OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B623/02

ADDITIONAL SCIENCE B

Unit 1 Modules B3 C3 P3 (Higher 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)

Wednesday 25 May 2011
Morning

Duration: 1 hour

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. 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.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **28** pages. Any blank pages are indicated.

DC (SHW 00621 4/10) 32733/6

EQUATIONS

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

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2}\,mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

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

Answer **all** the questions.

Section A – Module B3

1 Ethan is two years old.

His body mass has been measured every three months.

The table shows his results.

age in months	0	3	6	9	12	15	18	21	24
mass in kg	2.4	5.0	6.3	7.6	8.8	9.6	9.9	10.1	10.2

(a) Look at the table.

(i) In which three month period did Ethan's mass increase the **most**?

answer: from age ..... months to age ..... months **[1]**

(ii) In which three month period did Ethan's mass increase the **least**?

answer: from age ..... months to age ..... months **[1]**

(b) It is important to collect data on how the mass of a baby changes.

Why is it important?

.....

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

(c) Ethan started life when a sperm cell from his father fertilised an egg cell from his mother.

The fertilised egg cell then divided to form new cells.

(i) What type of cell division formed the new cells?

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

(ii) Put ticks (✓) in the table to show whether each type of cell is haploid or diploid.

	haploid	**diploid**
egg cell		
muscle cell		
skin cell		
sperm cell		

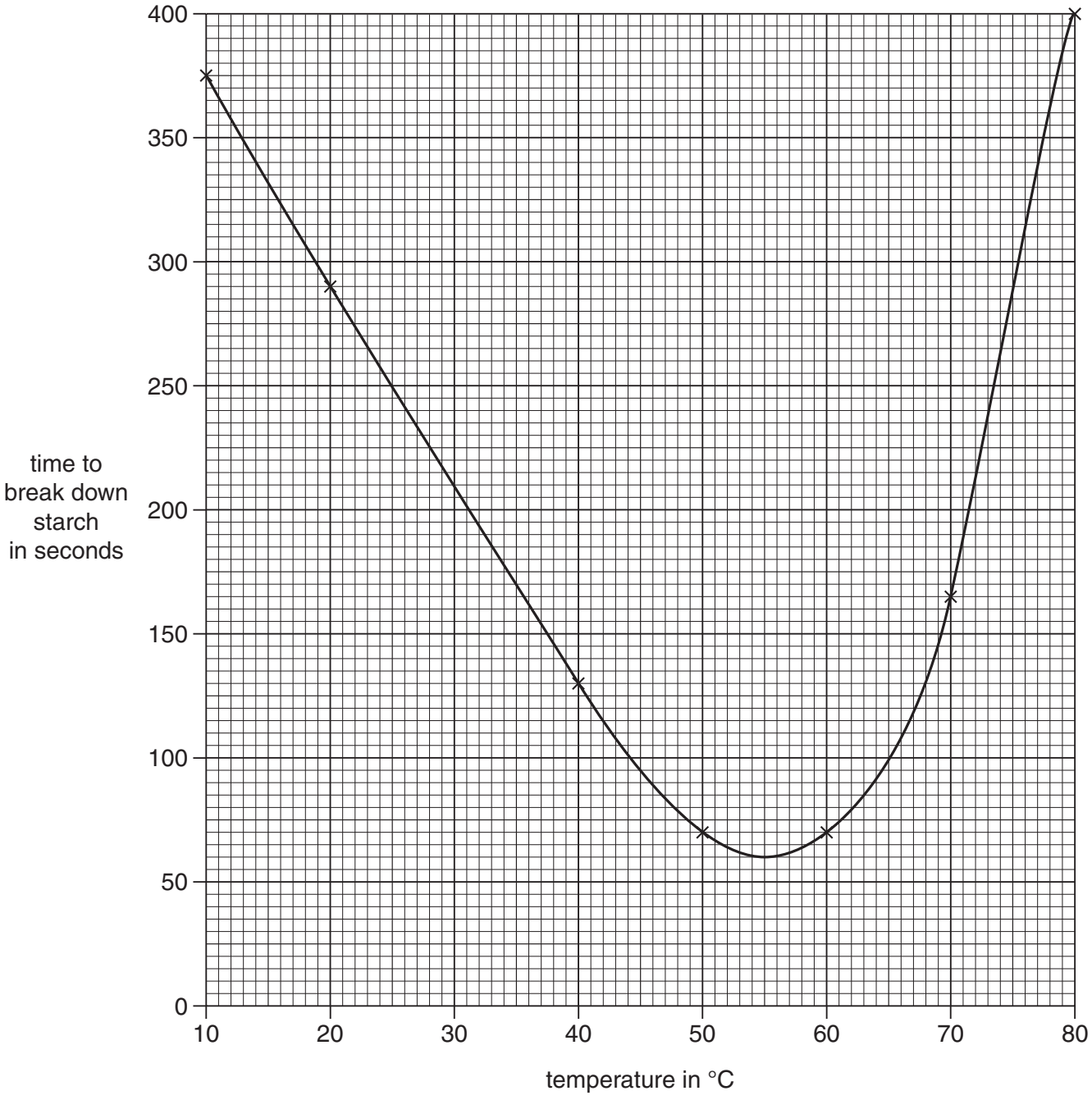
[1]

[Total: 5]

2 Amylase is an enzyme that breaks down starch.

(a) Ann investigates how quickly one type of amylase breaks down starch at different temperatures.

The graph shows her results.



(i) Look at the graph. What is the optimum temperature of this amylase?

answer ..... °C **[1]**

(ii) Explain what happens to the amylase at 70 °C.

.....

.....

.....

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

(b) In the digestive system, amylase helps break down starch molecules into glucose molecules.

The glucose molecules are absorbed into the blood.

(i) By what process are glucose molecules absorbed into the blood?

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

(ii) Starch has to be broken down into glucose before it can be absorbed into the blood.

Suggest why starch has to be broken down before it can be absorbed.

.....

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

(c) Glucose is absorbed into the blood in the small intestine.

Describe **two** ways the small intestine is adapted for the absorption of food.

1 .....

.....

2 .....

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

(d) Glucose is absorbed into the blood so it can be transported around the body.

Which part of the blood transports glucose?

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

[Total: 9]

3 **(a)** Many zoos have breeding programmes for endangered species.

This may involve breeding together animals from different zoos, and even from different countries.

One example of this is with cheetahs.

The breeding programmes are planned to avoid problems from **inbreeding**.

(i) What is inbreeding?

.....

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

(ii) Suggest why inbreeding might cause problems.

.....

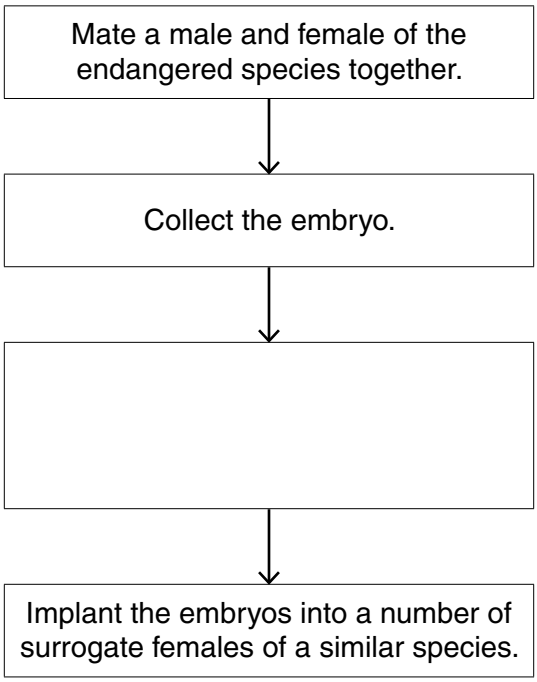
..... **[1]**

(b) Another way to help endangered species is to clone their embryos.

The embryos can be transplanted into surrogates of a similar species to grow.

One example of this is the gaur, an ox-like animal, whose embryos have been transplanted into cows.

(i) Complete the flow diagram to show how cloning by embryo transplant works.



[1]

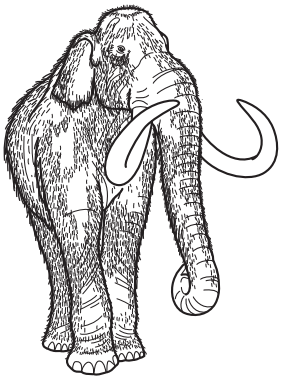
(ii) Suggest **one** advantage of reproducing endangered species by cloning and transplanting embryos rather than breeding them normally.

.....

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

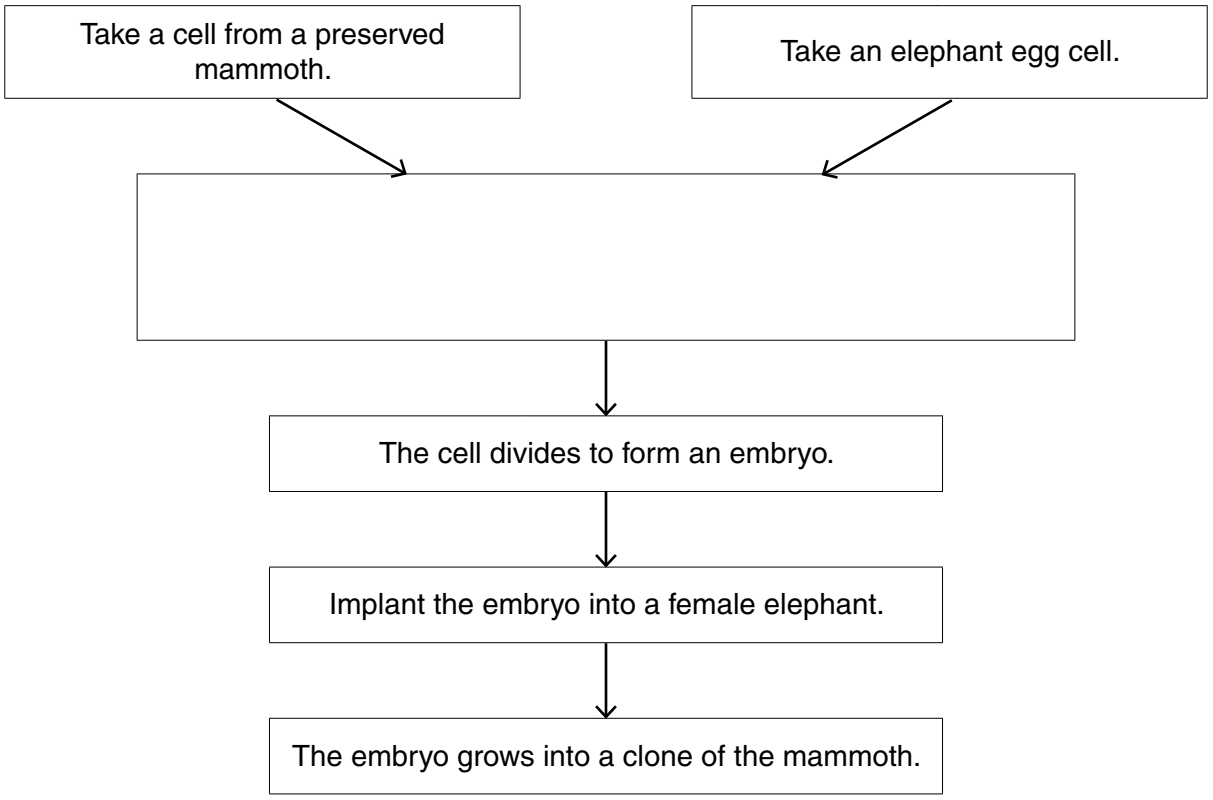
Turn over for the remainder of question 3

(c) Some scientists are trying to recreate extinct animal species, such as mammoths.



They are using a similar cloning technique to the one that was used to produce Dolly the sheep.

(i) Complete the diagram to show how this would work.



[1]

(ii) The scientists **cannot** use just any cell from the preserved mammoth.

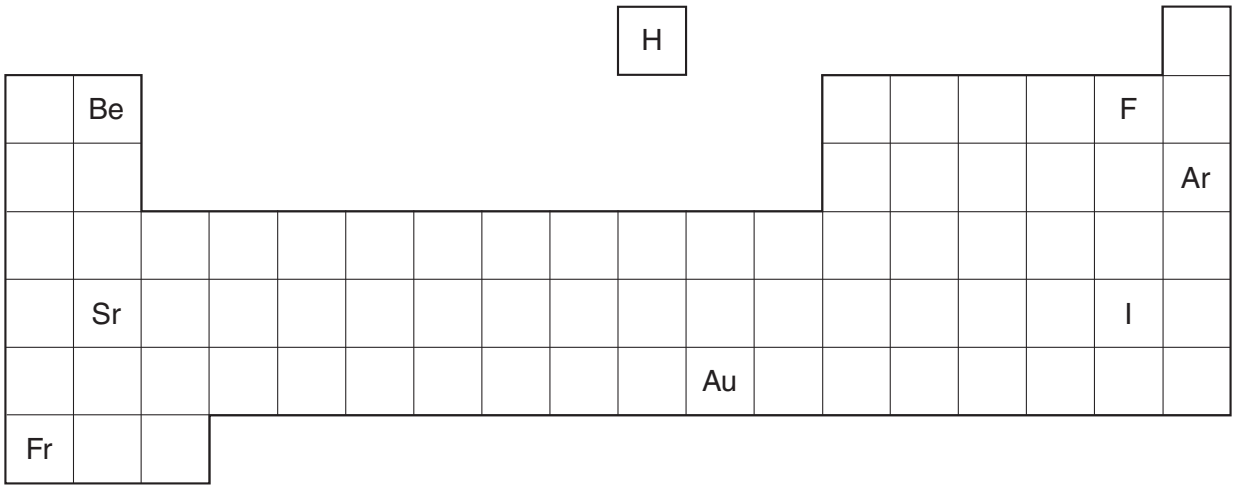
Suggest why a red blood cell would **not** be suitable.

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

[Total: 6]

Section B – Module C3

4 Look at the diagram. It shows an outline of the Periodic Table.



Answer the questions.

Choose your answers **only** from the symbols shown on the outline Periodic Table.

Each symbol can be used **once**, **more than once** or **not at all**.

(a) Which symbol shows an atom with a full outer shell of electrons?

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

(b) Which symbol shows an element in Group 7 that is a dark grey solid?

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

(c) Which symbol shows an atom with the electronic structure 2.7?

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

[Total: 3]

5 Jenny investigates the use of different metals for electrical wiring.

The table below shows information about four different metals.

metal	density in g/cm^3	relative electrical conductivity	melting point in °C	relative thermal conductivity
iron	8	10	1536	80
aluminium	3	38	660	237
copper	9	60	1084	401
magnesium	2	23	650	156

(a) (i) Iron is the cheapest of the four metals.

Iron is **not** used for electrical wiring in houses.

Explain why. Use information from the table.

.....

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

(ii) The picture shows some overhead power cables.

Aluminium is used for making overhead power cables instead of copper.

Aluminium is cheaper than copper.

Suggest one **other** reason why aluminium is used. Use information from the table.

.....

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

(b) Some metals can be used to make **superconductors**.

Superconductors are used in the Japanese MAGLEV train. The train floats above the track.

(i) What is meant by a superconductor?

.....

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

(ii) Write about **one** disadvantage of superconductors.

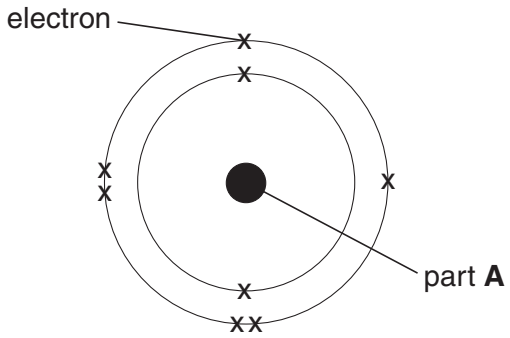
.....

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

[Total: 4]

6 This question is about atomic structure.

The diagram shows the structure of an oxygen atom.



Complete the crossword puzzle using the clues given. One has been done for you.

clues across

2 Protons and neutrons are found in the _ _ _ _ _ _ _ .

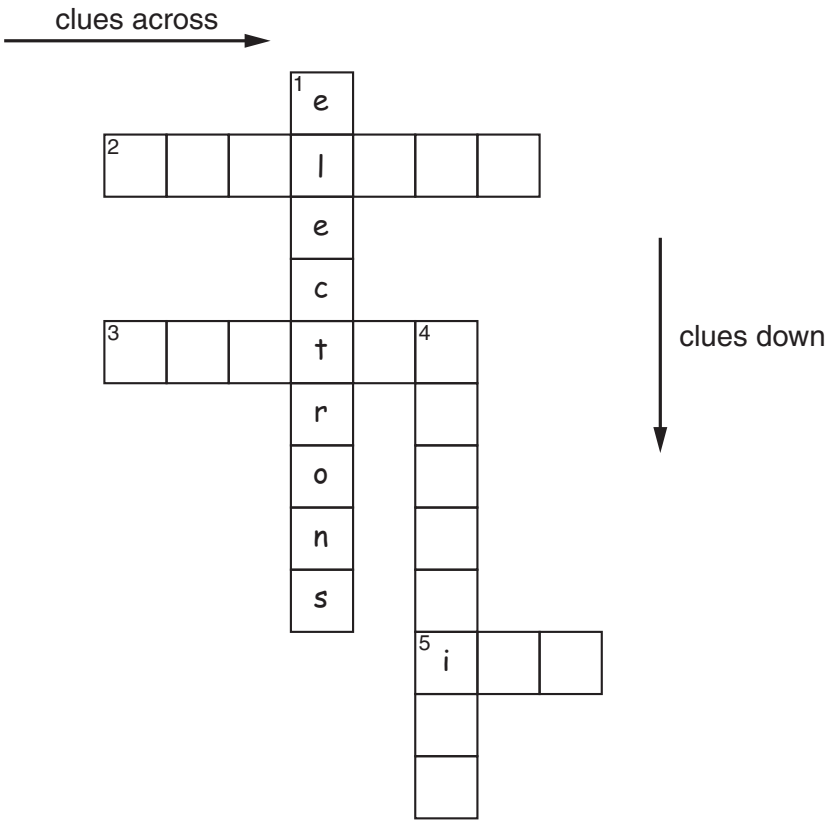
3 A particle with a relative mass of 1 is called a _ _ _ _ _ _ .

5 A particle made by the loss or gain of electrons is called an _ _ _ .

clues down

1 The space around part **A** is occupied by e l e c t r o n s .

4 The electrical charge on an electron is _ _ _ _ _ _ _ _ .

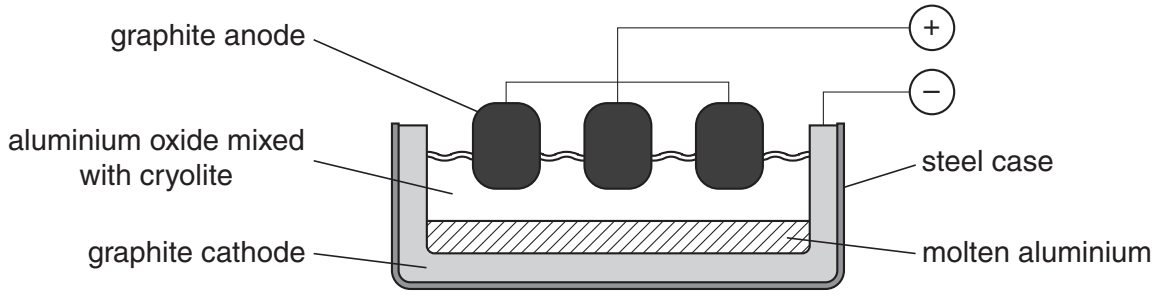


[4]

[Total: 4]

7 This question is about electrolysis.

(a) Aluminium is extracted by the electrolysis of aluminium oxide.



Write about how aluminium is extracted.

Your answer should include

- the name of the substance made at each electrode
- the reason why the aluminium oxide is mixed with cryolite
- the reason why the extraction of aluminium is expensive.

.....

.....

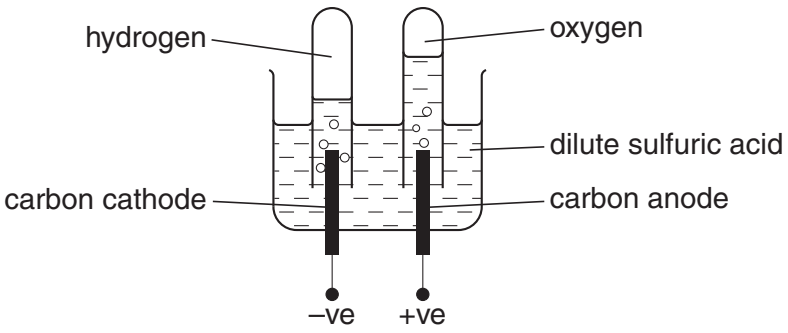
.....

.....

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

(b) Look at the diagram.

It shows the electrolysis of dilute sulfuric acid.



Hydroxide ions, OH^-, move to the positive electrode.

The hydroxide ions lose electrons. Oxygen, O_2, and water are made.

Write a **balanced symbol** equation for this reaction. Use e^- to represent an electron.

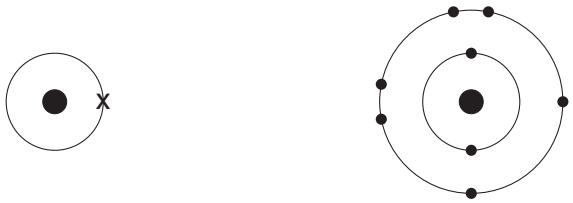
..... **[2]**

(c) Water is a molecule containing hydrogen – oxygen covalent bonds.

A covalent bond is a shared pair of electrons.

Look at the diagrams.

They show the electronic structures of hydrogen and oxygen.



hydrogen oxygen

Draw a 'dot and cross' diagram to show the bonding in water, H_2O.

[2]

[Total: 7]

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8 This question is about the Group 1 elements.

Lithium, sodium and potassium are Group 1 elements.

(a) Sodium reacts with water.

A gas that burns with a squeaky 'pop' is made.

Write down the name of this gas.

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

(b) Atoms of Group 1 elements all have one electron in their outer shell.

When they react, they lose this outer electron.

Potassium is more reactive than sodium.

Explain why.

.....

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

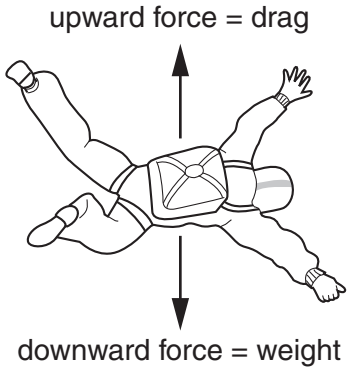
[Total: 2]

Section C – Module P3

9 **(a)** Patrick is a parachutist.

He jumps out of an aeroplane.

At first his speed increases.



(i) Why does his speed **increase**?

Choose from

A drag is greater than weight

B drag and weight are equal

C weight is increasing

D weight is greater than drag

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

(ii) What happens to the drag as Patrick's speed increases?

Choose from

A drag becomes less

B drag increases

C drag becomes greater than weight

D drag stays the same

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

(iii) Patrick reaches his **terminal speed** before he opens his parachute.

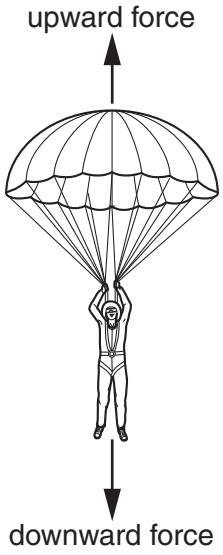
Why does Patrick travel at his terminal speed?

.....

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

(b) After falling 500 m at **this** terminal speed Patrick opens his parachute.

He then falls at a **different** terminal speed.



What happens to the time to fall 500 m at the new terminal speed?

Complete the sentences.

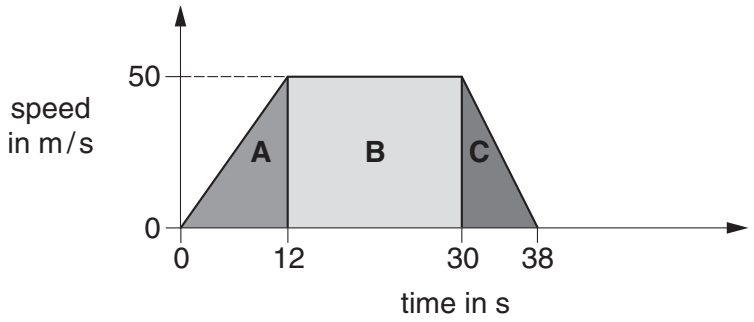
When Patrick's parachute is fully open he takes a ..... time to fall 500 m.

This is because he is falling at a ..... terminal speed. **[2]**

[Total: 5]

10 Fernando is a racing driver.

Look at the graph. It shows the speed of his car during part of a race.



(a) (i) Calculate the **distance** travelled in part **A** of the graph.

.....

.....

.....

answer ..... m **[2]**

(ii) The kinetic energy of the car remains constant in part **B** of the graph.

Explain why.

.....

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

(iii) The graph shows the following features:

- Part **A** is an acceleration, part **C** is a deceleration.
- The value of the deceleration in **C** is **greater** than the value of the acceleration in **A**.

Describe how the **graph** shows these two features.

.....

.....

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

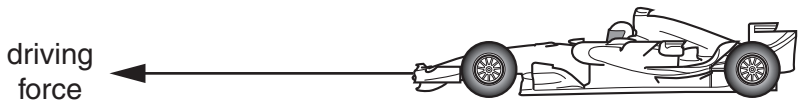
(b) In a different part of the race Fernando makes the car **accelerate** quickly.

(i) Complete the sentence.

Acceleration is the ..... in speed per unit ..... . **[1]**

(ii) The acceleration of the car is $5\,m/s^2$.

The total mass of the car and driver is 1200 kg.



Calculate the **driving force**.

The equations on page 2 may help you.

.....

.....

answer ..... N **[2]**

(iii) Fernando drives the car along a **straight** part of the racing circuit.

The length of the straight part of the racing circuit is 200 m.

The driving force is now 8000 N.

The driving force stays the same along the straight part of the racing circuit.

Calculate the **work done** by the car's engine.

The equations on page 2 may help you.

.....

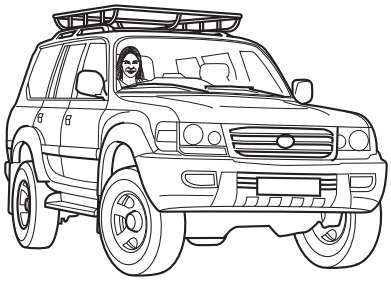
.....

.....

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

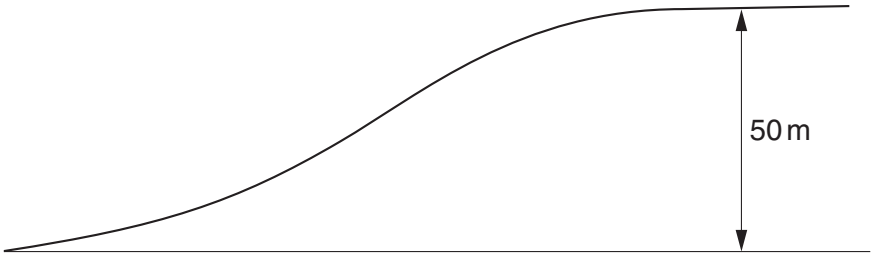
[Total: 9]

11 Amelia drives a car.

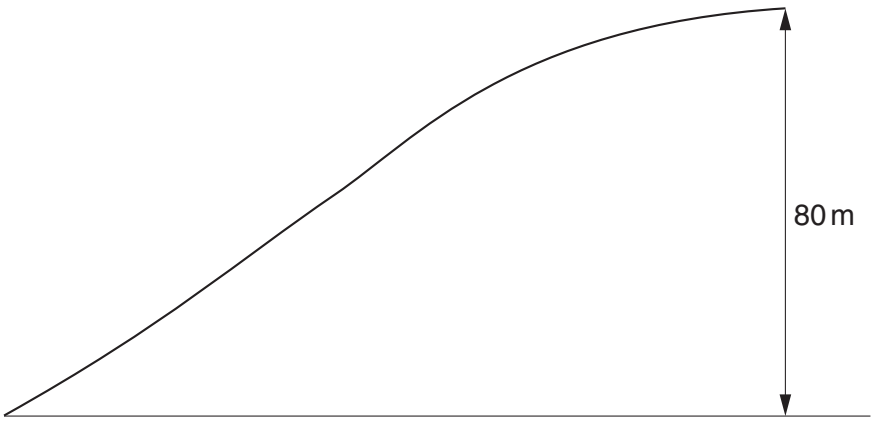


four wheel drive SUV
mass = 2000 kg

(a) She drives the car up a hill.



Leon then drives the **same** car up a different hill.



The fuel consumption is **higher** when Leon drives the car.

Suggest why the fuel consumption increases when Leon drives the car.

In your answer write about

- where the car was driven
- gravitational potential energy
- how Amelia and Leon drive the car.

.....

.....

.....

.....

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

(b) The car then travels down the hill.

The car travels at **twice** the speed that it did on the way up.

Complete the sentence to show how much the kinetic energy (KE) of the car changes.

When the **speed** of the car doubles, the KE of the car..... . **[1]**

[Total: 4]

12 This question is about a car braking.

A car can have a normal braking system or an anti-lock braking system (**ABS**).

Look at the table.

type of brakes	braking distance in m		
	on a dry road when braking from 15 m/s to 0 m/s	on a dry road when braking from 30 m/s to 0 m/s	on an icy road when braking from 15 m/s to 0 m/s
ABS	10	40	60
normal	12	48	80

Finish the sentences about braking by choosing the **best** words from this list.

Each word may be used **once**, **more than once** or **not at all**.

brake	**friction**	**higher**	**increase**
improves	**locking**	**lower**	**maximum**
the same	**thrust**	**turning**	

Braking distance is ..... when the car travels at a greater speed

or if there is a ..... frictional force.

On icy roads there is less ..... between the road and the tyres.

The braking distance is ..... with ABS brakes.

This is because the brakes are constantly going on and off.

This provides a ..... intermittent braking force which prevents skidding.

ABS brakes stop the wheels from ..... so that the driver can

keep control of the car. **[2]**

[Total: 2]

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.