

**Wednesday 30 May 2012 – Afternoon**

**GCSE GATEWAY SCIENCE  
ADDITIONAL SCIENCE B**

**B721/01** Additional Science modules B3, C3, P3 (Foundation Tier)

Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**Duration:** 1 hour 15 minutes

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**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 Periodic Table can be found on the back page.
- 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 **28** pages. Any blank pages are indicated.

**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

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

momentum = mass × velocity

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

GPE = mgh

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

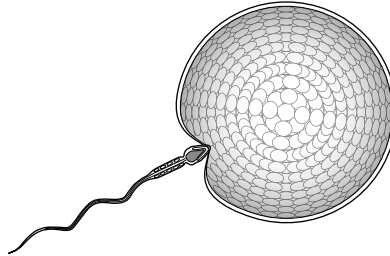
$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

Answer **all** the questions.

**Section A – Module B3**

1 Look at the picture.

It shows a sperm cell entering an egg cell.



(a) Write down the word used to describe the **joining** of an egg and a sperm cell.

Choose from this list.

**cloning**

**differentiation**

**fertilisation**

**replication**

answer ..... [1]

(b) Cell division takes place after the sperm joins with the egg.

Cell division is needed so that a new individual can grow.

Write down **other** uses of this type of cell division.

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

(c) The joining of the egg and the sperm cell is part of sexual reproduction.

Mint plants can make new individuals **without** sexual reproduction.



Look at the picture of mint.

Explain how it shows a mint plant reproducing without sexual reproduction.

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

**[Total: 5]**

**Turn over**

2 Arjun investigates his pulse rate.

He counts his pulse at rest.

He then runs for 3 minutes and counts his pulse again.

Arjun then repeats his experiment but changes the type of exercise.

The table shows Arjun's results.

type of exercise	pulse rate in beats per minute	change in pulse rate in beats per minute
rest	73	–
running	107	34
sit ups	111	38
star jumps	125	52
step ups	123	

(a) Arjun calculates his change in pulse rate after each exercise.

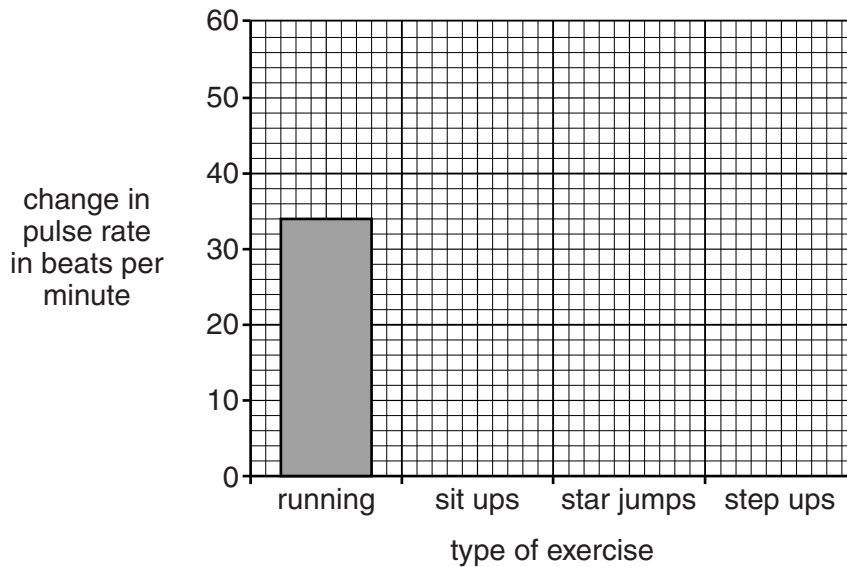
Calculate the change in pulse rate for **step ups**.

answer ..... beats per minute

[1]

(b) Finish the bar chart to show **change** in pulse rate.

[2]



(c) Arjun thinks that his body uses the **most** energy when he is doing star jumps.

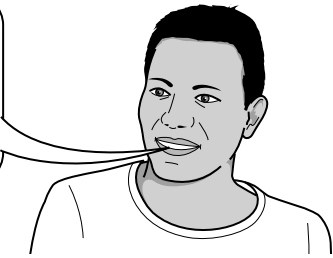
How does the data support this?

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

(d) Arjun explains his results.

Read his conclusion.

My pulse rate goes up when I exercise.  
This is because my muscles need more carbon dioxide.  
My muscle cells need to carry out respiration faster than normal.



Arjun has made a mistake in his conclusion.

(i) Write down the sentence that has the mistake.

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

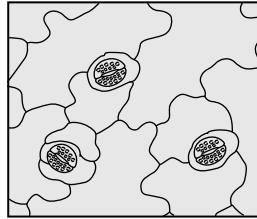
(ii) Write down what Arjun should have said to make the sentence correct.

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

[Total: 6]

3 Sara finds a photograph of some cells from the lower surface (epidermis) of a leaf.

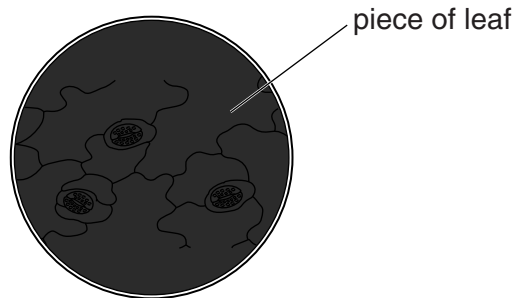
A microscope was used to photograph the cells.



(a) Sara decides to use a microscope to look at some leaf cells.

She cuts a small piece of leaf and puts it onto a microscope slide.

She puts it under the microscope but even with the light on, all she sees is a dark area.



Suggest where Sara went wrong.

.....

.....

.....

..... [3]

(b) Sara then looks at a microscope slide of blood.

Look at the names of parts of the blood.

Draw a straight line from each **part of the blood** to its **job**.

<b>part of the blood</b>	<b>job</b>
platelet	clot blood
white blood cell	transport oxygen
red blood cell	defend against disease

[2]

[Total: 5]





(b) Scientists have found that some wild potato plants are resistant to a disease called blight.

Scientists want to stop crop potatoes from getting blight.

(i) Scientists can use **genetic engineering** to change the crop potatoes so they will be resistant to blight.

Describe how.

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

(ii) Some people are concerned that there may be harmful side effects.

Suggest **one** harmful side effect of changing the crop potato plant by genetic engineering.

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

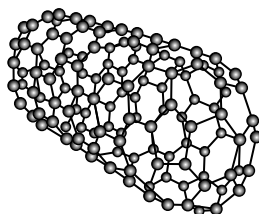
[Total: 9]

## Section B – Module C3

5 Carbon can exist in different solid forms.

One form of carbon is Buckminster fullerene.

Fullerenes can be joined together to make **nanotubes**.



Complete the sentences.

Choose words from this list.

**black**

**insulators**

**semiconductors**

**shiny**

**strong**

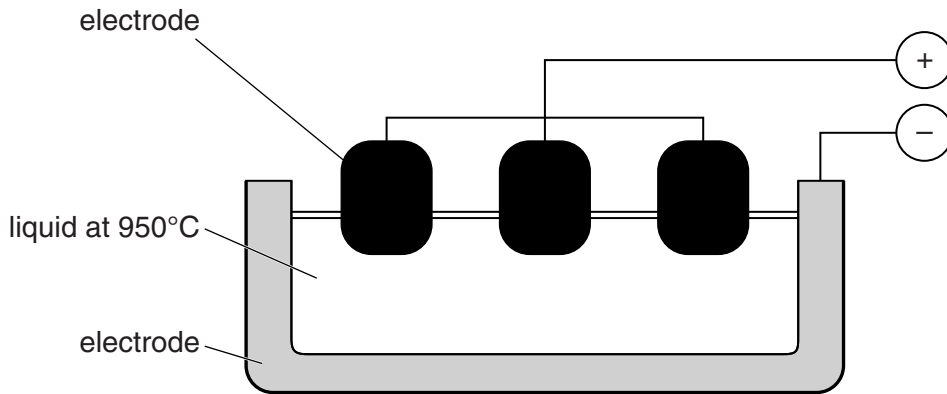
(a) Nanotubes are used to make electrical circuits because they are ..... [1]

(b) Nanotubes are used to make tennis racquets because they are ..... [1]

**[Total: 2]**

6 Different materials can be used as electrodes.

The diagram shows the electrolysis of a liquid.



Look at the properties of some materials.

material	melting point in °C	electrical conductivity	hardness
<b>A</b>	1550	does not conduct	high
<b>B</b>	3652	very good	medium
<b>C</b>	327	good	low

Choose the best material for making the electrodes.

Explain your answer using the data in the table.

.....

.....

..... [2]

[Total: 2]

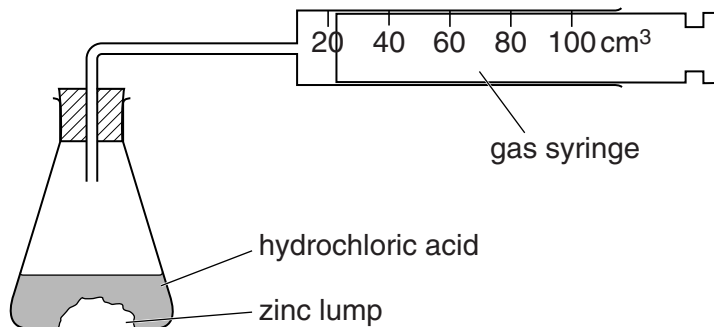


8 Christina investigates the reaction between zinc and hydrochloric acid.

Zinc chloride and hydrogen are made.

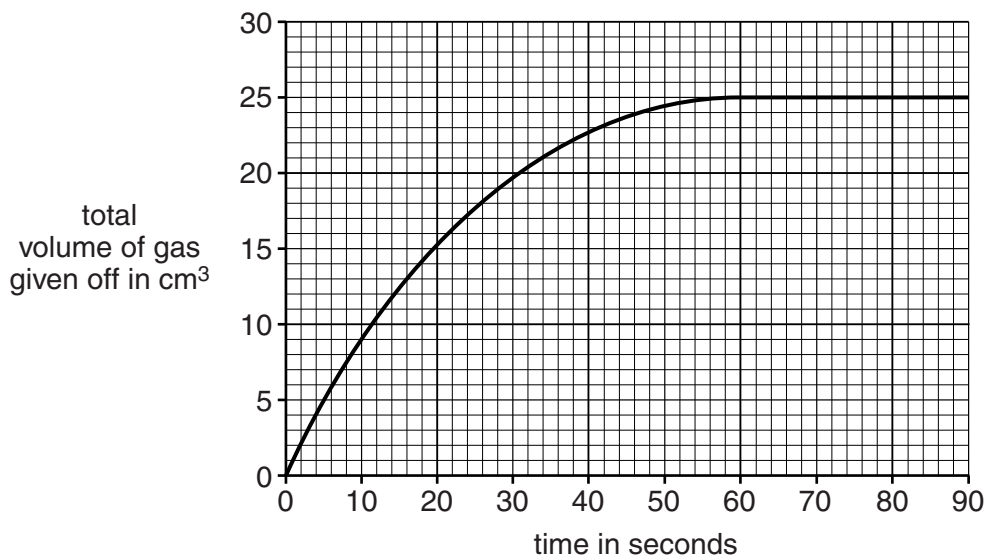
(a) Look at the diagram.

It shows the apparatus she uses.



Christina measures the volume of gas in the syringe every 10 seconds.

Look at the graph. It shows her results.



(i) Write down the total volume of hydrogen gas she collects after 20 seconds.

answer ..... cm<sup>3</sup> [1]

(ii) What happens to the rate of reaction between 0 and 90 seconds?

How can you tell this from the graph?

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

(b) Christina repeats the experiment.

She wants to make the reaction go **faster**.

She uses the same amount of zinc.

She finds out that using a catalyst can make this reaction go faster.

Write about **other** ways Christina can make this reaction go faster.

.....

.....

..... [2]

(c) An explosion is an example of a chemical reaction.

What is an explosion?

Put a tick (✓) in the box next to the best description.

A slow reaction producing a small volume of gas.

A slow reaction producing a large volume of gas.

A fast reaction producing a small volume of gas.

A fast reaction producing a large volume of gas.

[1]

[Total: 6]

9 This question is about the action of heat on zinc carbonate.

(a) Calculate the **relative formula mass**,  $M_r$ , of zinc carbonate,  $ZnCO_3$ .

The relative atomic masses,  $A_r$ , of Zn = 65, C = 12 and O = 16.

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

(b) Zinc carbonate,  $ZnCO_3$ , decomposes when heated.

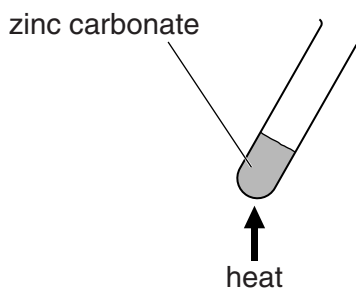
Zinc oxide,  $ZnO$ , and carbon dioxide,  $CO_2$ , are made.

(i) Write the **balanced symbol** equation for this reaction.

..... [1]

(ii) Michael investigates this reaction.

Look at the apparatus he uses.



Look at his results.

mass of zinc carbonate heated in g	mass of zinc oxide formed in g
1.25	0.81
2.50	1.62
3.75	2.43
5.00	.....

Calculate the mass of **carbon dioxide** gas Michael makes from 3.75 g of zinc carbonate.

answer ..... g [1]

(iii) In another experiment, Michael heats 5.00 g of zinc carbonate.

Calculate the mass of **zinc oxide** he makes.

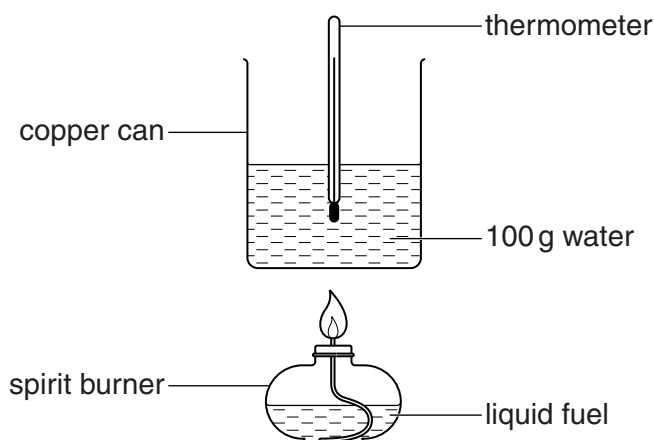
answer ..... g [1]

[Total: 4]

10 Sahid investigates three fuels. He wants to find out which fuel gives out the most energy.

The diagram shows the apparatus he uses each time.

Sahid burns 2 g of fuel in each experiment.



Look at the table.

It shows the results for the three fuels Sahid uses.

fuel	starting temperature of water in °C	final temperature of water in °C	energy transferred in J
A			9088
B	20	38	
C			9920

(a) Calculate the amount of heat energy transferred to the water by fuel B.

Use the formula:

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

The specific heat capacity of water is 4.2 J/g °C.

.....

.....

.....

answer ..... J [2]

(b) Which fuel, A, B, or C, gives the biggest temperature change when heating the water?

Explain your answer.

.....

..... [1]

[Total: 3]

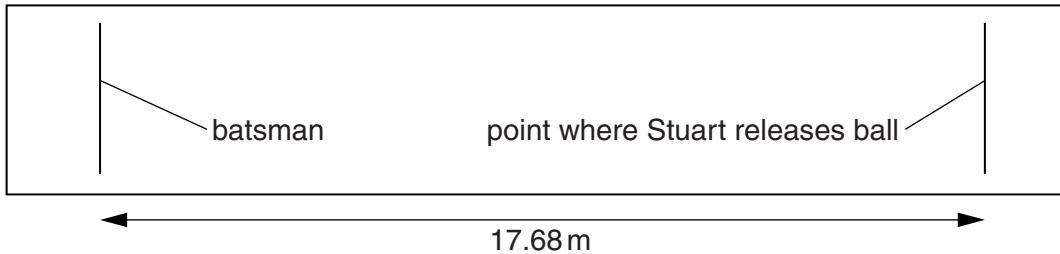


Section C – Module P3

11 Stuart is a keen cricketer.

In a match he bowls the ball six times (six **deliveries**).

For each delivery the ball was timed from when Stuart **releases** it until it reached the **batsman**.



(a) The time for the first delivery was 0.55 seconds.

Calculate the average speed for this delivery.

.....

.....

.....

.....

answer ..... m/s

[2]

(b) The table shows the average speed of the next 5 deliveries.

delivery	average speed in metres per second
1st	
2nd	29.2
3rd	30.3
4th	31.7
5th	28.5
6th	30.9

Compare the average speed of the first delivery to the other five and suggest how this speed could have happened.

.....

.....

.....

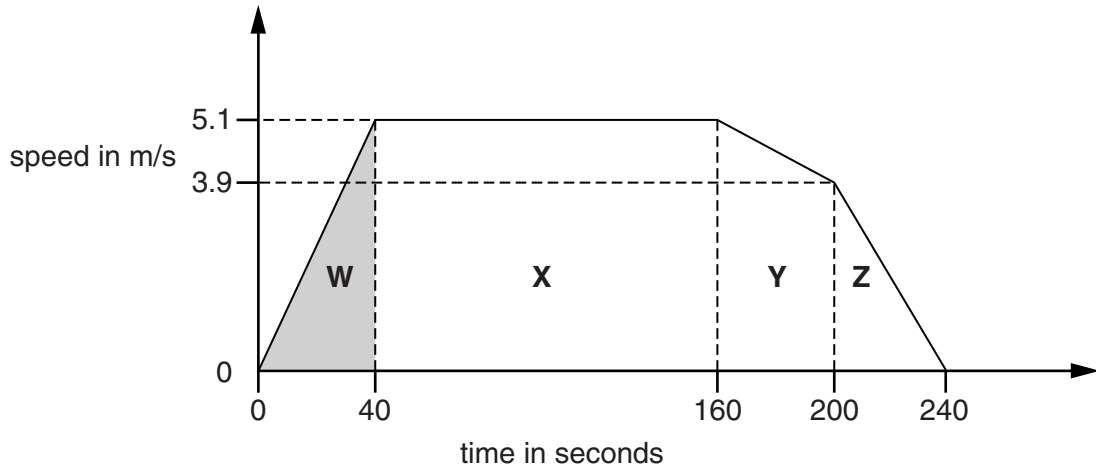
.....

[2]

[Total: 4]  
Turn over

12 Jessica is an athlete. She does a run in training.

The graph shows Jessica's speed during the run.



(a) Calculate the acceleration in section **W** of the graph.

Give your answer to **two** decimal places and include the **units** of acceleration.

.....

.....

.....

answer ..... units of acceleration = ..... [3]

(b) There are three other parts of Jessica's run shown in the graph.

Describe Jessica's acceleration for the rest of the run. Explain how the shape of each section of the graph shows this.

.....

.....

.....

.....

..... [3]

[Total: 6]

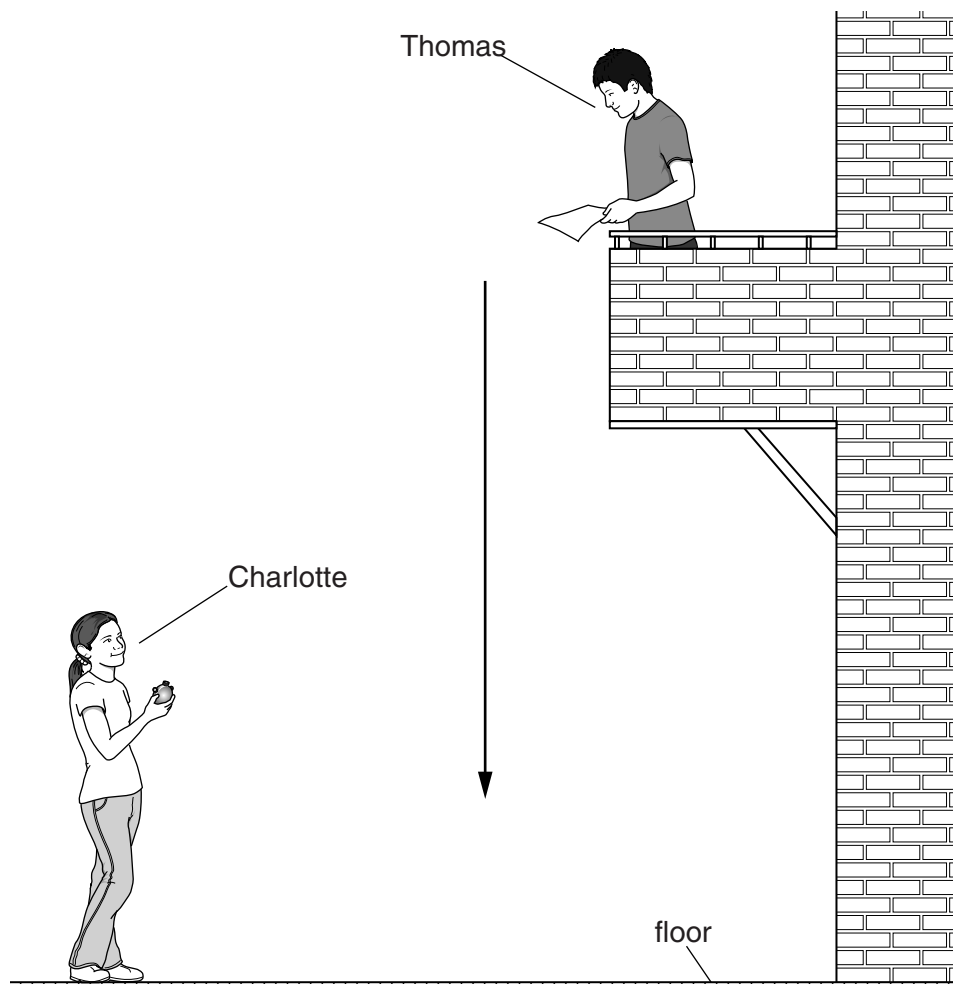


14 Thomas and Charlotte are investigating falling objects.

Thomas drops a piece of paper from a balcony in the school hall.




He drops the paper three times from the same height.

Charlotte measures the time it takes to fall to the floor.

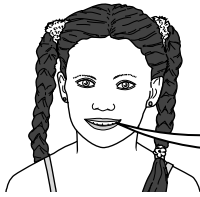


Each sheet reaches a terminal speed as it falls.

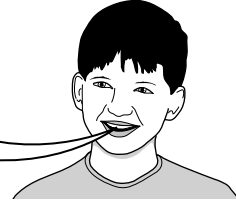
Look at Thomas and Charlotte's results.

shape	shape of paper that was dropped	description	time to fall in seconds
A		paper sheet dropped with large surface facing down	6.4
B		same sheet of paper folded in half dropped with large surface facing down	3.1
C		same sheet of paper now crushed into a ball shape and dropped	1.6

Look at the statements made by five of Thomas and Charlotte's classmates.



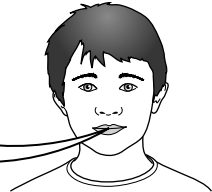
**Beth**  
Shapes **A**, **B** and **C**  
have the same air  
resistance.



**Matthew**  
Shape **A** has the most  
drag so takes the  
most time to fall.



**Miriam**  
Shape **A** falls at the  
lowest terminal speed  
because of the large  
surface area.



**James**  
Shape **C** falls in the  
shortest time as it has  
a greater mass.



**Rizwan**  
Shape **C** falls in the  
shortest time because  
it has more GPE at  
the start.

Which **two** classmates make correct statements?

answer ..... and ..... [2]

[Total: 2]

15 This question is about cars, speed and road safety.

Look at the table showing thinking distance and braking distance for a vehicle travelling at different speeds.

speed in km/h	thinking distance in m	braking distance in m
20	4	2.5
40	8	10.0
60	12	22.5
80	16	40.0
100	20	62.5

(a) (i) Calculate the **stopping distance** for a speed of 40 km/h and 80 km/h.

40 km/h stopping distance ..... m

80 km/h stopping distance ..... m

[1]

(ii) Explain how stopping distance and speed are important in terms of road safety.

Use your answer to part (i) to help you.

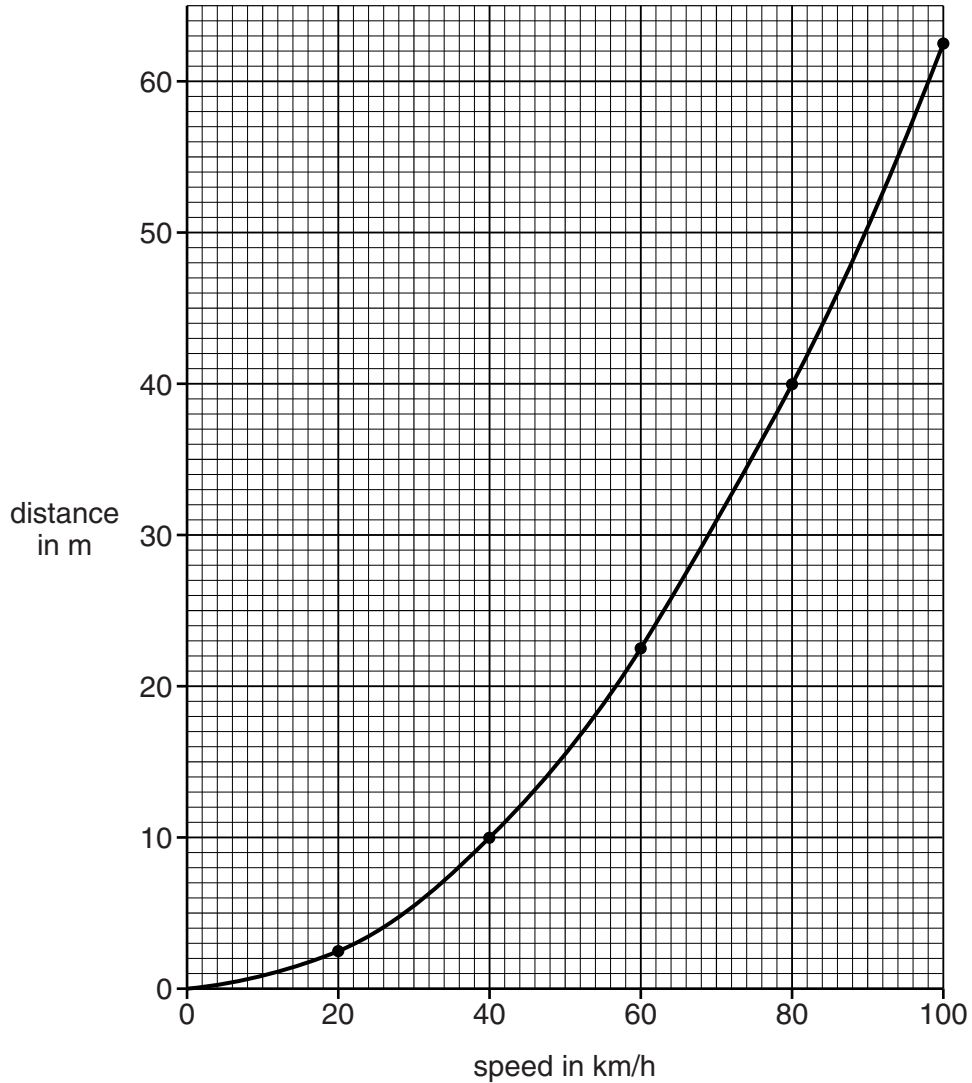
.....

.....

..... [2]

(b) (i) Plot the points and draw the graph for the **thinking distance** on the axes below.

The **braking distance** graph has been done for you.



[1]

(ii) Use the graphs to compare the trends in thinking and braking distance as speed increases.

.....

..... [1]

(c) Cars have many safety features.

Some safety features are intended to **prevent accidents**.

Other safety features **protect the occupants** of a car in a crash.

Look at the table showing some car safety features.

For each safety feature put a tick (✓) in the correct box.

One has been done for you.

<b>safety feature</b>	<b>prevents accidents</b>	<b>protects car occupants</b>
ABS brakes		
crumple zones		
air bags		
electric windows		
traction control	✓	

[2]

[Total: 7]

**END OF QUESTION PAPER**



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