THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

F

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.

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 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

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

momentum = mass × velocity

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

$$GPE = mgh$$

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

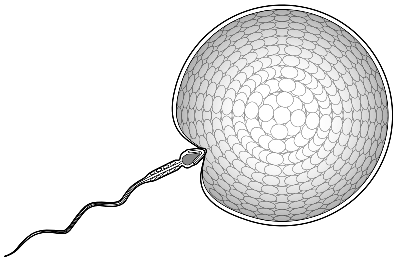
$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

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.

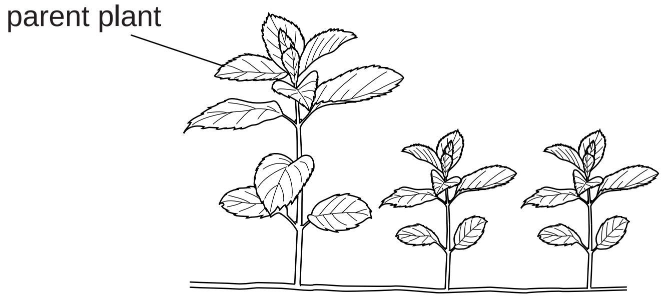
Write down **other** uses of this type of cell division.

....

.... **[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]

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.

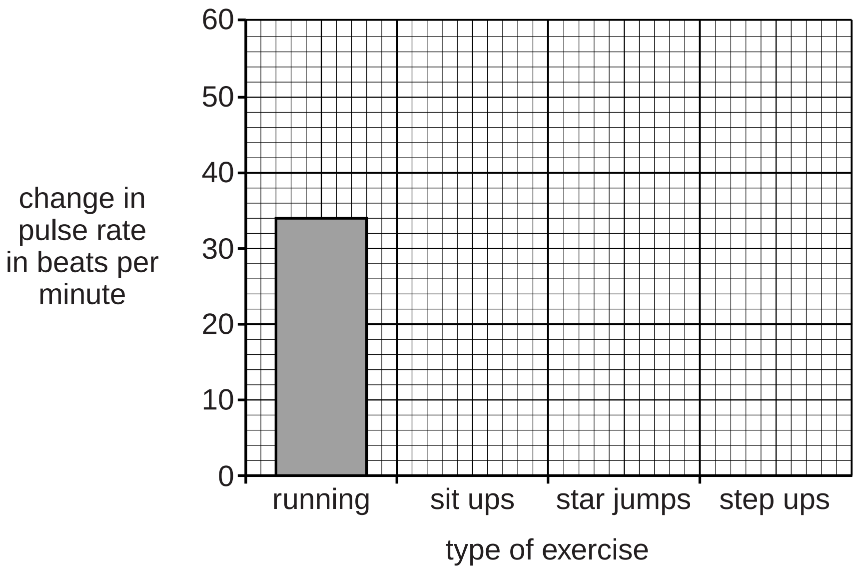
type of exercise	pulse rate in beats per minute	change in pulse rate in beats per minute
rest	73	–
running	107	34
sit ups	111	38
star jumps	125	52
step ups	123	

(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.

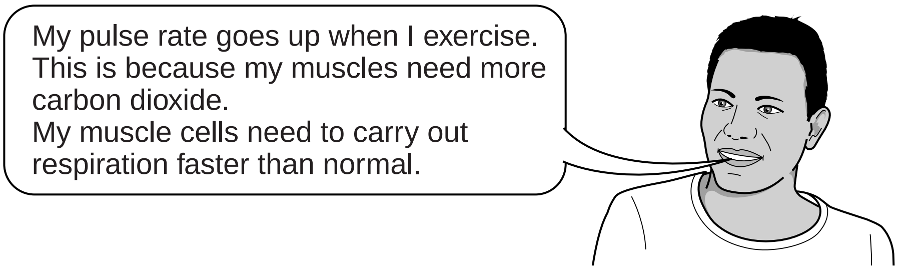
How does the data support this?

....

.... **[1]**

(d) Arjun explains his results.

Read his conclusion.



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.

....

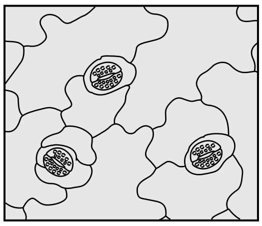
.... **[1]**

[Total: 6]

Turn over

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

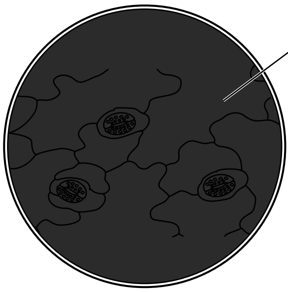
A microscope was used to photograph the cells.



(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**.

part of the blood	**job**
platelet	clot blood
white blood cell	transport oxygen
red blood cell	defend against disease

[2]

[Total: 5]

4 Look at the picture.

It shows two of the scientists who first worked out the structure of DNA.

(a) DNA is found in the nucleus of a cell.

DNA is needed by the body to make enzymes.

Write about the structure of DNA and why DNA is needed to make enzymes.

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

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.... **[6]**

(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]**

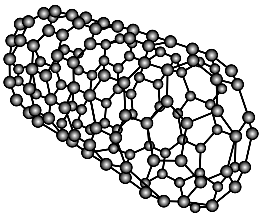
[Total: 9]

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

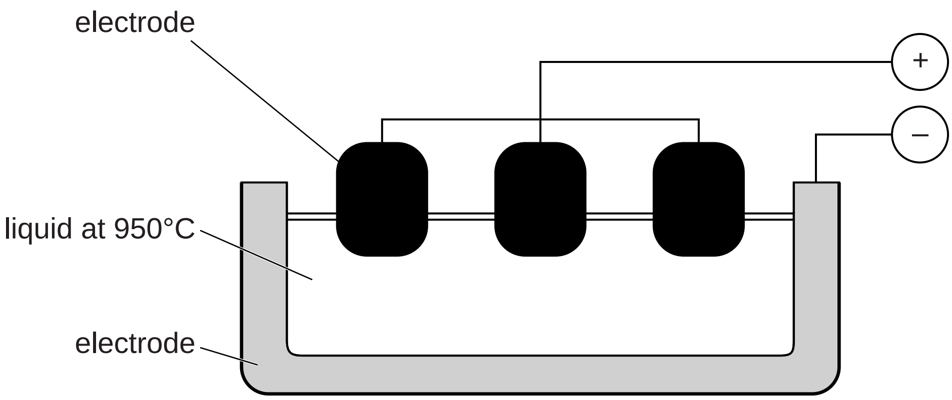
(a) Nanotubes are used to make electrical circuits because they are .... **[1]**

(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
A	1550	does not conduct	high
B	3652	very good	medium
C	327	good	low

Choose the best material for making the electrodes.

Explain your answer using the data in the table.

....

....

.... **[2]**

[Total: 2]

7 **(a)** Morphine is a medical drug.

It is a powerful pain killer extracted from poppies.

Drugs, such as morphine, are expensive to develop and make.

Write about the factors which affect the cost of making and developing medical drugs.

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

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.... **[6]**

(b) Scientists researching new drugs often publish their findings.

Explain why.

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....

.... **[2]**

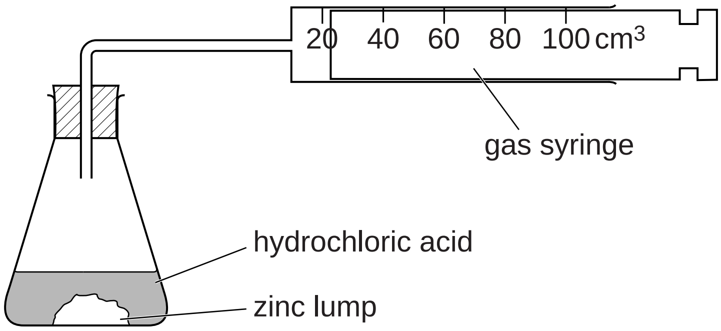
[Total: 8]

8 Christina investigates the reaction between zinc and hydrochloric acid.

Zinc chloride and hydrogen are made.

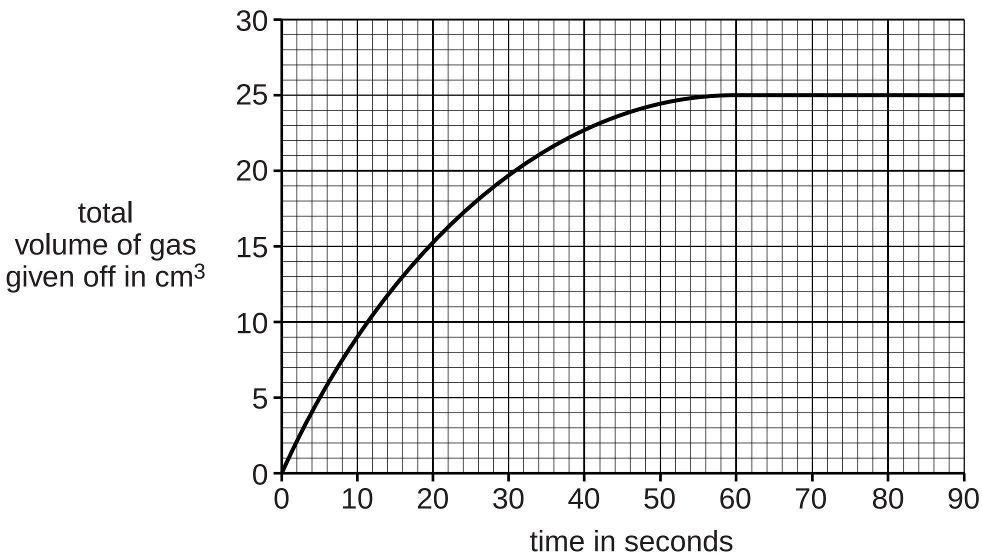
(a) Look at the diagram.

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^3 **[1]**

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

How can you tell this from the graph?

....

.... **[2]**

Turn over for the remainder of question 8

(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**, $\boldsymbol{M_r}$, 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.

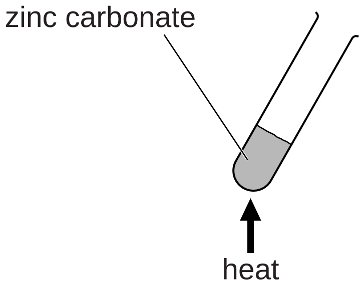
Zinc oxide, ZnO, and carbon dioxide, CO_2, are made.

(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.

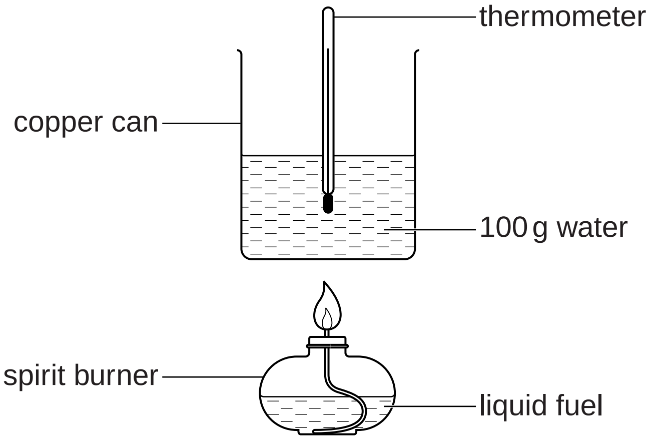
answer .... g **[1]**

[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:

energy = mass × specific heat capacity × 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]**

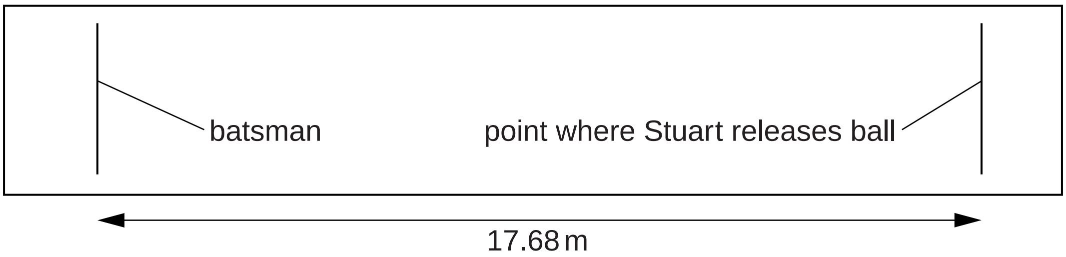
[Total: 3]

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.

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....

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.

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....

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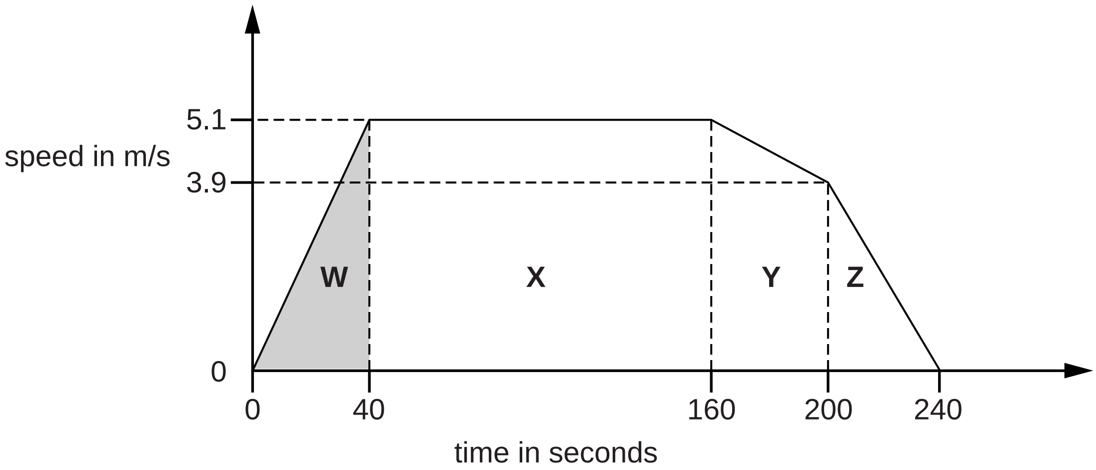
.... **[2]**

[Total: 4]

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.

....

....

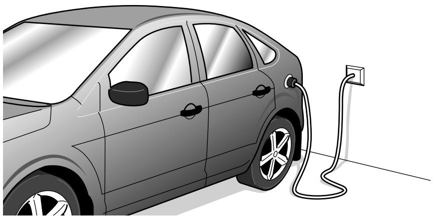
....

....

.... **[3]**

[Total: 6]

13 Look at the diagram of an electric car being charged.



In the future, electric cars will increasingly be used instead of cars that run on petrol or diesel.

Write about the arguments for and against the use of electric cars **and** how scientists can determine if the use of electric cars is a benefit to the environment.

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

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.... **[6]**

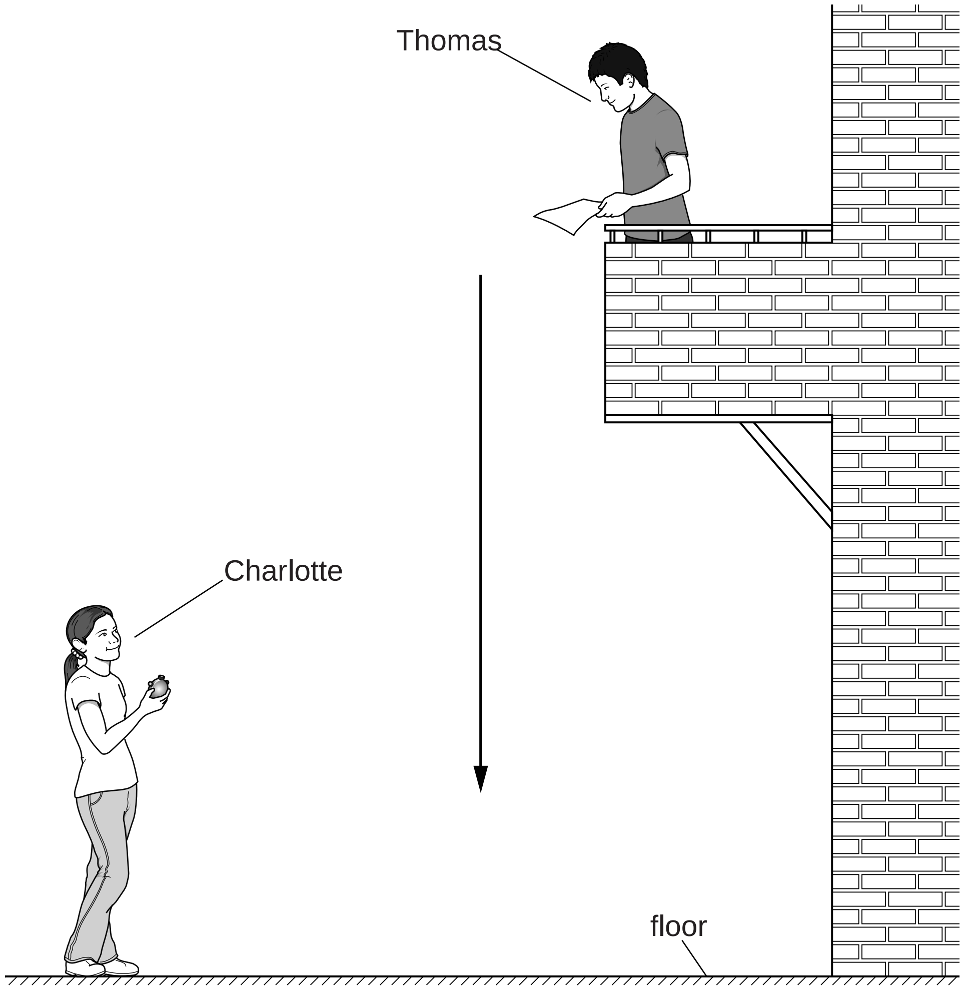
[Total: 6]

14 Thomas and Charlotte are investigating falling objects.

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

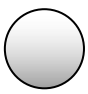
He drops the paper three times from the same height.

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

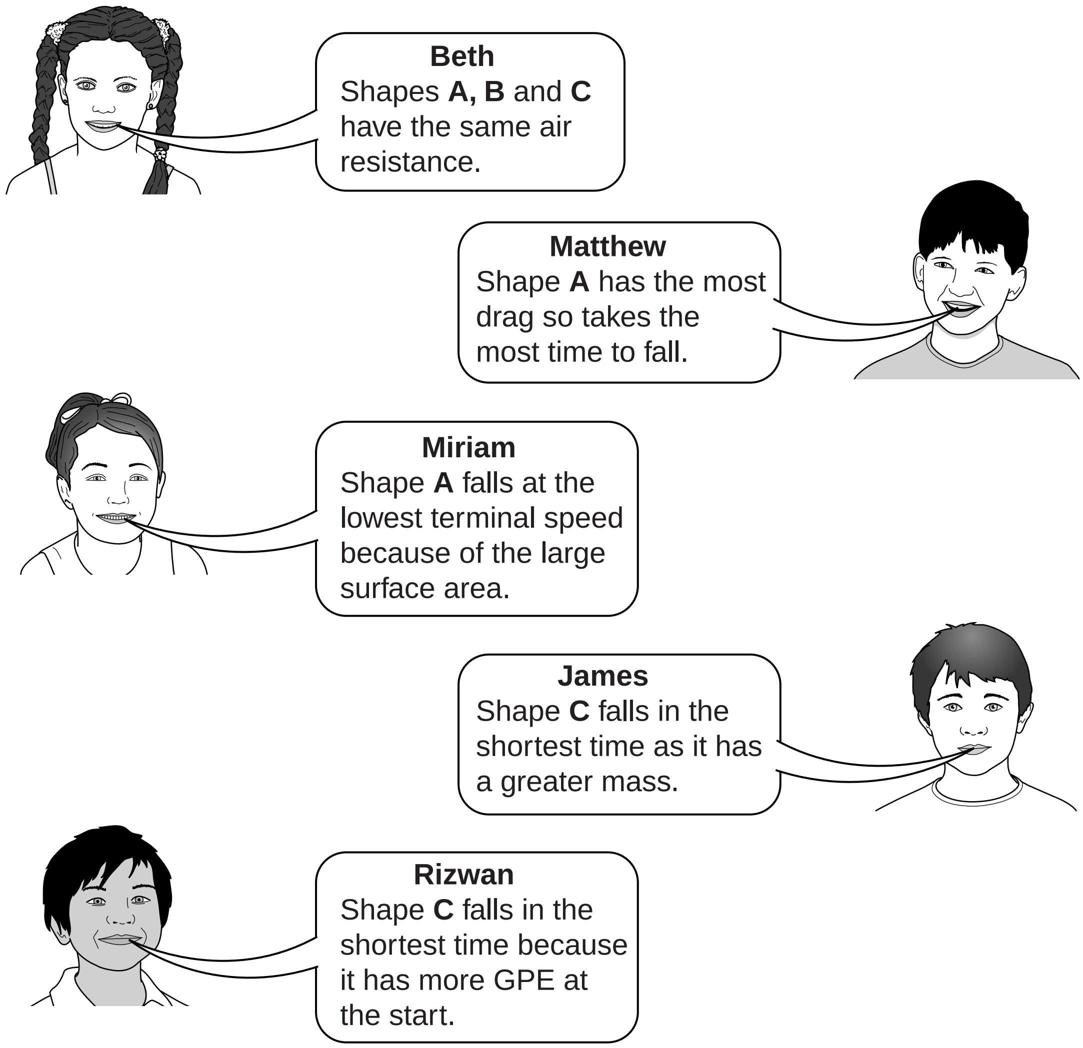


Each sheet reaches a terminal speed as it falls.

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.



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.

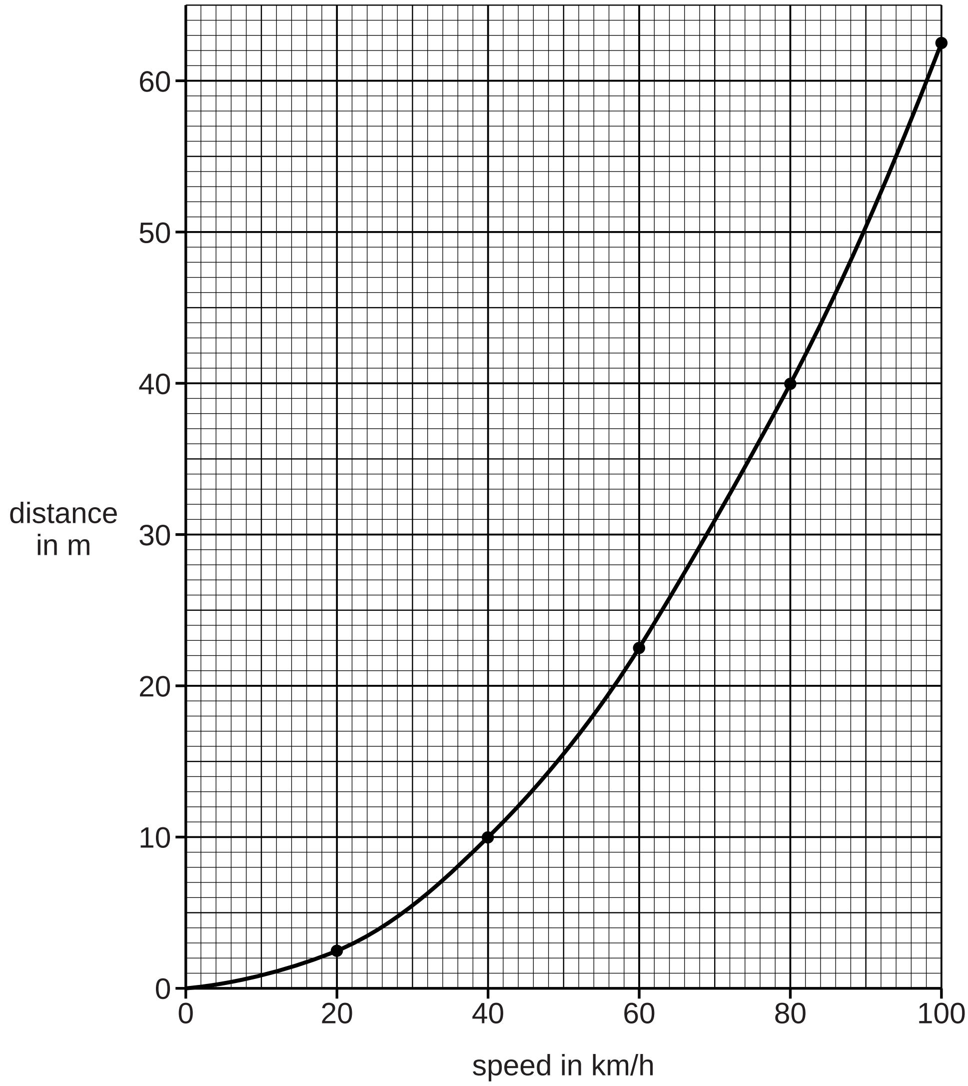
....

....

.... **[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]**

Turn over for the remainder of question 15

(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.

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

[2]

[Total: 7]

END OF QUESTION PAPER

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The Periodic Table of the Elements

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

1	2											3	4	5	6	7	0
						1 **H** hydrogen 1											4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.*

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.