OCR
Oxford Cambridge and RSA

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Tuesday 9 June 2015 – 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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$GPE = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

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

$$V_pI_p = V_sI_s$$

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Question 1 begins on page 4

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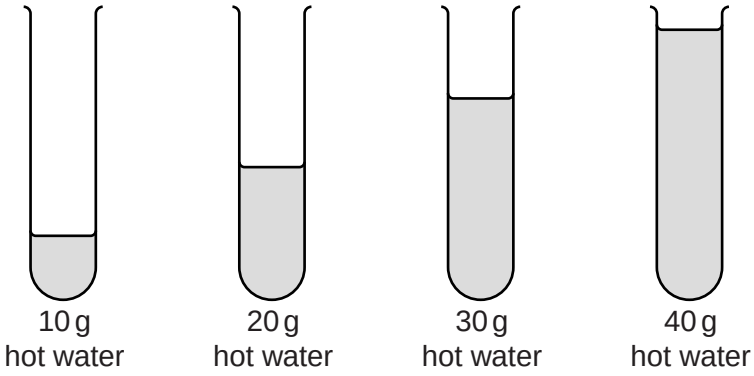
Answer **all** the questions.

SECTION A – Module P1

1 Susie does some experiments with heating and cooling water.

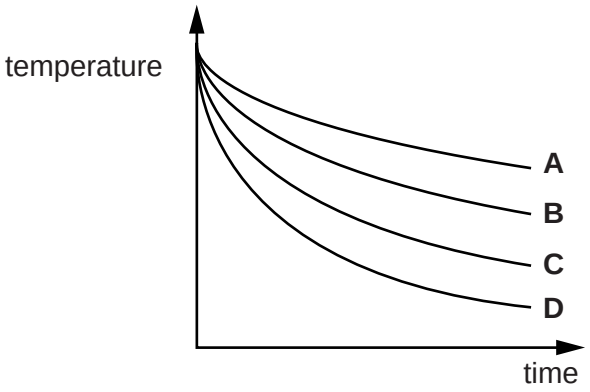
(a) Susie pours hot water into 4 test tubes.
Look at the diagram.



The water cools down.

Susie measures the temperatures of the water in each test tube as it cools.

Look at the graph of her results.



Which line shows the results for the test tube with 40 g of water?

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

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Explain your answer.

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

(b) Susie researches information about water and ice.

Table 1 shows the information she collects.

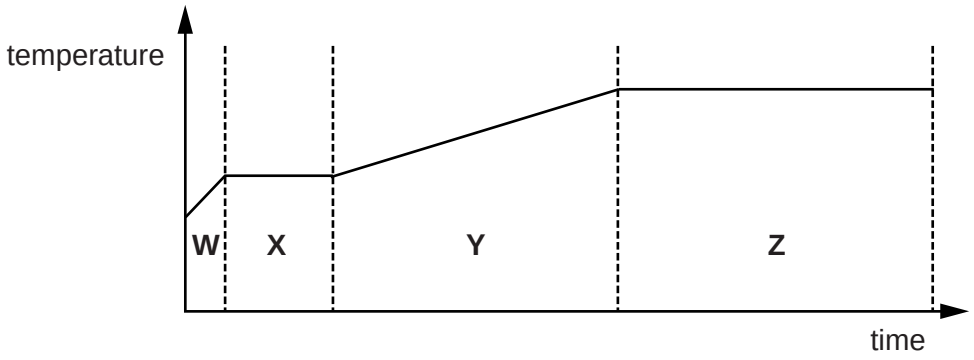
Table 1

	Specific heat capacity in J/kg °C	**Specific latent heat of fusion in kJ/kg**	**Specific latent heat of vaporisation in kJ/kg**
Water	4186	335	2272
Ice	2060	335	–

Susie heats a sample of ice.

She measures the temperature of the ice as it heats up and changes state.

Look at the simple graph of her results.



(i) Which section of the graph shows the temperature of **ice** rising?

Choose from **W**, **X**, **Y** and **Z**.

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

(ii) Which section of the graph shows the **water** boiling?

Choose from **W**, **X**, **Y** and **Z**.

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

(iii) Section **W** is **steeper** than section **Y**.

Use the information in Table 1 and the graph to explain why.

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

(iv) Suggest why section **Z** takes a **longer** time than section **X**.

Use the information in Table 1 and the graph to explain your answer.

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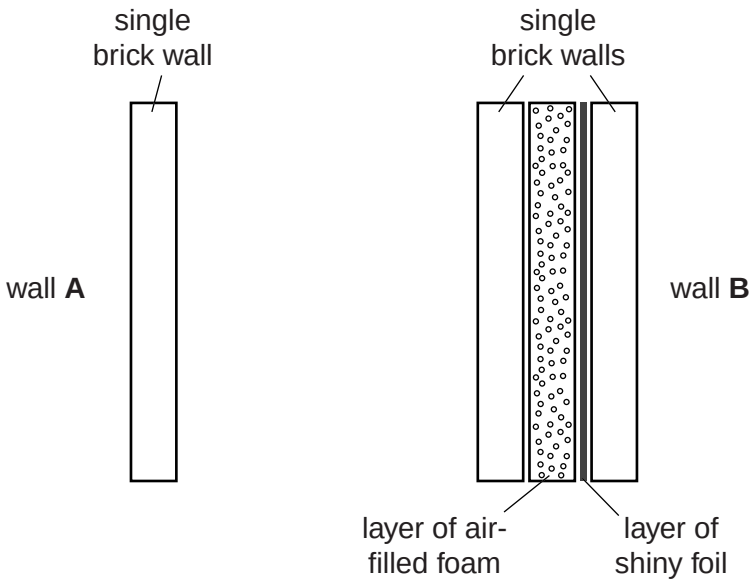
2 This question is about insulation in houses.

(a) Look at the diagrams of these two designs of wall that are used in building houses.



Houses with wall **B** lose **less** heat than houses with wall **A**.

Use ideas about conduction, convection and radiation to explain why wall **B** loses less heat than wall **A**.

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

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(b) Look at the advert about double glazing.

> *Buy **Evercosy** double glazing.*
>
> *Fitting double glazing to your house will save up to 18% on your energy costs.*
>
> *Spend a little and save a lot. Choose Evercosy.*

Simon has double glazing fitted in his house. He thinks it saves him money.
Look at the data.

Year	Double glazing	Annual energy cost in £
2009	none	1200
2010	none	1040
2011	none	1010
2012	fitted	950
2013	fitted	1020
2014	fitted	790

Before he fitted double glazing, Simon's average annual energy cost was £1083.

With an 18% saving the average annual energy cost should be £888.
How do Simon's actual annual energy costs from 2012 onwards compare to this figure?

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Suggest reasons for this difference.

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

3 Mobile phones are used by many people.

(a) What type of wave is used by mobile phones?

Choose from the list.

gamma

microwave

ultrasound

ultraviolet

X-rays

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

(b) Some parents have concerns about their children using mobile phones because of these waves.

(i) Describe these concerns about children using mobile phones.

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

(ii) There have been some studies into the dangers of using mobile phones.

What can you say about the conclusions of these studies?

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

4 Ricco's school has an infrared sensor over the front entrance.
This operates the automatic door.

He does some tests to find out how the system works.

Look at his data.

Test	Details	Result
A	Ricco wears his school uniform and approaches the sensor	Door **opens** automatically
B	Ricco rolls some footballs towards the sensor	Door does **not** open
C	Ricco covers himself in aluminium foil and approaches the sensor	Door does **not** open

(a) Explain why the door opens for test A.

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

(b) **(i)** The door does not open for test B. Explain why.

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

(ii) The door does not open for test C. Explain why.

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

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Question 5 begins on page 12

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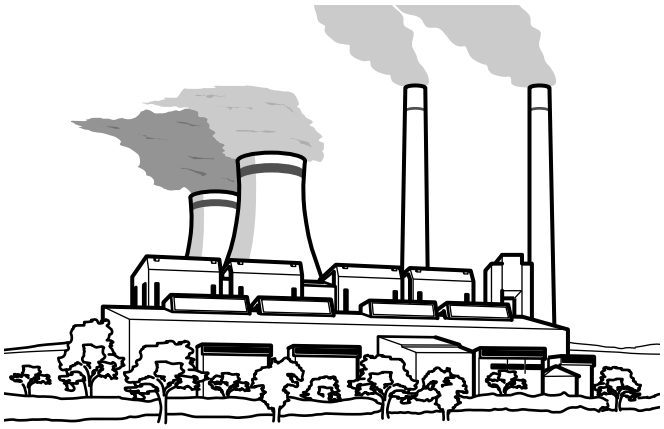
SECTION B – Module P2

5 This question is about power stations.



Power stations generate electricity.

(a) Name two **fossil** fuels used in power stations.

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

(b) Name one **renewable** fuel used in power stations.

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

(c) Complete the sentences.

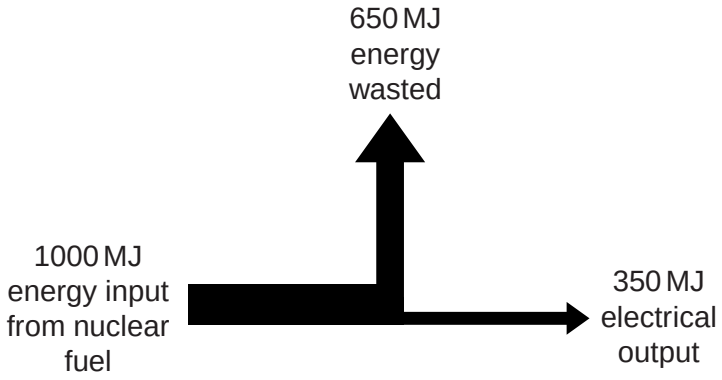
Electricity is generated in power stations.

It is transmitted around the UK through a system of power lines called the ..... .

This system connects the power station to **consumers** such as

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

(d) Look at the diagram. It shows the amount of energy used and wasted in a nuclear power station.



(i) Compare the energy input and all of the energy outputs for the nuclear power station. Suggest how the energy is wasted.

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

(ii) Calculate the efficiency of this power station.

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

6 Nuclear radiation can be beneficial or harmful.

Write about one beneficial use of nuclear radiation and also how nuclear radiation can harm people.

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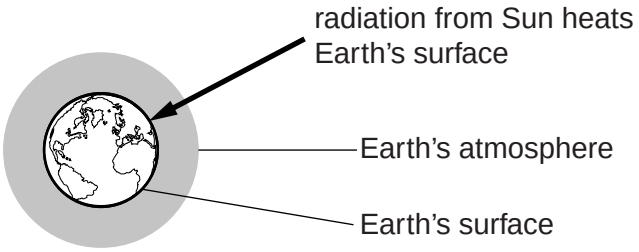
..... **[2]**

7 Scientists are worried about greenhouse gases.

Look at the simple diagram of the Earth and its atmosphere.



(a) Describe the greenhouse effect and suggest what may be causing it to increase.

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

(b) (i) Carbon dioxide can be man-made or produced naturally.
A man-made source of carbon dioxide is burning fuels.

Name a **natural** source of carbon dioxide.

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

(ii) A lot of scientists think that global warming is mostly caused by human activities.
A few scientists think that global warming is mostly a natural cycle.

Suggest a reason why some scientists think it is mostly a natural cycle.

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

(c) Each greenhouse gas gives a different contribution to the greenhouse effect.

Look at the information about each gas.

Greenhouse gas	Percentage of gas in atmosphere	How long it lasts	Global warming potential (GWP) over a few years	Contribution to the greenhouse effect
water vapour	0.01% to ~4%	A few days		36% to 66%
carbon dioxide	0.30%	100 years	1	10% to 26%
methane	0.06%	11 to 12 years	21 times more than carbon dioxide	4% to 9%

(i) The global warming potential (GWP) for water vapour has not been calculated.

Use data from the table to suggest why scientists do not calculate the GWP for water vapour.

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

(ii) Methane has a GWP that is 21 times more than carbon dioxide, but contributes less than carbon dioxide to the greenhouse effect.

Suggest why.

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

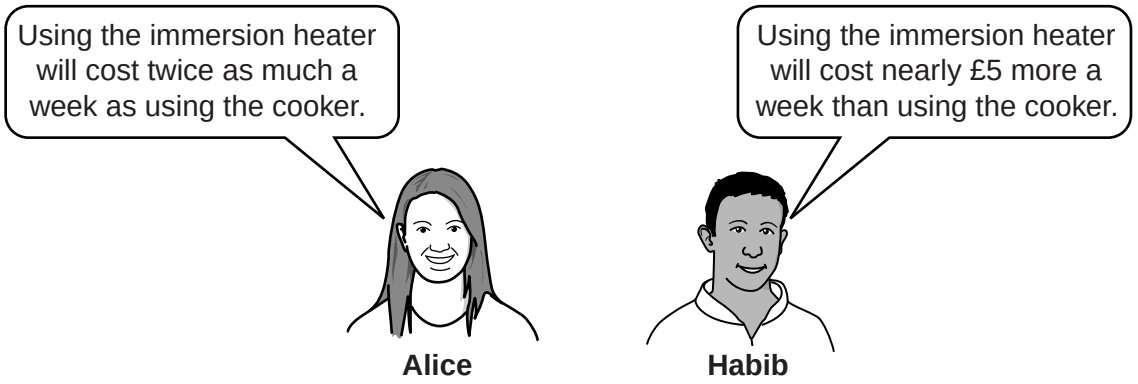
8 This question is about paying for electricity.

Alice checks the information on her electricity bill.
She also looks at information about some of her appliances.

Appliance	Average power in kW	Time used per week in hours
cooker	2.0	6
immersion heater	3.0	12
central heating	6.0	18

Habib also looks at the information.

He sees from the bill that the price of a unit of electricity is 20p.



Complete calculations to show who is correct.

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Who is correct? ..... **[3]**

9 Alec designs a house.
He wants the house to use **renewable** energy from the Sun.

He would like to use both of these methods:

- passive solar heating
- photocells.

Describe how Alec can use these two methods in his house to help reduce pollution to the environment. Explain how he can maximise the energy he collects by using these methods.

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

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SECTION C – Module P3

10 **(a)** Police can use average speed cameras to check the **average** speed of a car on many roads.

Explain how average speed cameras work.

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(b) A car travelling along a motorway takes 25 seconds to travel a distance of 800 metres.

Calculate the speed of the car.

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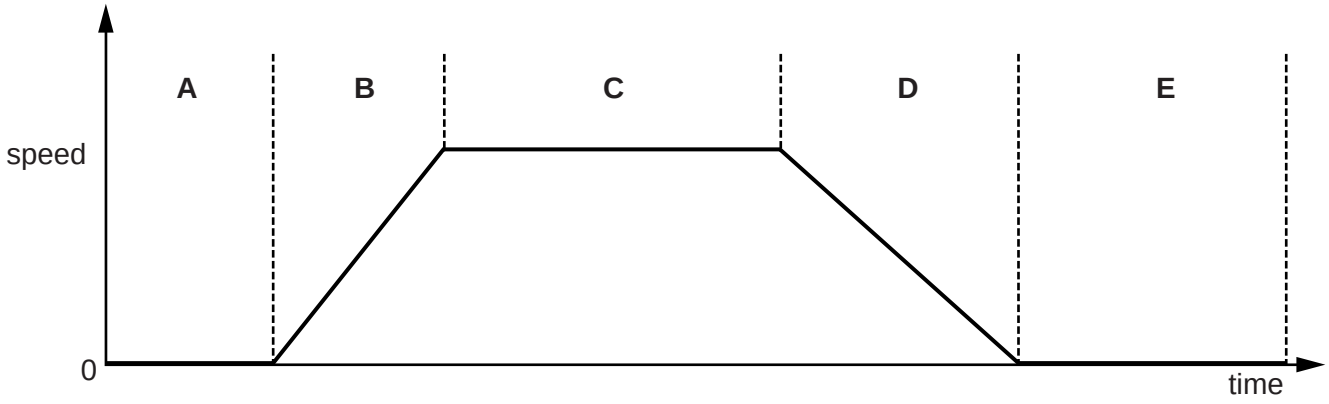
answer ..... m/s **[2]**

11 This question is about a car journey.

(a) Look at the simple speed-time graph for the journey.



(i) Which part of the graph shows an increase in speed?

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

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

(ii) Which part of the graph shows the car moving at a constant speed?

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

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

(b) The car runs out of fuel 80 m from a garage.

A passenger pushes the car to the garage with a constant force of 220 N.

Calculate the work done in pushing the car to the garage.

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

(c) The car is fitted with seatbelts.

Write about the risks and benefits of wearing a seat belt when travelling in a car.

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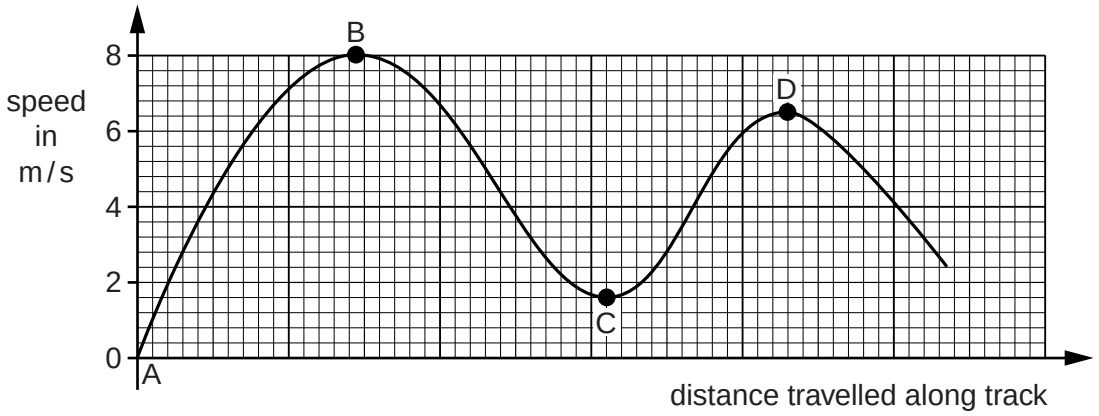
..... **[2]**

12 This question is about the kinetic energy of a roller coaster car.



The graph shows how the speed of a 400 kg roller coaster car changes as it goes along part of a roller coaster track.

Describe how the kinetic energy of the car changes as it moves from A to D and calculate the kinetic energy of the car at B.

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

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13 (a) Ben is considering buying a new car.

He investigates how the cost of journeys changes with the speed of the car and the distance travelled.

He does this for a car with a petrol engine and a car with a diesel engine. Both cars have the same size engine.

Look at the table for a petrol car.

	Speed in km/hr	**Cost of fuel per km for different distances in pence**		
		5 km	**25 km**	**100 km**
Petrol	10	38.2	38.2	38.2
	40	17.8	17.8	17.8
	80	10.0	10.0	10.0
	120	17.4	17.4	17.4

Look at the table for a diesel car.

	Speed in km/hr	**Cost of fuel per km for different distances in pence**		
		5 km	**25 km**	**100 km**
Diesel	10	30.6	30.6	30.6
	40	14.2	14.2	14.2
	80	8.4	8.4	8.4
	120	13.9	13.9	13.9

What conclusions can Ben make about the costs of fuel per km travelled using this data?

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

(b) Look at the information about thinking distance and braking distance for cars travelling at 13 m/s.

Driver	Thinking distance in metres	Braking distance in metres
Sam	9	14
Chris	9	25
Jo	15	14
Ben	7	10

One of the drivers is tired after driving for several hours.

Suggest which driver is tired.

answer .....

Explain fully why you chose this driver.

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One of the drivers was driving on an icy road.

Suggest which driver was driving on an icy road.

answer .....

Explain fully why you chose this driver.

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[2]

14 (a) Jin's car runs on petrol. Petrol is a fossil fuel.

She would like a car that does not use fossil fuels so that she can reduce her effect on the environment.

(i) Write down two possible alternatives to fossil fuels for cars.

1 .....

2 .....

[2]

(ii) Jin thinks that some alternatives may not be suitable to use in the UK.

Suggest **one** alternative that may not be suitable.
Explain your answer.

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

(b) Jin drives her car at a steady speed.

Look at the situations in which she drives her car along a straight road at 60 km/hr.

A with one passenger.
B with one passenger and towing a caravan.
C with one passenger and a roof rack on the car.
D with one passenger and a cycle rack attached to the back of the car.

Which situation will give her the best fuel consumption?

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

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

END OF QUESTION PAPER

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