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 20 May 2009
Afternoon

Duration: 1 hour

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

*   Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
*   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.
*   Do **not** write in the bar codes.
*   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.
*   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 **24** pages. Any blank pages are indicated.

OCR is an exempt Charity

Turn over

2

EQUATIONS

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

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

force = mass × acceleration

work done = force × distance

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

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

potential energy = mgh

weight = mass × gravitational field strength

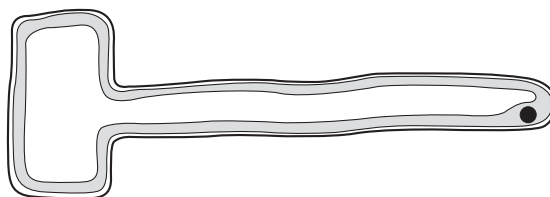$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

3

Answer **all** the questions.

Section A – Module B3

1   Sam is investigating roots.

She uses a microscope to look at a root hair cell.

The diagram shows one of the cells Sam sees.

(a) Write down the name of **one** part of this cell **not** found in animal cells.

.... **[1]**

(b) Oxygen moves into the root hair cell by diffusion.

What is meant by the term **diffusion**?

....

.... **[1]**

(c) Sam places a growing bean seed on a rotating disc.
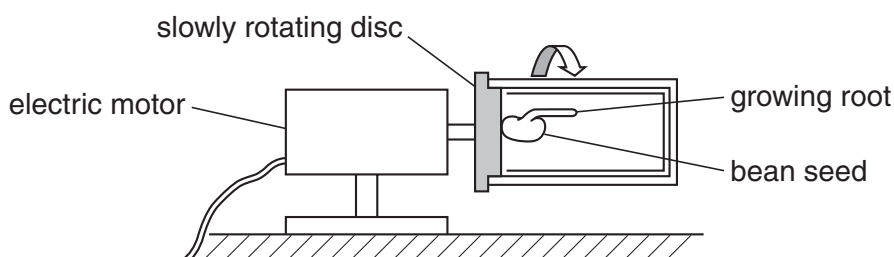
Finish the sentences about the growing root.

Roots normally grow downwards because they are positively ………………………… .

The root on this bean is growing outwards because Sam has removed the effect of

…………………………………… .

Root growth is controlled by a hormone called ………………………………… .   **[3]**

[Total: 5]

4

2 This question is about fertilisation.

Sperm and egg cells carry out fertilisation.

They both have a nucleus to carry genes.

sperm cell
(not to scale)

egg cell

sperm cells
(drawn to scale)

(a) (i) Write down the name of the type of cell division that **makes** egg and sperm cells.
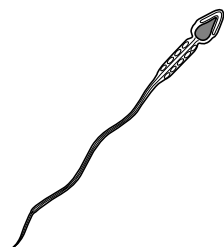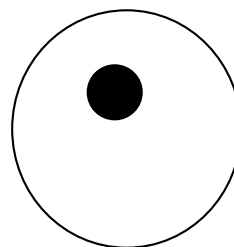
.... **[1]**

(ii) This type of cell division is different to the cell division that makes body cells.

Describe **one** difference.

.... **[1]**

(b) The nucleus of the egg and sperm both contain DNA.

After fertilisation the DNA replicates.

Describe the **two** stages involved in DNA replication.

You may draw a labelled diagram to help you.

1 ....

....

2 ....

.... **[2]**

[Total: 4]

3 Carol grows carrots to enter in the biggest carrot competition.

stem

tap root
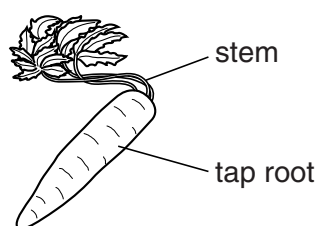
(a) She uses selective breeding to help her to produce large carrots.

    (i) Describe how Carol would carry out the selective breeding process.

       ....

       ....

       .... **[2]**

    (ii) Describe **one** reason why selective breeding may cause problems to a species.

       .... **[1]**

(b) Carrots contain a gene that controls beta-carotene production.

The beta-carotene gene can be removed from carrots and placed in rice plants.

This process can be used to help people who eat a lot of rice and have a vitamin A deficiency.

Explain why.

.... **[1]**

[Total: 4]

Turn over

6

4   Look at the diagram of an artery and vein.

thick muscle wall

large lumen

artery   vein
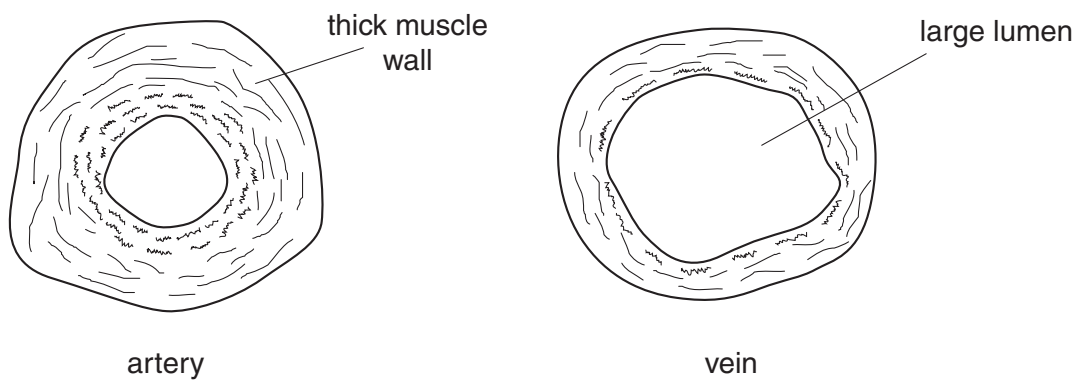
(a) Explain why the artery has a thick muscle wall.

....

.... **[1]**

(b) Explain why the vein has a large lumen.

....

.... **[1]**

[Total: 2]

7

5 Bill investigates the effect of the enzyme catalase.

He uses the enzyme to break down hydrogen peroxide into oxygen and water.

He measures the rate of the reaction by timing how long it takes to collect $10\,cm^3$ of oxygen.

He repeats the reaction at different pH values.

The table shows his results.

pH	time in minutes
2	no reaction
4	20
5	12
6	9
7	13
8	17

(a) Describe the pattern in the results between pH 4 and pH 8.

....

.... **[1]**

(b) What is the optimum pH for catalase?

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

(c) Explain the result for pH 2.

Use ideas about the lock and key theory in your answer.

....

....

....

....

.... **[3]**

[Total: 5]

Turn over

Section B – Module C3

6 This question is about the elements in the Periodic Table.

Look at the list of elements.

argon	**chromium**
hydrogen	**iodine**
magnesium	**neon**
nitrogen	**oxygen**
potassium	**sodium**

Answer the questions.

Choose your answers from the list.

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

The Periodic Table on the back page may help you.

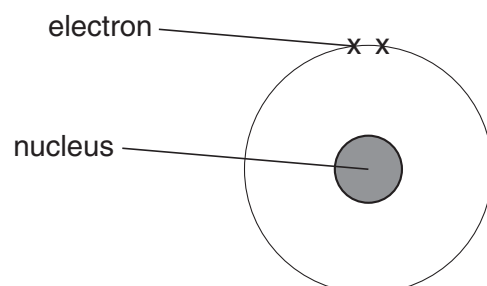**(a) (i)** Write down the name of the element which has only **6 electrons** in its outer shell.

.... **[1]**

(ii) Write down the name of the element which has the electronic structure **2.8.8.1**.

.... **[1]**

(b) Look at the diagram.

It shows a helium atom.

electron ———— x x

nucleus ————

The table shows some information about the particles found in the nucleus of a helium atom.

Complete the table.

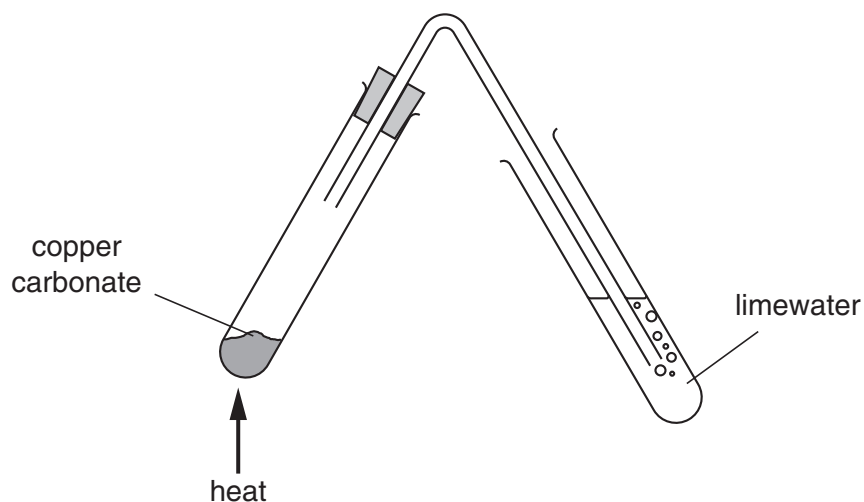| particle	relative mass	relative charge
neutron	………………………	………………………
proton	1	+1

[2]

[Total: 4]

Turn over

7 This question is about thermal decomposition.

Nick and Phil are heating some copper carbonate.

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

(a) Copper carbonate decomposes when it is heated.

Copper oxide and carbon dioxide are made.

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

.... **[1]**

(b) Copper is a transition element.

Write down one property of a **compound** of a transition element.

....

.... **[1]**

[Total: 2]

8   (a) Some metals become superconductors at very low temperatures.

Superconductors conduct electricity with no loss of power.

Explain why.

.... **[1]**

(b) The photograph shows a train built in Japan.

The train can travel at over 500 km per hour.

The train floats above a track.

This is possible by the use of superconductors.

(i) The Japanese train is held above the track by magnetism.

A superconductor uses a large current to make a powerful magnet.

Write down the name of this type of magnet.

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

(ii) These powerful magnets are an advantage of superconductors.

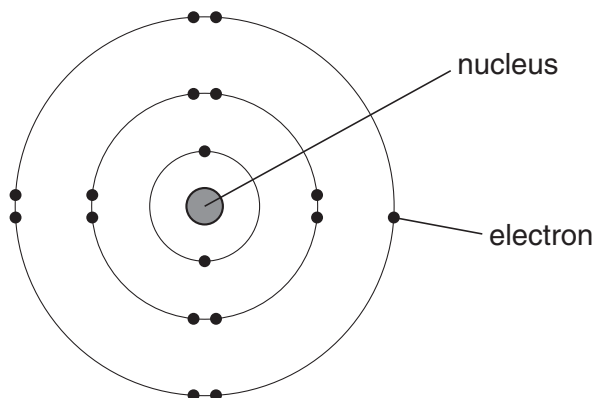Write down **one other** advantage and **one** disadvantage of using superconductors.

....

....

.... **[2]**

[Total: 4]

Turn over

12

9   This question is about the halogens.

They are in Group 7 of the Periodic Table.

Look at the diagram. It shows an **atom** of chlorine.

nucleus

electron

(a)   The halogens have similar chemical properties.

Explain why. Use ideas about electronic structure.

....

....   **[1]**

(b)   The atoms in a **molecule** of chlorine, Cl_2, are held together by a covalent bond.

Draw the 'dot and cross' diagram for a molecule of chlorine.

You only need to include the electrons in the outer shell of chlorine.

[2]

(c) Chlorine-35, $^{35}_{17}Cl$, and chlorine-37, $^{37}_{17}Cl$, are **isotopes** of chlorine.

What is the difference between these two isotopes?

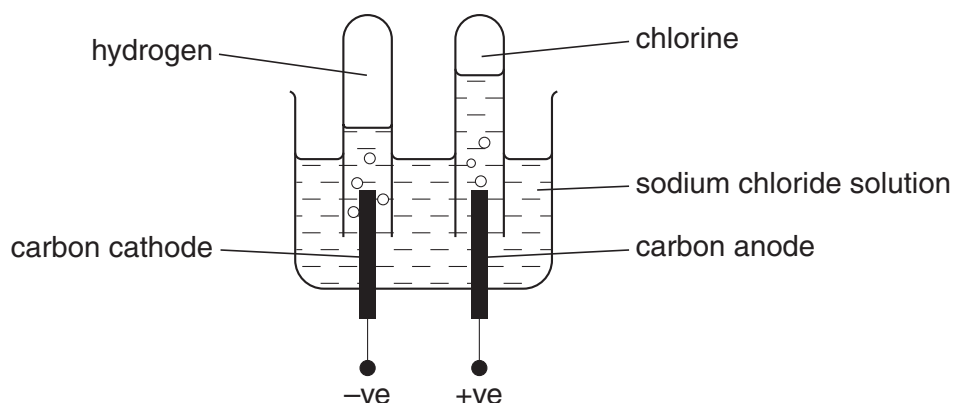...

.... **[1]**

[Total: 4]

Turn over

10 Sophie investigates passing an electric current through sodium chloride solution.

The diagram shows the apparatus she uses.

Look at the list. It shows the particles in the sodium chloride solution.

$$H^+ \qquad H_2O \qquad OH^- \qquad Cl^- \qquad Na^+$$

(a) Sophie finds that the solution conducts electricity.

Explain how a solution of sodium chloride conducts electricity.

.... **[1]**

(b) Sodium atoms, Na, lose electrons to make sodium ions, Na^+.

How many electrons does each sodium atom lose?

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

(c) At the cathode hydrogen ions, H^+, gain electrons to make hydrogen gas, H_2.
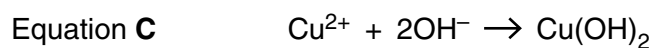
Write down the **equation** for the electrode reaction.

Use e^- to show an electron.

.... **[2]**

[Total: 4]

11 This question is about oxidation and reduction.

Look at these equations.

Equation **A** $\quad\quad Cl_2 + 2e^- \longrightarrow 2Cl^-$

Equation **B** $\quad\quad Cu^{2+} + 2e^- \longrightarrow Cu$

Equation **C** $\quad\quad Cu^{2+} + 2OH^- \longrightarrow Cu(OH)_2$

Equation **D** $\quad\quad Al - 3e^- \longrightarrow Al^{3+}$

(a) Which equation is an example of oxidation **only**?

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

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

(b) Which equation is **not** an example of an oxidation or reduction reaction?

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

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

[Total: 2]

Turn over

16

Section C – Module P3

12 This question is about gravitational potential energy.

(a) Look at the information in the table.

planet	gravitational field strength in N/kg
Earth	10
Jupiter	25
Mercury	4
Neptune	11
Pluto	1
Venus	9

Oliver calculates the gravitational potential energy for a 1 kg mass at a height of 2 m above the surface of each planet.

Where will the 1 kg mass have the greatest gravitational potential energy?

Choose from

Earth

Jupiter

Mercury

Neptune

Pluto

Venus

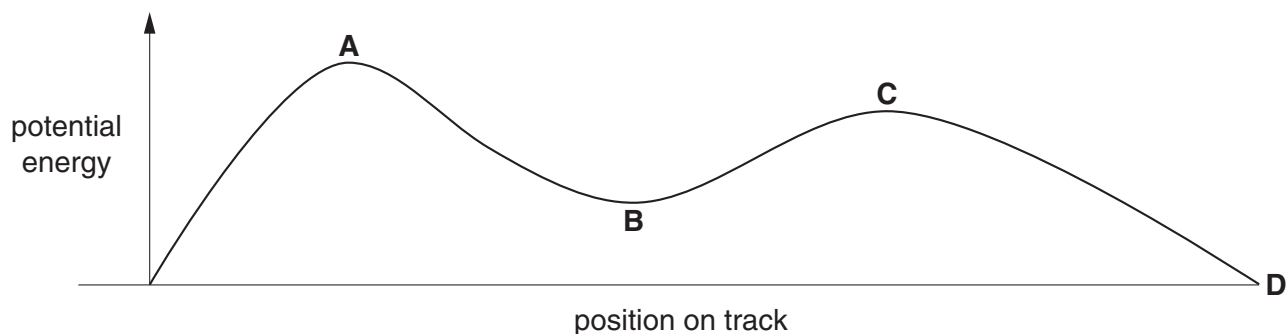answer .... **[1]**

(b) Look at the graph.

It shows how the potential energy of a roller coaster car changes as it moves along the track.

The car is pulled to the top of the roller coaster and starts with a speed of 0 m/s at point **A**.

Complete the table to show how the energy of the car changes as it moves along the track.
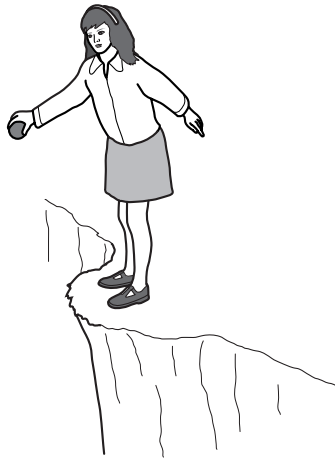
position on track	potential energy	kinetic energy
A → B	decreases	
B → C		
C → D	decreases	increases

[2]

Turn over for the remainder of question 12

(c) Rosalind drops a ball from the edge of a cliff.

Look at the drawing.

The ball will reach its terminal speed.

(i) Explain how the ball reaches its terminal speed.

In your answer, use ideas about

- forces

- speed.

....

....

.... **[2]**

(ii) At the terminal speed

- the kinetic energy of the ball is at its maximum

- the potential energy of the ball is decreasing.

What happens to this potential energy?

....

.... **[1]**

[Total: 6]

13 (a) There are large forces in a high speed crash.

Air bags change shape in a crash and absorb energy.

This reduces the forces on the driver.

Explain how air bags reduce the forces in a collision.

In your answer, use ideas about

- speed
- acceleration
- time.

....

....

....

.... **[2]**

(b) Some safety devices make driving safer.

They do not reduce injury in a crash.

Adjustable seating is one of these safety devices.

Explain how this makes driving safer.

....

....

.... **[1]**

(c) Drivers who have been drinking alcohol are more likely to have accidents.

This is because their reaction time and thinking distance have increased.

Write down one **other** factor that can increase thinking distance.

....

.... **[1]**

(d) Braking distance increases in certain conditions.

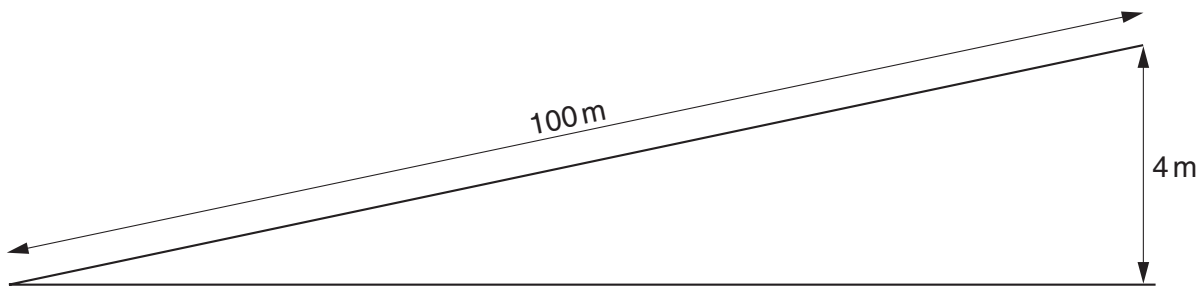Write down **one** factor that can increase braking distance.

....

.... **[1]**

[Total: 5]

14 Penny drives her car up a hill.

(a) Look at the diagram.

Her car climbs 4 m for every 100 m that it moves along the road.

The car weighs 7000 N.

(i) Show that the work done is 28 000 J.

The equations on page 2 may help you.

....

....

.... **[1]**

(ii) It takes 8 seconds to do 28 000 J of work.

Calculate the power the engine needs to climb the hill.

The equations on page 2 may help you.

....

....

....

answer .... W   **[2]**

(b) (i) Look at the graph.

It shows how the driving force produced by Penny's car engine increases with speed.

driving force

speed in miles per hour (mph)
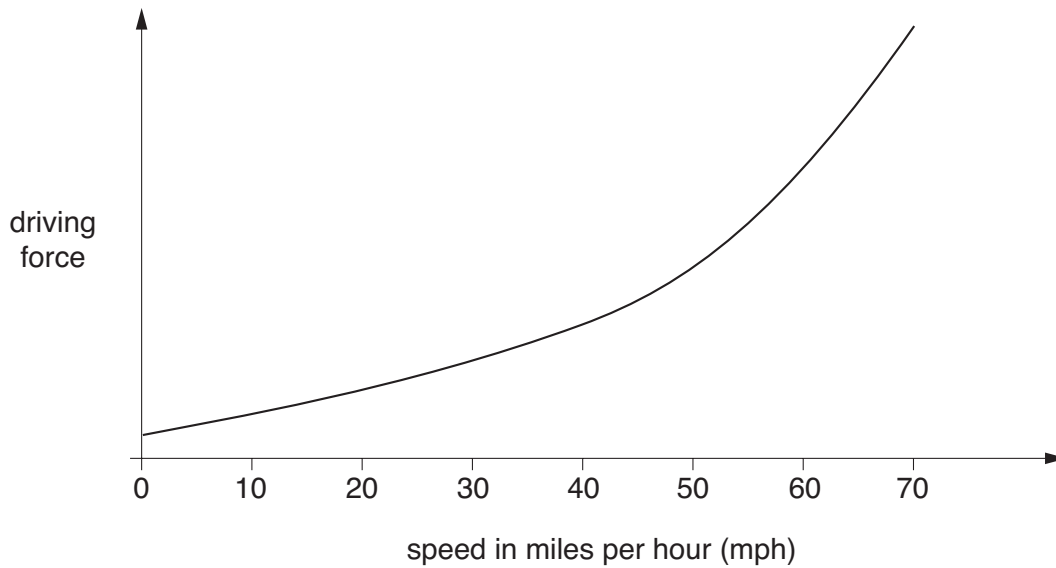
The fuel consumption at 70 mph is **much** larger than Penny expected.

Use the graph to explain why.

....

.... **[1]**

(ii) Apart from speed, write down one **other** factor that affects fuel consumption in Penny's car.

.... **[1]**

(c) Penny is concerned about polluting the environment.

She is thinking of buying an electrically powered car.

The salesman says that it does **not** cause pollution.

Is he really correct?

Explain your answer.

....

....

....

.... **[2]**

[Total: 7]

15 This question is about motion.
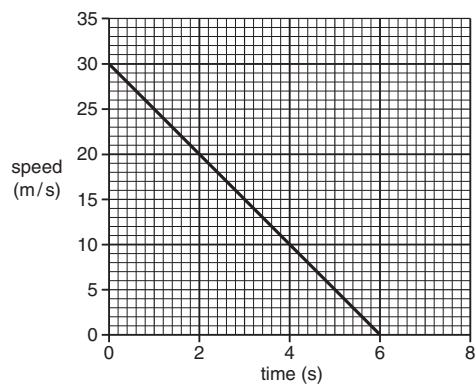
The diagram shows speed-time graphs in the first column.

There is a list of statements in the second column.

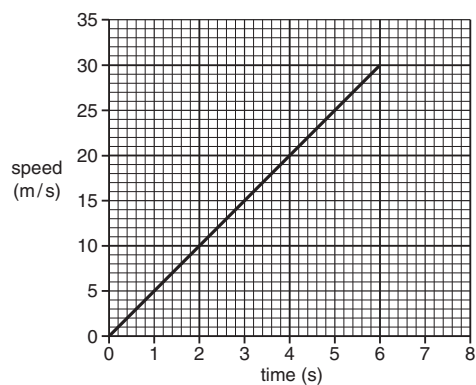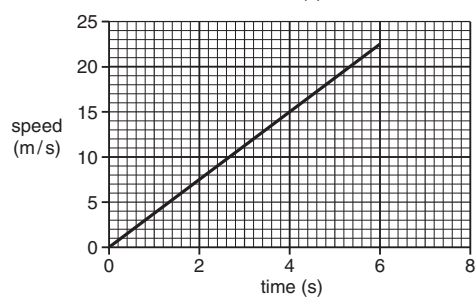Draw a straight line to join each **speed-time graph** with its correct **statement**.
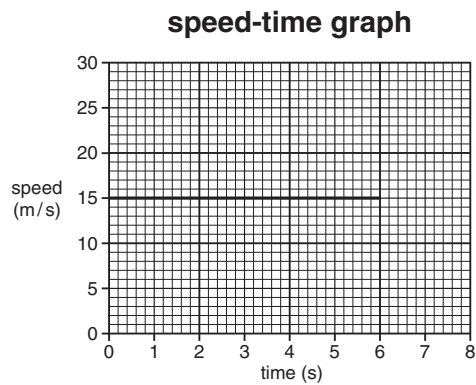
speed-time graph   **statement**

accelerates at $5\,m/s^2$

is travelling at a steady speed

travels 50 m in the first 2 seconds

travels 30 m in the first 4 seconds

[2]

[Total: 2]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

The Periodic Table of the Elements

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

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

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.