Candidate Forename		Candidate Surname	

Centre Number					Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

B623/02

GATEWAY SCIENCE
ADDITIONAL SCIENCE B

UNIT 1 Modules B3 C3 P3
(Higher Tier)

WEDNESDAY 20 MAY 2009: Afternoon

DURATION: 1 hour

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

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.**

- **A list of physics equations is printed on page three.**

- **The Periodic Table is printed on the back page.**

- **The total number of marks for this paper is 60.**

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

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

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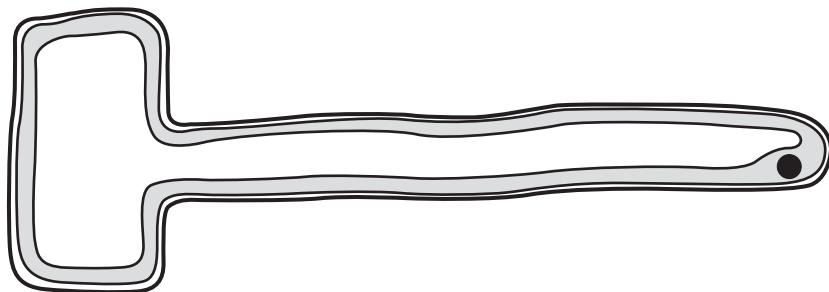
   **(a) Write down the name of ONE part of this cell NOT found in animal cells.**

   _____ **[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.

slowly rotating disc

electric motor

growing root

bean seed
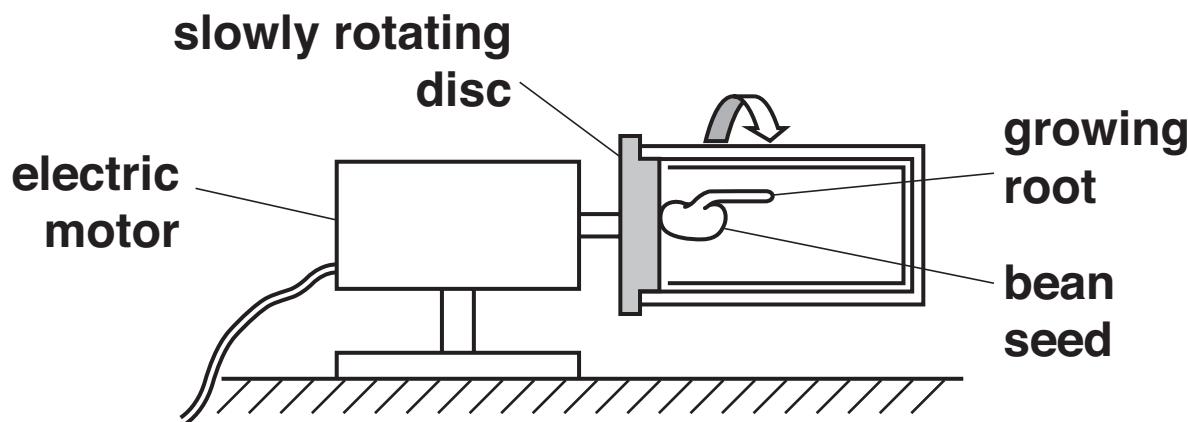
Finish the sentences about the growing root.

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]

2   **This question is about fertilisation.**

Sperm and egg cells carry out fertilisation.

They both have a nucleus to carry genes.
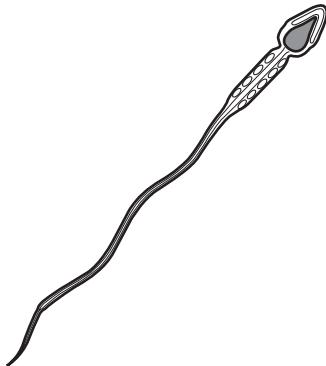
SPERM CELL
(not to scale)

EGG CELL
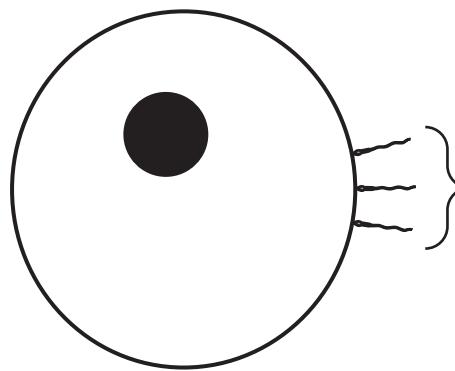
sperm cells
(drawn to
scale)

(a) (i) Write down the name of the type of cell division that <u>MAKES</u> egg and sperm cells.

_____ **[1]**

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

Describe <u>ONE</u> difference.

_____ **[1]**

6

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

After fertilisation the DNA replicates.

Describe the <u>TWO</u> stages involved in DNA replication.

You may draw a labelled diagram to help you.

1 _____

_____

2 _____

_____ **[2]**

[Total: 4]

7

3 **Carol grows carrots to enter in the biggest carrot competition.**
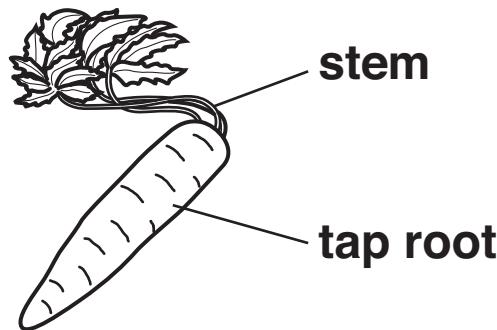
(a) **She uses selective breeding to help her to produce large carrots.**

   (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]

9

4   **Look at the diagram of an artery and vein.**

thick muscle wall

large lumen

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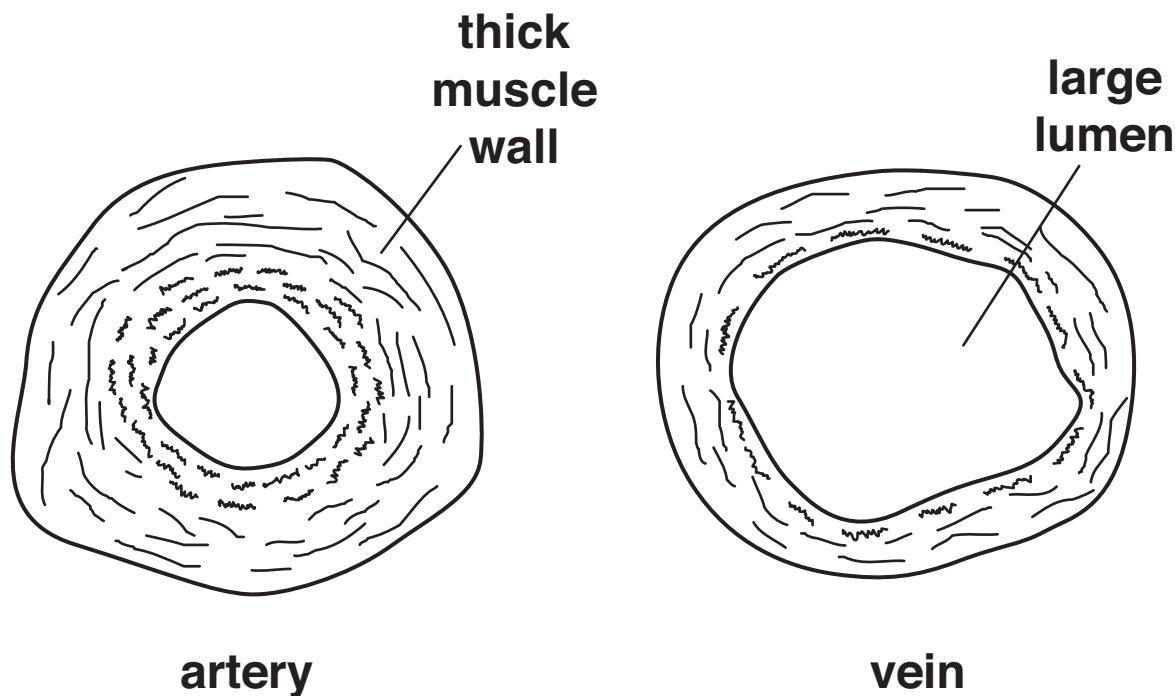
(a) Explain why the artery has a thick muscle wall.

_____

_____ **[1]**

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

_____

_____ **[1]**

[Total: 2]

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 cm³ of oxygen.

He repeats the reaction at different pH values.

The table shows his results.

pH	<u>TIME IN MINUTES</u>
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]**

11

(c) **Explain the result for pH 2.**

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

_____

_____

_____

_____

_____ **[3]**

[Total: 5]

12

SECTION B – MODULE C3

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

Look at the list of elements.

<div align="center">

ARGON   **CHROMIUM**

HYDROGEN   **IODINE**

MAGNESIUM   **NEON**

NITROGEN   **OXYGEN**

POTASSIUM   **SODIUM**

</div>

Answer the questions.

Choose your answers from the list.

Each element can be used <u>ONCE</u>, <u>MORE THAN ONCE</u> or <u>NOT AT ALL</u>.

The Periodic Table on the back page may help you.

**(a) (i) Write down the name of the element which has only <u>6 ELECTRONS</u> in its outer shell.**

_____ **[1]**

(ii) Write down the name of the element which has the electronic structure <u>2.8.8.1</u>.

_____ **[1]**

(b) **Look at the diagram.**

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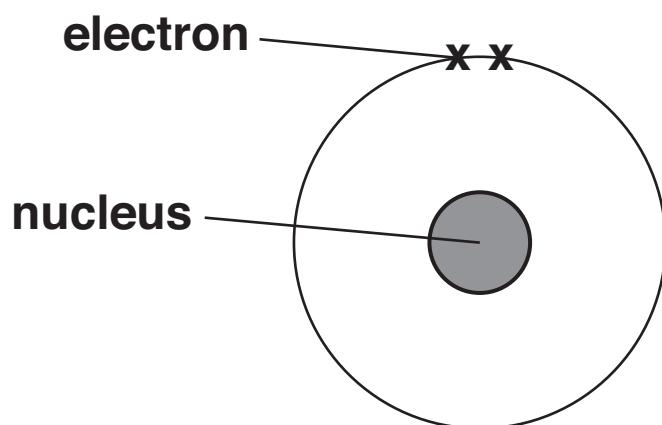
The table shows some information about the particles found in the nucleus of a helium atom.

COMPLETE the table.

| PARTICLE	RELATIVE MASS	RELATIVE CHARGE
neutron	_____	_____
proton	1	+1

[2]

[Total: 4]

14

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.

copper carbonate

heat

limewater
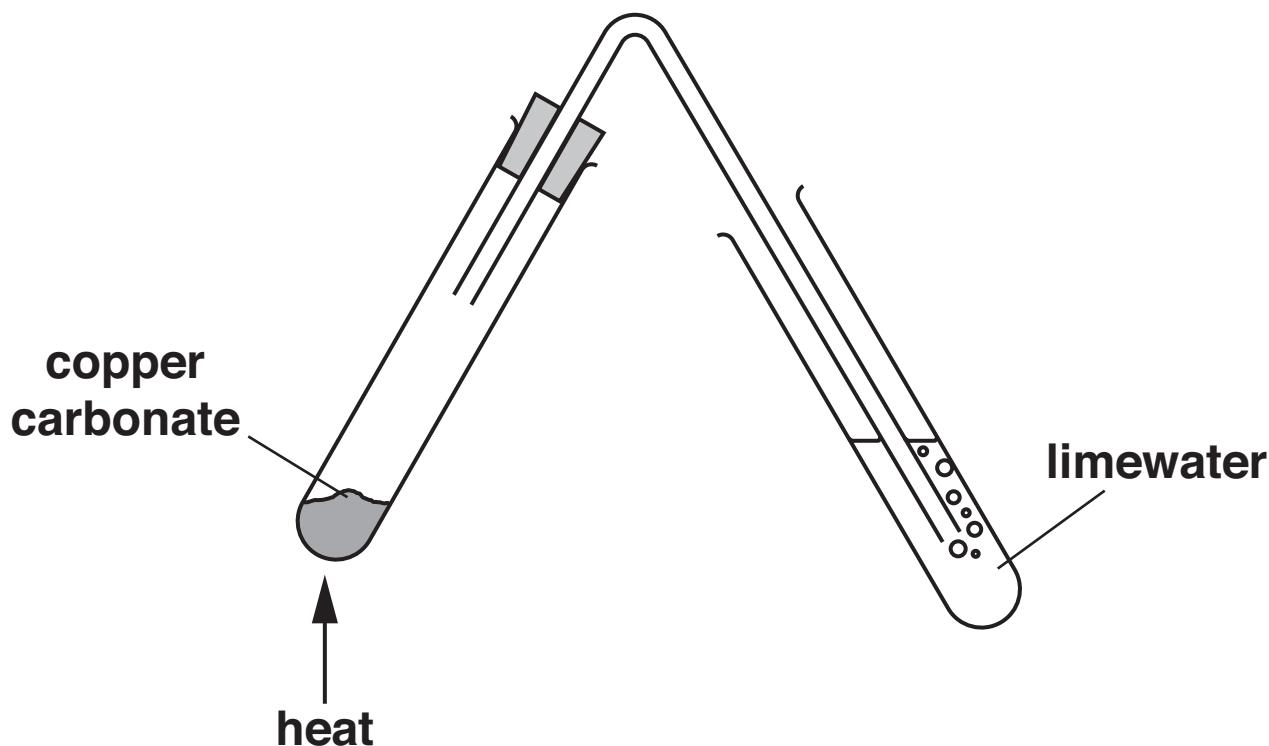
(a) Copper carbonate decomposes when it is heated.

Copper oxide and carbon dioxide are made.

Write down the <u>WORD</u> equation for this reaction.

_____ **[1]**

(b) Copper is a transition element.

Write down one property of a <u>COMPOUND</u> of a transition element.

_____

_____ **[1]**

[Total: 2]

15

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

Superconductors conduct electricity with no loss of power.

Explain why.

_____ [1]

(b) A train built in Japan 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]

16

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

Write down <u>ONE OTHER</u> advantage and <u>ONE</u> disadvantage of using superconductors.

_____

_____

_____ **[2]**

[Total: 4]

17

9 **This question is about the halogens.**

They are in Group 7 of the Periodic Table.

Look at the diagram. It shows an <u>ATOM</u> of chlorine.

nucleus
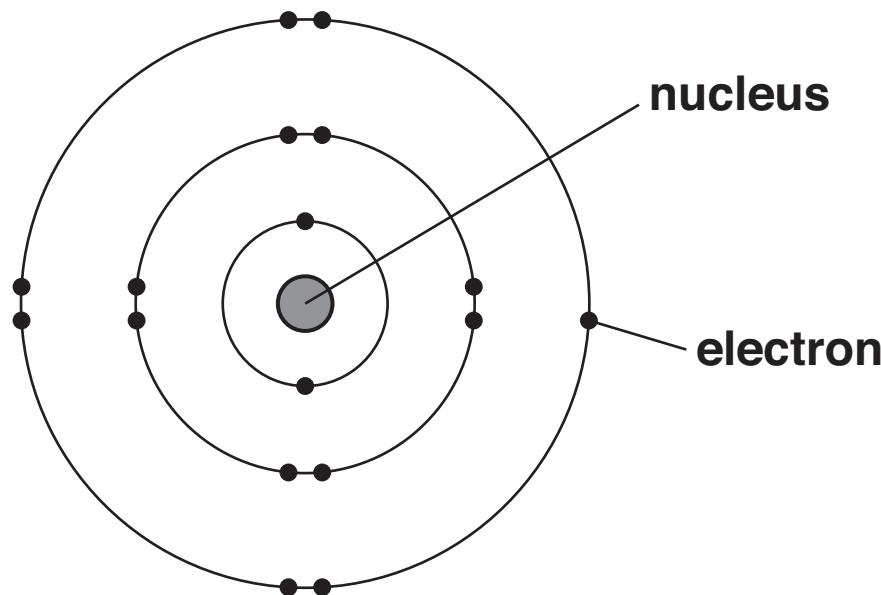
electron

(a) The halogens have similar chemical properties.

Explain why. Use ideas about electronic structure.

_____

_____ **[1]**

(b) The atoms in a **<u>MOLECULE</u>** 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 **<u>ISOTOPES</u>** of chlorine.

What is the difference between these two isotopes?

_____

_____ **[1]**

[Total: 4]

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

The diagram shows the apparatus she uses.
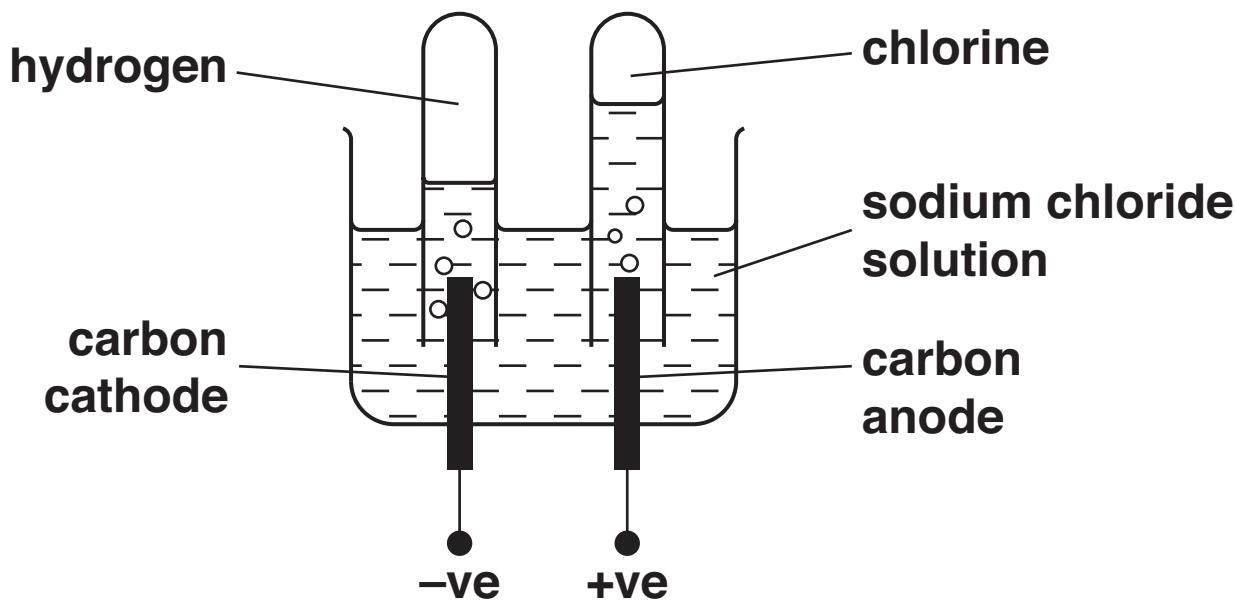
Look at the list. It shows the particles in the sodium chloride solution.

H^+ H_2O OH^- Cl^- 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]

20

(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]

21

11 This question is about oxidation and reduction.

Look at these equations.

Equation <u>A</u> $Cl_2 + 2e^- \rightarrow 2Cl^-$

Equation <u>B</u> $Cu^{2+} + 2e^- \rightarrow Cu$

Equation <u>C</u> $Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$

Equation <u>D</u> $Al - 3e^- \rightarrow Al^{3+}$

(a) Which equation is an example of oxidation <u>ONLY</u>?

Choose <u>A</u>, <u>B</u>, <u>C</u> or <u>D</u>.

answer _____   [1]

(b) Which equation is <u>NOT</u> an example of an oxidation or reduction reaction?

Choose <u>A</u>, <u>B</u>, <u>C</u> or <u>D</u>.

answer _____   [1]

[Total: 2]

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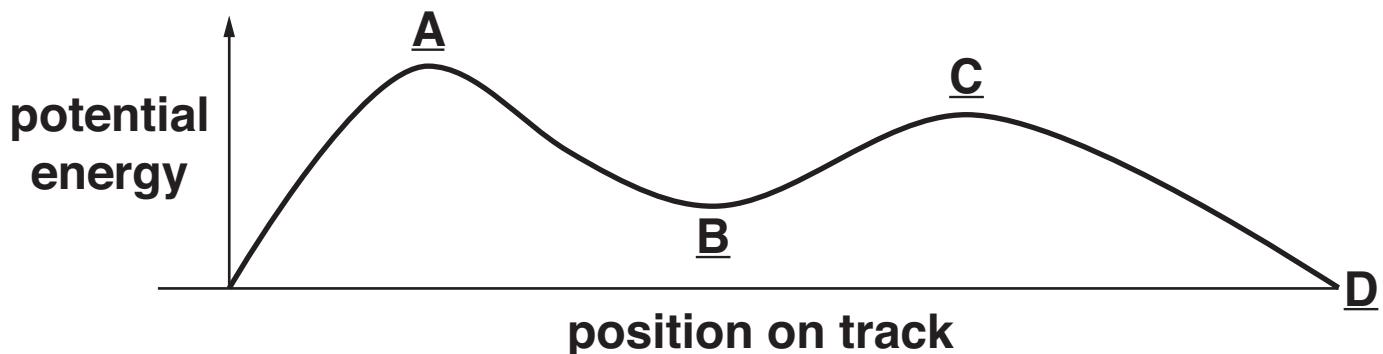
The car is pulled to the top of the roller coaster and starts with a speed of 0 m/s at point **A**.

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]

24

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

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]

25

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]

26

(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 <u>OTHER</u> factor that can increase thinking distance.

_____

_____ **[1]**

**(d)** Braking distance increases in certain conditions.

Write down <u>ONE</u> factor that can increase braking distance.

_____

_____ **[1]**

[Total: 5]

27

14 **Penny drives her car up a hill.**

(a) Look at the diagram.
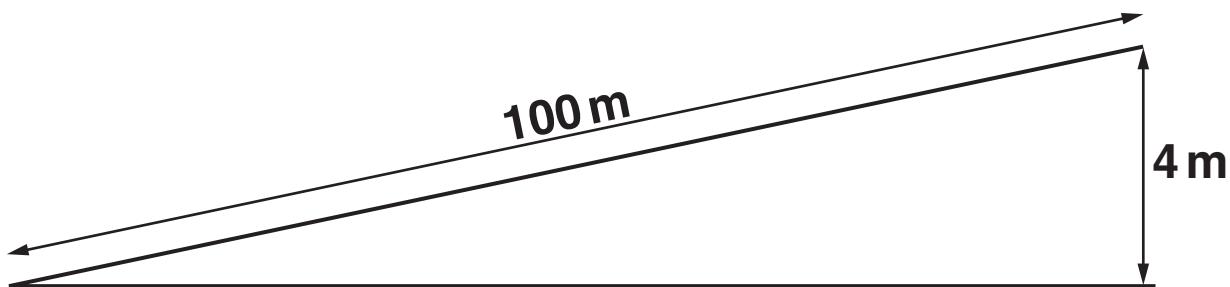
Her car climbs 4 m for every 100 m that it moves along the road.

The car weighs 7000 N.

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

The equations on page 3 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 3 may help you.

_____

_____

_____

answer _____ **W** **[2]**

28

(b) (i) Look at the graph.

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

driving force

0   10   20   30   40   50   60   70

speed in miles per hour (mph)
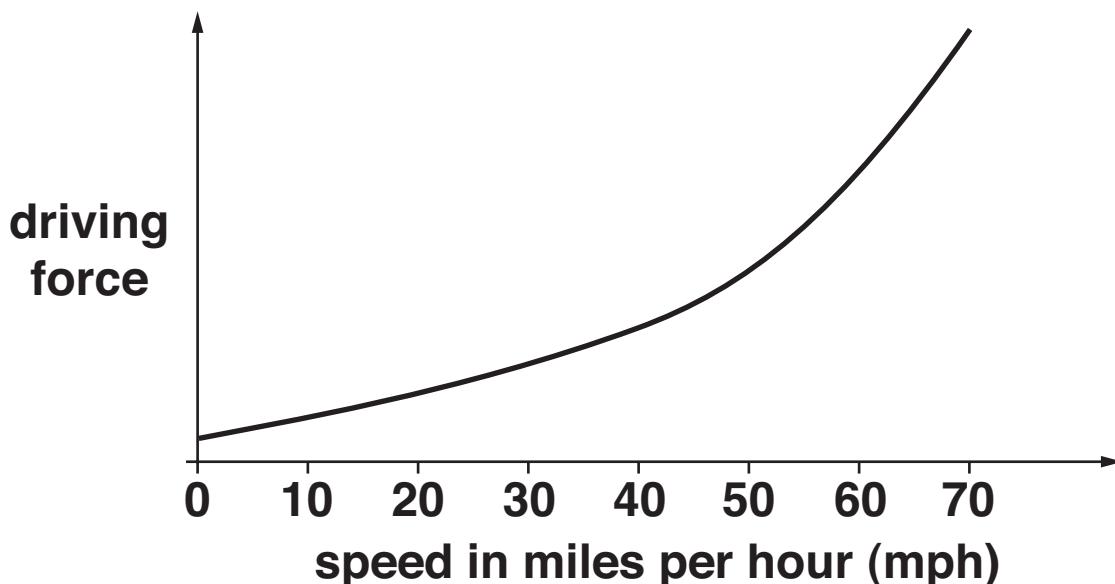
The fuel consumption at 70 mph is <u>MUCH</u> larger than Penny expected.

Use the graph to explain why.

_____

_____ **[1]**

(ii) Apart from speed, write down one <u>OTHER</u> 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 <u>NOT</u> cause pollution.

Is he really correct?

Explain your answer.

_____

_____

_____

_____ **[2]**

[Total: 7]

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15 **This question is about motion.**

The diagram opposite 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. **[2]**

[Total: 2]

END OF QUESTION PAPER

**32**

SPEED-TIME GRAPH
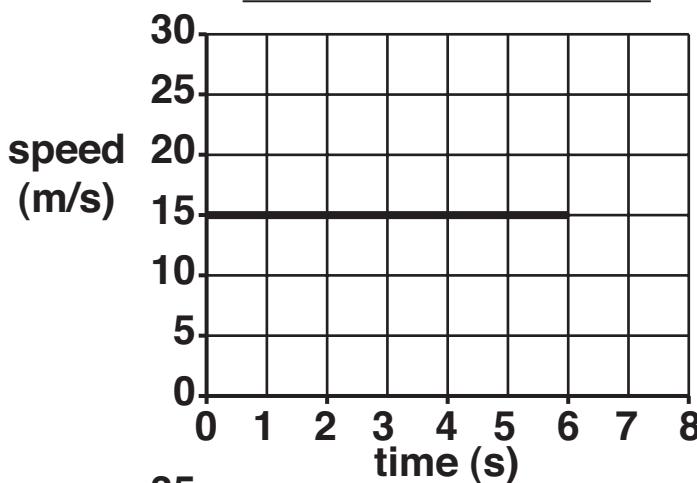
STATEMENT

accelerates at 5 m / s²
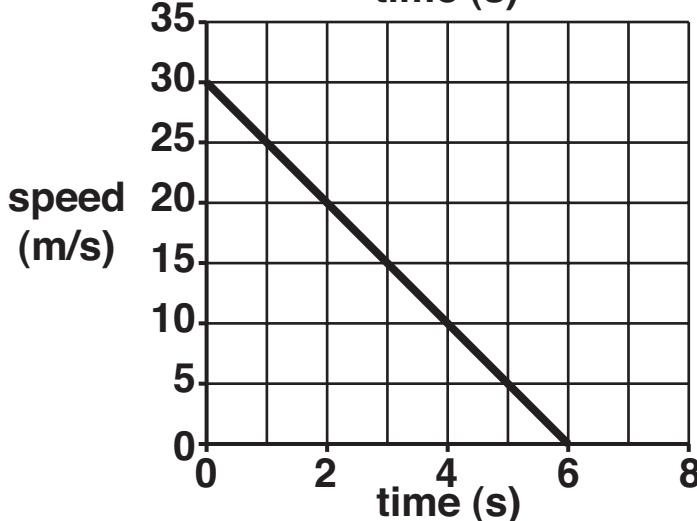
is travelling at a steady speed
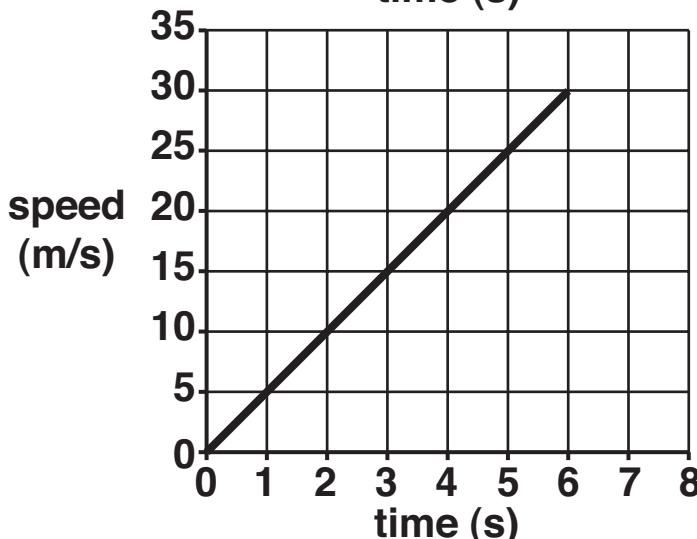
travels 50 m in the first 2 seconds
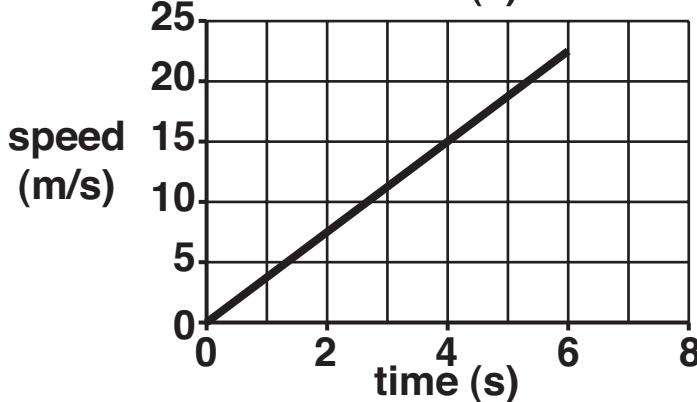
travels 30 m in the first 4 seconds

33

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The Periodic Table of the Elements

Key

relative atomic mass	
atomic symbol	
name	
atomic (proton) number	

Group 1	Group 2												Group 3	Group 4	Group 5	Group 6	Group 7	Group 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.