OCR

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Tuesday 10 June 2014 – Afternoon

GCSE GATEWAY SCIENCE
ADDITIONAL SCIENCE B

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

120032474 1

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

- The 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

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

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 This question is about blood and circulation.

(a) (i) The blood has parts that do different jobs.

Finish the table by writing in the name of the part of the blood which does each job.

One has been done for you.

Job	Part of the blood
transports food	plasma
clots blood	
carry oxygen	

[2]

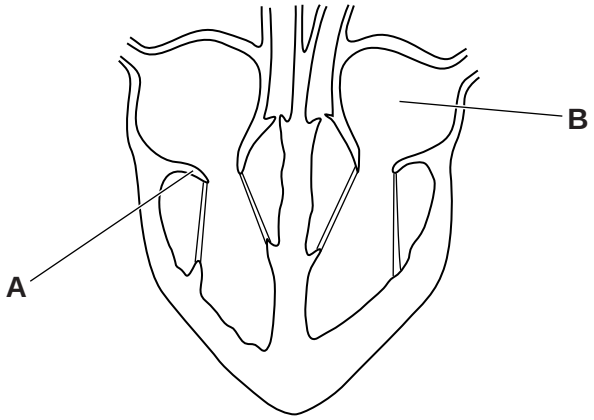
(ii) A person cuts their hand and it gets infected.

The person's cells will need to divide. Explain why

.....

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

(b) Look at the diagram of a heart.



(i) Write down the names of **A** and **B**.

A .....

B .....

[2]

(ii) The heart pumps blood out of both the left and right sides.

Describe where the blood goes when it leaves **each** side of the heart.

.....

.....

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

[Total: 8]

Question 2 begins on page 6

2 This question is about enzymes.

Enzymes are proteins.

(a) There are other examples of proteins.

Look at the list.

Put ticks (✓) in the boxes next to **two** proteins.

amino acid	☐
cellulose	☐
glucose	☐
haemoglobin	☐
insulin	☐
lactic acid	☐

[2]

(b) Cells need energy to make proteins.

Write down the name of the reaction that provides cells with energy.

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

(c) Pepsin and trypsin are enzymes in the digestive system that break down proteins.

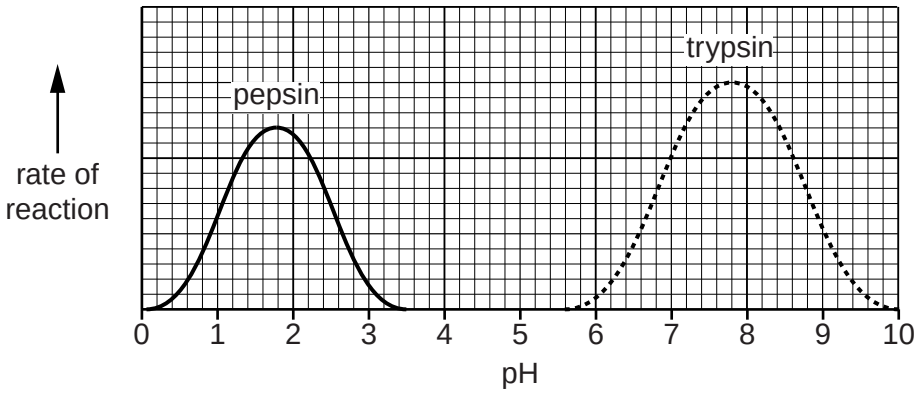
In the stomach, the pH is between 1 and 2.

In the small intestine, the pH is between 7 and 8.

Look at the graph.

It shows the rate of reaction of these enzymes when the pH is changed.

Pepsin works in the stomach. Trypsin works in the small intestine.



Pepsin stops working when it reaches the small intestine.

Trypsin will **not** work in the stomach.

Explain these two observations.

Use data from the graph in your answer.

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.....

.....

.....

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

[Total: 6]

3 This question is about genetic engineering.

The picture shows a crop of corn growing in a field.

Farmers try to produce the largest crop of corn.

The corn plants grow tall and need space between rows.

Weeds grow in the spaces and insects quickly spread and damage the crop.

Farmers usually spray their crops with chemicals to kill the weeds and insects.

Scientists can genetically engineer corn plants to improve them.

Write about the **features** that would be useful to add to the corn plant.

Suggest advantages **and** risks from genetically engineered corn.

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

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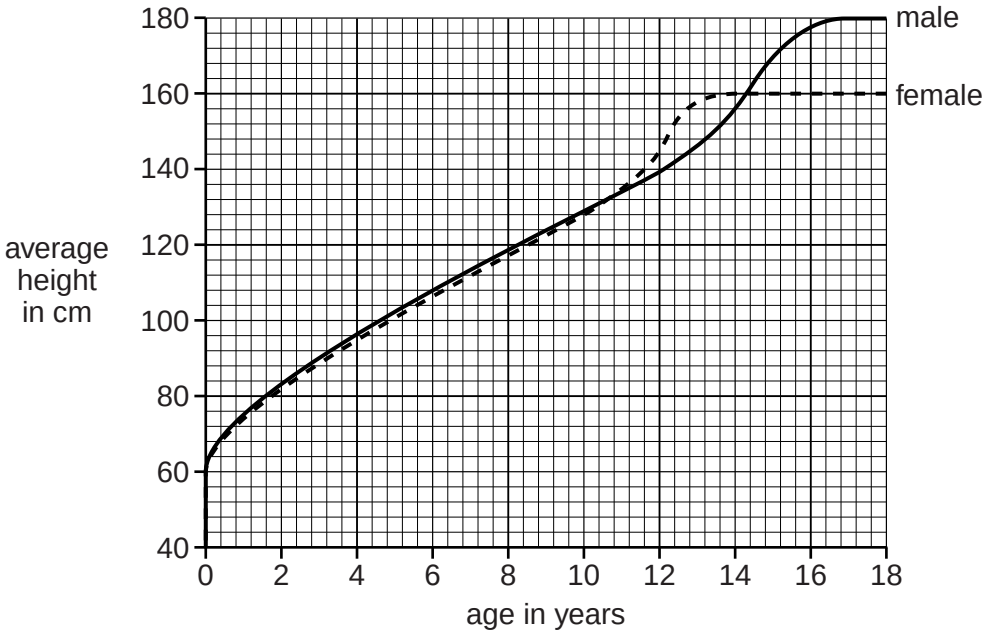
..... **[6]**

[Total: 6]

4 Look at the graph.

It shows the average height for males and females at different ages.



(a) Describe the pattern of growth in males.

.....

.....

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

(b) What is the maximum difference in height between males and females of the same age?

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

(c) An average 12 year old female needs **more** protein in her diet than an average 12 year old male.

Explain why.

.....

.....

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

[Total: 5]

SECTION B – Module C3

5 This question is about different forms of carbon.

(a) Diamond is one form of carbon.

One **physical property** of diamond is that it is colourless.

Write about **two other** physical properties of diamond.

.....

.....

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

(b) Graphite is another form of carbon.

Graphite is used in pencil leads.

Explain why graphite is used in pencil leads.

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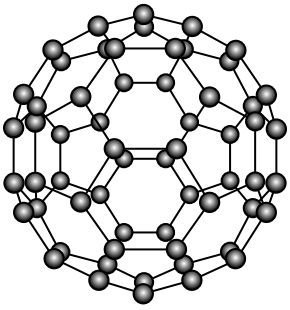
..... **[1]**

(c) Another form of carbon was first made in a laboratory over 25 years ago.

Look at this form of carbon.



Write down the **name** of this form of carbon.

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

[Total: 4]

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Question 6 begins on page 12

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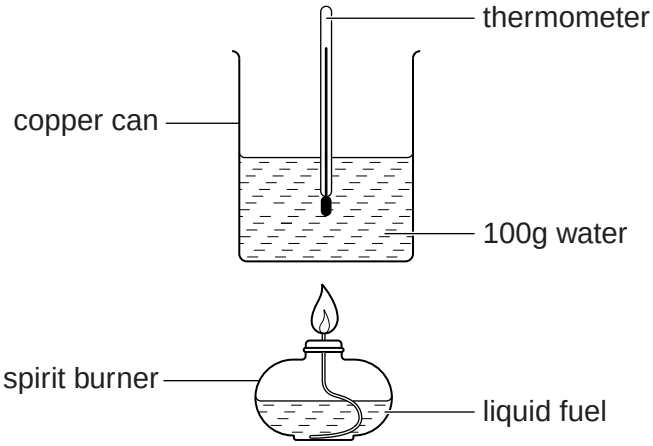
6 Tim and Liz investigate the energy transferred by three different fuels.

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



(a) Tim and Liz want to make their experiment a fair test.

Write down **two** ways that help them to do this.

.....

.....

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

(b) When fuels burn, energy is given out as heat.

What is the name of the type of reaction that gives out heat?

Choose from the list.

catalysed

continuous

endothermic

exothermic

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

(c) Tim and Liz record their results in a table.

Fuel	Start temperature of water in °C	Final temperature of water in °C
ethanol	20	35
propanol	22	40
butanol	19	40

(i) Look at their results.

Which fuel transfers **most** energy to the water?

.....

Explain your answer.

.....

.....

[2]

(ii) Look at the results for **propanol**.

Tim and Liz used 1.0 g of propanol to heat 100 g of water.

Calculate the energy supplied to the water by the propanol.

energy transferred = mass × specific heat capacity × temperature change

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

Write your answer to **two significant figures**.

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.....

.....

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

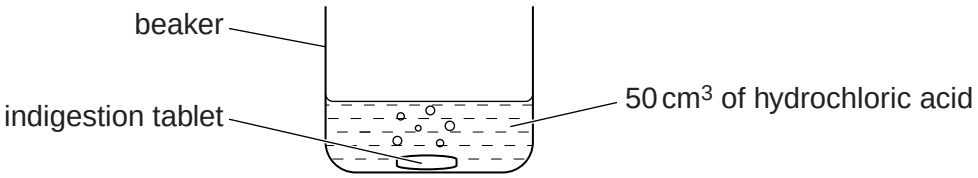
[Total: 7]

7 This question is about rates of reaction.

Chris investigates indigestion tablets.

Indigestion tablets neutralise acids.

He adds an indigestion tablet to 50 cm^3 of hydrochloric acid.



(a) The indigestion tablet contains calcium carbonate.

Calcium carbonate reacts with hydrochloric acid.

Calcium chloride, water and carbon dioxide are made.

Write the **word** equation for this reaction.

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

(b) Chris measures the time it takes for the indigestion tablet to react completely.

This is called the reaction time.

Look at his results.

Experiment	Volume of acid in cm^3	Relative concentration of acid	Temperature of acid in °C	Time for tablet to react in seconds
1	50	2.0	40	17
2	100	2.0	20	68
3	50	2.0	20	68
4	50	1.0	20	100

(i) In **Experiment 1** the reaction stops after 17 seconds.

Explain why the reaction stops.

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

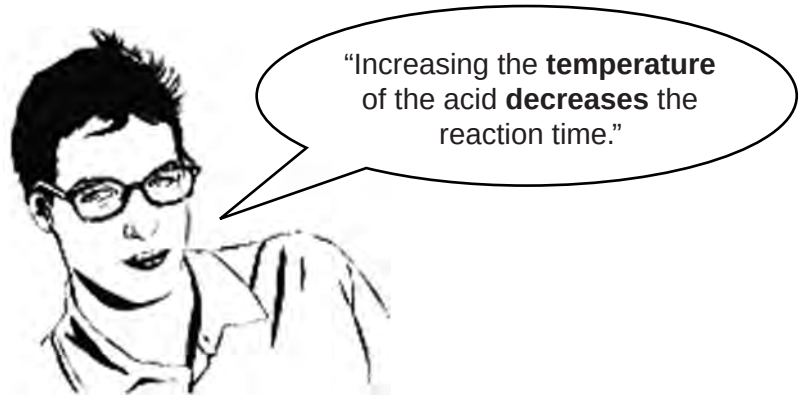
(ii) **Experiments 2** and **3** show that the volume of acid does not affect the reaction time.

Explain how the results of **Experiments 2** and **3** show this.

.....

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

(iii) Chris uses his table of results to make a conclusion.



Which experiments support his conclusion?

Explain, using the reacting particle model, why **increasing** the temperature **decreases** the reaction time.

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

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

[Total: 9]

8 Aspirin is a painkiller used to treat headaches and reduce fevers.

A pharmaceutical company makes aspirin using the following reaction.

salicylic acid + ethanoic anhydride → aspirin + ethanoic acid

(a) A scientist reacts 6.9 g salicylic acid with 5.1 g of ethanoic anhydride.

She makes 3.0 g of ethanoic acid and some aspirin.

Calculate the mass of aspirin that she makes. Use the principle of conservation of mass.

.....

.....

mass of aspirin ..... g **[2]**

(b) Another scientist at the company makes some aspirin.

His reaction does not make all the product he expects.

This is due to experimental loss of product.

What percentage yield indicates the **greatest** experimental loss?

Choose from the list.

30%

50%

75%

100%

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

(c) Look at these word equations for two reactions.

Reaction 1

salicylic acid + ethanoic anhydride → aspirin + ethanoic acid

Ethanoic acid is a waste product in this reaction.

Reaction 2

carbon dioxide + hydrogen → methanol

Comment on the **atom economy** of each reaction.

Explain your answer.

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

[Total: 5]

SECTION C – Module P3

9 This question is about a car stopping.

(a) Look at the description.

The distance travelled between the need to brake and the brakes starting to act.

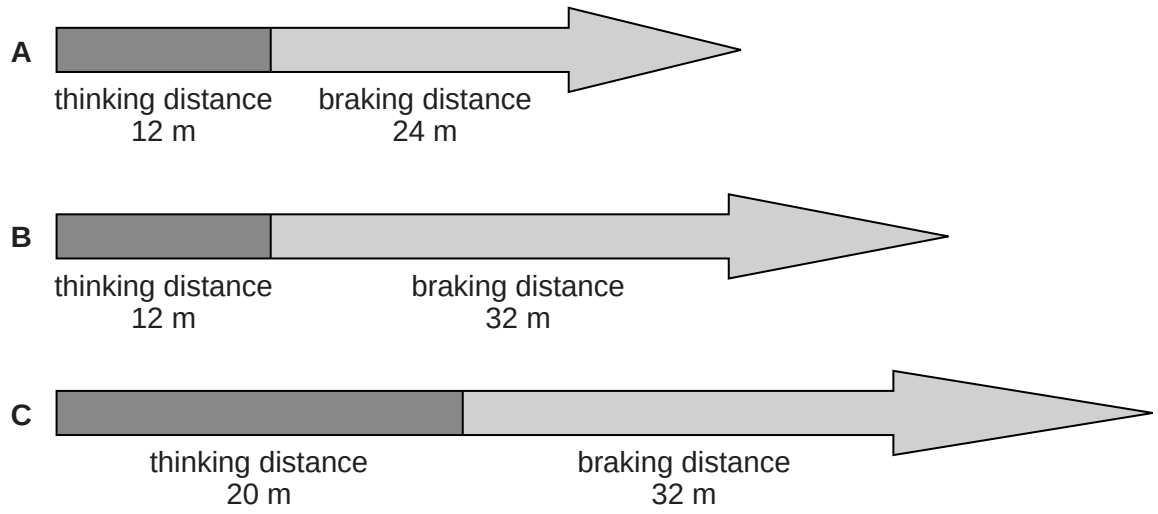
Put a tick (✓) next to the name of this distance.

braking distance	☐
stopping distance	☐
thinking distance	☐

[1]

(b) Look at diagrams **A**, **B** and **C**.

They show three stopping distances for the same car.



(i) What is the **longest** stopping distance shown in the diagrams?

Choose your answer from

20 m **32 m** **52 m** **640 m**

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

(ii) On two different days, the car travels along the same road at the same speed.

The stopping distances for these two days are shown in diagram **B** and diagram **C**.

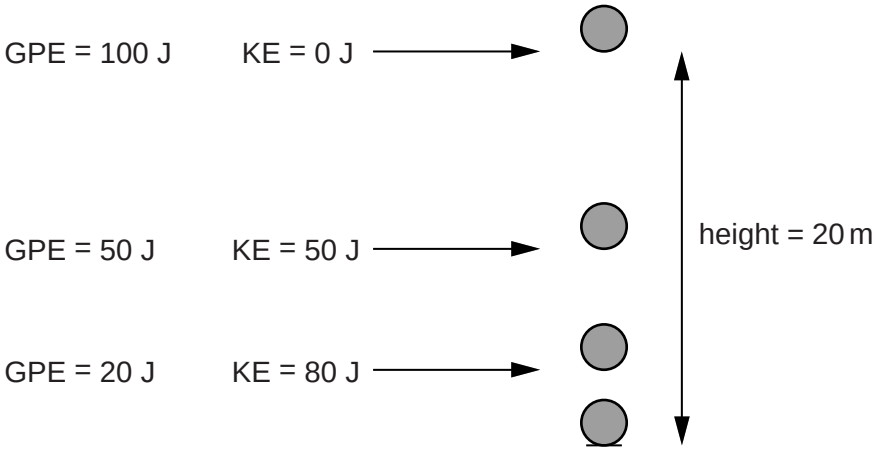
Name one factor that may have caused the change in the **stopping distance** shown between diagram **B** and diagram **C**.

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

[Total: 3]

10 This question is about gravitational potential energy (GPE) and kinetic energy (KE).

Look at the diagram and information about a small ball falling from a height of 20 m.



Explain the changes in GPE and KE and describe what would happen to the GPE and KE if the mass of the ball was doubled.

Use equations to help explain your answer.

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

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

[Total: 6]

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Question 11 begins on page 22

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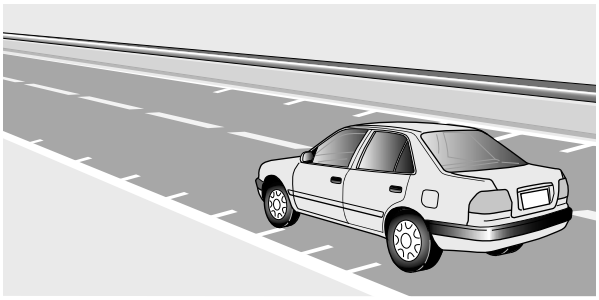
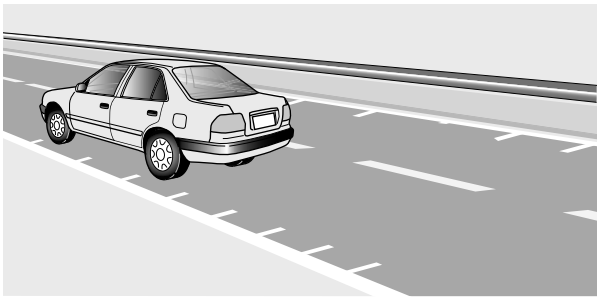
11 There are different types of speed cameras.

One type of speed camera takes two photographs.

photograph 1



photograph 2



(a) Why is it important for the photographs to show the lines on the road?

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

(b) The time between the photographs is always 0.5 seconds.

(i) It is important for the time between each photograph to be checked regularly.

Explain why.

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

(ii) Suggest why a longer time of 4 seconds is **not** used in these cameras.

.....

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

(c) Look at the data collected from this type of speed camera.

Car	Time between photographs in seconds	Distance travelled in m
A	0.5	4.4
B	0.5	5.0
C	0.5	6.2
D	0.5	3.8
E	0.5	4.2

The speed limit on the road is 9 m/s.

(i) Is car **A** speeding?

.....

Explain your answer using a calculation.

.....

.....

[2]

(ii) How many cars are speeding?

Choose your answer from

1 car **2 cars** **3 cars** **4 cars** **5 cars**

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

[Total: 7]

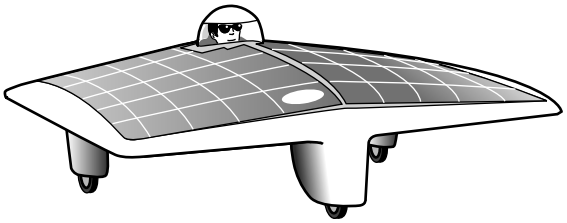
12 Cars need a source of energy to move.

(a) Write down the names of **two** fossil fuels used in cars.

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

(b) Solar powered cars do **not** use fossil fuels.

Look at the picture of a solar powered car.



(i) How do solar powered cars get their energy?

.....

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

(ii) This solar powered car races across Australia from Darwin to Adelaide.

It takes 5 days for the solar powered car to reach the finish.

Suggest **two** reasons why it takes a long time.

.....

.....

.....

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

(iii) To win the race, the solar powered car must travel at the highest possible top speed.

Describe how technology can be used to increase the top speed of the car.

In your answer consider the risks this has for the driver.

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.....

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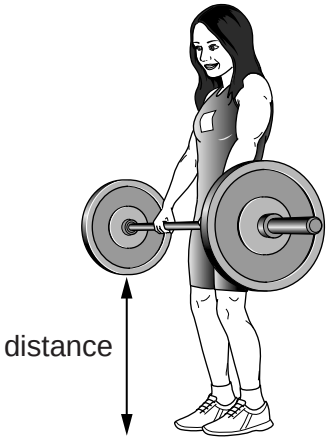
..... **[2]**

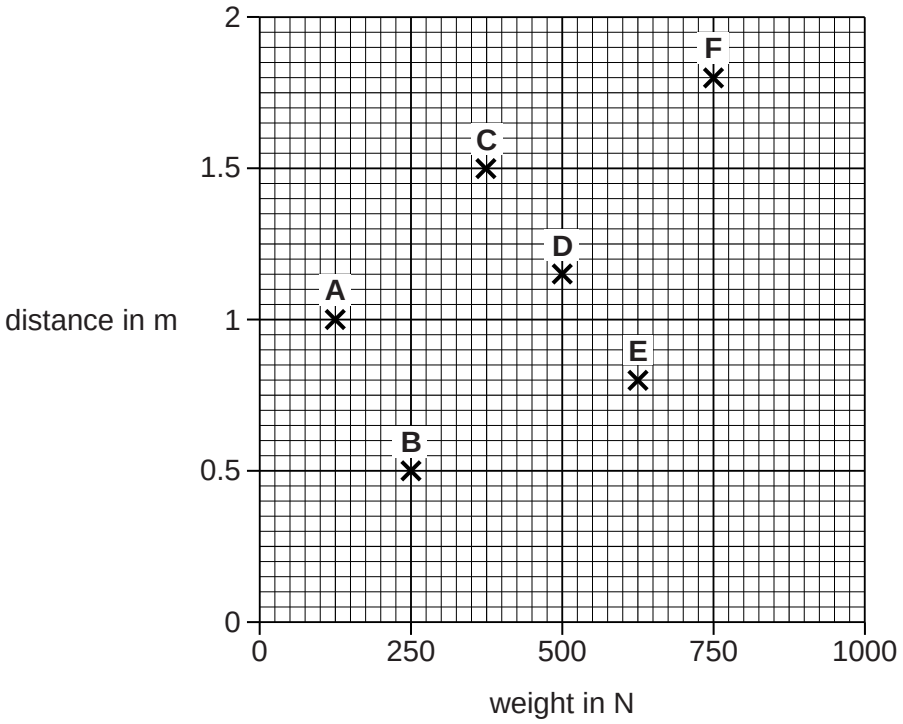
[Total: 6]

13 Deng is a weightlifter.



She lifts six different weights.

The plots on the graph show the distance she lifts each weight.



Deng does work to lift each weight.

For which lift did Deng do the most work?

Choose from

A B C D E F

Lift .....

Use the graph and a calculation to explain your answer.

.....

.....

.....

.....

.....

[3]

[Total: 3]

END OF QUESTION PAPER

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.