk.



(i) Which part of the graph shows Paul **stationary**?

Use the letters **A B C D E F** shown on the graph.

answer: between letter and letter

[1]

(ii) Which **two** parts of the graph show Paul moving at a **steady speed**?

Use the letters **A B C D E F** shown on the graph.

answer: between letter and letter

and between letter and letter

[2]

(b) (i) Laura takes 9 minutes to walk around the school sports field.

She

- walks 400 m at a steady speed away from Paul
- then accelerates for 50 m away from Paul and
- then walks 450 m at a steady speed back towards Paul.

Calculate the **average** speed for Laura in metres per second.

Give your answer to **two** significant figures.

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

answer m/s [2]

(ii) Paul tells Laura that although this is her average speed she may never actually walk steadily at this speed during her walk.

Is Paul correct?

answer

Explain your answer.

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..... [1]

[Total: 6]

11 A car manufacturer tests a car to find out its mean fuel consumption.

Six different drivers, **A**, **B**, **C**, **D**, **E** and **F**, drive the car 700 m in a test drive.

The car was identical apart from the differences shown in the table.

driver	car windows	roof box fitted to car?	fuel consumption in kilometres per litre	CO ₂ emissions in grams per kilometre
A	closed	x	15.5	150
B	closed	x	17	140
C	open	✓	12	180
D	open	x	16	155
E	closed	✓	14.5	165
F	closed	✓	15.0	160

(a) Calculate the **mean** fuel consumption for the car from these results.

.....

answer kilometres per litre [1]

(b) Driver **C**'s test has the worst fuel consumption compared to the mean.

Use information in the table to identify and explain possible reasons for this result.

.....

 [3]

(c) Which test drive had the greatest effect on the atmosphere?

Explain why.

answer: test drive by driver

explanation
 [1]

(d) The car has a weight of 12 000 N.

(i) It was driven by **driver A** with a driving force of 1500 N for a distance of 700 m.

Calculate the **work done** moving the car.

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.....
.....

answer J [2]

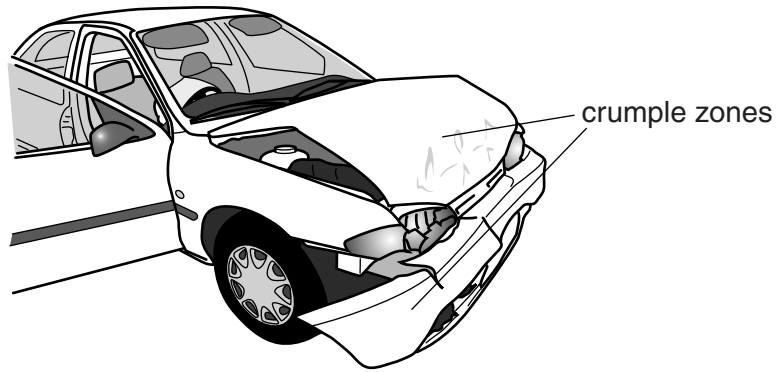
(ii) In test **C**, the car was the same total weight as in test **A**.

More work was done in moving the car during test **C**. Explain why.

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

[Total: 8]

12 Cars have many safety features, such as crumple zones.



Crumple zones help to protect the occupants if a car is involved in a crash.

Car manufacturers continually try to improve safety features for drivers and passengers.

Explain in detail how crumple zones work and describe how manufacturers test crumple zones and use the results to improve future car design.



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

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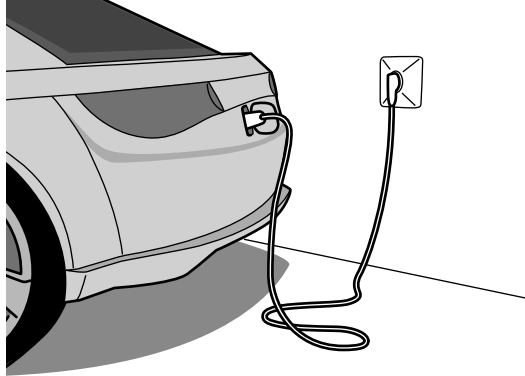
..... [6]

[Total: 6]

13 Electric powered cars are becoming more popular.

John lives in the centre of a city.

He is considering buying a **battery powered** electric car.



What effect will driving an electric car have on the **environment**, the **atmosphere** and John as a **driver**?

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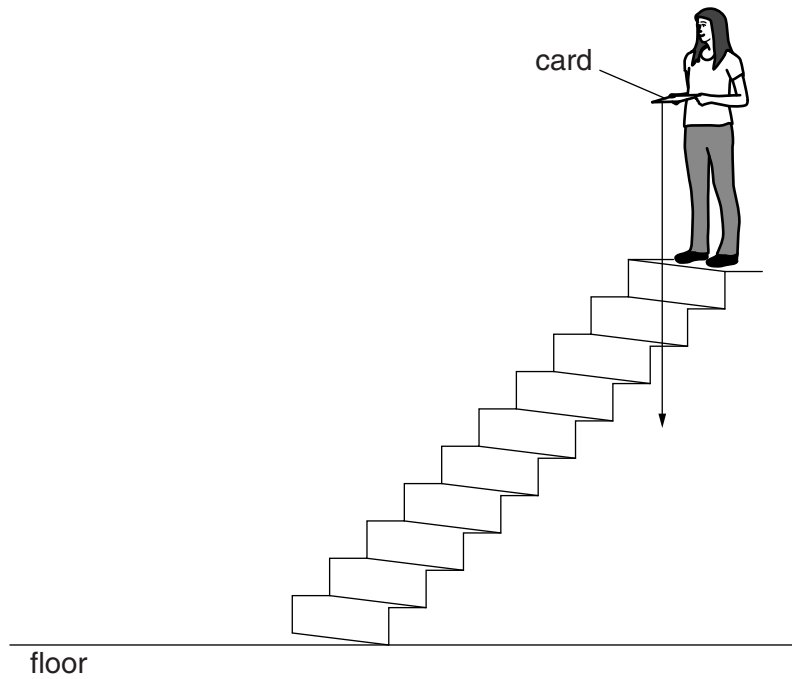
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[Total: 3]

14 Molly is investigating falling objects in a science lesson.

She drops a piece of thin card from the top of a staircase and measures the time it takes to fall to the floor. She then changes its shape and repeats the test.



Look at Molly's results.

thin card	shape of card that was dropped	description	time to fall in seconds
A		thin card sheet dropped with large surface facing down	5.2
B		thin card sheet folded in half dropped with large surface facing down	3.8
C		card crushed into a ball shape	1.2

Molly has started to write a conclusion about her results.

Her conclusion is not finished.

Finish the conclusion to explain her results.

Card C falls fastest and card A falls slowest because

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..... [2]

[Total: 2]

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