Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A215/01

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

UNIT 1: Modules B4 C4 P4
Foundation Tier

WEDNESDAY 20 MAY 2009: Afternoon

DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper
Calculators may be used

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (KN) OV90902 13006/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

INFORMATION FOR CANDIDATES

- **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 42.**
- **A list of physics equations is printed on page 4 and 5.**
- **The Periodic Table is printed on the back page.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

kinetic energy = $\frac{1}{2}$ × mass × [velocity]^2

ELECTRIC CIRCUITS

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer ALL the questions.

1 Ben is on holiday. The weather is very hot and dry.

(a) What happens to Ben's core body temperature as he sits in the sun?

Put a tick (✓) in the box next to the correct answer.

His core body temperature decreases. ☐

His core body temperature increases. ☐

His core body temperature remains steady. ☐

[1]

(b) Ben's body has control systems to respond to changes in temperature.

Draw a straight line from each RESPONSE to the correct PART OF HIS CONTROL SYSTEM.

RESPONSE	PART OF HIS CONTROL SYSTEM
The change in temperature is detected by his skin.	processing centre
His sweat glands produce more sweat.	receptor
His brain receives information and triggers his sweat glands.	effector

[2]

(c) Ben sits in the sun for too long and develops heat stroke.

(i) What are the symptoms of heat stroke?

Put a (ring) around each of the TWO correct answers.

HOT DRY SKIN

RAPID PULSE RATE

SHIVERING

SLOW PULSE RATE

SWEATING

VOMITING

[2]

(ii) These statements describe how heat stroke may develop.

They are in the wrong order.

Put the letters A, B, C, D and E in the boxes in the right order.

One has been done for you.

A sweating is reduced

B sweating increases

C the body is exposed to high temperatures

D dehydration develops

E body temperature increases above normal

				E

[2]

[Total: 7]

2 The kidneys help to maintain a constant internal environment in the body.

(a) What is the name of this process?

Put a (ring) around the correct answer.

HOMEOSTASIS

HYPOTHALAMUS

HYPOTHERMIA

[1]

(b) The kidneys filter chemicals from the blood and reabsorb some of them.

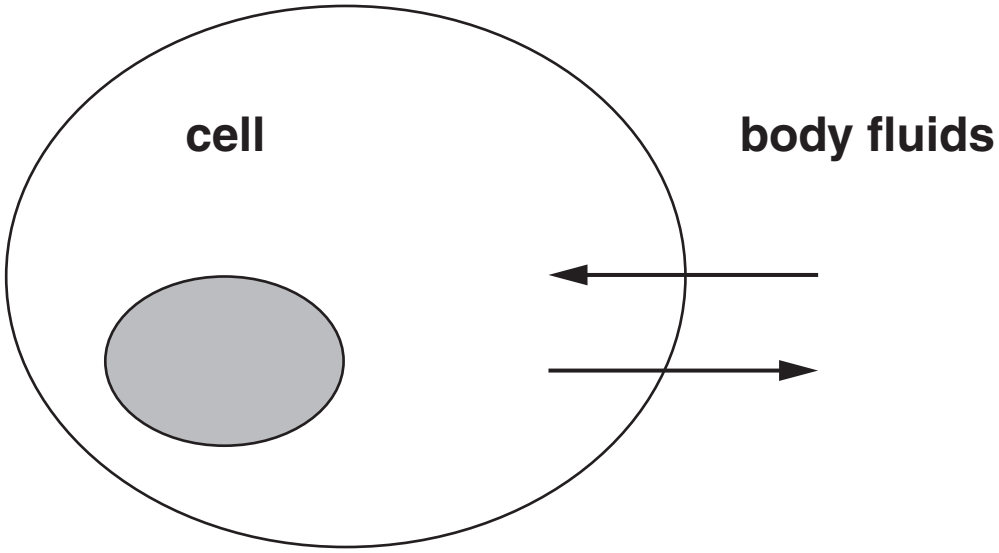
Complete the table.

Put ticks (✓) in the correct boxes to show whether ALL, SOME or NONE of each chemical is reabsorbed.

chemical	all reabsorbed	some reabsorbed	none reabsorbed
water			
sugar			
salt			
urea			

[4]

(c) The diagram shows a cell surrounded by body fluids.



The arrows show movement of chemicals between cells and body fluids.

(i) Name one <u>GAS</u> that moves into or out of cells by diffusion.

_____ **[1]**

(ii) What is the name of the process that describes the overall diffusion of <u>WATER</u> through a cell membrane?

_____ **[1]**

[Total: 7]

3 Sam's sunglasses go darker when sunlight gets brighter.

This is caused by silver iodide in the glass.

(a) The formula of silver iodide is AgI.

Draw a straight line from each <u>ELEMENT</u> in silver iodide to its <u>SYMBOL</u>.

<u>ELEMENT</u>	<u>SYMBOL</u>
	A
silver	Ag
	g
iodine	gI
	I

[1]

(b) The sunglasses go dark in bright light.

Silver iodide breaks apart to form silver and iodine.

(i) Fill in the boxes to make a word equation for this reaction.

[1]

(ii) In the reaction, silver iodide makes silver <u>ATOMS</u> and iodine <u>ATOMS</u>.

Put a tick (✓) in the box next to the equation for this reaction.

$AgI \rightarrow Ag + I$ ☐

$2AgI \rightarrow 2Ag + I_2$ ☐

$Ag + I \rightarrow AgI$ ☐

$AgI \rightarrow Ag^+ + I^-$ ☐

[1]

(c) An iodine atom has 53 protons in its nucleus.

An iodine atom has a relative atomic mass of 127.

(i) How many <u>ELECTRONS</u> are in an iodine atom?

Put a (ring) around the correct answer.

<u>53</u> <u>74</u> <u>127</u> <u>180</u>

[1]

(ii) Iodine is in group 7 of the Periodic Table and it forms iodide ions.

How does an iodine atom form an iodide ion?

Put a tick (✓) in the box next to the correct answer.

It gains 1 electron. ☐

It gains 7 electrons. ☐

It loses 1 electron. ☐

It loses 7 electrons. ☐

[1]

(d) Iodine is similar to bromine.

Bromine forms molecules.

Put a (ring) around the formula of a bromine molecule.

Br **Br_2** **Br_3** **Br_7**

[1]

[Total: 6]

4 NASA plans to send a mobile laboratory to the surface of Mars.

One idea is to use a laser to find out what elements are in Martian rocks.

The laser heats a rock until it vaporises.

The vapour gives out light.

The mobile laboratory then identifies the elements present.

(a) What is the best way of identifying the elements present in the rock?

Put a tick (✓) in the box next to the <u>BEST</u> answer.

dissolve the rock	☐
photograph the rock pieces	☐
study the spectrum of the light	☐
weigh the rock	☐

[1]

(b) Sodium chloride and potassium chloride have been found on Mars.

Draw a straight line from each <u>COMPOUND</u> to its <u>FORMULA</u>.

<u>COMPOUND</u>	<u>FORMULA</u>
	KC*l*
sodium chloride	NaCl_2
	NaC*l*
	PCl_3
potassium chloride	PoC*l*
	SC*l*

[2]

[Total: 3]

5 Potassium, rubidium and caesium are in group 1 of the Periodic Table.

(a) Put a tick (✓) in the box next to the correct statement about caesium.

CAESIUM IS …

… a halogen. ☐

… a metal. ☐

… a coloured gas. ☐

… a bleach. ☐

[1]

(b) Look at the symbols below.

Put a (ring) around each of the TWO symbols of elements in group 1.

Be La Li Mg Na Pt

[2]

(c) Potassium, rubidium and caesium are all easy to melt.

Here are some of their melting points.

ELEMENT	MELTING POINT
potassium	63 °C
rubidium	
caesium	29 °C

Which is the most likely melting point of rubidium?

Put a (ring) around the BEST answer.

16 °C **29 °C** **39 °C** **63 °C** **78 °C**

[1]

(d) Potassium reacts violently with water.

Some students are asked how caesium reacts with water.

LIZ:	**Caesium reacts more violently than potassium.**
GLEN:	**Caesium reacts just as violently as potassium.**
MIKE:	**Caesium reacts less violently than potassium.**
MAUREEN:	**Caesium doesn't react with water.**

Who gave the BEST answer?

answer _____ [1]

[Total: 5]

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6 Sylvia drives her car along a horizontal road at a constant speed of 12 m/s.

(a) Sylvia has a mass of 65 kg.

How is her kinetic energy calculated?

Put a (ring) around the correct answer.

65 × 12 J

0.5 × 65 × 12 × 12 J

0.5 × 65 × 12 J

0.5 × 65 × 12 × 2 J

[1]

(b) Put a (ring) around the correct word to complete these sentences.

Friction is a type of

ENERGY FORCE POWER.

The car moves at a steady speed against friction.

The kinetic energy of the car

DECREASES INCREASES STAYS THE SAME.

This is because the engine of the car is able to

do ENERGY POWER WORK on the car.

[1]

(c) The wheels apply a backwards force of 500 N on the road when the car is moving at a constant speed of 12 m/s.

How much WORK do the wheels do on the car when it moves a distance of 10 m?

Put a (ring) around the correct answer.

120 J **500 J** **5000 J** **6000 J**

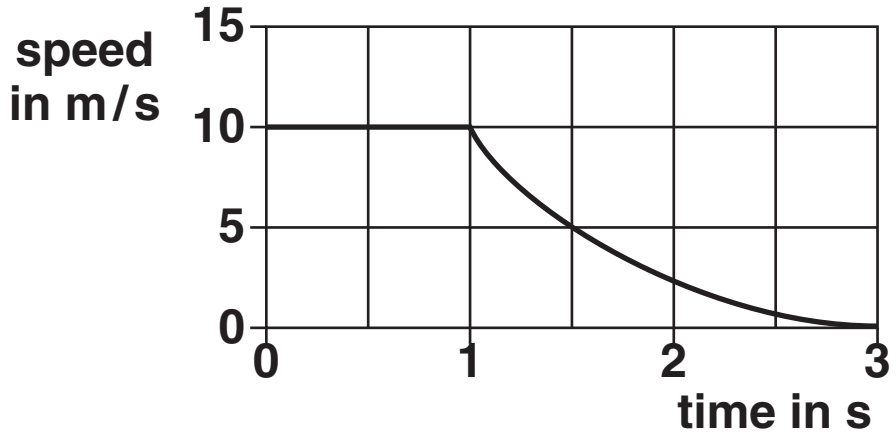
[1]

(d) Sylvia spots a child in the road ahead and stops the car.

Her speed drops steadily from 12 m/s to 0 m/s in 2 s.

Which of these speed-time graphs, A, B, C or D, shows this?

A



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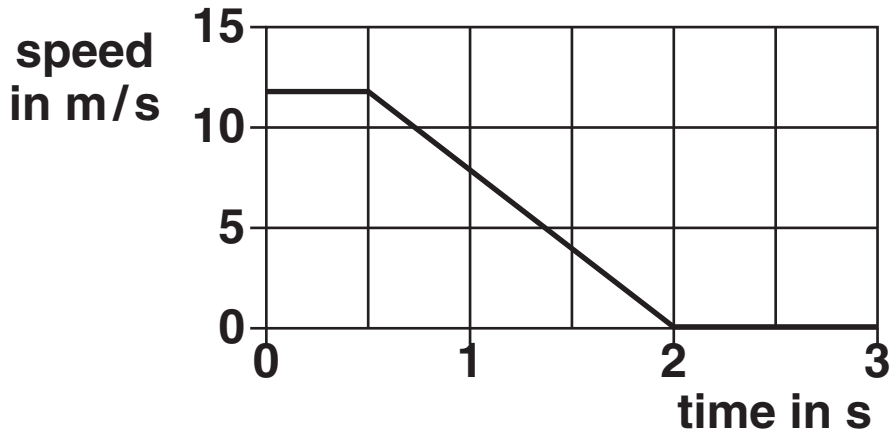
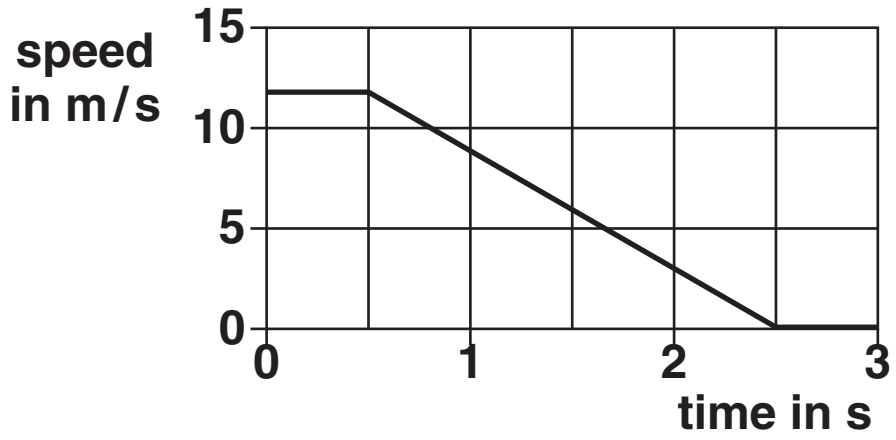
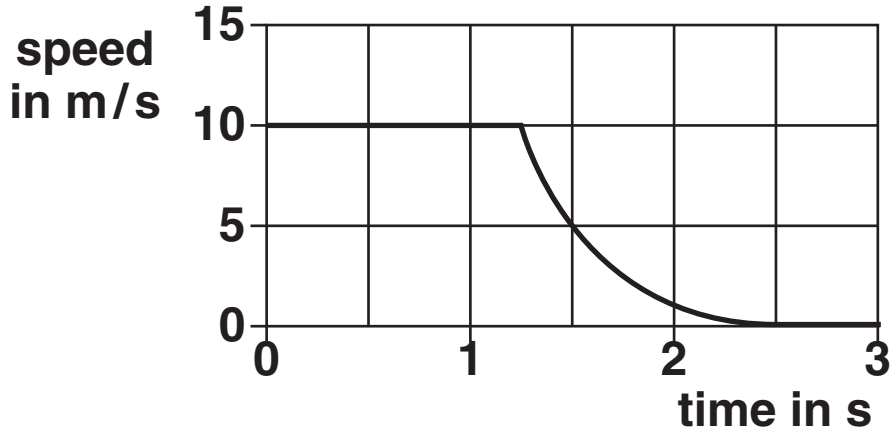


C



D

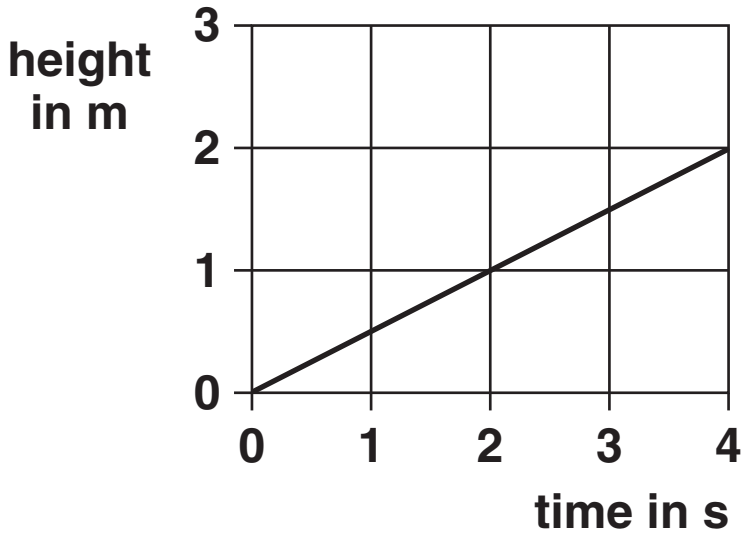


answer _____ **[1]**

[Total: 4]

7 Serena goes up in a hot air balloon.

(a) The graph shows how the height of the balloon changes with time.



Which of the calculations below shows the speed of the balloon?

Put a (ring) around the correct answer.

$\frac{4.0}{2.0} = 2.0\,m/s$ $\quad 2.0 \times 4.0 = 8.0\,m/s$ $\quad \frac{2.0}{4.0} = 0.5\,m/s$

[1]

(b) Two forces act on the balloon as it moves up.

Its weight acts downwards, and the air around it pushes it up.

Why does the balloon move up at a <u>CONSTANT</u> speed?

Put a tick (✓) in the box next to the correct reason.

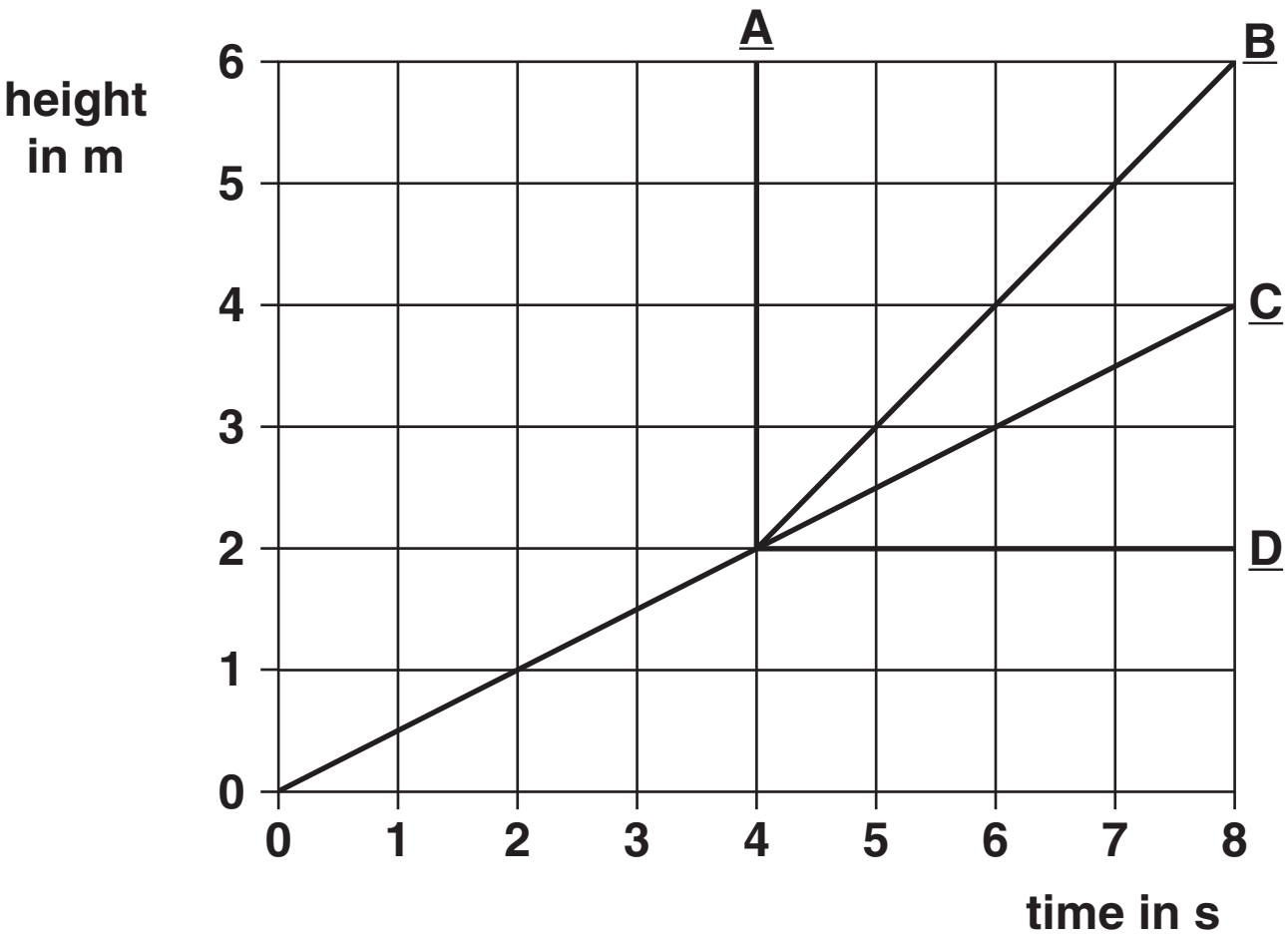
the upwards push is less than the weight	☐
the upwards push is bigger than the weight	☐
the upwards push is the same size as the weight	☐

[1]

(c) After 4 seconds Serena releases a sandbag.

This suddenly increases the speed of the balloon.

Which of the lines, A, B, C or D, shows the new, steady speed of the balloon?



correct line _____ **[1]**

(d) Complete the sentences.

Choose words from the list

FALLING

GRAVITATIONAL POTENTIAL

HEATING

KINETIC

As the sandbag falls through the air it loses

_____ energy.

It speeds up, gaining

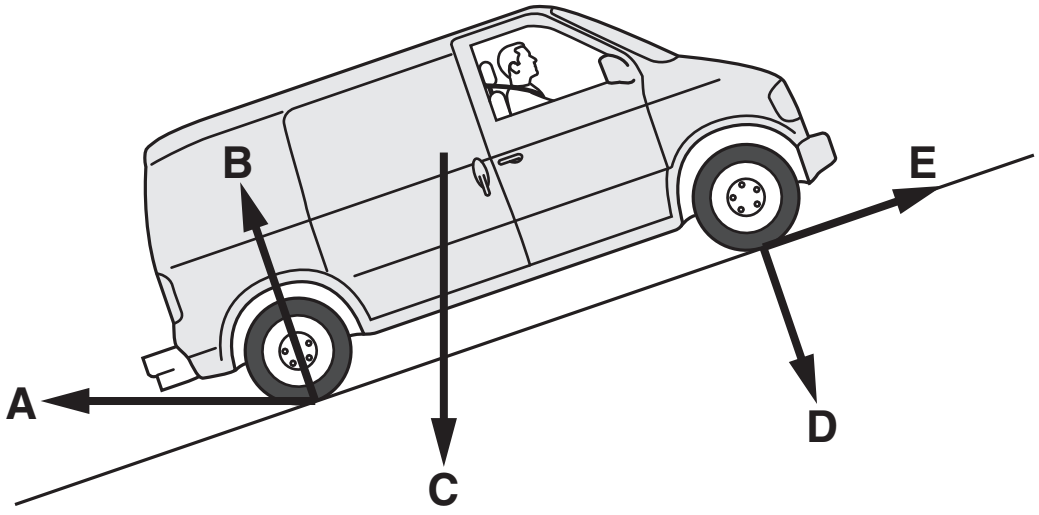
_____ energy.

Air resistance results in the loss of some energy

by _____ . [2]

[Total: 5]

8 Alan parks his van on a hill.



(a) Five possible force arrows are shown on the diagram.

Here are three descriptions of forces acting on the van and the road.

Choose the BEST force arrow to show each force.

Enter A, B, C, D or E next to each description.

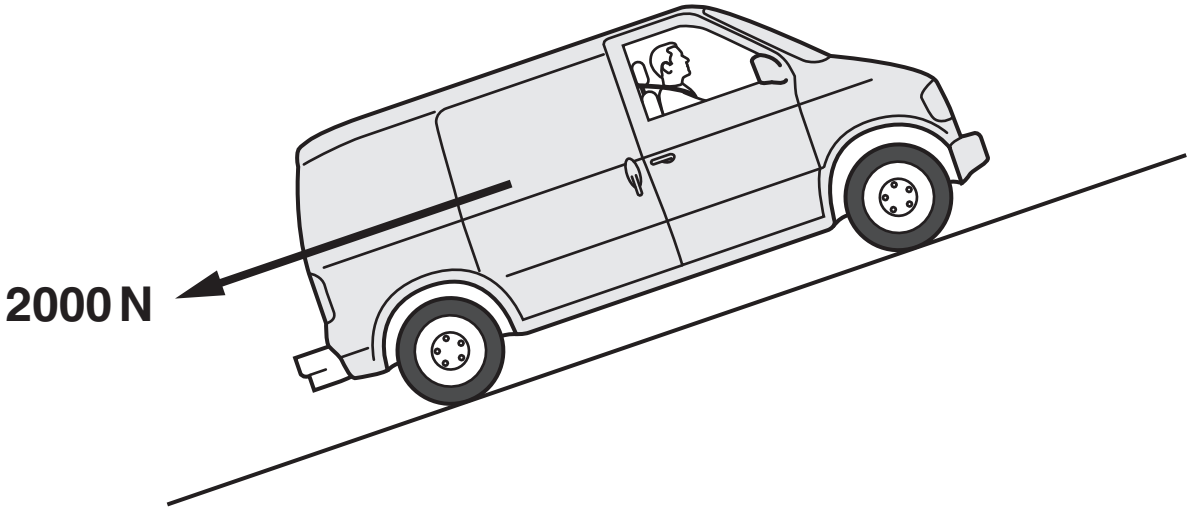
The weight of the van. ☐

The reaction of the road on the van. ☐

The friction on the van from the road. ☐

[3]

(b) The brakes fail and the van rolls back down the hill.



The resultant force pulling the van down the hill is 2000 N.

How should Alan calculate the change in momentum of the van after 10 seconds?

Put a (ring) around the correct calculation.

$\frac{2000}{10}$ kg m/s 2000 × 10 kg m/s $\frac{10}{2000}$ kg m/s

[1]

(c) The van hits a tree and stops.

Alan is unhurt because the back of the van crumples.

Put a tick (✓) in the box next to the reason why Alan is unhurt.

The crumpling reduces Alan's momentum slowly.	☐
The crumpling reduces Alan's momentum quickly.	☐
Alan's seatbelt reduces his momentum quickly.	☐

[1]

[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.