

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	
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Centre Number						Candidate Number				
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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.

EQUATIONS

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

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

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

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

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

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

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

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

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

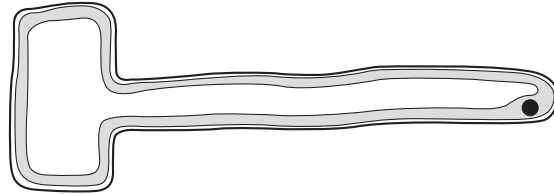
Answer **all** the questions.

Section A – Module B3

1 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.

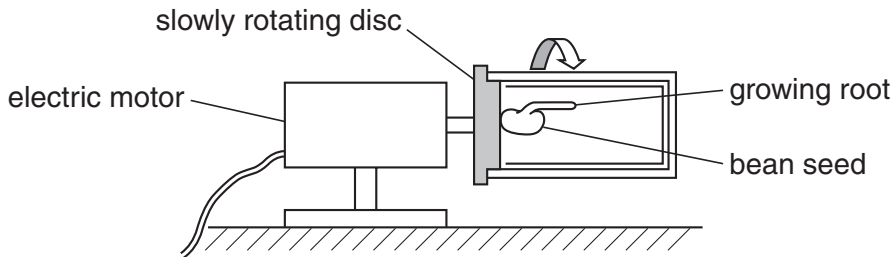
..... [1]

(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

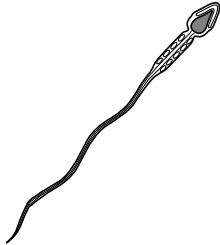
Root growth is controlled by a hormone called [3]

[Total: 5]

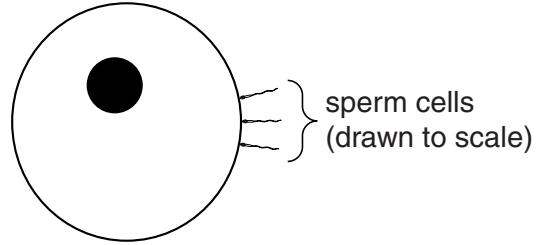
2 This question is about fertilisation.

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.

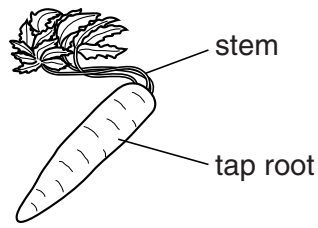
1

2

[2]

[Total: 4]

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



(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.

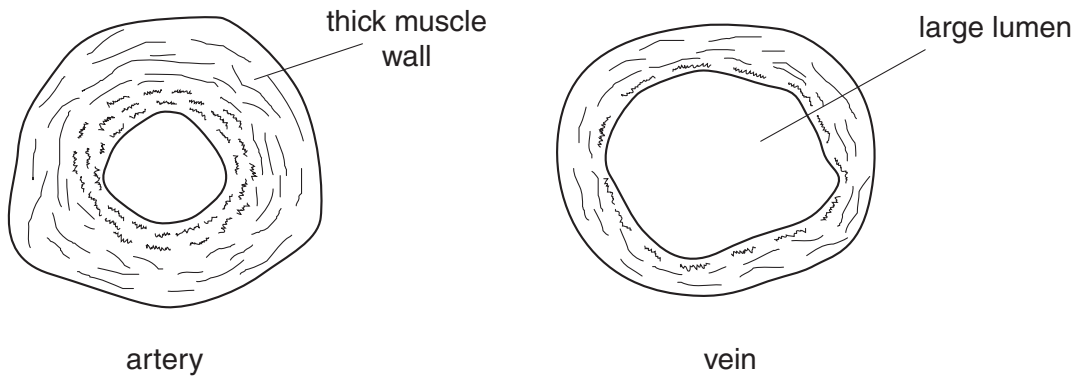
This process can be used to help people who eat a lot of rice and have a vitamin A deficiency.

Explain why.

..... [1]

[Total: 4]

4 Look at the diagram of an artery and 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 10cm³ 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]

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.

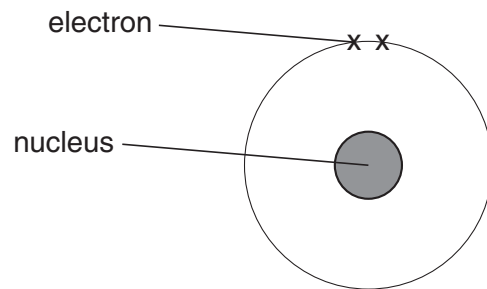
..... [1]

- (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.



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

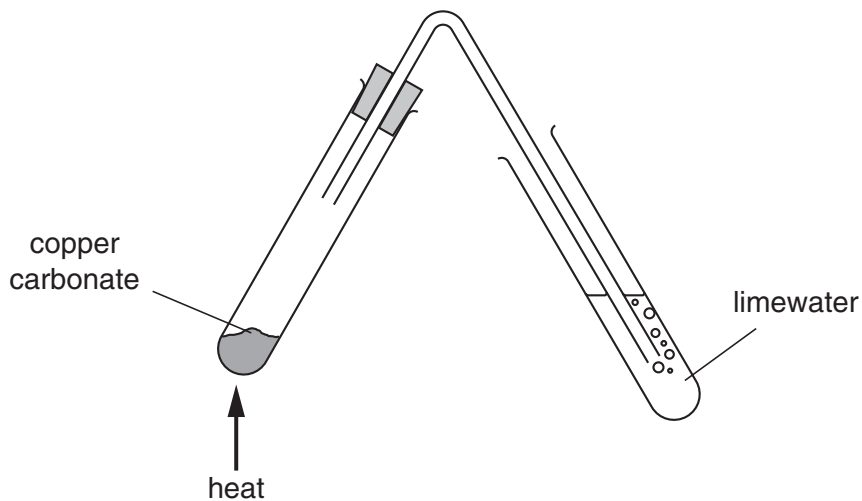
[2]

[Total: 4]

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.

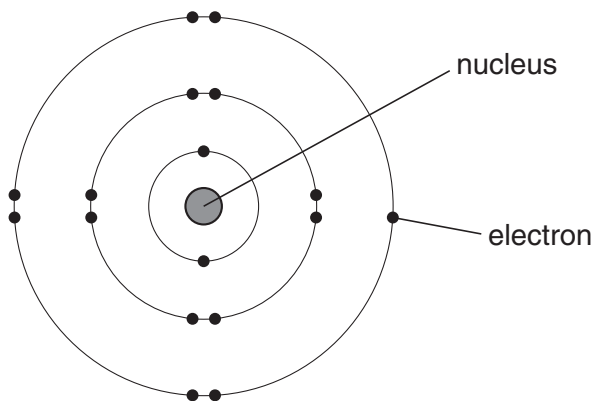
.....
.....
..... [2]

[Total: 4]

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.



(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, ${}_{17}^{35}\text{Cl}$, and chlorine-37, ${}_{17}^{37}\text{Cl}$, are **isotopes** of chlorine.

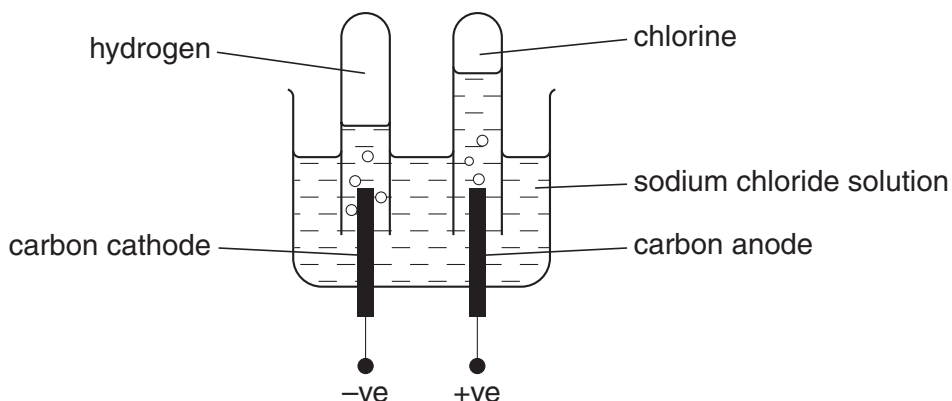
What is the difference between these two isotopes?

.....
..... [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]

(c) At the cathode hydrogen ions, H^+ , gain electrons to make hydrogen gas, H_2 .

Write down the **equation** for the electrode reaction.

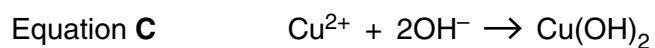
Use e^- to show an electron.

..... [2]

[Total: 4]

11 This question is about oxidation and reduction.

Look at these equations.



(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]

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

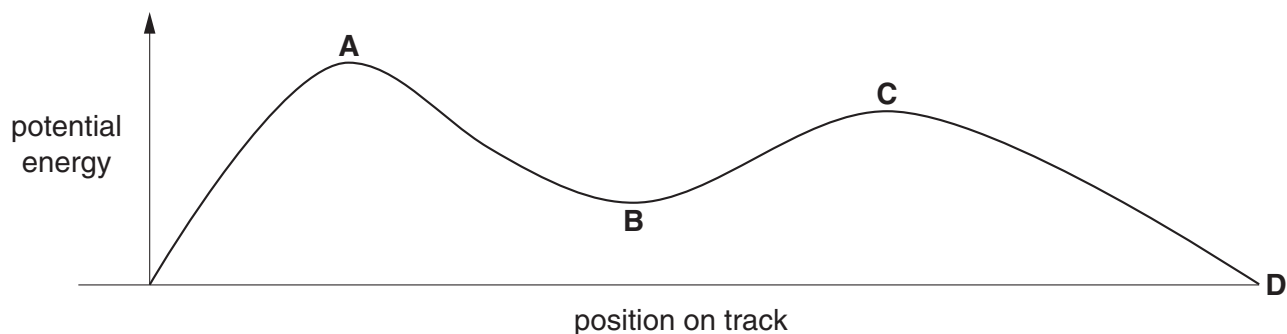
Venus

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]

(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.

.....

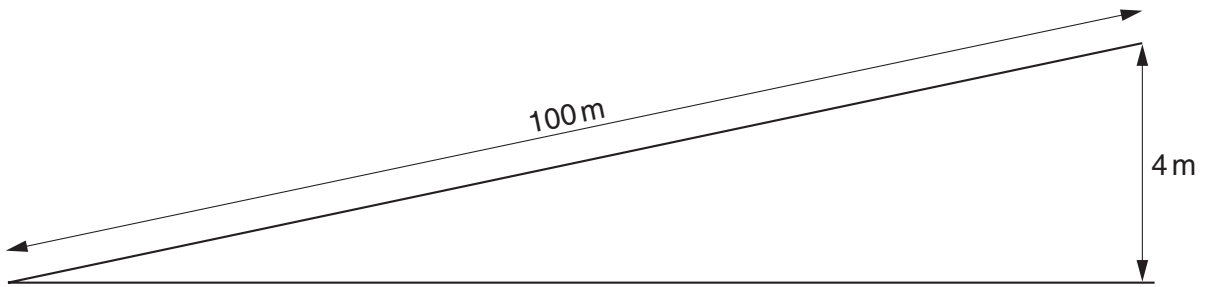
..... [1]

[Total: 5]

Turn over

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.

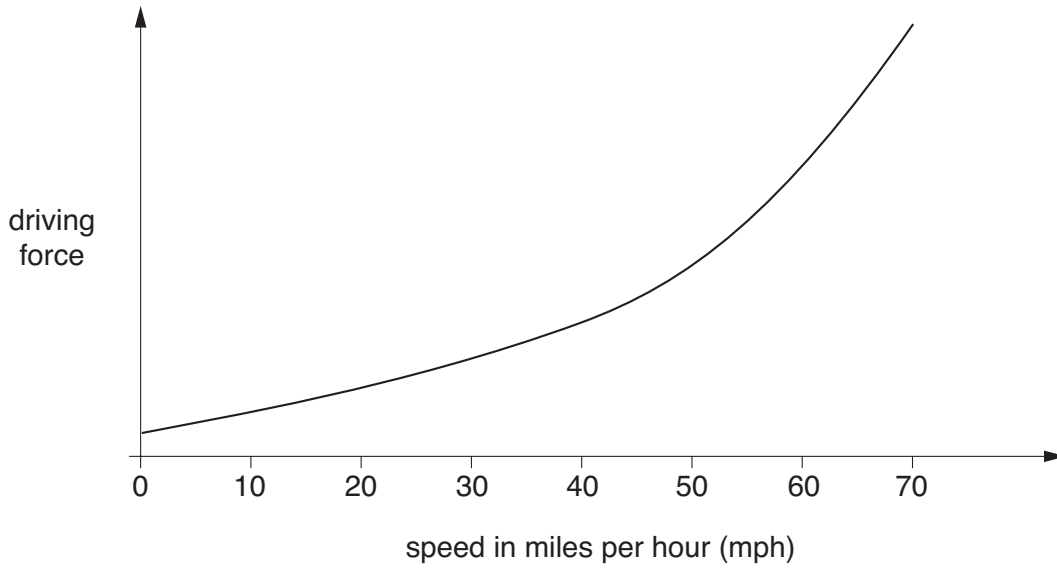
The equations on page 2 may help you.

.....
.....
.....

answer W [2]

(b) (i) Look at the graph.

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



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]

Turn over

15 This question is about motion.

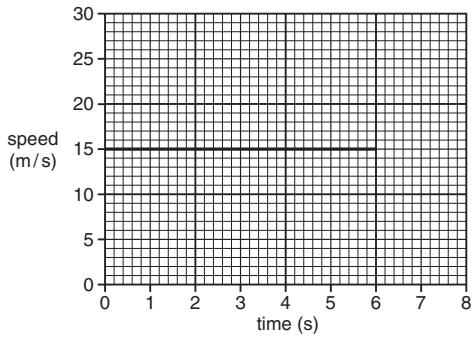
The diagram shows speed-time graphs in the first column.

There is a list of statements in the second column.

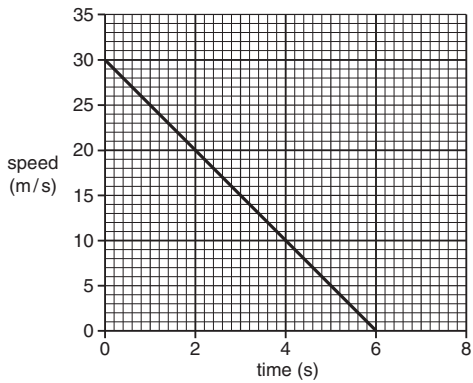
Draw a straight line to join each **speed-time graph** with its correct **statement**.

speed-time graph

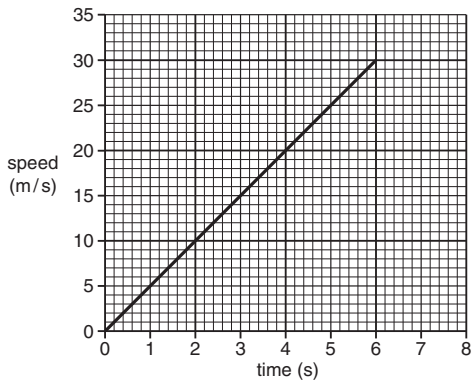
statement



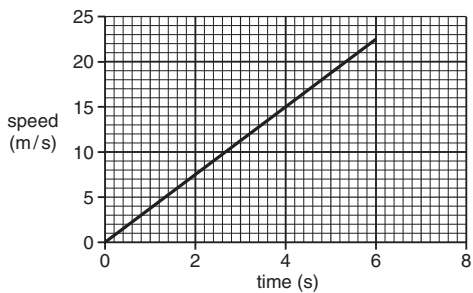
accelerates at 5 m/s^2



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]

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The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27
37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium [98]	44 Ru ruthenium 44	45 Rh rhodium 45
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77
87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109
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
199 K potassium 19	200 Ca calcium 20	201 Sc scandium 21	202 Ti titanium 22	203 V vanadium 23	204 Cr chromium 24	205 Mn manganese 25	206 Fe iron 26	207 Co cobalt 27
263 Rb rubidium 37	268 Sr strontium 38	269 Y yttrium 39	270 Zr zirconium 40	271 Nb niobium 41	272 Mo molybdenum 42	273 Tc technetium [98]	274 Ru ruthenium 44	275 Rh rhodium 45
337 Cs caesium 55	342 Ba barium 56	343 La* lanthanum 57	372 Hf hafnium 72	373 Ta tantalum 73	374 W tungsten 74	375 Re rhenium 75	376 Os osmium 76	377 Ir iridium 77
403 K potassium 19	408 Ca calcium 20	409 Sc scandium 21	410 Ti titanium 22	411 V vanadium 23	412 Cr chromium 24	413 Mn manganese 25	414 Fe iron 26	415 Co cobalt 27
517 Rb rubidium 37	522 Sr strontium 38	523 Y yttrium 39	524 Zr zirconium 40	525 Nb niobium 41	526 Mo molybdenum 42	527 Tc technetium [98]	528 Ru ruthenium 44	529 Rh rhodium 45
687 Cs caesium 55	692 Ba barium 56	693 La* lanthanum 57	722 Hf hafnium 72	723 Ta tantalum 73	724 W tungsten 74	725 Re rhenium 75	726 Os osmium 76	727 Ir iridium 77
853 K potassium 19	858 Ca calcium 20	859 Sc scandium 21	860 Ti titanium 22	861 V vanadium 23	862 Cr chromium 24	863 Mn manganese 25	864 Fe iron 26	865 Co cobalt 27
1017 Rb rubidium 37	1022 Sr strontium 38	1023 Y yttrium 39	1024 Zr zirconium 40	1025 Nb niobium 41	1026 Mo molybdenum 42	1027 Tc technetium [98]	1028 Ru ruthenium 44	1029 Rh rhodium 45
1367 Cs caesium 55	1372 Ba barium 56	1373 La* lanthanum 57	1372 Hf hafnium 72	1373 Ta tantalum 73	1374 W tungsten 74	1375 Re rhenium 75	1376 Os osmium 76	1377 Ir iridium 77
1837 K potassium 19	1842 Ca calcium 20	1843 Sc scandium 21	1844 Ti titanium 22	1845 V vanadium 23	1846 Cr chromium 24	1847 Mn manganese 25	1848 Fe iron 26	1849 Co cobalt 27
2417 Rb rubidium 37	2422 Sr strontium 38	2423 Y yttrium 39	2424 Zr zirconium 40	2425 Nb niobium 41	2426 Mo molybdenum 42	2427 Tc technetium [98]	2428 Ru ruthenium 44	2429 Rh rhodium 45
3167 Cs caesium 55	3172 Ba barium 56	3173 La* lanthanum 57	3172 Hf hafnium 72	3173 Ta tantalum 73	3174 W tungsten 74	3175 Re rhenium 75	3176 Os osmium 76	3177 Ir iridium 77
3917 K potassium 19	3922 Ca calcium 20	3923 Sc scandium 21	3924 Ti titanium 22	3925 V vanadium 23	3926 Cr chromium 24	3927 Mn manganese 25	3928 Fe iron 26	3929 Co cobalt 27
5017 Rb rubidium 37	5022 Sr strontium 38	5023 Y yttrium 39	5024 Zr zirconium 40	5025 Nb niobium 41	5026 Mo molybdenum 42	5027 Tc technetium [98]	5028 Ru ruthenium 44	5029 Rh rhodium 45
6667 Cs caesium 55	6672 Ba barium 56	6673 La* lanthanum 57	6672 Hf hafnium 72	6673 Ta tantalum 73	6674 W tungsten 74	6675 Re rhenium 75	6676 Os osmium 76	6677 Ir iridium 77
8117 K potassium 19	8122 Ca calcium 20	8123 Sc scandium 21	8124 Ti titanium 22	8125 V vanadium 23	8126 Cr chromium 24	8127 Mn manganese 25	8128 Fe iron 26	8129 Co cobalt 27
10617 Rb rubidium 37	10622 Sr strontium 38	10623 Y yttrium 39	10624 Zr zirconium 40	10625 Nb niobium 41	10626 Mo molybdenum 42	10627 Tc technetium [98]	10628 Ru ruthenium 44	10629 Rh rhodium 45
13917 Cs caesium 55	13922 Ba barium 56	13923 La* lanthanum 57	13922 Hf hafnium 72	13923 Ta tantalum 73	13924 W tungsten 74	13925 Re rhenium 75	13926 Os osmium 76	13927 Ir iridium 77
17917 K potassium 19	17922 Ca calcium 20	17923 Sc scandium 21	17924 Ti titanium 22	17925 V vanadium 23	17926 Cr chromium 24	17927 Mn manganese 25	17928 Fe iron 26	17929 Co cobalt 27
23417 Rb rubidium 37	23422 Sr strontium 38	23423 Y yttrium 39	23424 Zr zirconium 40	23425 Nb niobium 41	23426 Mo molybdenum 42	23427 Tc technetium [98]	23428 Ru ruthenium 44	23429 Rh rhodium 45
30917 Cs caesium 55	30922 Ba barium 56	30923 La* lanthanum 57	30922 Hf hafnium 72	30923 Ta tantalum 73	30924 W tungsten 74	30925 Re rhenium 75	30926 Os osmium 76	30927 Ir iridium 77
36717 K potassium 19	36722 Ca calcium 20	36723 Sc scandium 21	36724 Ti titanium 22	36725 V vanadium 23	36726 Cr chromium 24	36727 Mn manganese 25	36728 Fe iron 26	36729 Co cobalt 27
4817 Rb rubidium 37	4822 Sr strontium 38	4823 Y yttrium 39	4824 Zr zirconium 40	4825 Nb niobium 41	4826 Mo molybdenum 42	4827 Tc technetium [98]	4828 Ru ruthenium 44	4829 Rh rhodium 45
6367 Cs caesium 55	6372 Ba barium 56	6373 La* lanthanum 57	6372 Hf hafnium 72	6373 Ta tantalum 73	6374 W tungsten 74	6375 Re rhenium 75	6376 Os osmium 76	6377 Ir iridium 77
8017 K potassium 19	8022 Ca calcium 20	8023 Sc scandium 21	8024 Ti titanium 22	8025 V vanadium 23	8026 Cr chromium 24	8027 Mn manganese 25	8028 Fe iron 26	8029 Co cobalt 27
10517 Rb rubidium 37	10522 Sr strontium 38	10523 Y yttrium 39	10524 Zr zirconium 40	10525 Nb niobium 41	10526 Mo molybdenum 42	10527 Tc technetium [98]	10528 Ru ruthenium 44	10529 Rh rhodium 45
13867 Cs caesium 55	13872 Ba barium 56	13873 La* lanthanum 57	13872 Hf hafnium 72	13873 Ta tantalum 73	13874 W tungsten 74	13875 Re rhenium 75	13876 Os osmium 76	13877 Ir iridium 77
17617 K potassium 19	17622 Ca calcium 20	17623 Sc scandium 21	17624 Ti titanium 22	17625 V vanadium 23	17626 Cr chromium 24	17627 Mn manganese 25	17628 Fe iron 26	17629 Co cobalt 27
2317 Rb rubidium 37	2322 Sr strontium 38	2323 Y yttrium 39	2324 Zr zirconium 40	2325 Nb niobium 41	2326 Mo molybdenum 42	2327 Tc technetium [98]	2328 Ru ruthenium 44	2329 Rh rhodium 45
3067 Cs caesium 55	3072 Ba barium 56	3073 La* lanthanum 57	3072 Hf hafnium 72	3073 Ta tantalum 73	3074 W tungsten 74	3075 Re rhenium 75	3076 Os osmium 76	3077 Ir iridium 77
3647 K potassium 19	3652 Ca calcium 20	3653 Sc scandium 21	3654 Ti titanium 22	3655 V vanadium 23	3656 Cr chromium 24	3657 Mn manganese 25	3658 Fe iron 26	3659 Co cobalt 27
4717 Rb rubidium 37	4722 Sr strontium 38	4723 Y yttrium 39	4724 Zr zirconium 40	4725 Nb niobium 41	4726 Mo molybdenum 42	4727 Tc technetium [98]	4728 Ru ruthenium 44	4729 Rh rhodium 45
6267 Cs caesium 55	6272 Ba barium 56	6273 La* lanthanum 57	6272 Hf hafnium 72	6273 Ta tantalum 73	6274 W tungsten 74	6275 Re rhenium 75	6276 Os osmium 76	6277 Ir iridium 77
7817 K potassium 19	7822 Ca calcium 20	7823 Sc scandium 21	7824 Ti titanium 22	7825 V vanadium 23	7826 Cr chromium 24	7827 Mn manganese 25	7828 Fe iron 26	7829 Co cobalt 27
10317 Rb rubidium 37	10322 Sr strontium 38	10323 Y yttrium 39	10324 Zr zirconium 40	10325 Nb niobium 41	10326 Mo molybdenum 42	10327 Tc technetium [98]	10328 Ru ruthenium 44	10329 Rh rhodium 45
13767 Cs caesium 55	13772 Ba barium 56	13773 La* lanthanum 57	13772 Hf hafnium 72	13773 Ta tantalum 73	13774 W tungsten 74	13775 Re rhenium 75	13776 Os osmium 76	13777 Ir iridium 77
17417 K potassium 19	17422 Ca calcium 20	17423 Sc scandium 21	17424 Ti titanium 22	17425 V vanadium 23	17426 Cr chromium 24	17427 Mn manganese 25	17428 Fe iron 26	17429 Co cobalt 27
22917 Rb rubidium 37	23022 Sr strontium 38	23023 Y yttrium 39	23024 Zr zirconium 40	23025 Nb niobium 41	23026 Mo molybdenum 42	23027 Tc technetium [98]	23028 Ru ruthenium 44	23029 Rh rhodium 45
2947 Cs caesium 55	2952 Ba barium 56	2953 La* lanthanum 57	2952 Hf hafnium 72	2953 Ta tantalum 73	2954 W tungsten 74	2955 Re rhenium 75	2956 Os osmium 76	2957 Ir iridium 77
35917 K potassium 19	36022 Ca calcium 20	36023 Sc scandium 21	36024 Ti titanium 22	36025 V vanadium 23	36026 Cr chromium 24	36027 Mn manganese 25	36028 Fe iron 26	36029 Co cobalt 27
4647 Rb rubidium 37	4652 Sr strontium 38	4653 Y yttrium 39	4654 Zr zirconium 40	4655 Nb niobium 41	4656 Mo molybdenum 42	4657 Tc technetium [98]	4658 Ru ruthenium 44	4659 Rh rhodium 45
6147 Cs caesium 55	6152 Ba barium 56	6153 La* lanthanum 57	6152 Hf hafnium 72	6153 Ta tantalum 73	6154 W tungsten 74	6155 Re rhenium 75	6156 Os osmium 76	6157 Ir iridium 77
7717 K potassium 19	7722 Ca calcium 20	7723 Sc scandium 21	7724 Ti titanium 22	7725 V vanadium 23	7726 Cr chromium 24	7727 Mn manganese 25	7728 Fe iron 26	7729 Co cobalt 27
10217 Rb rubidium 37	10222 Sr strontium 38	10223 Y yttrium 39	10224 Zr zirconium 40	10225 Nb niobium 41	10226 Mo molybdenum 42	10227 Tc technetium [98		