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**GCSE (9–1) Combined Science (Physics)****A (Gateway Science)****J250/12 Paper 12 (Higher Tier)**

## Sample Question Paper

**H****Date – Morning/Afternoon**

Time allowed: 1 hour 10 minutes

**You must have:**

- the Data Sheet

**You may use:**

- a scientific or graphical calculator
- a ruler



First name

Last name

Centre  
numberCandidate  
number**INSTRUCTIONS**

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**INFORMATION**

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [ ].
- Quality of extended responses will be assessed in questions marked with an asterisk (\*).
- This document consists of **20** pages.

## SECTION A

You should spend a maximum of 20 minutes on this section.

Answer **all** the questions.

- 1 A boy kicks a football.



The football has a mass of 400 g.

What is the potential energy of the football when it is 0.8 m above the ground?

Use the constant: gravitational field strength ( $g$ ) = 10 N/kg

- A 0.032 J
- B 3.2 J
- C 320 J
- D 3 200 J

Your answer

[1]

- 2 The National Grid transfers energy efficiently using high voltages.

Why are high voltages more efficient?

- A Increasing the voltage increases the current, which heats the wires less.
- B Increasing the voltage decreases the current, which heats the wires more.
- C Increasing the voltage increases the current, which heats the wires more.
- D Increasing the voltage decreases the current, which heats the wires less.

Your answer

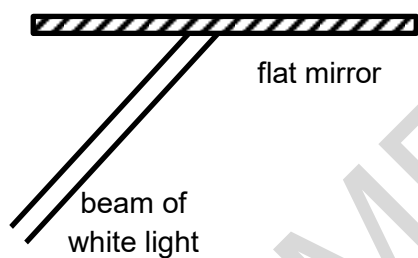
[1]

- 3 Which factors affect braking distance but **not** thinking distance?
- A Drinking alcohol and a car full of people.
- B Speed and drinking alcohol.
- C Speed and wet road conditions.
- D Wet road conditions and a car full of people.

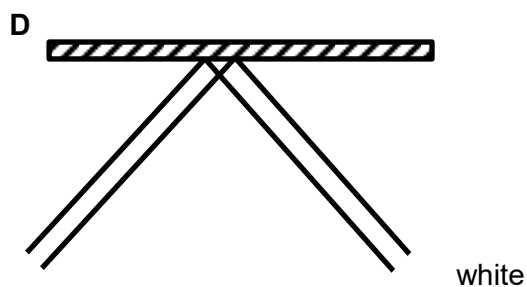
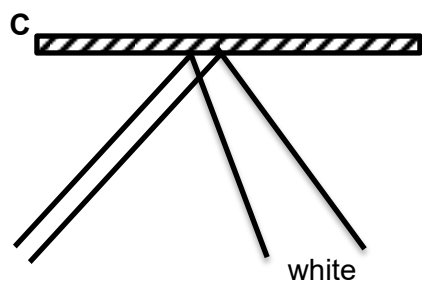
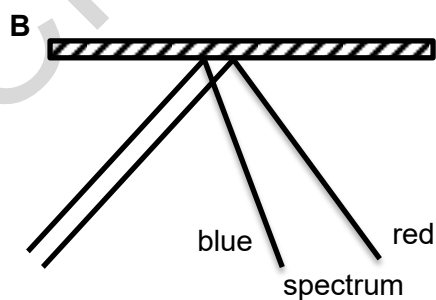
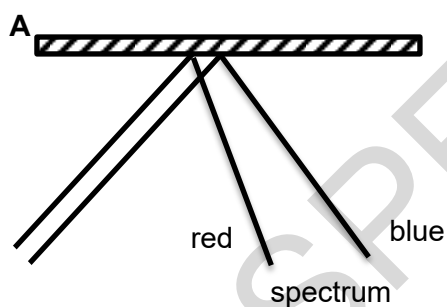
Your answer

[1]

- 4 A parallel beam of white light is reflected from a flat mirror.



Which diagram shows the beam reflected correctly?



Your answer

[1]

- 5 Which row gives the features of the domestic electricity supply in the UK?

	Direct current	Frequency (Hz)	Voltage (V)
<b>A</b>	no	50	230
<b>B</b>	no	230	50
<b>C</b>	yes	50	230
<b>D</b>	yes	230	50

Your answer

[1]

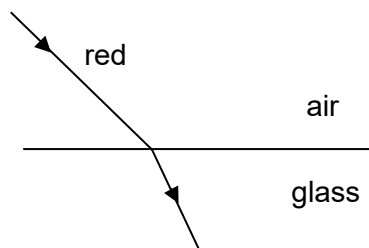
- 6 Which row would increase the efficiency of a machine?

	Decreased energy input without changing the energy output	Increased energy losses due to friction	Increased work output without changing the work input
<b>A</b>	no	yes	yes
<b>B</b>	no	yes	no
<b>C</b>	yes	no	no
<b>D</b>	yes	no	yes

Your answer

[1]

- 7 Red light refracts when it enters glass from air.



The red light is replaced by blue light.

Which statement is correct about the refraction of **blue** light?

- A It refracts less than red because its speed in glass is greater than that of red light.
- B It refracts less than red because its speed in glass is less than that of red light.
- C It refracts more than red because its speed in glass is greater than that of red light.
- D It refracts more than red because its speed in glass is less than that of red light.

Your answer

[1]

- 8 The most abundant form of radium is radium-226.

Its nuclear mass is 226 and its nucleus contains 138 neutrons.

Which of the following is an **isotope** of radium?

- A nuclear mass 226; 137 neutrons
- B nuclear mass 226; 139 neutrons
- C nuclear mass 227; 138 neutrons
- D nuclear mass 227; 139 neutrons

Your answer

[1]

- 9 10.0 J of work is done lifting a ball a distance of 1.8 metres.

How much force was used to lift the ball?

- A 0.18 N
- B 18 N
- C 5.6 N
- D 8.2 N

Your answer

[1]

- 10 A kettle full of water takes 3 minutes to boil.

It has a power output of 2kW.

How much energy does it transfer?

- A 360 000 J
- B 36 000 J
- C 6 000 J
- D 600 J

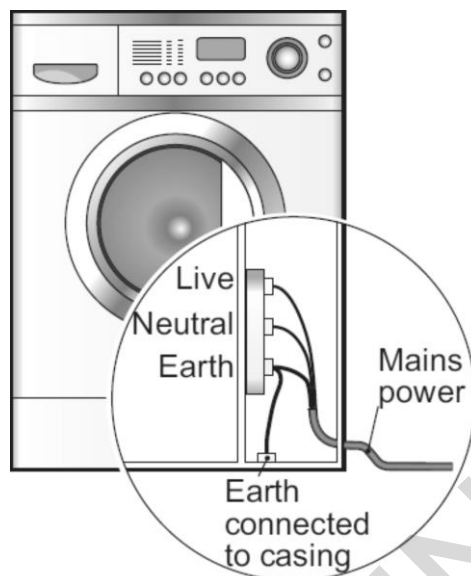
Your answer

[1]



- (b) Washing machines have an outer casing made of metal.

The picture shows the earth wire connected to the outer casing.



The live wire becomes loose and touches the outer casing.

- (i) Explain why this does **not** give you an electric shock.

.....

.....

.....

[3]

- (ii) The earth wire is thicker than the live wire and neutral wire.  
Suggest why the earth wire is thicker.

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[1]



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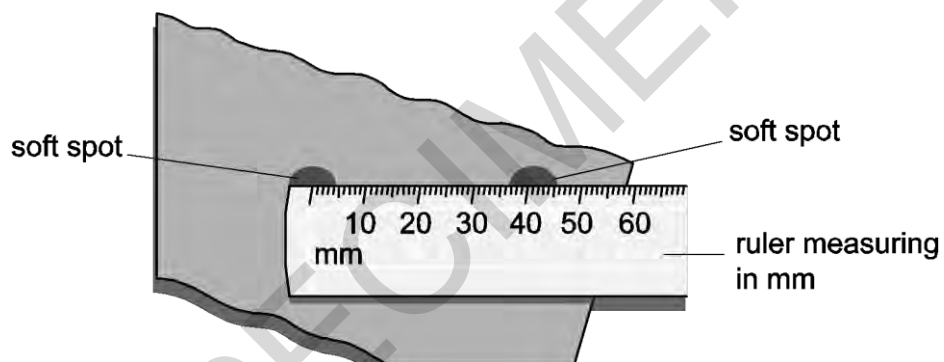
SPECIMEN

12 (a) State the **two** changes to an electromagnetic wave when it travels from a medium of low density to high density.

.....  
.....

[2]

(b) The wavelength of microwaves can be measured using chocolate.  
The turntable is taken out of the microwave and the chocolate is put in the microwave.  
The chocolate is left on full power for 10 seconds.  
The picture shows the closest two soft spots in the chocolate.



Here is the position of the soft spots on a wave diagram.



What is the wavelength of this microwave **in metres**?

.....  
.....

answer ..... m

[2]

(c) The frequency of the microwave is 2 450 MHz.

Calculate the speed of this microwave.

Use the wavelength you measured from part (b).

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**answer** ..... m/s

**[3]**

(d) The speed of all electromagnetic waves in air is approximately  $3 \times 10^8$  m/s.

How far apart should the spots have been?

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

**answer** ..... m

**[3]**

(e) The investigation is repeated with bread dough.

Why is the wavelength measured of the microwave different than in chocolate?

.....  
.....

**[1]**

13 Some nuclei are radioactive because they are unstable.

(a) The terms half-life and random decay are used when describing radioactivity.

(i) Explain the concept of half-life.

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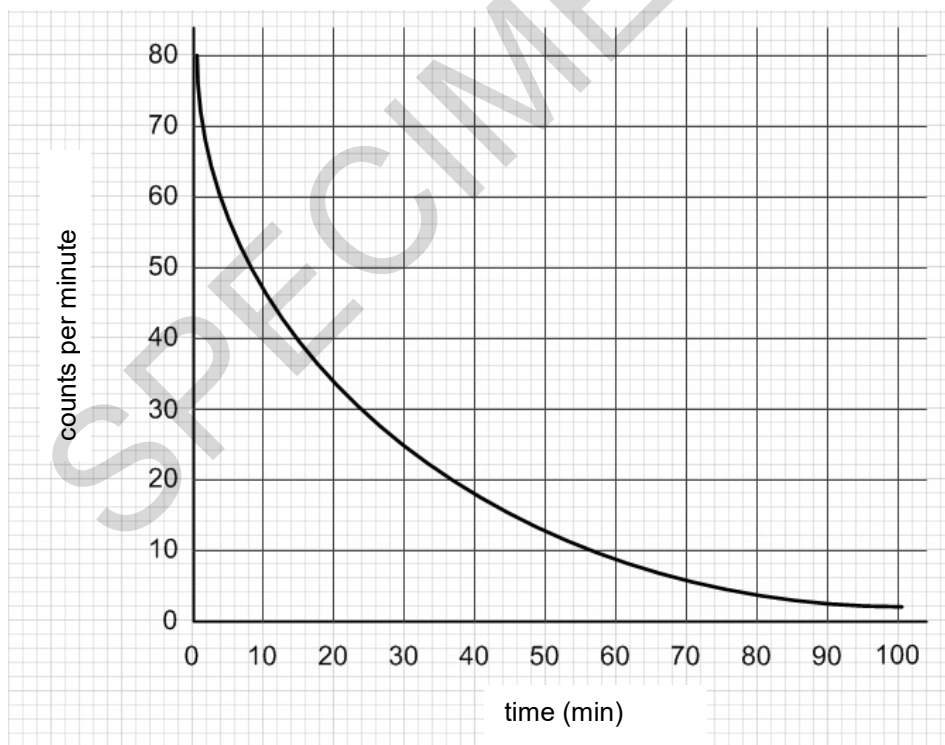
[2]

(ii) Why is radioactive decay described as random?

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[1]

(b) A student collects information about the half-life of francium-223.



(i) Calculate the half-life of francium.

.....

answer ..... minutes

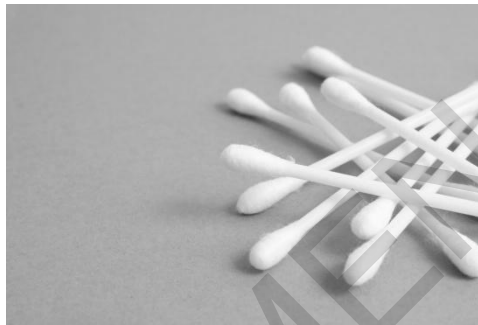
[1]

- (ii) Calculate the net decline, expressed as a ratio, during radioactive emission after 3 half- lives.

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.....

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

- (c) These cotton wool buds that have been treated with gamma rays.



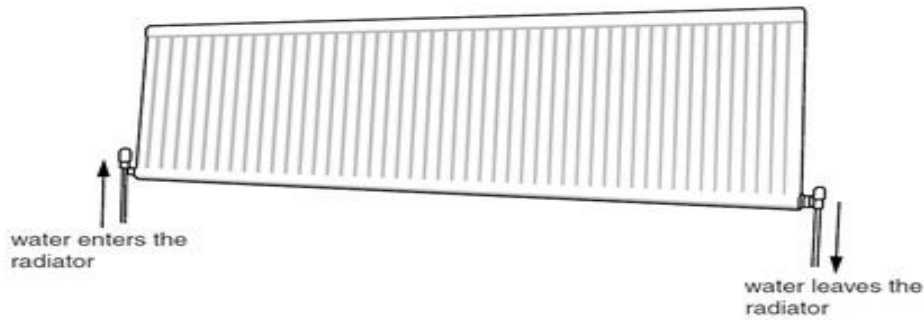
The cotton wool buds have been **irradiated** but not **contaminated**.

Describe the difference between irradiated and contaminated.

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.....  
.....

**[2]**

14 The picture shows a radiator in one room of a house.



The radiator is full of water.

(a) Describe the energy transfers that are taking place.

Assume no energy is lost from the room.

.....  
.....

[2]

(b) There is a temperature change of  $3\text{ }^{\circ}\text{C}$  in the room.

This is caused by the radiator giving out  $18\,900\text{ J}$  of energy each second.

The specific heat capacity of water is  $4200\text{ J /kg}^{\circ}\text{C}$ .

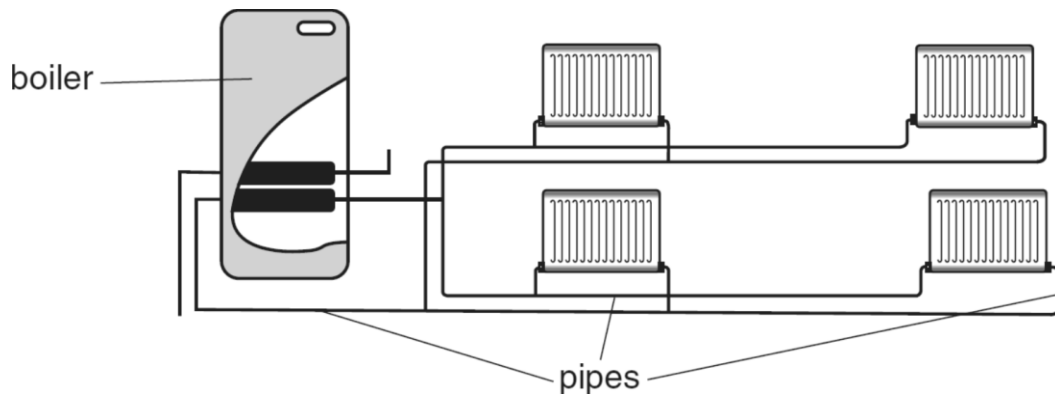
Calculate the mass of water flowing through the radiator to cause it to give out  $18\,900\text{ J}$  of energy each second.

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

answer ..... kg

[2]

(c) The picture shows the radiators in the house connected by pipes to the boiler.



The main boiler can be replaced to improve efficiency.

Describe **three** different ways the efficiency of the **pipe** system can be improved.

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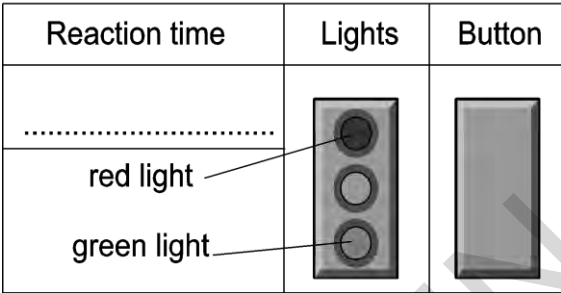
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[3]

SPECIMEN

- 15** The stopping distance of a car is important for road safety.  
 One factor that affects stopping distance is reaction time.  
 The instructions below are for a reaction time test.

**Instructions**  
 Press button to start.  
 Wait for red light to go off and green light to go on. When green light is on press the button again.



- (a) (i)** Use the experiment above to write a method to compare the reaction time with different distractions.

In your method describe the variables you have controlled and how you made the test precise.

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.....

**[4]**



- (ii) The table shows six of the results collected.

Reaction time (s)
0.60
0.97
0.88
0.67
0.99
0.71

Select the **three** reaction times from the table when there were **no** distractions and calculate the mean of these.

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answer ..... s

[1]

- (iii) State why it is important that the driver of a car is not distracted?

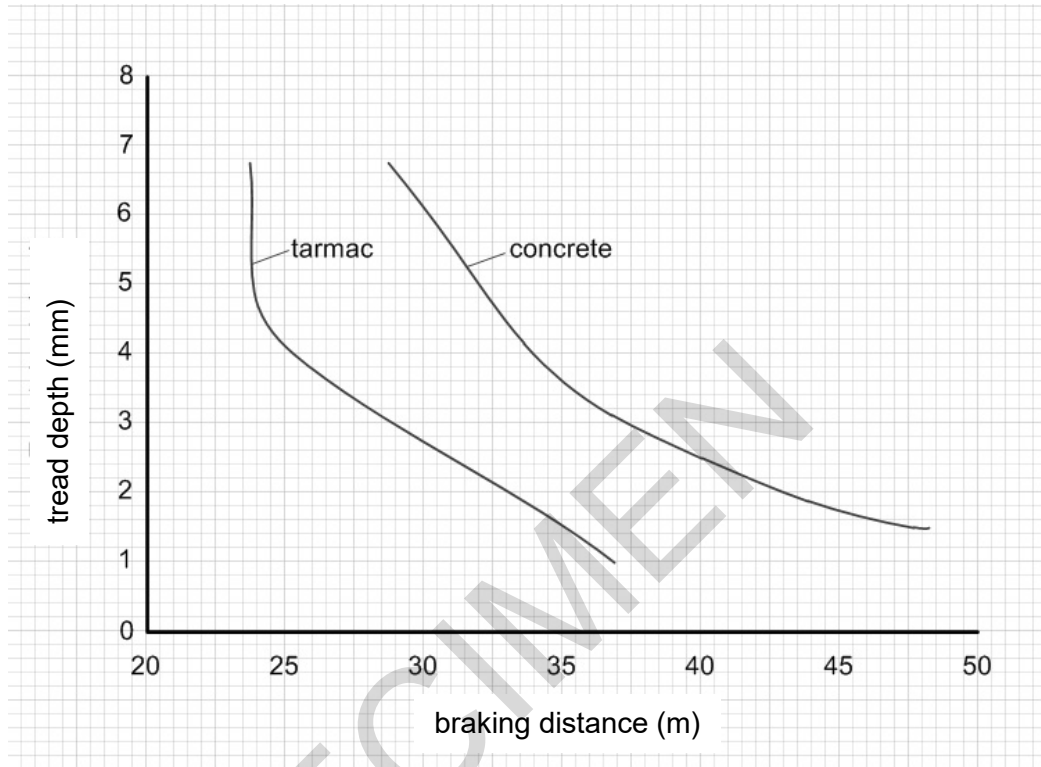
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[1]

(b) Another factor that affects stopping distance is braking distance.

The graph shows braking distances for tyres of different tread depths on concrete and tarmac.

The car is always travelling at the same speed.



The legal minimum tyre tread depth is 1.6 mm.

What conclusions can you make from the graph about the tread depth on different surfaces affects the braking distance?

Use data from the graph in your answer.

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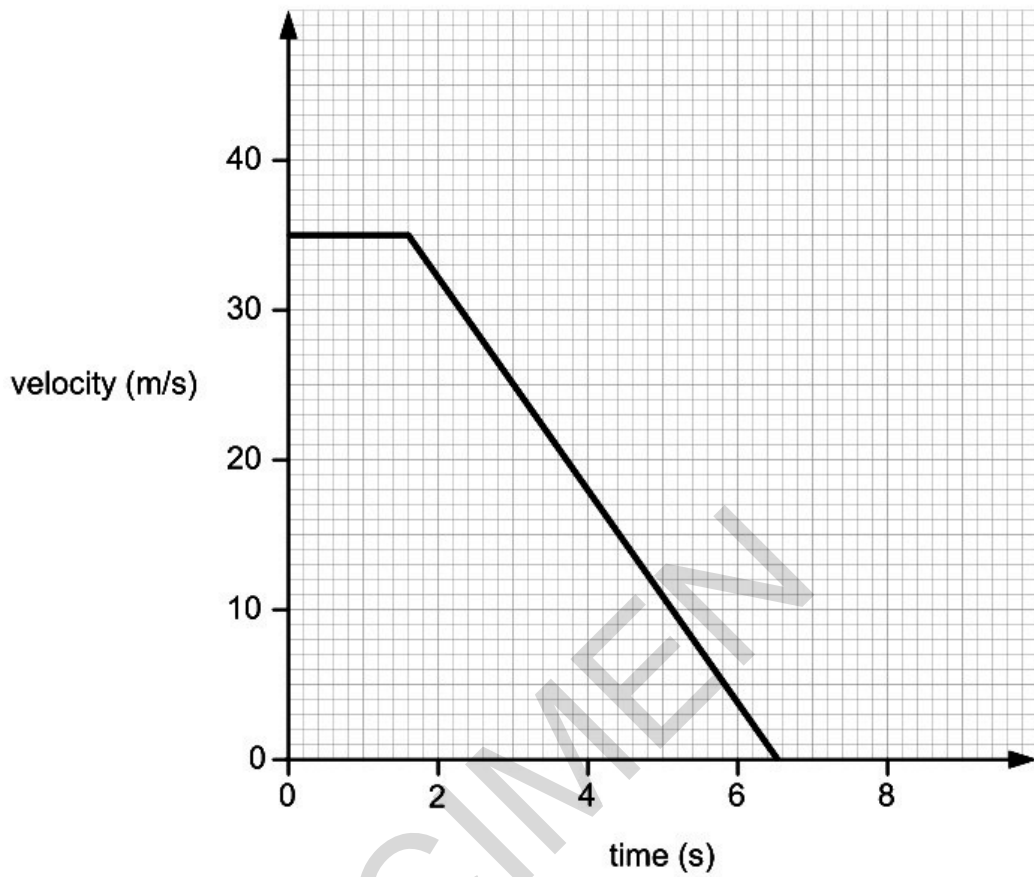
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[4]

(c) The graph below shows the motion of a car before it comes to rest.



(i) Shade the section which shows the braking distance. [1]

(ii) Use the graph to calculate the stopping distance of the car.  
Show your working.

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.....

answer ..... m [3]

**END OF QUESTION PAPER**

SPECIMEN

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