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 19 JANUARY 2011: Morning
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (AC/SW) 11MEP01141 40158/3

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **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).**
- **Answer ALL the questions.**

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 pages 4 and 5.**
- **The Periodic Table is provided.**

BLANK PAGE

QUESTION 1 BEGINS ON PAGE 6

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

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

ELECTRIC CIRCUITS

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

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

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

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

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

THE WAVE MODEL OF RADIATION

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

Answer ALL the questions.

1 Brad is riding in a cycle race.

He gets hot.

His body tries to keep his internal temperature constant.

(a) Put a (ring) around the correct word to complete the sentence.

This is an example of

HOMEOSTASIS

HOMOLOGY

HYDROTHERAPY. **[1]**

(b) The day gets hotter.

The temperature of Brad's blood rises.

Complete the sentences using words from the list.

BRAIN

HEAT STROKE

HYPOTHERMIA

KIDNEY

SHIVERING

SKIN

The blood temperature rise is detected by receptors in the _____ .

His body responds using effectors in the _____ .

This reduces his blood temperature.

If his blood temperature stays too high he is suffering from _____ . **[3]**

(c) Early in the race Brad sweats a lot.

Later in the race his skin is hot and dry.

Explain why his temperature then gets higher.

_____

_____

_____ **[2]**

[Total: 6]

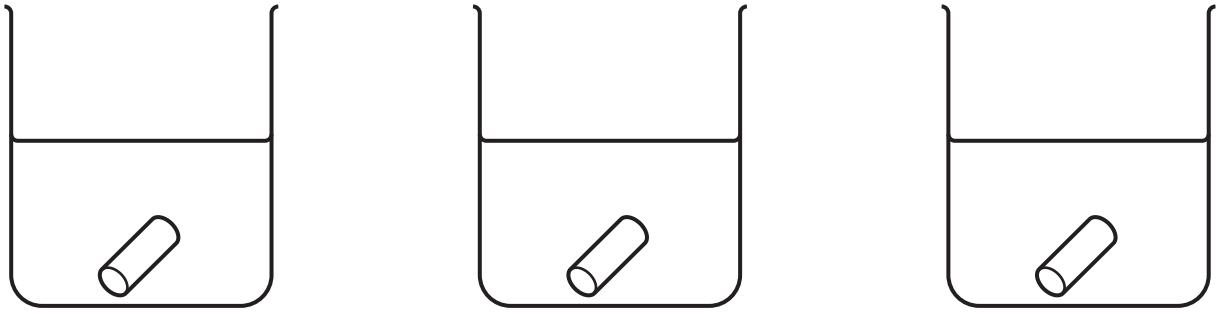
BLANK PAGE

QUESTION 2 BEGINS ON PAGE 10

2 Lisa investigates the movement of water into and out of potato cells.

She cuts three potato cylinders, each 50 mm long.

She places each potato cylinder in a different solution A, B or C.



solution A
distilled water

solution B
strong sugar soluton

solution C
weak sugar solution

After 60 minutes, she removes the potato cylinders and measures each of their lengths.

(a) Complete the table to show which solution each potato cylinder was placed in.

Use A, B and C.

LENGTH OF POTATO CYLINDER IN mm		SOLUTION
AT THE START	AFTER 60 MINUTES	
50	47	
50	52	
50	50	

[2]

(b) What do Lisa's results tell her about the membrane around the potato cells?

Complete the sentence.

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

The membrane is ...

... partially permeable. ☐

... permeable. ☐

... rigid. ☐

[1]

(c) What is the name for the movement of water into and out of these potato cells?

Put a (ring) around the correct answer.

EXCRETION OSMOSIS RESPIRATION

[1]

[Total: 4]

3 Molly is doing an experiment with the enzyme peroxidase.

Peroxidase speeds up the breakdown of hydrogen peroxide.

Bubbles of oxygen gas are produced.

(a) Peroxidase CANNOT be used to break down other chemicals such as starch.

Explain why.

_____

_____

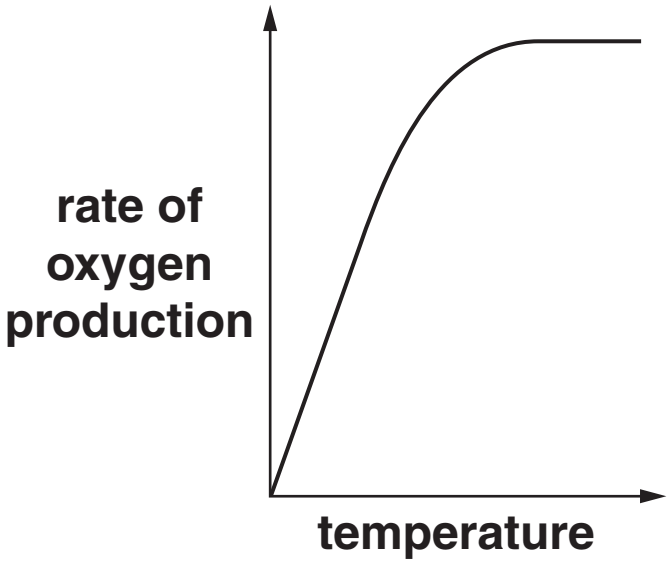
_____ **[2]**

(b) Molly changes the temperature of her mixture of enzyme and hydrogen peroxide.

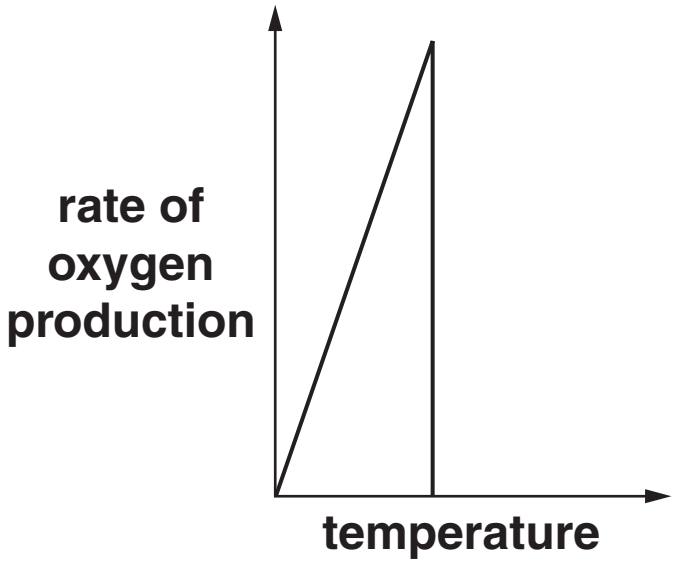
She measures the rate of oxygen production.

(i) Which graph, A, B, C or D, shows the pattern of her results as she increases the temperature to 80 °C?

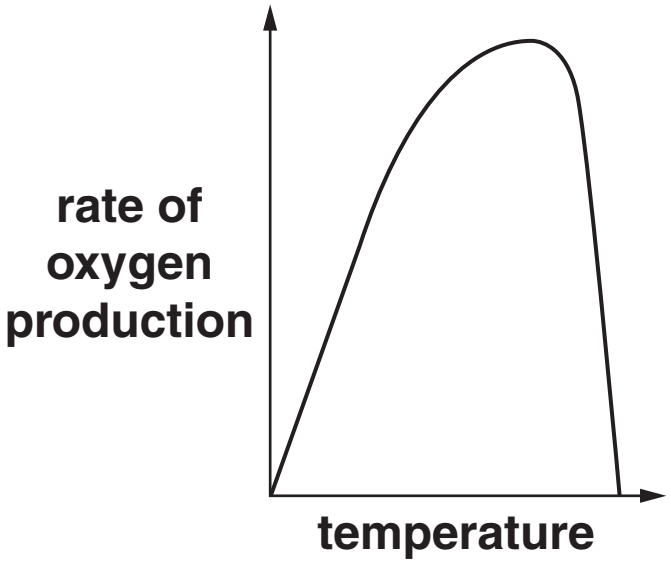
A



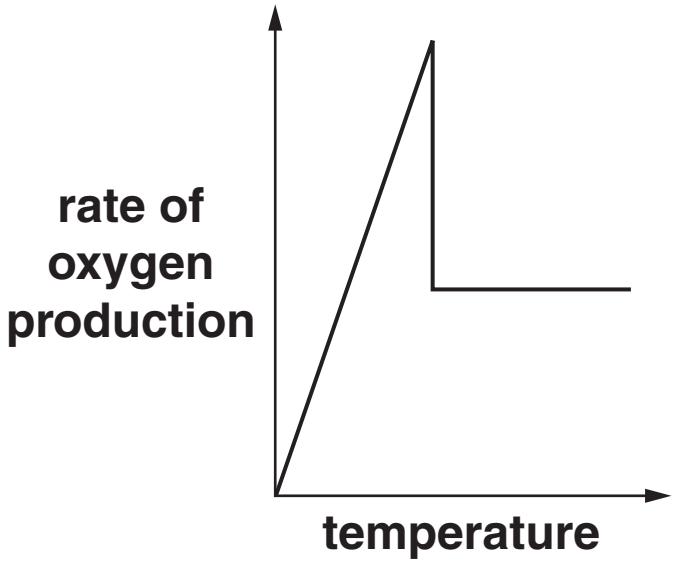
B



C



D



answer _____ **[1]**

(ii) Why does the rate of oxygen production increase in the first part of the graph?

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

The frequency of collisions increases. ☐

The enzyme is denatured. ☐

The hydrogen peroxide molecules are changing shape. ☐

The rate of collisions decreases. ☐

The size of hydrogen peroxide molecules increases. ☐

[1]

[Total: 4]

4 David's teacher tells the class about the elements in Group 1 of the Periodic Table.

She shows them three of the elements, lithium, sodium and potassium.

(a) Write the chemical symbols for lithium and potassium in the empty boxes.

You may use the Periodic Table provided.

ELEMENT	SYMBOL
lithium	
sodium	Na
potassium	

[1]

(b) The teacher puts small pieces of the metals into beakers of water.

They all react with the water.

(i) Draw lines from each ELEMENT to the REACTION that David sees.

ELEMENT	REACTION
lithium	floats, remains solid, moves slowly
sodium	floats, melts, moves rapidly, bursts into lilac flames
potassium	floats, melts, moves rapidly, fizzes

[2]

(ii) What is made when sodium reacts with water?

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

sodium hydroxide ☐

sodium hydroxide and hydrogen ☐

sodium hydroxide, hydrogen and water ☐

sodium hydroxide and carbon dioxide ☐

[1]

(c) Sodium also reacts with chlorine to make sodium chloride.

What is the chemical formula of sodium chloride?

answer _____ **[1]**

(d) Some streetlights use an electric current to heat elements so that they give out light.

David knows that the light from the streetlight outside his house comes from sodium atoms.

How can he tell this?

_____

_____ **[1]**

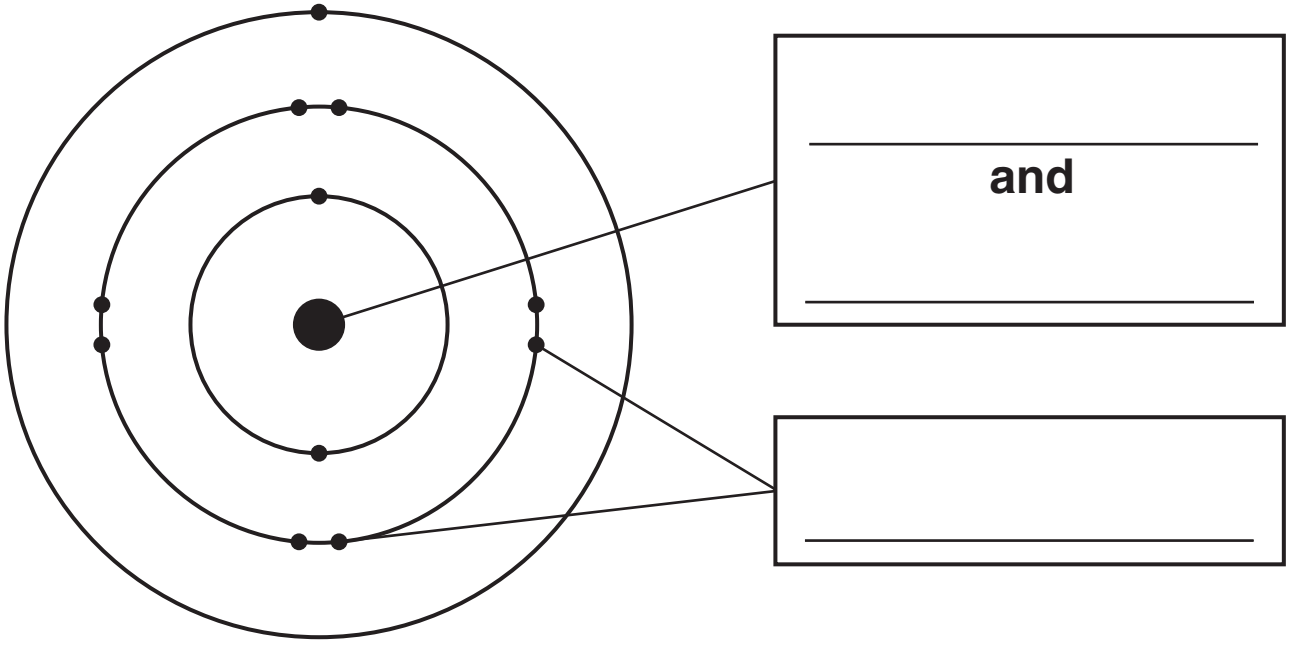
(e) Which element in Group 1 is the MOST reactive?

Use the Periodic Table provided to help you.

element name _____ [1]

[Total: 7]

5 Jo draws a diagram of a neutral atom of an element.



(a) (i) Write labels in the empty boxes to show what an atom is made of.

Use the words ELECTRONS, NEUTRONS and PROTONS. [1]

(ii) How many PROTONS does this atom have?

answer _____ [1]

(iii) Jo looks at the diagram.

Which group of the Periodic Table is the element in?

Explain how she can tell this.

group number _____

explanation _____

_____

_____ **[3]**

(iv) This atom can easily form an ion.

How does it do this?

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

It loses an electron. ☐

It gains an electron. ☐

It loses a proton. ☐

It gains a proton. ☐

[1]

(b) Another atom has a relative atomic mass of 39 and a proton number of 19.

How many neutrons does this atom contain?

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

19 ☐

20 ☐

39 ☐

58 ☐

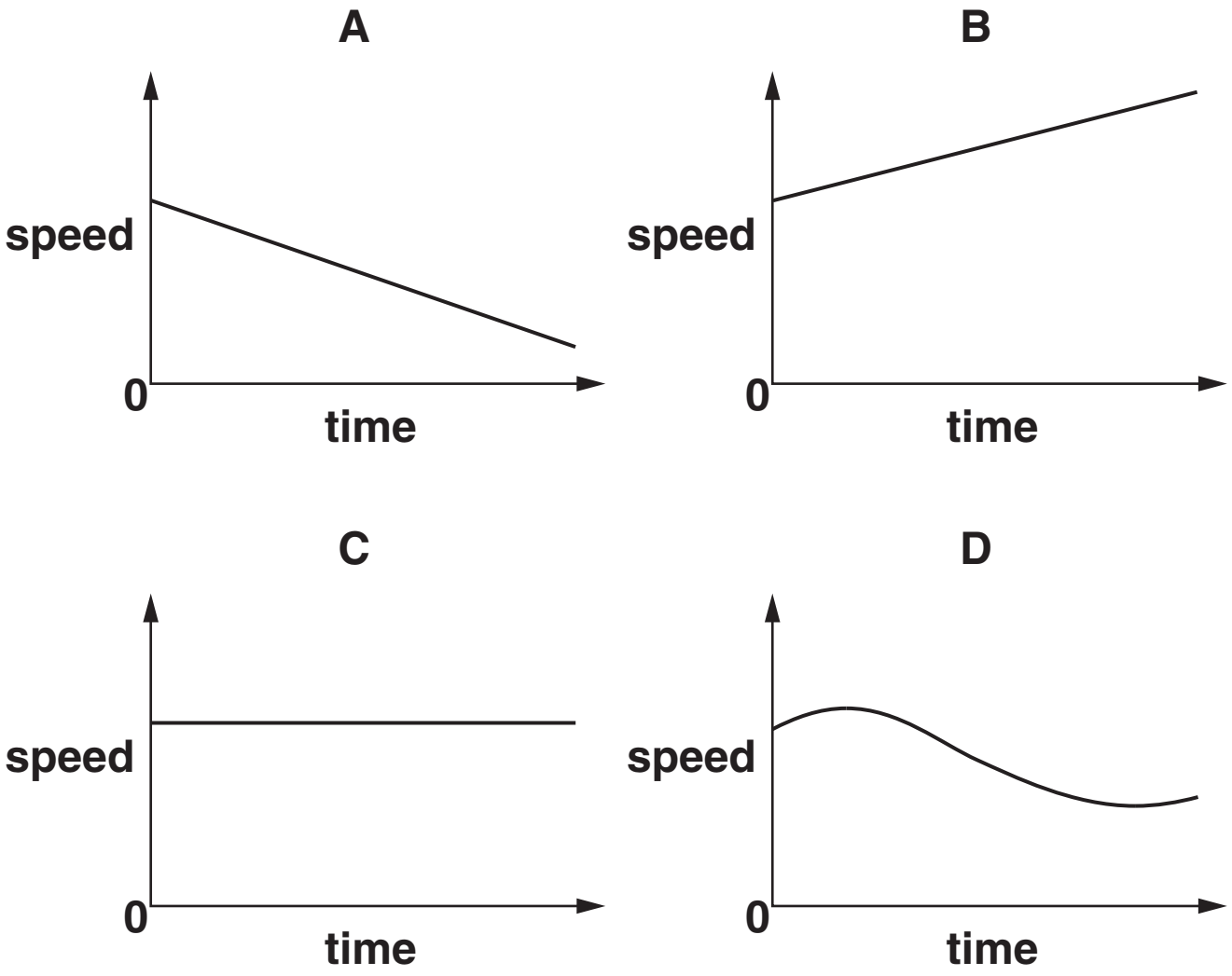
[1]

[Total: 7]

6 Sam is a truck driver.

Sam's truck contains a tachograph. This records a speed-time graph for her truck.

(a) Here are some speed-time graphs.



Which graph, A, B, C or D, shows the truck moving at a constant speed?

answer _____ **[1]**

(b) Sam drives her truck from the factory to a supermarket along small roads and motorways.

The journey takes four hours.

The tachograph correctly records her AVERAGE speed as 90 kilometres per hour.

Trucks are not allowed to go faster than 90 kilometres per hour.

Explain why Sam must have gone faster than this at some point.

_____

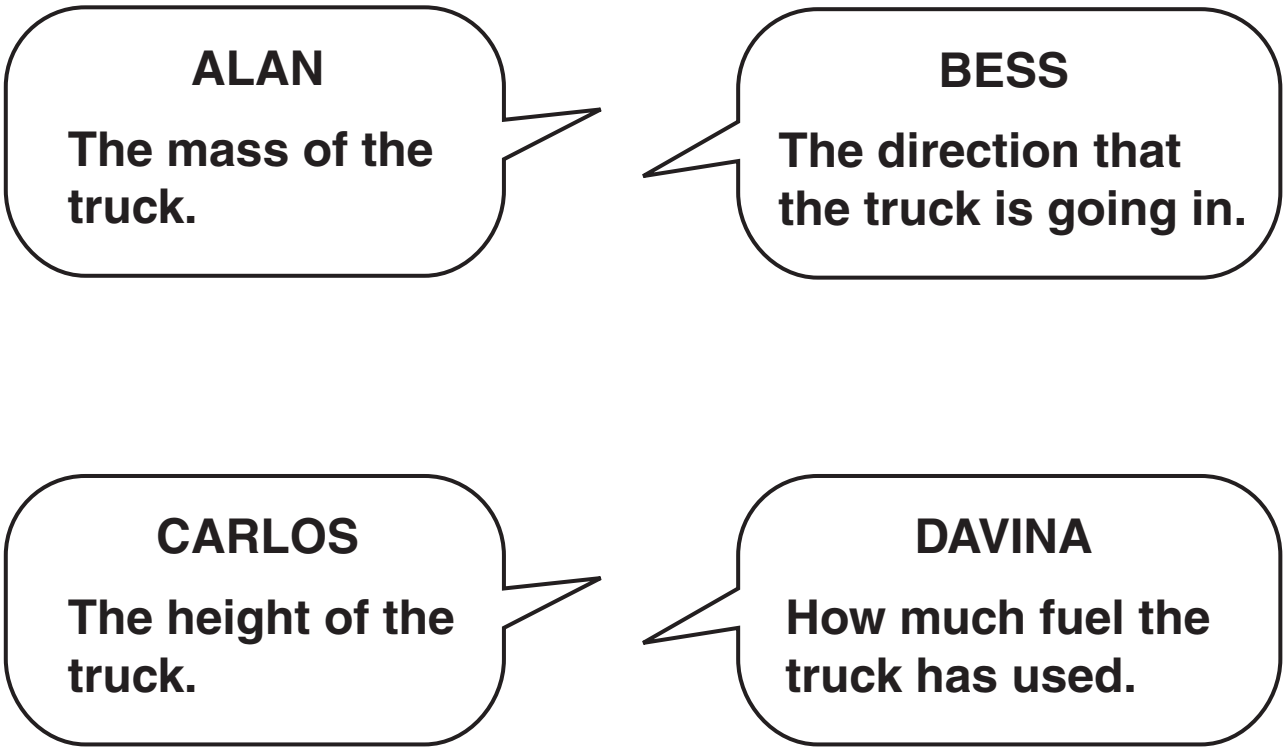
_____

_____

_____ **[2]**

(c) Sam knows that the velocity of her truck tells her how fast it is going.

She asks her friends what ELSE velocity tells her about her truck.



Which friend is correct?

answer _____ **[1]**

(d) Sam reverses the truck into a parking space.

This requires a change of distance of –15 m.

The next morning she moves the truck forward, just out of the parking space.

What change of distance will this require?

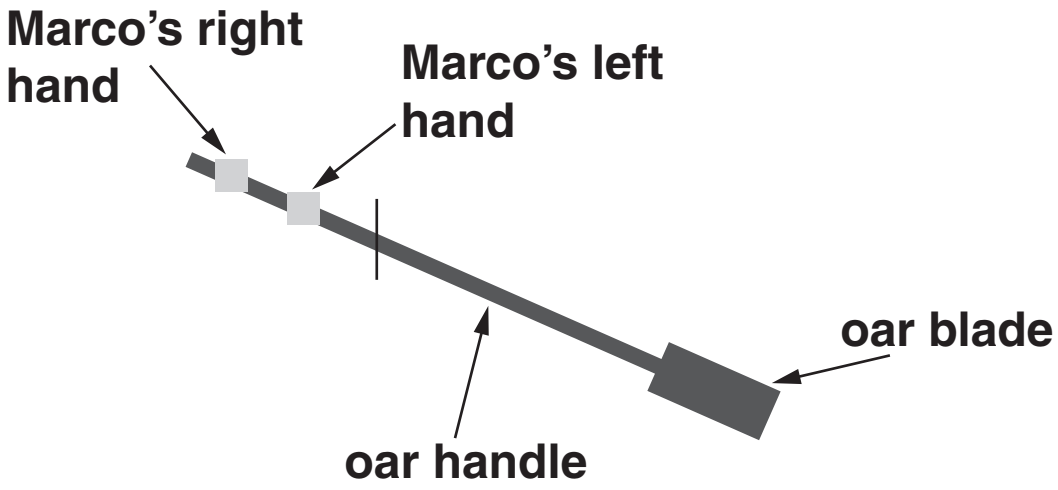
Put a (ring) around the correct answer.

–30 m **–15 m** **0 m** **+15 m**

[1]

[Total: 5]

7 Marco rows a boat along a canal.



(a) Marco's hand and the OAR HANDLE are an interaction pair.

Complete the sentences by putting a (ring) around the best words.

Marco pushes the oar handle forwards.

The oar handle pushes on

MARCO'S HAND / THE WATER.

The direction of the force from the oar handle on Marco's hand is

BACKWARDS / FORWARDS. [1]

(b) The OAR BLADE exerts a force on the water.

The blade moves as it exerts the force.

What effect does this have on the water?

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

The water stops moving. ☐

Some work is done on the water. ☐

The mass of the water increases. ☐

The temperature of the water goes down. ☐

[1]

(c) Marco uses his oar to change the energy of his boat as it moves through the water.

What is this type of energy called?

_____

What happens to this energy when Marco changes the speed of the boat?

_____

_____

_____

_____ **[3]**

[Total: 5]

BLANK PAGE

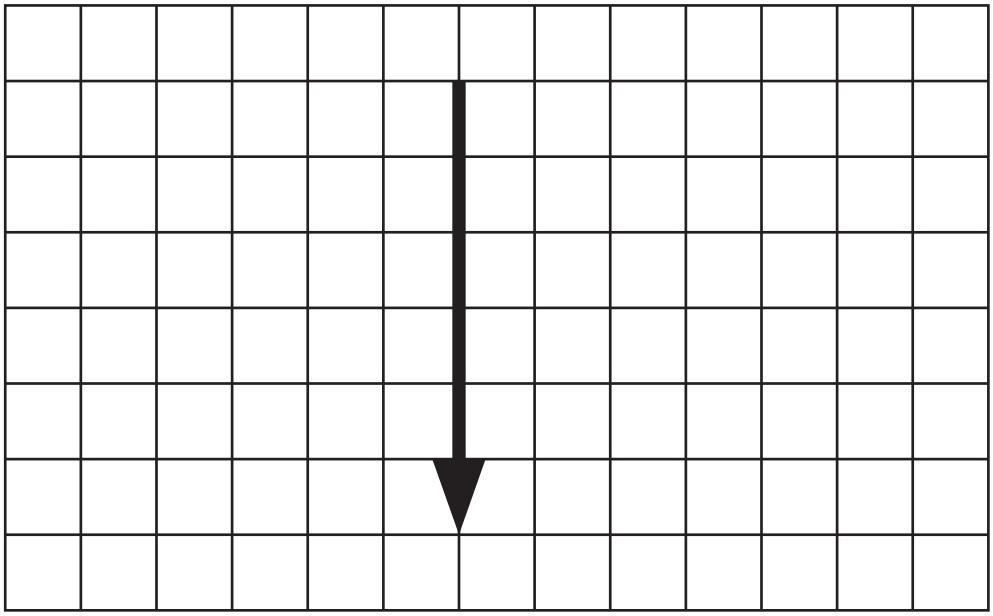
QUESTION 8 BEGINS ON PAGE 30

8 Ivan uses a snowmobile while he is on holiday.

At one place in the journey, these five forces act on the snowmobile.

FORCE ACTING	DIRECTION	SIZE IN NEWTONS
reaction from snow	upwards	1800
snowmobile's weight	downwards	1200
Ivan's weight	downwards	600
driving force	forwards	300
counter force	backwards	100

(a) This arrow represents the force of Ivan's weight on the snowmobile.



Draw another arrow on the grid to represent the DRIVING FORCE on the snowmobile. [1]

(b) What is the size and direction of the RESULTANT force in the HORIZONTAL direction?

Draw one line to link the SIZE of the RESULTANT horizontal force to its DIRECTION.

SIZE	DIRECTION
100 N	forwards
200 N	backwards
300 N	
400 N	

[1]

(c) The resultant vertical force on the snowmobile is zero.

Here are some statements about the snowmobile.

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

The vertical momentum of the snowmobile is constant. ☐

The total mass of the snowmobile is zero. ☐

The snowmobile starts to move upwards. ☐

The snowmobile starts to slow down. ☐

[1]

(d) The speed of the snowmobile is 15 m/s.

Ivan's mass is 60 kg and his weight is 600 N.

Put a (ring) around the correct value for Ivan's momentum in kg m/s.

4 40 900 9000

[1]

[Total: 4]

END OF QUESTION PAPER

BLANK PAGE

BLANK PAGE

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.