THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

F

Thursday 13 June 2013 – Morning

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

B721/01

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 **24** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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

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

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

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Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

SECTION A – Module B3

1 Look at the picture of chromosomes.

(a) Finish the sentences about chromosomes.

Use words from this list.

clones **cytoplasm**

genes **nucleus** **protein** **zygotes**

Chromosomes are found in the …… of the cell.

Chromosomes carry coded information in the form of …… .

Two organisms with identical chromosomes are called …… . **[3]**

(b) Chromosomes are made from a chemical called DNA.

Describe the structure of DNA. You may draw a labelled diagram.

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.....

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

(c) Polar bears have 74 chromosomes in their white blood cells.

How many chromosomes will there be in **one** egg cell from a polar bear?

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

[Total: 6]

2 Soya beans are grown as food.

Soya bean plants are often genetically modified.

(a) Which features would be useful in a genetically modified soya bean plant?

Put ticks (✓) next to the **two** correct answers.

herbicide resistance	☐
low protein content	☐
low yield	☐
slow growth rate	☐
survive in drought	☐

[2]

(b) Genetically modified soya bean plants can grow in parts of the world where unmodified soya bean plants cannot grow.

(i) Suggest why this would be an advantage.

.....

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

(ii) Some people object to growing genetically modified soya bean plants.

This is because they think the soya beans could be harmful when eaten.

Write about **other** reasons why people may object.

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

[Total: 5]

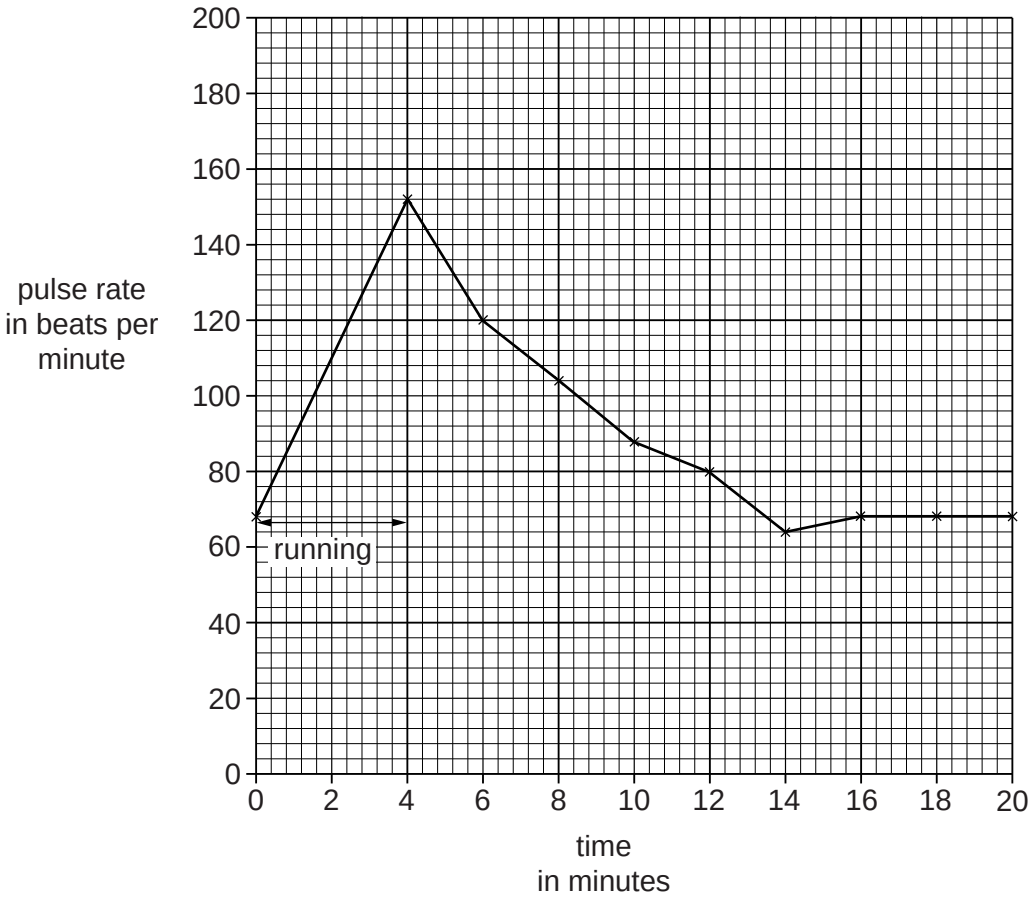
3 Peter is investigating how exercise affects his pulse rate.

He uses a pulse meter to measure his pulse rate.

He runs as fast as he can for four minutes.

He then sits down and measures his pulse rate again every two minutes for the next 16 minutes.

The graph shows his results.



(a) Describe and explain the patterns in the graph.

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

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

(b) Peter then compares his recovery time after exercising for different lengths of time.

He does this by repeating his experiment but changing how long he exercises.

(i) Write down **one** variable Peter must keep the same when he repeats the experiment.

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

(ii) Look at his results.

Length of exercise in minutes	Recovery time in minutes
4	10
6	12
8	14
10	14

Peter concludes that recovery time increases the longer he exercises.

Use the results to evaluate Peter's conclusion.

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

[Total: 9]

4 Jenny and Fred investigate plant growth using two identical plants.

They put plant **A** in a warm room and plant **B** in a cold room.

Both plants get the same amount of light, needed for photosynthesis and growth.

They use a ruler to measure the height of each plant once a week.

Look at their results.

Time in weeks	Height in cm	
	Plant A warm room (20 °C)	Plant B cold room (10 °C)
0	4.5	4.5
1	5.3	4.8
2	5.8	5.2
3	6.2	5.7
4	6.9	6.0
5	7.4	6.3

(a) Explain the differences in the growth. Use ideas about enzymes in your answer.

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

(b) Jenny and Fred could extend their investigation to get more information on the effect of temperature on plant growth.

Describe how they could extend their investigation.

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

[Total: 5]

SECTION B – Module C3

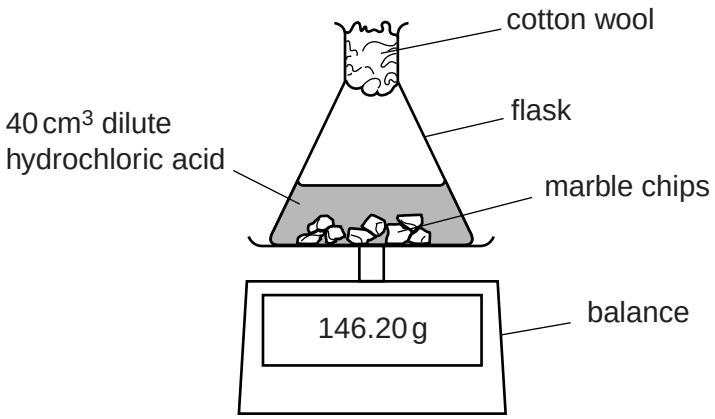
5 This question is about rates of reaction.

Julie and Trevor investigate the reaction between marble chips (calcium carbonate) and dilute hydrochloric acid.

They use 20.0 g of marble chips and 40 cm^3 of dilute hydrochloric acid.

The temperature of the acid is 25 °C.

Look at the diagram. It shows the apparatus they use.



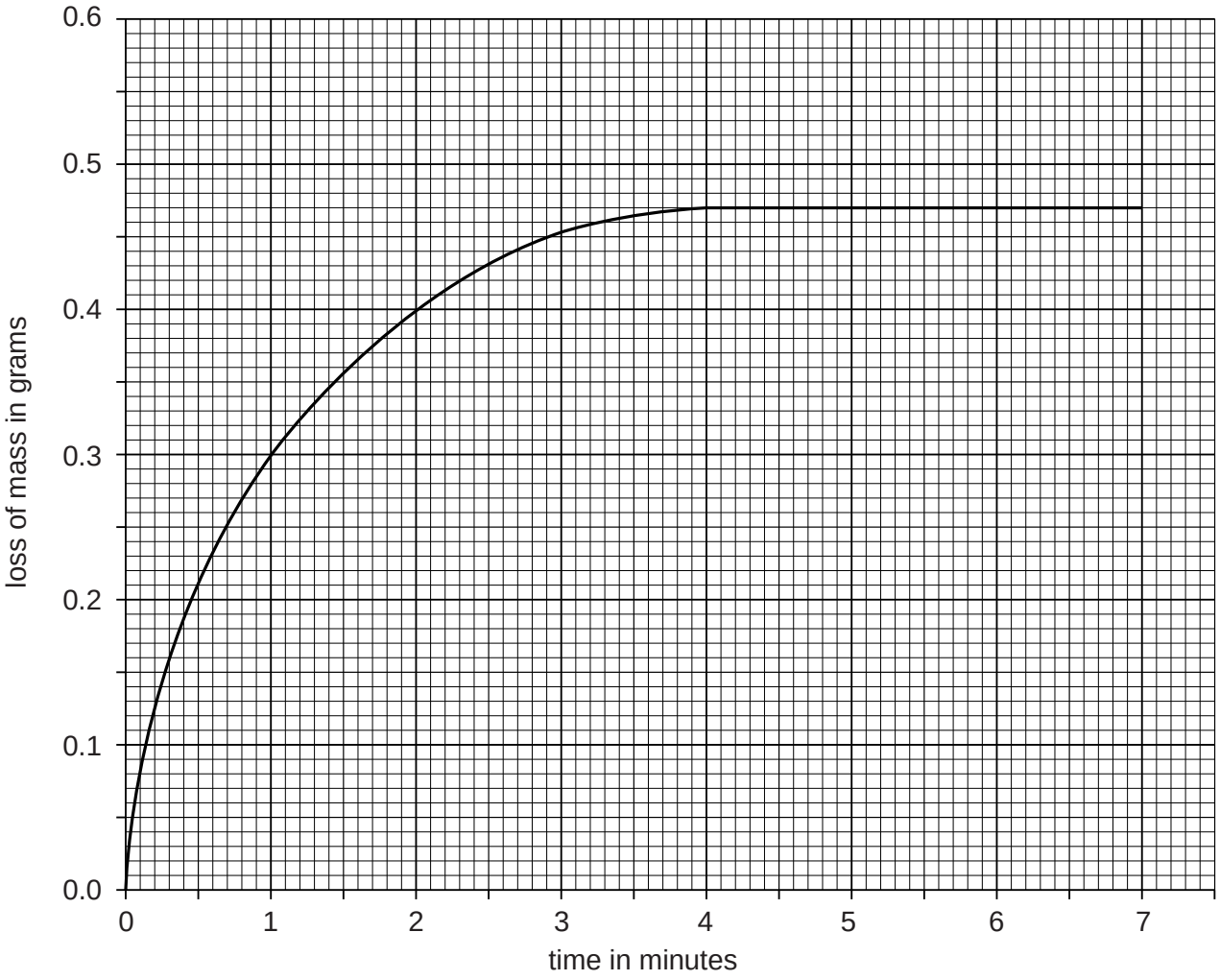
They measure the mass every minute until the reaction stops.

They calculate the loss in mass.

Look at the graph on the next page.

Turn over for the remainder of question 5

10



(a) What is the loss in mass after 2 minutes?

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

(b) Some marble chips are still left at the end of the experiment.

The hydrochloric acid is the **limiting reactant**.

What is meant by the limiting reactant?

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

(c) **(i)** Julie and Trevor repeat the experiment using different sized marble chips.

They use the same volume of hydrochloric acid at the same temperature.

Look at the results for their second experiment.

Time in minutes	0	1	2	3	4	5	6	7
Loss of mass in grams	0	0.20	0.36	0.43	0.46	0.47	0.47	0.47

Plot their results on the graph. Draw the best line through the points. **[2]**

(ii) What do the results tell you about the size of the marble chips in the second experiment compared to their first experiment?

Explain your answer.

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

(d) Julie and Trevor can increase the rate of reaction between marble chips and hydrochloric acid by:

- increasing the concentration of the hydrochloric acid
- increasing the temperature of the hydrochloric acid.

Explain, in terms of the reacting particle model, why both these methods increase the rate of this reaction.

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

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

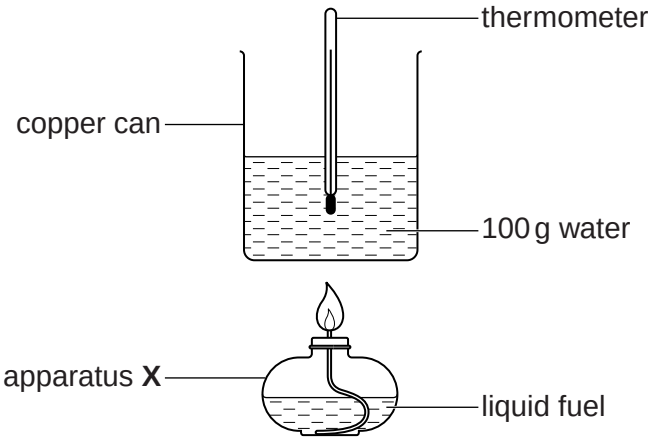
[Total: 11]

6 Mike wants to find a fuel to heat his garden shed.

He decides to investigate the energy given out by four different fuels.

Look at the diagram.

It shows the apparatus Mike uses.



(a) What is the name of apparatus **X**?

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

(b) Look at the table. It shows Mike's results.

Fuel	Temperature at start in °C	Temperature at end in °C	Mass of fuel burned in grams
A	18	38	1.1
B	22	42	0.9
C	18	38	0.6
D	25	45	0.7

Mike decides that fuel **C** is the best fuel to use to heat his garden shed.

Is this a sensible choice?

Use the information in the table to explain your answer.

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

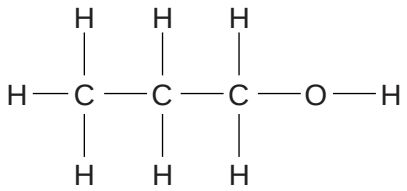
(c) Burning fuels is an **exothermic** reaction.

What is meant by an exothermic reaction?

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

(d) Fuel **B** is propanol.

Look at the displayed formula for propanol.



Complete the table to show the number of each type of atom in propanol.

Atom	Number
C	……
H	……
O	……

[2]

[Total: 6]

7 Ibuprofen is a painkiller used to treat headaches and toothache.

Ibuprofen was first made in the 1960s.

In the original method for making ibuprofen, the **atom economy** was 40%.

A new way of making ibuprofen was developed in the 1980s.

The new method had an atom economy of 77%.

(a) Why is a **higher** atom economy better?

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

(b) A pharmaceutical company investigates ways of making a new painkiller.

They use four different methods.

Look at their results.

Method	Atom economy	Percentage yield
A	50%	40%
B	85%	95%
C	40%	60%
D	80%	90%

Which method should they use to make the painkiller?

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Explain your choice.

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

(c) **(i)** One of the costs involved in making the new painkiller is the cost of the **raw materials**.

Write about **other** costs involved in making the painkiller.

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

(ii) Some raw materials for the painkiller are made synthetically in a laboratory.

Other raw materials come from natural sources.

Write down **one** of these natural sources.

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

(d) The pharmaceutical company has to make sure that the new painkiller is tested before it can be sold.

Explain why.

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

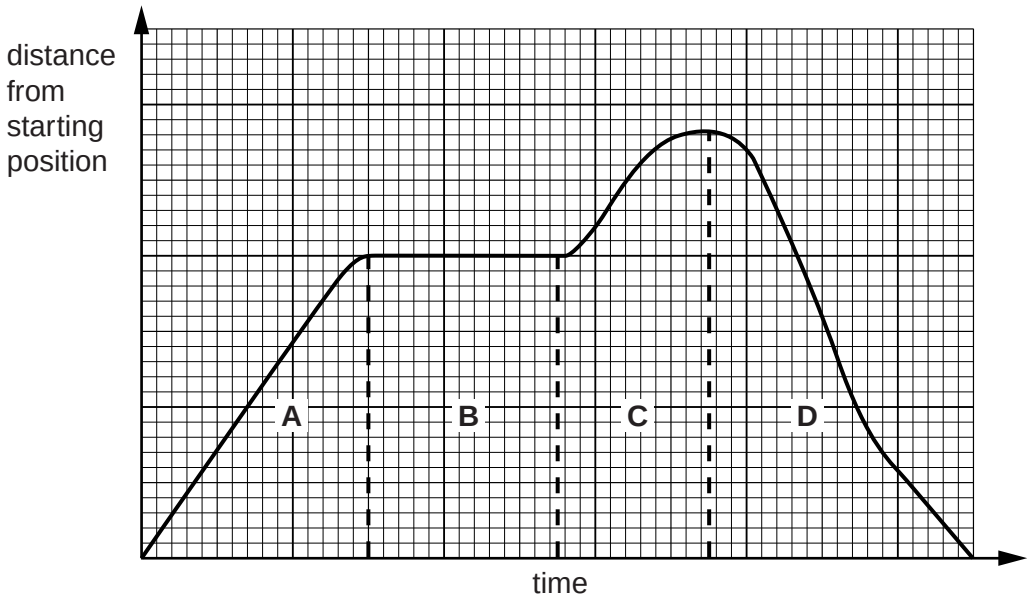
[Total: 8]

SECTION C – Module P3

8 Ravi drives his car on a straight road.

Look at the distance-time graph for his car journey.

There are four sections shown on the graph, **A**, **B**, **C** and **D**.



(a) (i) Which **section** shows the car stationary?

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

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

(ii) Which **section** shows the car returning to its starting position?

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

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

(iii) Which **two** sections show the car moving away from the starting position?

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

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

(b) (i) The total distance travelled for Ravi's journey was 3.0 km.

It took him 500 seconds for the journey.

Calculate the average speed of Ravi's journey in m/s.

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average speed ..... m/s **[2]**

(ii) Ravi thinks he only travelled at this speed for a short time.

Explain how Ravi could be correct.

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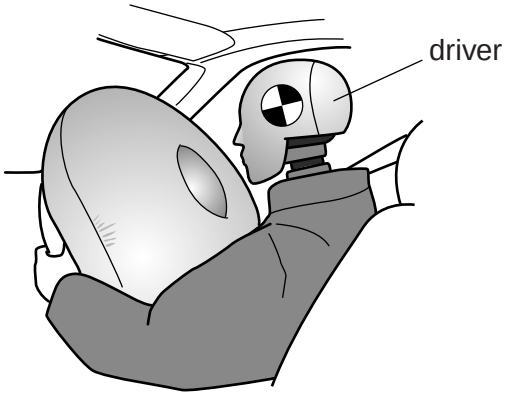
..... **[2]**

[Total: 7]

9 **(a)** Airbags are useful if a car is involved in a crash.



The table shows some information about a crash test carried out by a car manufacturer.

	Initial speed of driver in metres per second	**Mass of driver in kilograms**	**Time to stop driver's forward motion in seconds**
Without airbags	15	50	0.02
With airbags	15	50	0.05

Use the information in the table to describe and explain how airbags help to protect the driver in a crash. Use relevant calculations in your answer.

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

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

(b) Seatbelts are another car safety feature that can be useful in a crash.

When seatbelts were first fitted to cars, not everyone thought that they were a good idea.

However, there was scientific evidence which showed the benefit of wearing seatbelts.

Suggest reasons why some people thought it was **not** safe to wear seatbelts.

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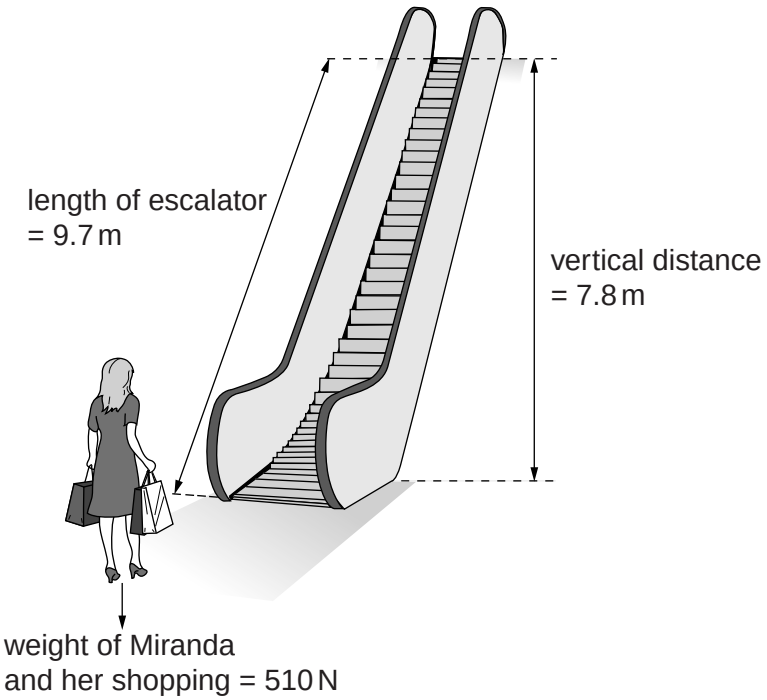
..... **[2]**

[Total: 8]

10 Miranda is shopping.

She travels up an escalator.



(a) (i) Calculate the work done when Miranda travels from the bottom to the top of the escalator.

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.....

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

(ii) Complete the sentence about Miranda's energy as she stands on the escalator.

Miranda moves up the escalator at **steady speed**.

Her ……..…… energy is constant

and her ……..……

energy is increasing. **[2]**

(b) Miranda meets a friend and they travel up an identical escalator.

Miranda's friend and her shopping **also** weigh 510 N.

Which statement about work done is true for the **second escalator** journey?

Put a tick (✓) in the box beside the correct statement.

Twice as much work was done during the second escalator journey. ☐

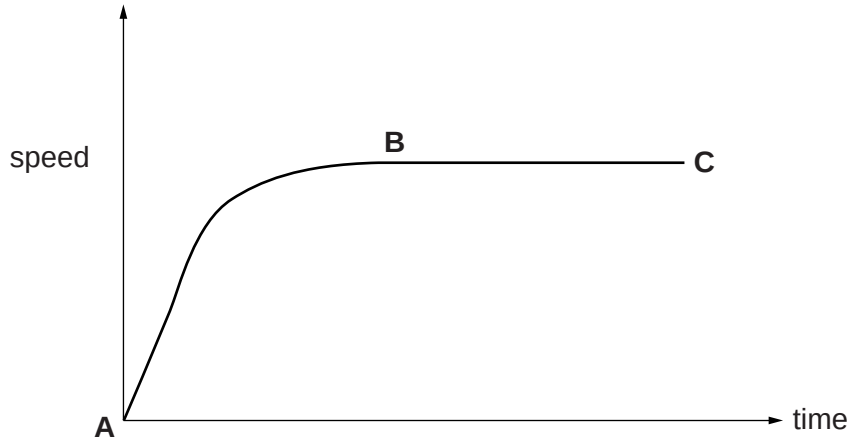
The same amount of work was done during the second escalator journey. ☐

Half as much work was done during the second escalator journey. ☐

[1]

[Total: 5]

11 The graph shows the speed of a ball dropped from a tall building.



(a) Between **A** and **B** the speed of the ball increases. Between **B** and **C** the speed stays the same.

Describe and explain the forces acting on the ball between **A** and **B** and why the ball travels at a steady speed between **B** and **C**.

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

(b) If the same ball was dropped from the same height on the **Moon**, the ball would not reach a steady speed.

Put ticks (✓) in the **two** boxes that explain why the ball would not reach a steady speed.

There is no gravity on the Moon.	☐
There is no atmosphere on the Moon.	☐
Objects have no weight on the Moon.	☐
There is no drag as the object falls.	☐
More drag is produced as the object falls.	☐

[2]

[Total: 5]

END OF QUESTION PAPER

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The Periodic Table of the Elements

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						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

** 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.