OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B751/01

PHYSICS B

Unit B751: 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 clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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 for each question 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.

Examiner's Use Only:			
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	
Total			

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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

$$KE = \tfrac{1}{2}\, mv^2$$

momentum = mass × velocity

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

GPE = mgh

$$mgh = \tfrac{1}{2}\, mv^2$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

power loss = (current)^2 × resistance

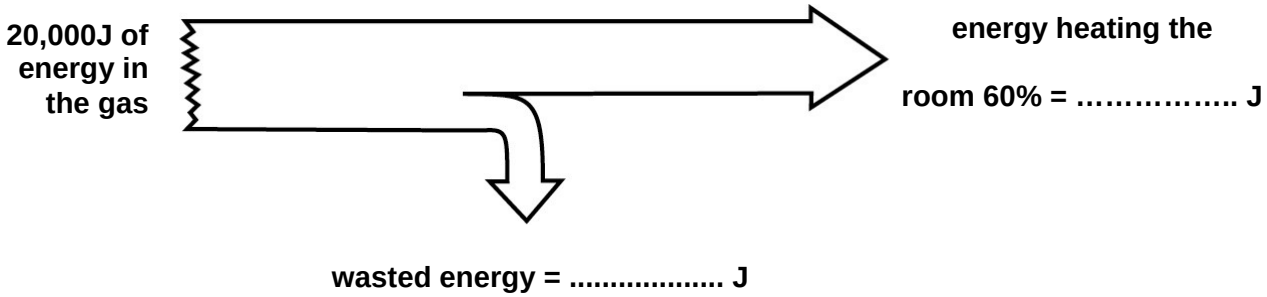
$$V_pI_p = V_sI_s$$

Answer **all** the questions.

Section A – Module P1

1 Asif has an old gas fire that heats the living room of his house.

(a) The diagram shows how much of the energy in the gas actually heats the room.



The total energy **input** is 20 000 J.

Complete the Sankey diagram.

[2]

(b) Asif changes his old gas fire for a new one because he thinks a more efficient fire will save him money.

Look at the data in the table about new gas fires.

model of gas fire	efficiency (%)	cost to buy gas fire in £	1 year saving on fuel costs compared to old gas fire in £
aspect	76	900	80
concept	74	600	70
firewell	70	750	50
moment	69	475	45
tinder	74	850	70

Asif plans to keep the new gas fire for **10 years**.

The salesman recommends that Asif buys the model with the highest efficiency.

Asif considers the payback time for each gas fire and the saving on fuel cost.

Which model of gas fire should Asif choose?

answer .....

Explain your answer.

.....

.....

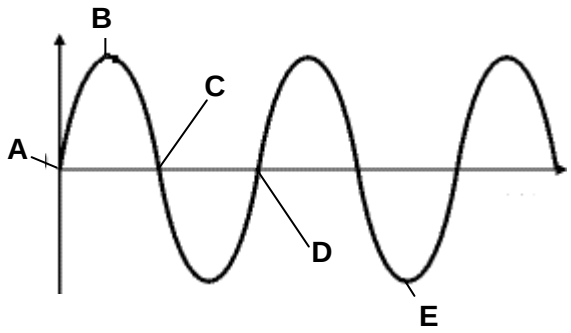
..... **[2]**

[Total: 4]

2 This question is about waves.

(a) A water wave is a transverse wave.

Look at the diagram of a transverse wave.



Use the letters on the diagram to identify the wavelength of this wave.

The **wavelength** is ..... **[1]**

(b) **(i)** The following measurements of some water waves on a lake were recorded.

4 waves pass a point in 2 seconds,

the wavelength = 1.25 m,

the depth of water is unknown.

Calculate the **speed** of this water wave.

.....

.....

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

(ii) The **speed** of water waves **varies with the depth** of the lake.

Look at the information in the table.

It shows the speed of waves as they cross the lake.

depth of water in m	speed of wave in m/s
1.8	3.2
0.9	2.7
0.3	1.7

Use your answer from question (b) to estimate the depth of water in which the measurements were made.

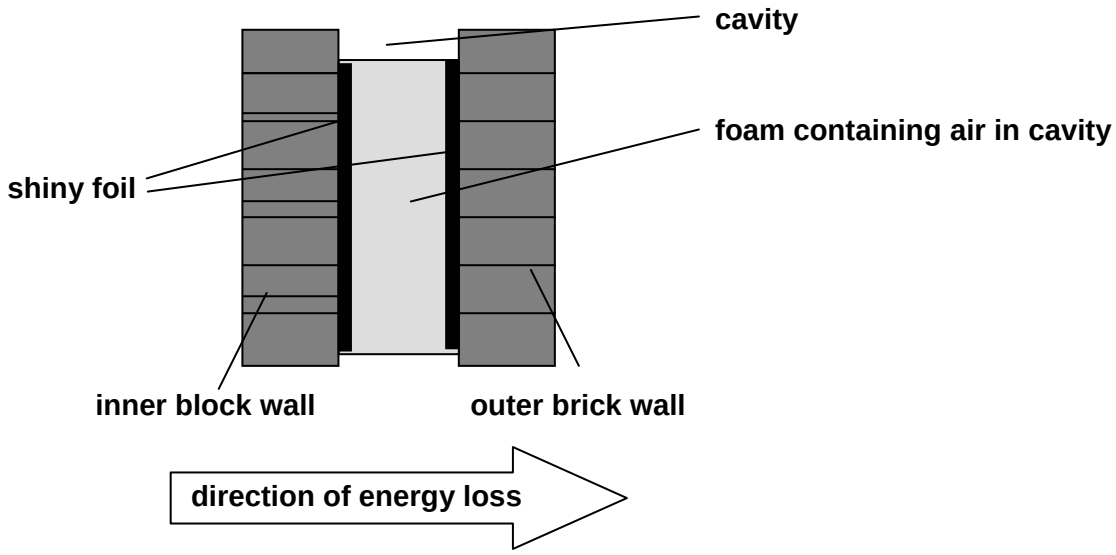
.....

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

[Total: 4]

3 Energy losses in the home can be reduced by energy saving measures.

One measure is to put foam covered with shiny foil as insulation in the cavity.



Describe how energy is lost through the wall from the inside to the outside **and** how the insulation reduces the different types of energy loss.

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

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

[Total: 6]

4 This question is about radiation from the Sun.

Radiation is harmful.

One of the harmful effects of radiation is increased risk of cataracts.

Write about **one other** harmful effect of radiation from the Sun and **different** ways to reduce the risk of damage.

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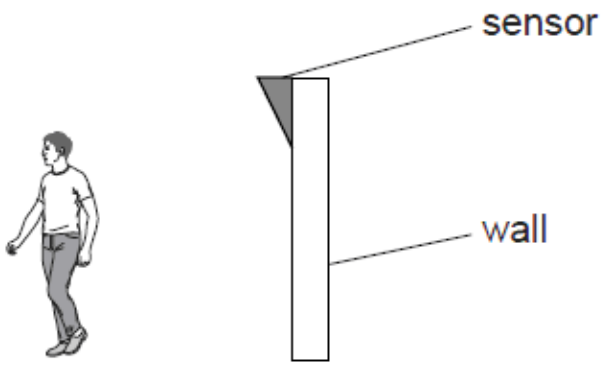
..... **[3]**

[Total: 3]

5 This question is about using waves and signals.

(a) Infrared sensors are used in burglar alarms.

Look at the diagram.



Why does this sensor detect a burglar but not a curtain moving in the wind?

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.....

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

(b) **(i)** Look at the digital signal.

Write the code for this signal in the boxes below.

[1]

(ii) Here is another signal.

How can you tell this is not a digital signal?

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

(c) Many years ago it was difficult to send messages long distances.

A runner had to carry a written message.

Technology has developed so that light can be used to send messages.

One example of such technology is optical fibres.

Describe one advantage and one disadvantage of using light to send messages.

.....

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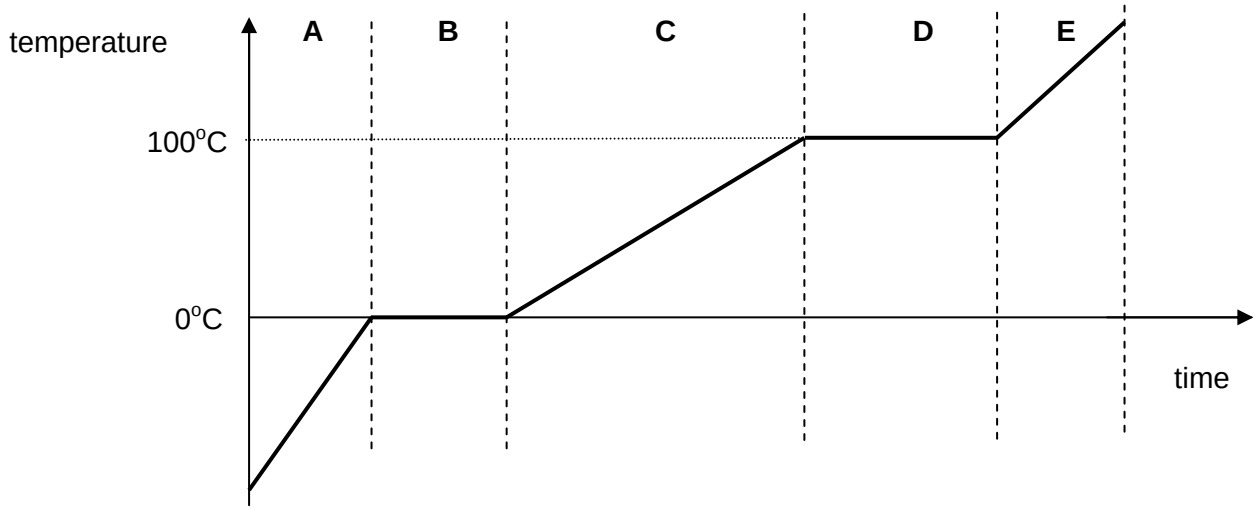
..... **[2]**

[Total: 6]

6 This question is about heating a solid.

The solid is warmed.

Look at the graph.



(a) Why does the temperature remain constant in part **B** of the graph?

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

(b) Explain why the temperature goes up in part **E** after staying constant in part **D**.

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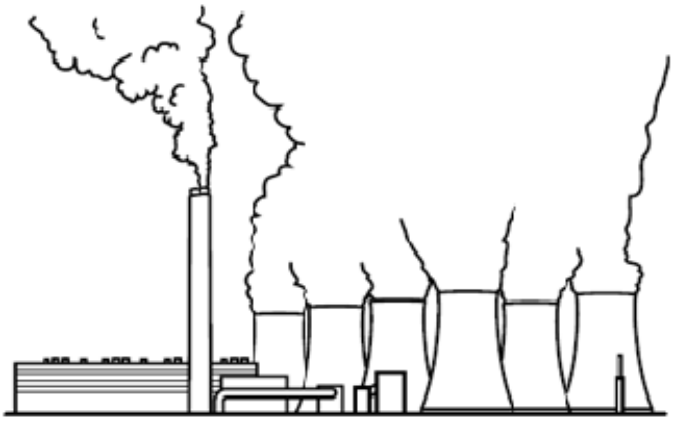
..... **[1]**

[Total: 2]

Section B – Module P2

7 Electricity is produced by power stations.



(a) Describe the distribution of mains electricity.

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

(b) The **total input** for a power station is 6MW of power from the fuel.

The **useful output** is 2MW of electrical power.

Calculate the efficiency of the power station.

.....

.....

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

(c) Look at the table. It gives information about the efficiency of different power stations.

type of power station	**efficiency (the longer the bar the more efficient)**
hydroelectric	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
tidal power	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
nuclear fission	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
wind turbine	IIIIIIIIIIIIIIIIIIIIIIIIII
geothermal	IIIIIIIIIIII
oceanic thermal conversion	III

(i) What can be concluded about tidal power stations from this table?

....

.... **[1]**

(ii) How could the presentation of this data be improved?

.... **[1]**

[Total: 6]

8 Distant galaxies can be observed from Earth using telescopes.

Mary is an astronomer.

She makes some observations of a distant galaxy. She finds it contains millions of stars.

She has found a dark region in the middle of several stars.

Mary makes a hypothesis that there must be a black hole in this darker region.

Other astronomers are not sure she is right.

What should Mary do to increase confidence in her hypothesis?

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

[Total: 3]

9 Photocells can make use of energy from the Sun.

Look at the picture of a panel of photocells.

Joshua works as a park keeper in a very remote area.

He is keen to use photocells for all of the energy needs of the park.

Discuss if this is a good idea or not.

In your answer suggest arguments for **and** arguments against using only photocells in the park.

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

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

[Total: 6]

10 This question is about using electrical appliances.

Look at the information about some electrical appliances.

appliance	power rating in kilowatts	time used each week in hours
CD player	0.01	5
computer	0.18	10
dishwasher	1.20	2
garage door opener	0.35	0
popcorn maker	0.25	1
satellite dish	0.01	168
vacuum cleaner	0.60	1
washing machine	0.50	8
iron		4

(a) The iron is connected to the 230 V mains.

3.5 A flows through the circuit.

Calculate the power rating of the iron in kilowatts.

Copy your answer into the table.

.....

.....

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

(b) Alan needs to save some money on his electricity bills.

Use the information in the table to identify which appliance **costs the most** to run each week **and** explain why.

.....

.....

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

(c) Alan prepares for a power cut. He supplies his family with battery-powered torches.

(i) Name the type of current supplied by a battery.

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

(ii) Write down **one difference** between the power supplied by a battery and the power supplied by the National Grid.

.....

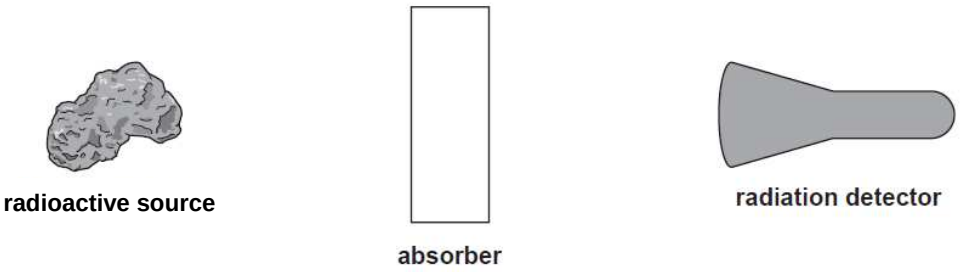
..... **[1]**

[Total: 6]

11 This question is about radioactivity.

Claire investigates the relative penetrating power of different types of radiation.

Here is a diagram of her apparatus.



(a) Claire is considering using nuclear radiation emitters as tracers **inside** the human body.

A radiation detector would detect the nuclear radiation outside the patient's body.

Look at the table.

type of emitter	typical range in air in cm	typical range in soft body tissue in cm
alpha	3.7	0.0005
beta	90	1.2
gamma	70000	100

Claire decided that alpha emitters should not be used as tracers in the human body.

Use the information in the table to suggest why.

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

(b) Claire uses radioactive materials for her investigation.

This can be dangerous.

What **precautions** should she take when handling radioactive materials?

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

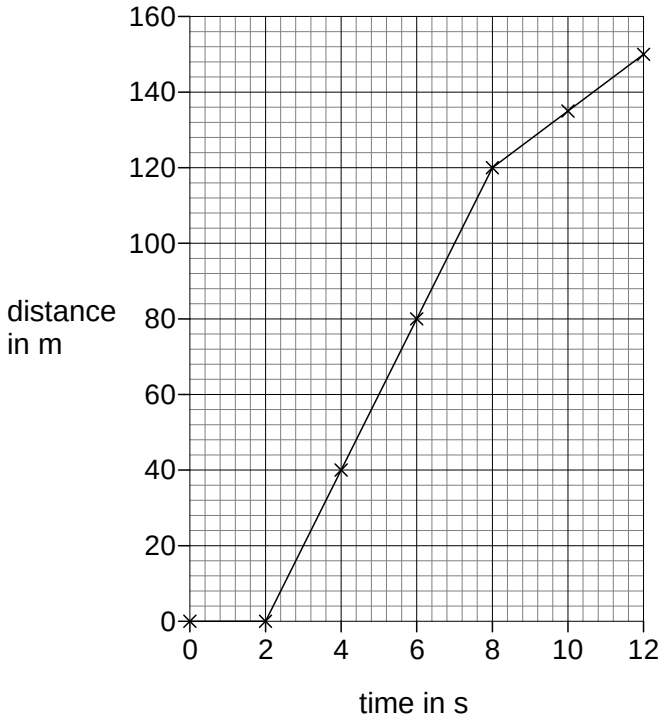
[Total: 4]

Section C – Module P3

12 This question is about motion and speed.

Brian drives 150m.

Look at the graph of Brian's journey.



(a) Describe what the graph shows about Brian's journey.

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.....

.....

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

(b) The speed limit is 13 m/s.

(i) An average speed camera took a photograph at 0 seconds and at 12 seconds.

Would the average speed camera have found Brian to be speeding? Use calculations to support your answer.

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.....

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

(ii) Did Brian break the speed limit at any point in his journey? Use evidence from the graph to support your answer.

.....

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

(c) Brian drove the same journey again at half the average speed.

How will this affect the time it takes for him to drive 150 m?

.....

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

[Total: 6]

13 (a) This question is about cars **accelerating**.

(i) Pat measures the speeds of two cars.

Both cars start from rest.

The diagram shows the speed changes of the cars after **3 seconds**.

car **A**

speed change of car A = 10 m/s

car **B**

speed change of car B = 15 m/s

Calculate the acceleration of **car A**.

.....

.....

.....

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

(ii) **Car B** has a greater acceleration.

Explain how you know this without calculating acceleration.

.....

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

(b) The driver of **car B** has to stop her car quickly.

The total distance the car travels before it stops is the **stopping distance**.

Name the two parts which make up the stopping distance and explain why it is important to know the stopping distance of a car.

.....

.....

.....

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

[Total: 5]

14 This question is about fuel consumption for a lorry.

(a) Look at the information about fuel consumption for this lorry in different driving conditions.

driving condition	windows of lorry	deflector fitted on lorry	fuel consumption in four tests in kilometres per litre	mean fuel consumption in kilometres per litre
A	closed	no	6.6, 6.8, 6.5, 6.5	6.6
B	closed	yes	7.6, 6.9, 7.0, 7.3	7.2
C	open	no	5.0, 6.0, 5.5, 5.9	5.6
D	open	yes	7.2, 7.0, 6.7, 6.7	

Calculate the **mean** fuel consumption for driving condition **D**.

Write your answer in the table.

.....

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

(b) Which driving condition gives the best fuel consumption?

Use the information in the table to explain why.

.....

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

(c) Car manufacturers are required to publish environmental and running cost data about the cars they manufacture. This is to help car buyers choose which car to buy.

car	fuel consumption in kilometres per litre	engine size (capacity) in cc	fuel costs in £ per 20 000 kilometres	CO_2 emissions in grams/kilometre	noise levels in dB
V	23.5	999	1103	122	73.0
W	20.4	1149	1273	138	72.4
X	18.2	1498	1428	158	72.0
Y	17.1	1598	1516	165	73.7
Z	16.7	1390	1559	172	70.0

Ronan and Anna want to buy a new car.

They want a car which provides the best balance between economic and environmental impact.

Ronan says 'We should buy car **Z**, because this car has the lowest fuel consumption and is the quietest model'. Anna realises that Ronan is wrong.

Use the data in the table to explain why Ronan is wrong. Which car should Anna and Ronan choose? Give the reasons for your choice.

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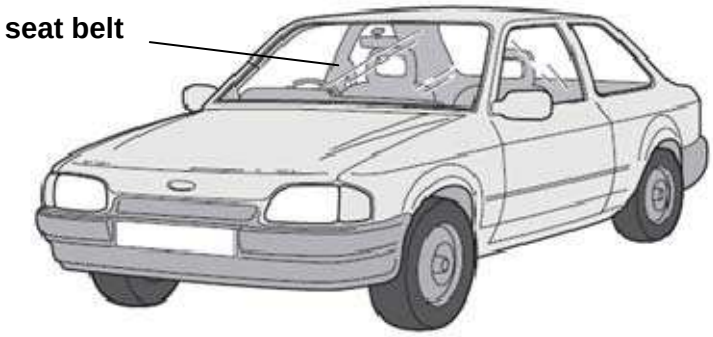
..... **[3]**

[Total: 5]

15 This question is about car safety.

Modern cars have **many** safety features.

Look at the diagram.



Some safety features **prevent** accidents and some **protect** the driver.

Seat belts are an important safety feature.

Explain how they work and why they have to be replaced after a crash.

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

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

[Total: 6]

16 Britney is a skydiver.

She jumps out of a plane.

(a) After 10 seconds, Britney is falling at a steady speed.

What is the name of this steady speed?

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

(b) Explain how Britney reaches this steady speed.

.....

.....

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

[Total: 3]

Paper Total [75]

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