Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GCSE

B751/02

GATEWAY SCIENCE

PHYSICS B

Physics modules P1, P2, P3 (Higher Tier)

WEDNESDAY 30 MAY 2012: Afternoon

DURATION: 1 hour 15 minutes
plus your additional time allowance

MODIFIED ENLARGED

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)

READ INSTRUCTIONS OVERLEAF

DC (CW/CGW) 12MEP06224 63315/1

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. 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).**

INFORMATION FOR CANDIDATES

- **Your quality of written communication is assessed in questions marked with a pencil ().**
- **A list of equations can be found on pages 4–6.**
- **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.**

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EQUATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\text{GPE} = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

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

$$V_pI_p = V_sI_s$$

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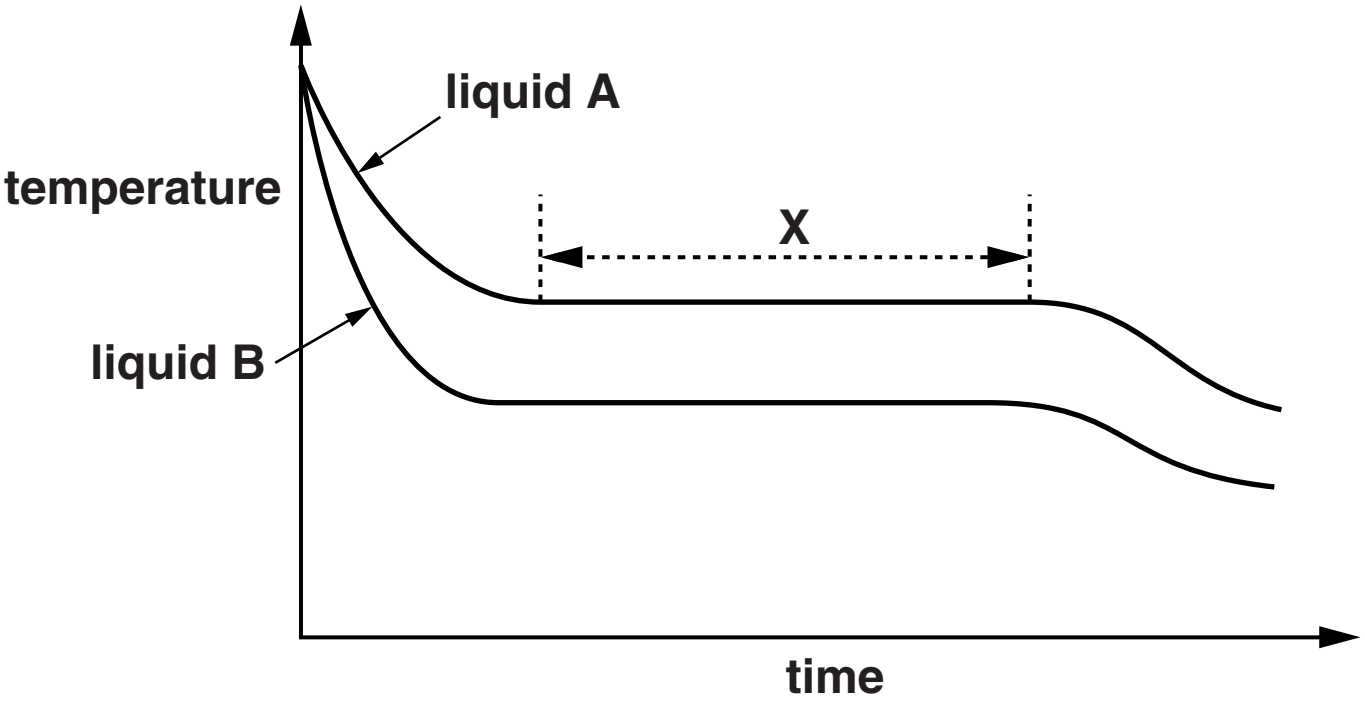
Answer ALL the questions.

SECTION A – MODULE P1

1 Amir investigated the cooling of two liquids.

Both liquids had a mass of 350 g.

Look at the graph of his results.



(a) Suggest why liquid B cools quicker than liquid A at the start of the experiment.

_____

_____ **[1]**

(b) What is the direction of the energy flow and what is the effect on the surroundings?

_____

_____ **[1]**

(c) (i) Calculate the energy that was transferred for liquid A in part X of the graph.

The specific latent heat of A is 200 000 J/kg.

_____

_____

_____

_____

energy transferred _____ J [2]

(ii) Describe and explain what is happening during part X of the graph while this energy is being transferred.

_____

_____

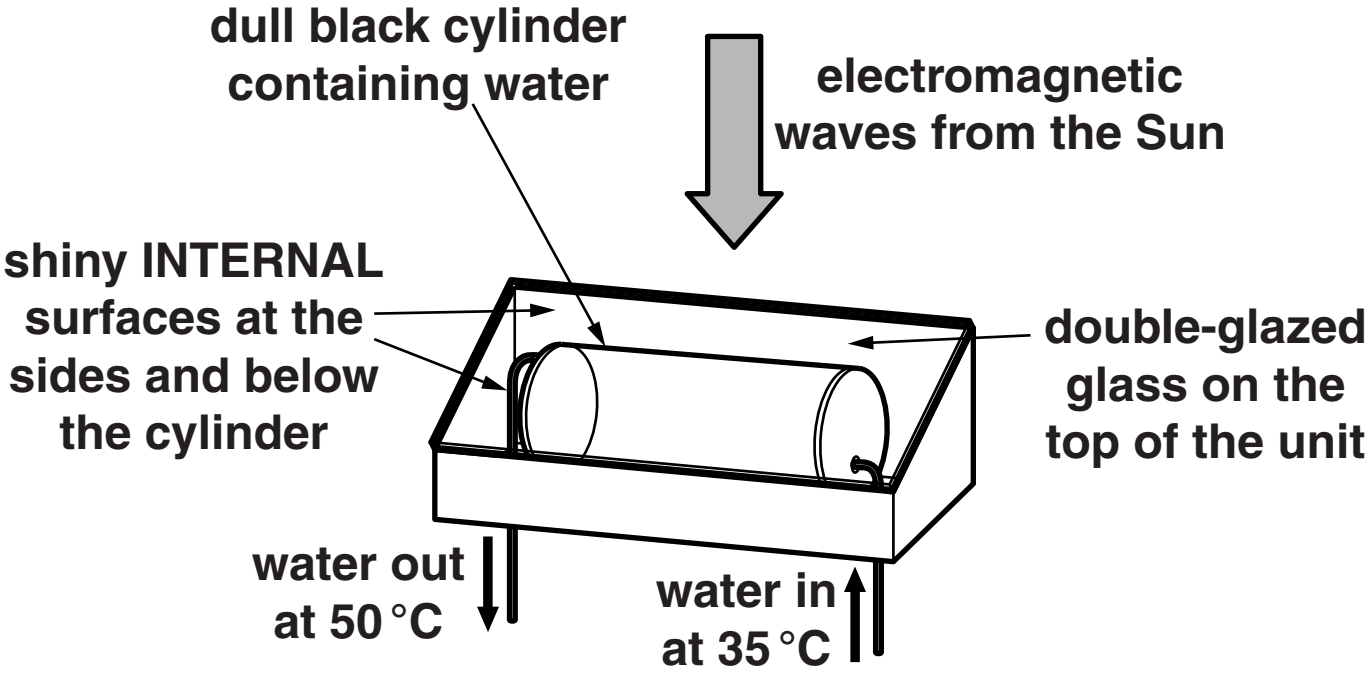
_____

_____ **[2]**

[Total: 6]

2 John installs a solar water-heating unit on the roof of his house.

Look at the diagram of the unit.



(a) Energy is transferred through parts of the unit by different methods.

(i) What is the main method of energy transfer from above the glass to the surface of the cylinder?

_____ **[1]**

(ii) The black cylinder absorbs energy and transfers it to the water inside.

Explain how the water inside then heats up.

_____

_____

_____

_____ **[2]**

(b) (i) These solar water-heating units have an efficiency of 85%.

Calculate the useful energy output for every 200 000 J of energy input.

_____

_____

answer _____ J [2]

(ii) Describe how ONE feature of the solar water-heating unit has helped to produce this high level of energy efficiency.

_____

_____ **[1]**

(c) (i) Some infrared waves have a wavelength of 1 mm.

The speed of electromagnetic waves is 3×10^8 m/s.

Show, using a calculation, that the frequency of the infrared waves is 3×10^{11} Hz.

_____

_____

_____ **[2]**

(ii) The infrared waves which heat the metal cylinder have much shorter wavelengths.

Explain how the energy of these waves is different to those with a wavelength of 1 mm.

_____

_____

_____ **[2]**

[Total: 10]

3 Over twenty years ago scientists working in Antarctica discovered that a deterioration in part of the Earth's atmosphere had led to an increased level of UV reaching the Earth's surface.

Jane is concerned that the increased UV levels put her more at risk when sunbathing.

Explain how human activity has increased the threat from UV, why Jane is concerned and how internationally, GOVERNMENTS took action to reduce the risk.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

[Total: 6]

4 Ricky is interested in radio and TV.

(a) Ricky has a portable analogue radio that he listens to at different places in his house and out in the garden.

His favourite stations are shown in the table.

STATION	MHz
BBC 2	88.1
Galaxy	106.4
Real Radio	101.8
TFM	96.6
Smooth FM	101.2
Spice FM	98.8

While listening to one of these stations, he often hears another station on his radio.

Which two radio stations can Ricky hear at the same time?

Station _____ and

station _____ .

Explain your answer.

_____

_____ **[2]**

(b) Many radio stations have switched to DAB broadcasting.

If Ricky switches to a radio using a DAB signal he would not hear two stations at once.

Write down one OTHER advantage of using a DAB signal.

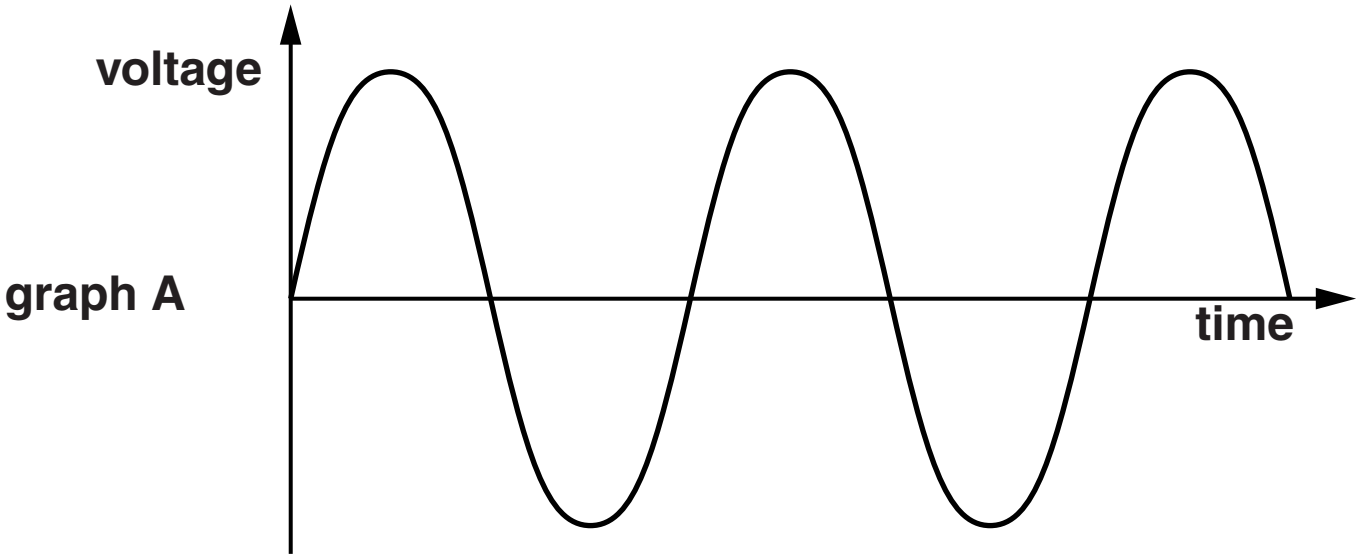
_____

_____ **[1]**

[Total: 3]

5 Electrical generators produce alternating current (AC).

Graph A is the VOLTAGE-TIME graph for an electrical generator.

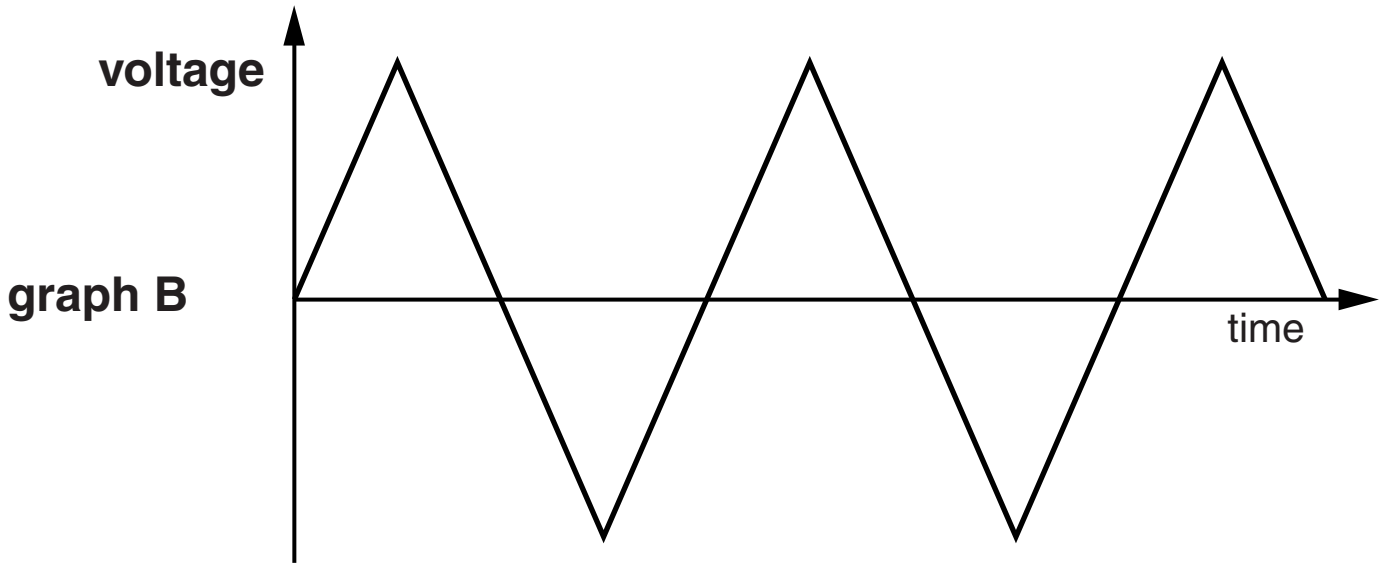


(a) The frequency shown in graph A is 50 Hz.

An alternating voltage produces an alternating current.

On graph A draw another line with a HIGHER frequency. [1]

(b) Look at graph B.



Does graph B also show an alternating voltage?

_____

Explain your answer by COMPARING it with graph A.

_____

_____ **[1]**

[Total: 2]

6 Stars are part of the Universe.

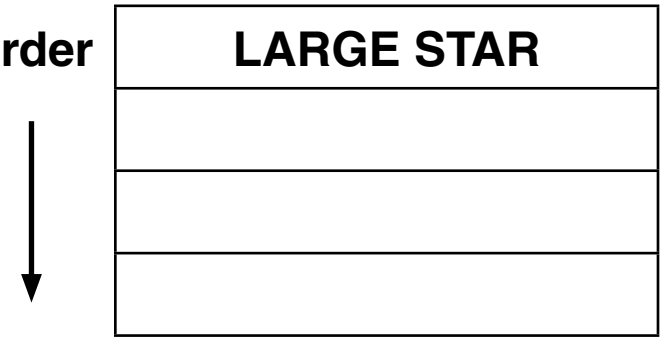
(a) The END of the 'life cycle' OF A STAR depends on its mass.

Put the life cycle stages from this list into the correct ORDER for a large star.

BLACK HOLE

RED SUPERGIANT

SUPERNOVA



[1]

(b) The brightest supergiant stars in our galaxy have very high surface temperatures and appear blue in colour.

Using powerful telescopes these 'super bright' stars can be observed in galaxies other than our own.

Observations of the radiation emitted by these stars can help to accurately calculate the distance to these other galaxies, and provides more evidence for the age of the Universe.

Explain the value of more than one team of scientists investigating these blue supergiants.

_____

_____

_____

_____ **[2]**

[Total: 3]

7 Tricia is a scientist investigating the RADIOACTIVITY of a liquid.

(a) Tricia wants to measure the penetrating power of the radiation emitted.

(i) Alpha, beta and gamma radiation can be stopped by different materials.

Which material would be the best material to show that alpha radiation is emitted?

_____

_____ **[1]**

(ii) She may have difficulty measuring the penetrating power of ALPHA radiation IN A LIQUID.

Suggest ONE of the problems she may have.

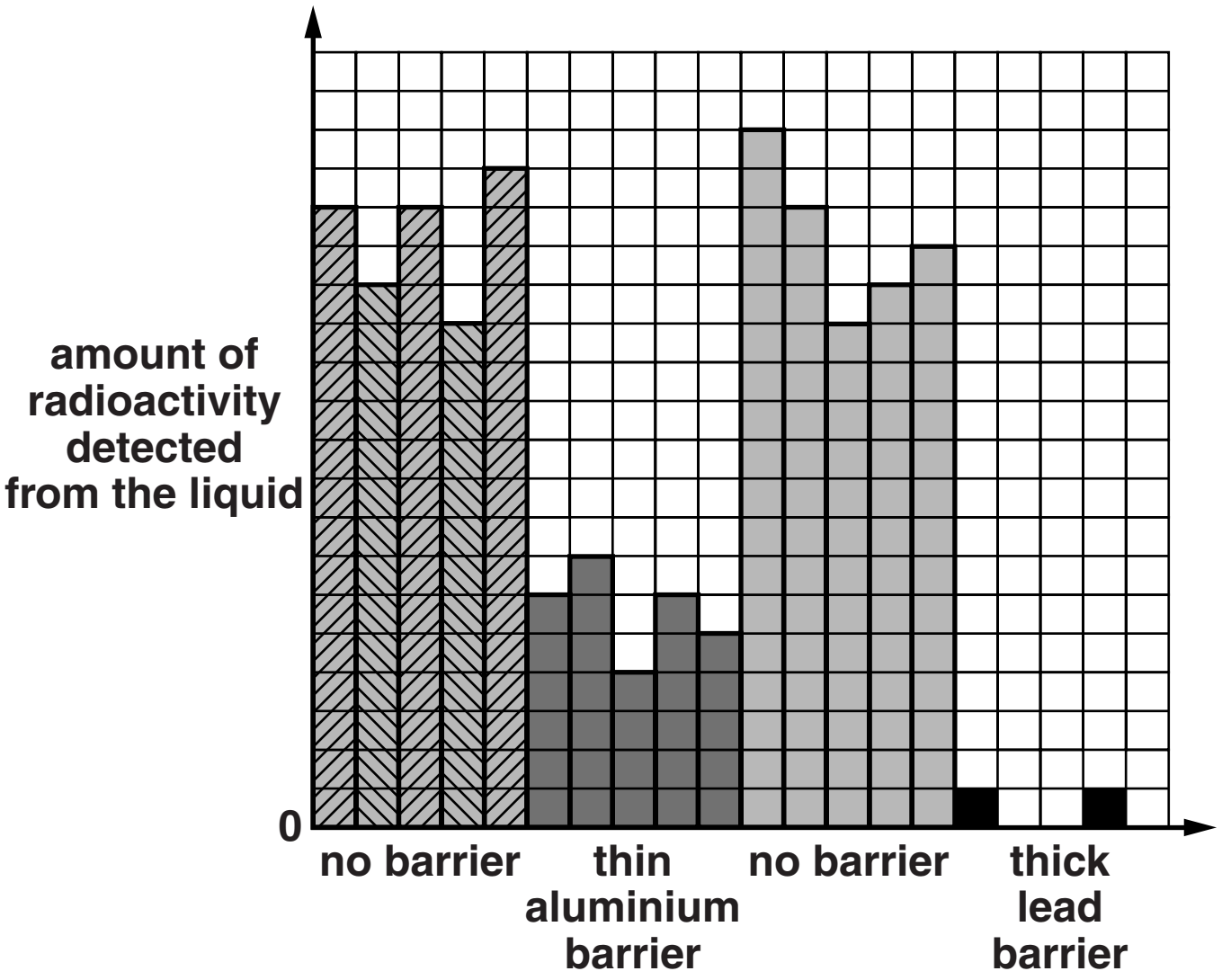
_____

_____

_____ **[1]**

(b) Here are her results.

She carried out each investigation five times.



(i) Explain why she carried out each investigation five times.

_____

_____

_____ **[1]**

(ii) Interpret her results to identify the types of radiation emitted.

_____

_____

_____

_____ **[2]**

[Total: 5]

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TURN OVER FOR QUESTION 8

8 Zack uses many appliances in his home.

Look at the information about the appliances he uses the MOST.

kettle used for 0.5 hours
during the day
current of 9 amps

vacuum cleaner used for 0.25 hours
during the day
current of 6 amps

dishwasher used for 1.5 hours
during the day
current of 9 amps

heater used for 12 hours
at night
current of 9 amps

cooker used for 1 hour
during the day
current of 14 amps

fridge-freezer on for 12 hours during the day and 12 hours at night
current of 1.8 amps

All the appliances use the 230V mains voltage. The currents shown are average values.

(a) The heater is only used at night.

(i) Calculate the power rating for the heater in KILOWATTS.

_____

_____

_____

_____

power rating _____ kilowatts [2]

(ii) Calculate the total energy supplied to the heater in one night in KILOWATT HOURS.

_____

_____

_____

_____

total energy supplied _____ kilowatt hours [2]

(b) Zack pays 12p per kilowatt hour for electricity he uses during the DAY.

He pays 6p per kilowatt hour for electricity he uses during the NIGHT.

He is considering switching to the same cost for DAY AND NIGHT of 10p.

This would not save him money.

Suggest reasons why.

_____

_____

_____

_____ **[2]**

[Total: 6]

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TURN OVER FOR QUESTION 9

9 This question is about photocells.

(a) Describe how LIGHT produces an ELECTRICAL CURRENT in a photocell.

_____

_____

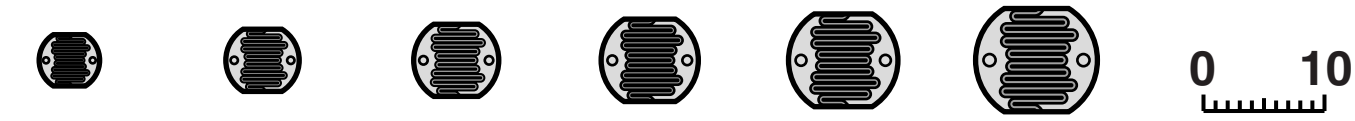
_____

_____

_____ **[3]**

(b) PHOTOCELLS can have different surface areas.

Look at the diagrams of six photocells.



The electric current produced by these photocells changes with their surface area.

Describe how you could investigate this and explain what results you might expect from this experiment.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

[Total: 9]

10 Dave and Fred are discussing issues about road safety.

(a) Look at the graph (opposite).

It shows data about the risks to road users.

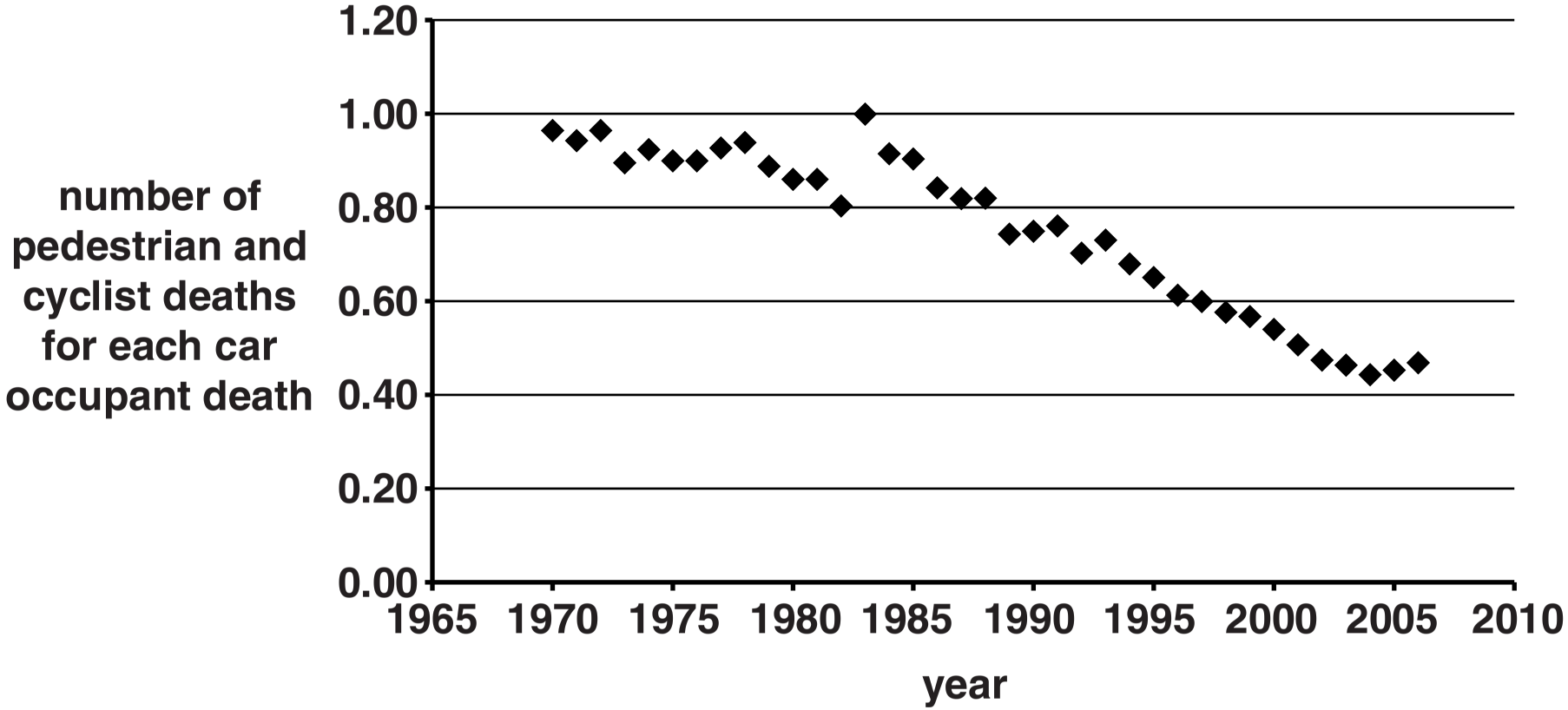
Dave thinks these data show that cycling has become safer since 1970, and that fewer cyclists die in accidents.

(i) Explain how the graph partly supports Dave's view.

_____

_____

_____ **[1]**


number of pedestrian and cyclist deaths for each car occupant death
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
year

(ii) Fred is less confident about what the data shows and feels he needs more information.

Suggest what other information about the data Fred needs to be more convinced.

_____

_____

_____

_____

_____

_____ **[2]**

(b) Cars and their occupants have MOMENTUM when moving.

Seatbelts STRETCH in a crash.

Use these ideas to explain how seatbelts reduce injury in a crash.

_____

_____

_____

_____

_____ **[2]**

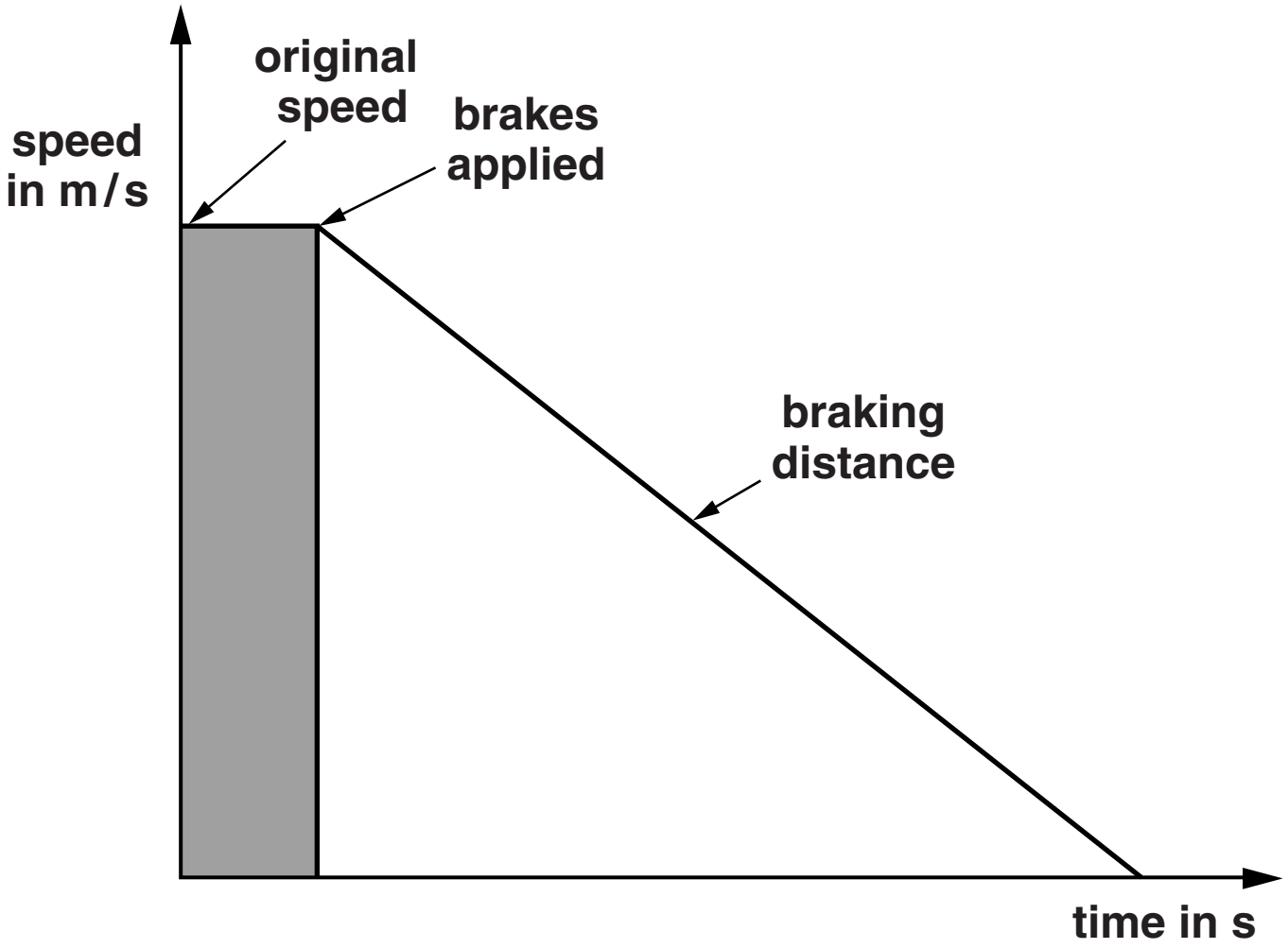
[Total: 5]

11 The police take measurements after some road accidents.

They can measure the braking distance by measuring the length of the skid marks on the road.

This can give them an estimate of the original speed of the vehicles.

Look at the graph of a car stopping.



The car takes 5 s to brake and the skid mark is 75 m long.

(a) Calculate the ORIGINAL speed of the vehicle using this distance.

_____

_____

answer _____ m/s [2]

(b) The speed limit is 32 m/s.

The police are not sure if the driver was travelling at a higher speed than the speed limit.

Suggest why the skid mark may NOT give an accurate estimate of the original speed of the driver.

_____

_____

_____ **[2]**

(c) Police know that braking distances are related to speed.

This is because kinetic energy is transferred in braking.

Look at the diagram.

(i) Car A and car B are travelling at the same speed.

Car A has double the mass of car B.

Compare the amount of kinetic energy of car A and car B.

_____ **[1]**

(ii) What happens to the kinetic energy of car A when its SPEED is doubled?

_____

_____ **[1]**

(iii) What happens to the braking distance when the speed is doubled?

_____

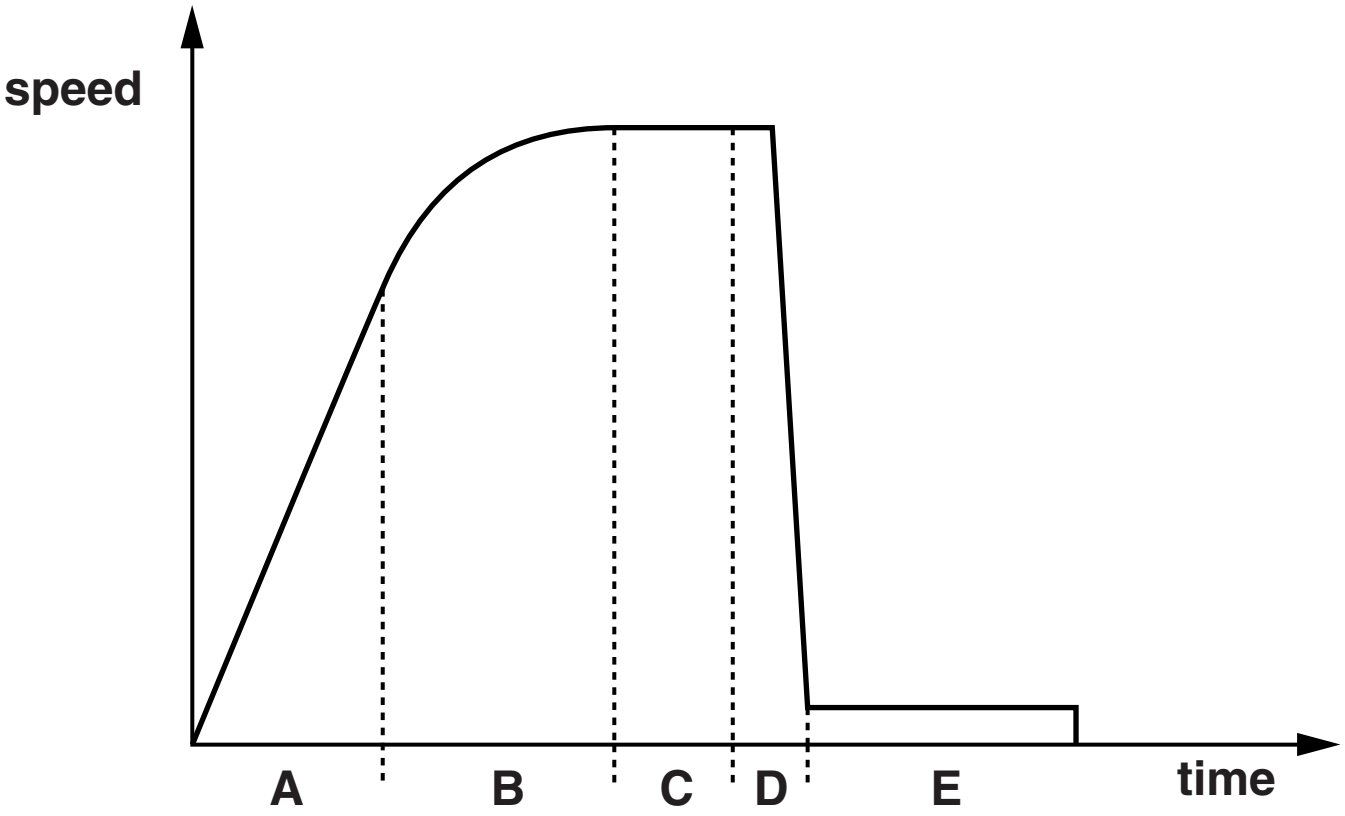
_____ **[1]**

[Total: 7]

12 Alex is a sky-diver.

He jumps out of an aeroplane, and sky-dives before opening his parachute.

Look at the graph of Alex's speed as he falls.



As he falls there are two forces acting on Alex

- **weight**
- **drag.**

(a) In part A of the graph his speed INCREASES.

Explain why.

_____

_____ **[1]**

(b) Part C of the graph shows Alex travelling at terminal speed BEFORE his parachute opens.

Explain why terminal speed is reached.

_____

_____ **[1]**

(c) In part D the parachute opens and the speed reduces very QUICKLY.

Explain why.

_____

_____ **[1]**

(d) Part E of the graph shows the terminal speed AFTER the parachute opens.

Explain why the open parachute causes Alex to have a LOWER terminal speed than in part C of the graph.

_____

_____

_____ **[2]**

(e) The parachute is used again. This time it is used with a much HEAVIER person.

His fall is different to Alex's.

Part E of the graph has a higher speed.

Explain why.

_____

_____

_____

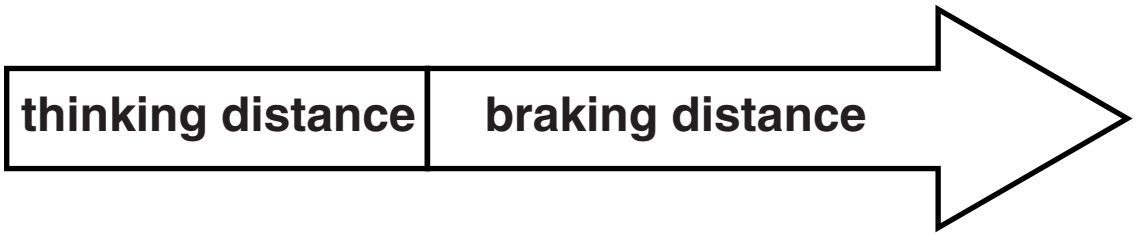
_____ **[2]**

[Total: 7]

13 Stopping distances are important for road safety.

The Highway Code uses diagrams to show stopping distances.

Look at the diagram.



There are two parts to the stopping distance

- **thinking distance**
- **braking distance.**

Both of these can be INCREASED by different factors.

Explain in detail how ROAD CONDITIONS, SPEED and ALCOHOL can affect road safety.

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

_____

_____

_____

_____

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_____

_____

_____ **[6]**

[Total: 6]

END OF QUESTION PAPER

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