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F

Wednesday 30 May 2012 – Afternoon

GCSE GATEWAY SCIENCE
PHYSICS B

B751/01 Physics modules P1, P2, P3 (Foundation Tier)

B722330612

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

B751601

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.

EQUATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$GPE = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

$$\frac{\begin{matrix}\text{voltage across}\\ \text{primary coil}\end{matrix}}{\begin{matrix}\text{voltage across}\\ \text{secondary coil}\end{matrix}} = \frac{\begin{matrix}\text{number of}\\ \text{primary turns}\end{matrix}}{\begin{matrix}\text{number of}\\ \text{secondary turns}\end{matrix}}$$

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

$$V_pI_p = V_sI_s$$

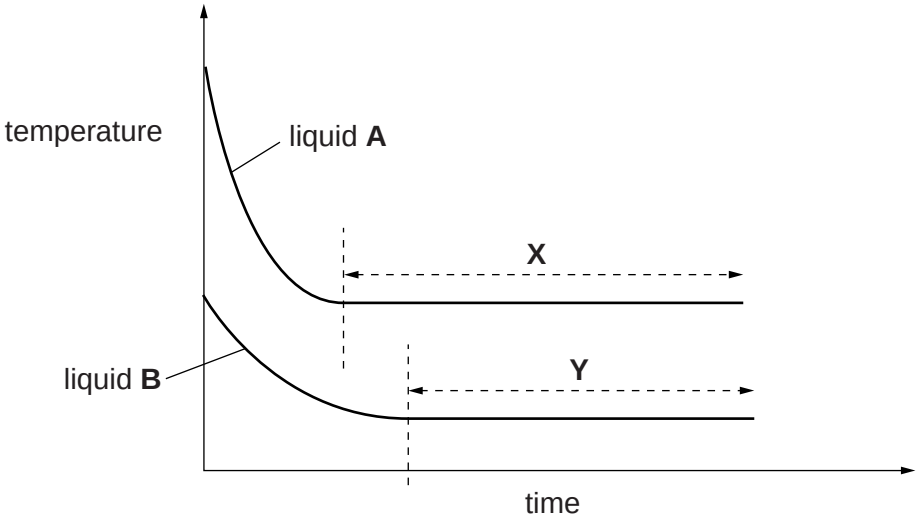
Answer **all** the questions.

Section A – Module P1

1 Amir investigated the cooling of two different liquids.

He used the **same mass** of each liquid.

Look at the graph of his results.



(a) Suggest a reason why liquid **A** cooled more quickly than liquid **B** at the **start**.

.....

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

(b) Look at parts **X** and **Y** of the graph.

(i) What is happening to the liquids in parts **X** and **Y** of the graph?

Choose from

boiling **freezing** **melting**

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

(ii) What unit is energy measured in?

Put a tick (✓) in the box next to the correct answer.

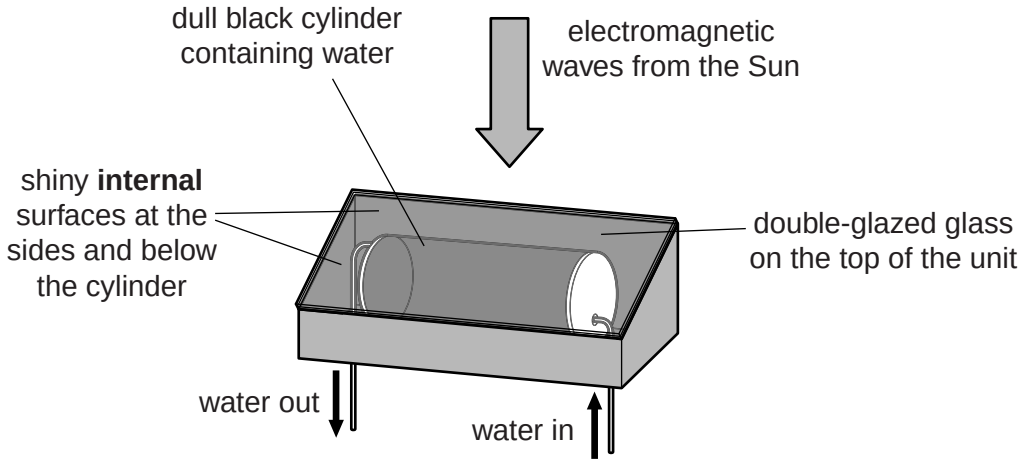
°C	
Hz	
J	
kg	

[1]

[Total: 3]

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

Look at the diagram of the unit.



(a) Energy from the Sun travels in electromagnetic waves.

Which electromagnetic wave is **mainly** responsible for heating the water in the solar heating unit?

Put a (ring) around the correct answer.

infrared

light

microwaves

ultraviolet

[1]

(b) (i) For every 20 000 Joules that enter the unit, 16 000 Joules heat the water.

Calculate the **efficiency** of the unit.

.....

.....

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

(ii) The glass top is double-glazed.

This improves efficiency by reducing energy loss from the solar water-heating unit.

Explain how.

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

(iii) Explain how **other** design features of the water-heating unit help to heat the water efficiently.

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

[Total: 8]

3 Jane likes to sunbathe.

She has read about risks from sunbathing and how to reduce them.

She thinks she is not at risk from sunbathing because she has dark skin.

Explain why Jane is **not completely correct** by writing about the risks from sunbathing.

Include methods of reducing the risk in your answer.

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

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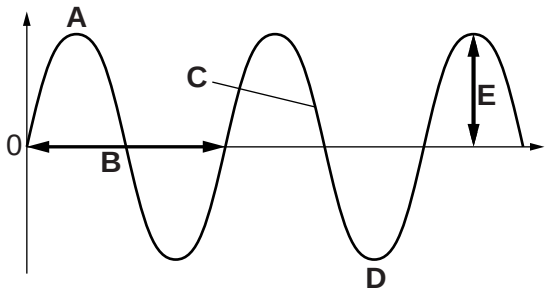
..... **[6]**

[Total: 6]

4 Look at the diagram of a water wave.



(a) (i) Which letter represents the amplitude of the wave?

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

(ii) Which letters represent the crest and trough of the wave?

crest .....

trough .....

[1]

(b) (i) The wavelength of the water wave is 5 cm.

8 waves pass a point in 10 seconds.

Calculate the speed of the wave.

.....

.....

.....

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

(ii) How does the speed of the water wave compare to the speed of an electromagnetic wave travelling in space?

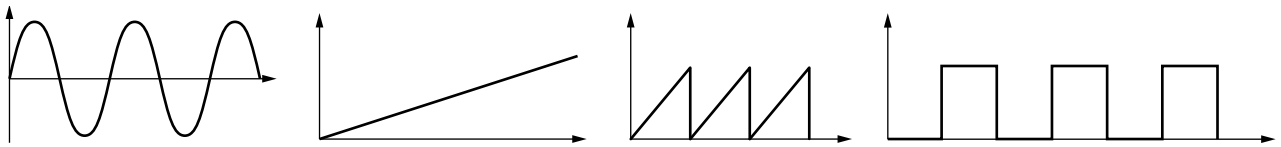
.....

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

[Total: 5]

5 Ricky is learning about analogue and digital signals.

Look at the diagrams of some signals. **One** of them is a **digital** signal.



A **B** **C** **D**

(a) Ricky thinks that signal **A** is a digital signal.

Explain why Ricky is incorrect and explain which signal is actually the digital one.

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

(b) Ricky learns that digital light signals can be sent along optical fibres.

Write down **one** advantage of using digital signals in optical fibres.

.....

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

[Total: 3]

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Section B begins on page 10.

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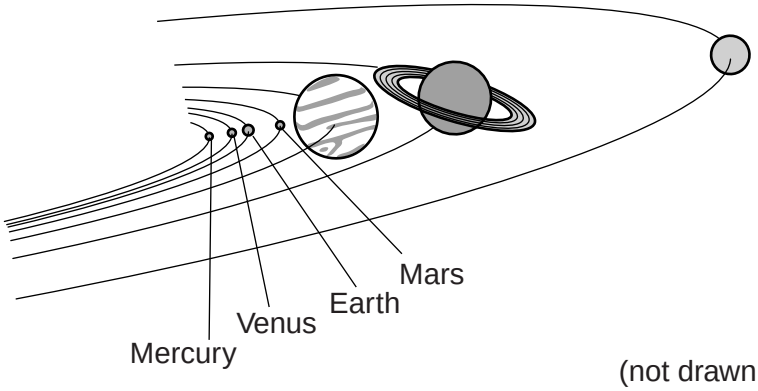
Section B – Module P2

6 Stars and planets are part of the Universe.

(a) The distance between the **Earth's orbit** and a planet's orbit can be measured.



(not drawn to scale)

planet	distance from the Earth's orbit in astronomical units
	0.27
Jupiter	4.20
Mars	0.52
Mercury	0.62
	18.20
	8.50

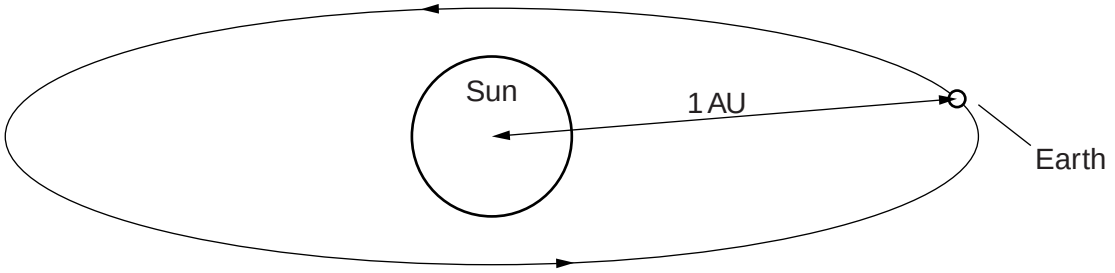
(i) Complete the table to show the relative positions of the other planets.

Choose your answers from this list.

Saturn **Uranus** **Venus**

[2]

(ii) The distance from the Earth to the Sun is 1.00 astronomical unit (AU).



(not drawn to scale)

Use the table to find the distance from **Mars** to the **Sun**.

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

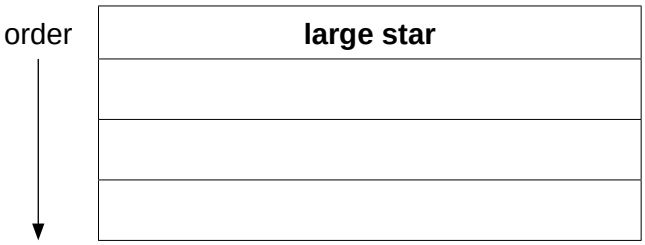
(b) (i) The **end** of the 'life cycle' **of a star** depends on its mass.

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

black hole

red supergiant

supernova



[1]

(ii) Light **cannot** escape from a black hole.

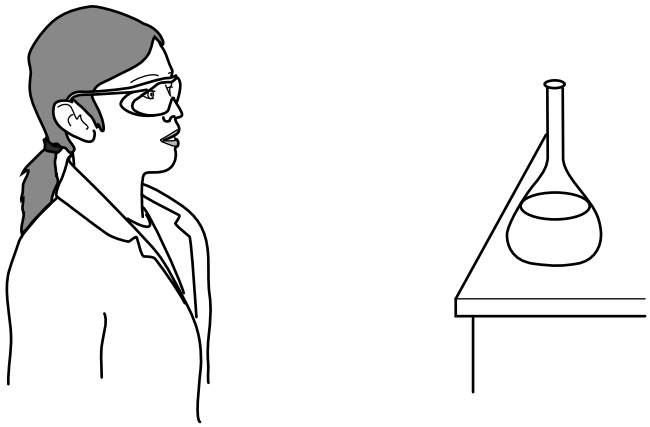
Explain why.

.....

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

[Total: 5]

7 Tricia is a scientist investigating the **radioactivity** of a liquid.



(a) She knows **beta** is the type of nuclear radiation involved.

Describe the safety measures she should take with the radioactive liquid **and** explain how these measures protect her from beta radiation.

.....

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

(b) A student has some ideas about the effect of radiation on **living cells**.

She writes down some of her ideas.

> **Can radiation cause cancer?**
> Yes, I think radiation is very dangerous. I have known about this for a long time.
>
> **Can radiation be used to treat cancer?**
> I know that gamma radiation is used in hospitals so it must be true.

Explain why the student **cannot** use only these ideas to make informed decisions about the effect of radiation on living cells.

.....

.....

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

[Total: 5]

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Question 8 begins on page 14.

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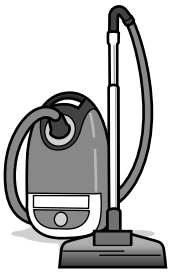
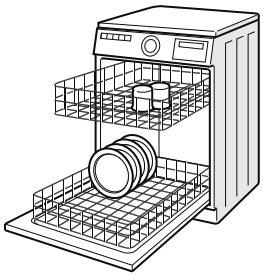
8 Zack uses many appliances in his home.

Look at the information about the appliances he uses the **most**.

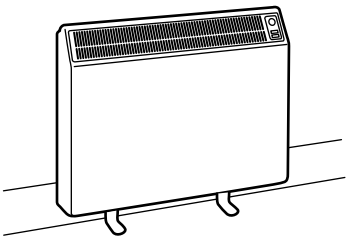
kettle used for 0.5 hours
during the day
current of 9 amps



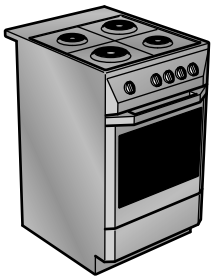
vacuum cleaner used for
0.25 hours during the day
current of 6 amps



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**.

.....

.....

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power rating ..... kilowatts **[2]**

(ii) Calculate the total energy supplied to the heater in one night in **kilowatt hours**.

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.....

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.

.....

.....

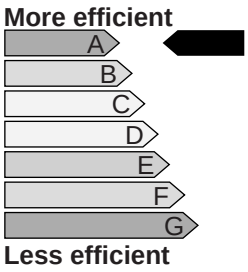
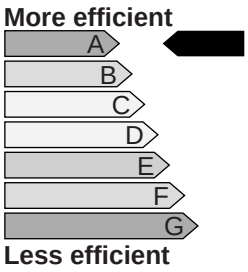
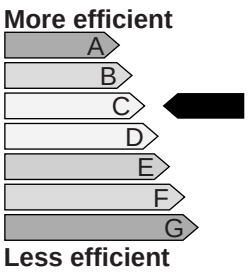
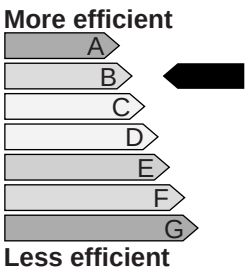
.....

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

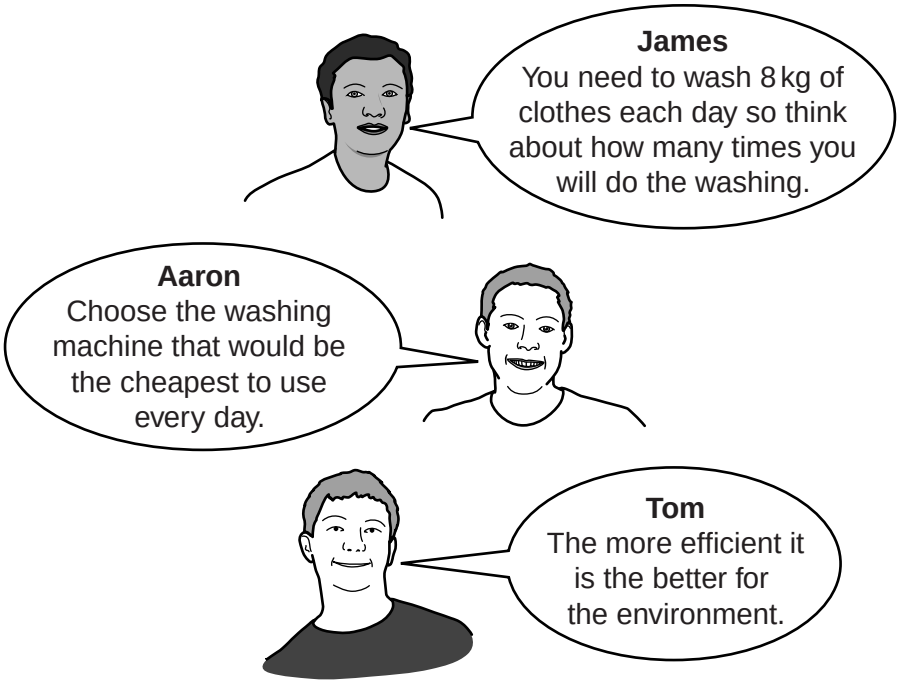
[Total: 6]

9 Tarek wants to buy a new **washing machine**.

Look at the **information** he has collected to help him make a choice.

name of washing machine	efficiency rating	average power rating in watts	average time for one complete wash in minutes	maximum mass of clothes per wash in kilograms
classic		700	60	2
feature		800	50	4
novel		1500	90	6
supreme		1000	60	4

His friends also give him some **advice**.



Which washing machine should Tarek buy?

Use the information and advice to explain why.

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

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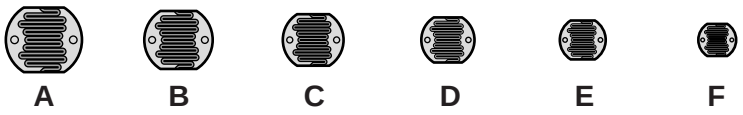
..... **[6]**

[Total: 6]

10 Look at the diagram of different **photocells**.



They are all exposed to the **same** brightness of **light**.

(a) Will they all produce the same current?

.....

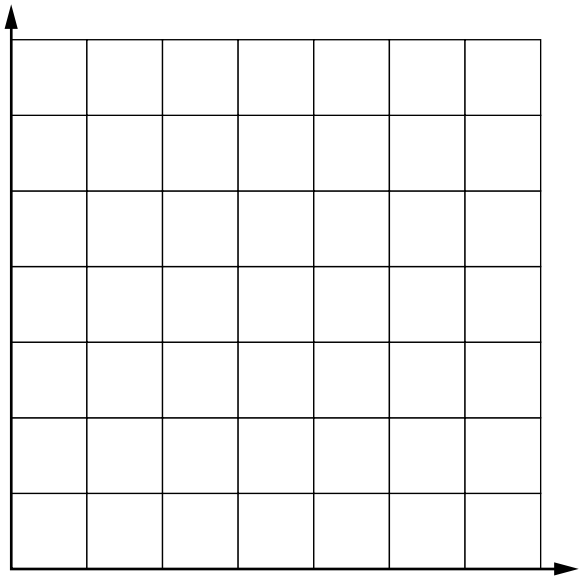
Explain your answer.

.....

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

(b) Sketch a graph to show what happens to the current as the size of the photocells changes.

Make sure you label the axes.



[2]

[Total: 3]

Section C – Module P3

11 There is a speed camera outside Rachel's school.

(a) This type of speed camera takes two photographs.

Explain how these photographs can be used to check the speed of a car.

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.....

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

(b) Rachel does her own measurements of vehicles as they pass the school.

Look at her results.

vehicle	distance moved in m	time taken in s
bicycle	22	4
scooter	44	7
blue car	10	4
silver car	10	0.5

Calculate the speed of the vehicle which travels fastest past the school.

.....

.....

.....

speed = ... m/s **[3]**

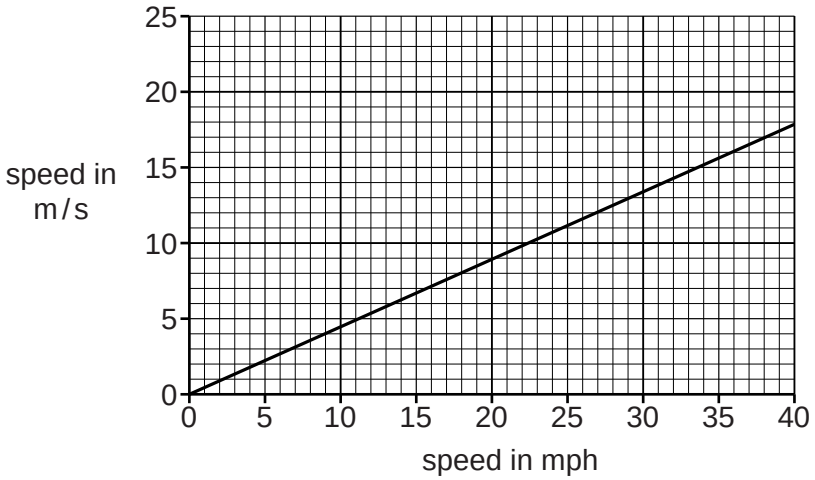
Turn over for the remainder of question 11

(c) Rachel rides her bike past the school at 11 m/s.

The speed limit outside the school is 20 mph.

She wants to know if she is breaking the speed limit.

Look at the graph.



Is Rachel breaking the 20 mph speed limit?

.....

Use the graph to explain your answer.

.....

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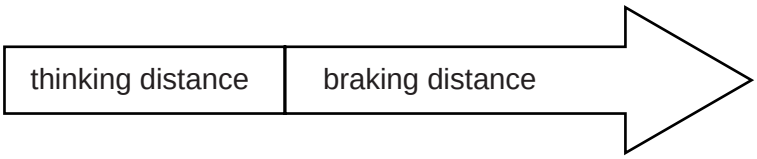
..... **[1]**

[Total: 6]

12 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]

13 Scientists collect data on car safety.

They perform test crashes with dummies in cars.

They study the momentum in a collision.

(a) What **measurements** do scientists make to find the momentum of a dummy before the collision?

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.....

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

(b) Scientists publish the data they collect on road safety. It is used by other scientists and car makers (manufacturers).

(i) Why might other scientists use this data?

.....

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

(ii) What might **car manufacturers** use this data for?

.....

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

(c) Scientists have found that **changes** in momentum are the key to understanding the dangers of collisions.

Explain how **momentum** is linked to injuries in a crash.

.....

.....

.....

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

(d) Airbags are useful in a crash because they **reduce injuries**.

Look at the information about three different airbags.

airbag	depth of airbag in cm	ability to change shape
A	40	high
B	20	low
C	5	medium

Suggest which airbag is the best one to reduce injury and explain why.

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

[Total: 9]

Please turn over for question 14.

14 Chris does an experiment with bouncing balls.

He drops the first ball from 4 m.

(a) What type of energy does the ball have when it is still at 4 m high?

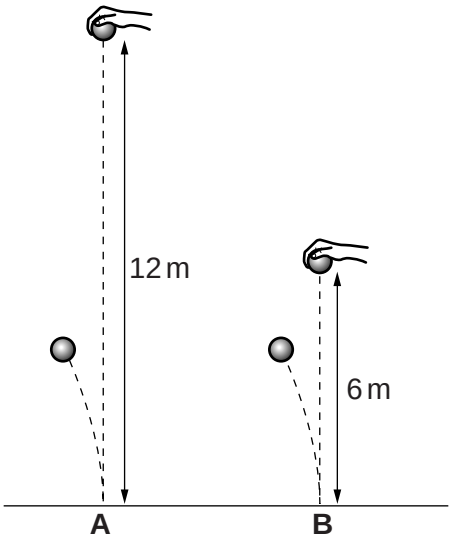
..... **[1]**

(b) What type of energy does the ball gain as it falls?

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

(c) He then drops two balls of the same mass.

He drops ball **A** from 12 m and ball **B** from 6 m.



Both the balls bounce to the same height, 4 m.

Compare the amounts of energy the balls have before they fall and after they have bounced.

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

[Total: 4]

END OF QUESTION PAPER