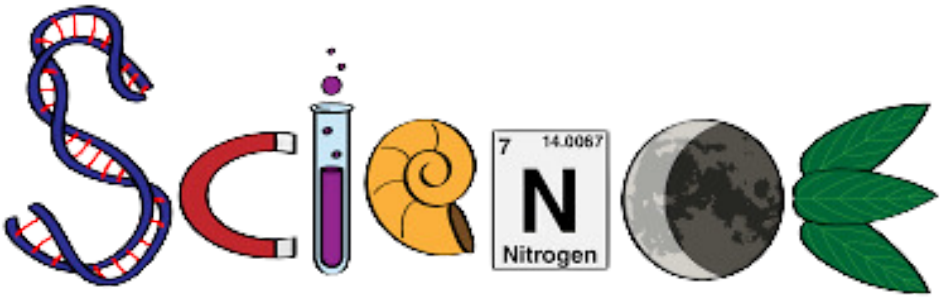
Meopham School



HOMEWORK BOOKLET

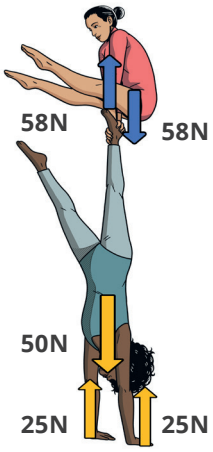
Year 9 Term 1

Homework 1

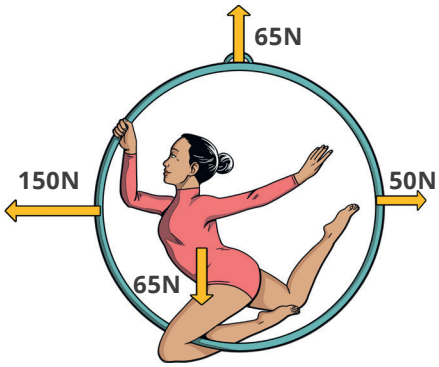
Balanced, Unbalanced and Resultant Forces

1. Tick **one** box below each diagram to show whether the forces acting on the objects are balanced or unbalanced.

2. In the box below each diagram, write down the resultant force and, if applicable, the direction of the resultant force.



☐ balanced ☐ unbalanced



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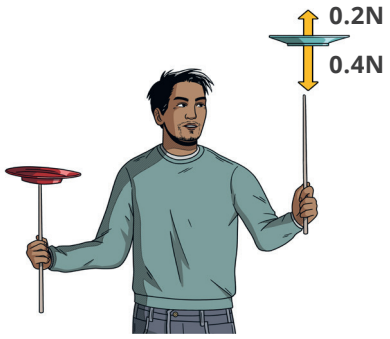

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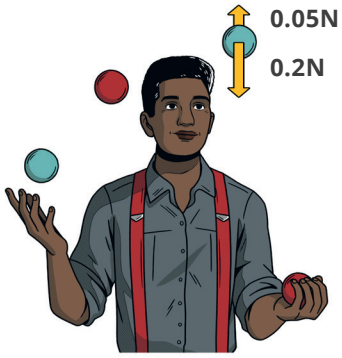

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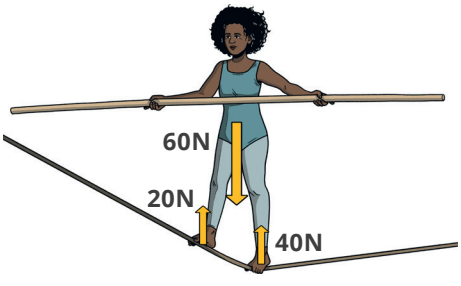

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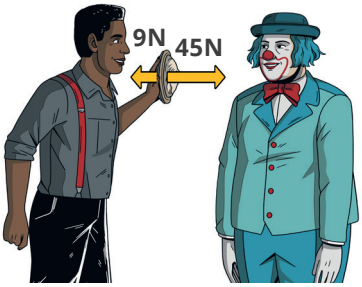


☐ balanced ☐ unbalanced

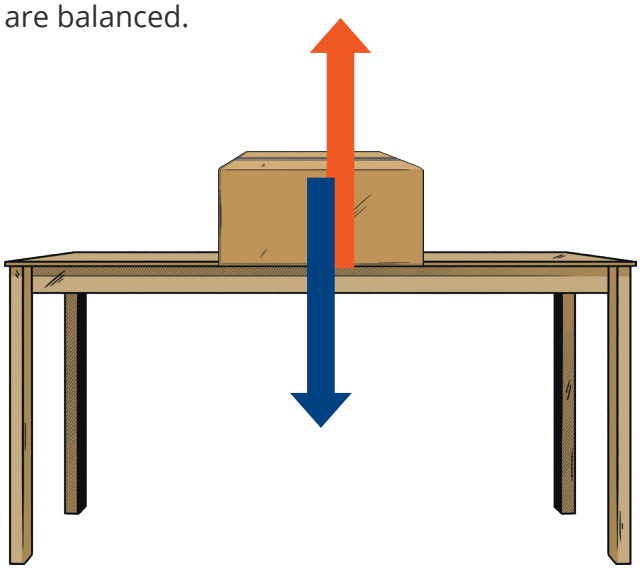
Force Diagrams

Homework 1

You add force arrows to a diagram to show which forces are acting. The arrows show the direction and the size of the force (the longer the arrow, the bigger the force).

The arrows must touch the object in the diagram.

If an object is stationary, or moving at a constant speed, the forces on it are balanced. Balanced forces act in opposite directions and are the same size. The forces in the diagram below are balanced.

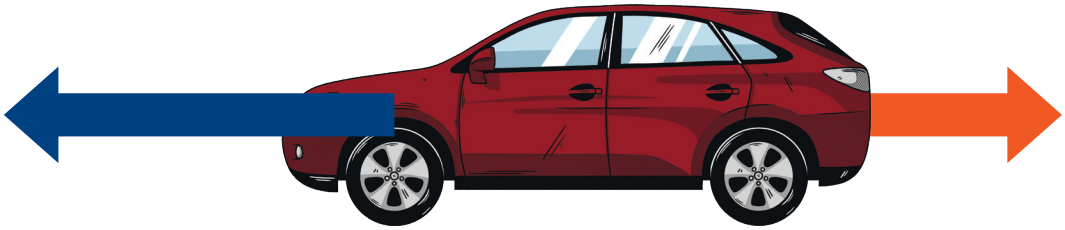


The upwards arrow represents the **reaction** force. This is the force of the table supporting the box.

The downwards arrow represents the gravitational force acting on the box, also known as **weight**. This is the force of the Earth acting on the box.

If forces acting on an object are unbalanced, the object will be speeding up (accelerating) or slowing down.

If an object is speeding up, the forward arrow will be larger.



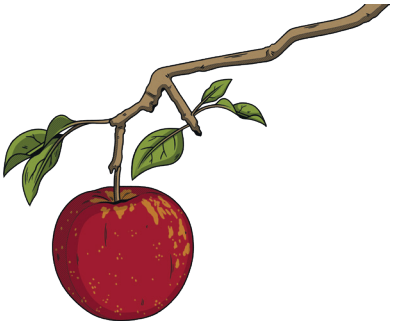
If an object is slowing down, the backward arrow will be larger.

BEYOND SCIENCE

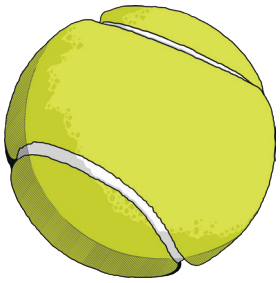
Homework 1

Add force arrows to the diagrams below. Label the arrows with the force and add a description that says whether the forces are balanced or unbalanced.

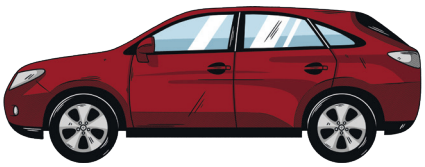
A person sitting on a chair.



An apple hanging on a tree.



A ball accelerating downwards.



A car travelling at a constant speed.

Work Done Calculations

Homework 2

Work done can be calculated using the equation:

work done = force × distance (along the line of action of the force)

1. Calculate the work done on an object when:

a) A force of 10 N acts on an object to move it 3 m.

work done = _____ J

b) A force of 6 N acts on an object to move it 4.5 m.

work done = _____ J

c) A force of 25 N acts on an object to move it 3.6 m.

work done = _____ J

A person with a weight of 637 N climbs to a height of 4 m.

2. Calculate the work done by the climber.

work done = _____ J

A person with a height of 164 cm lifts a 1200 N barbell from the floor to a distance 40 cm above their head.

3. Calculate the work done to lift the barbell.

work done = _____ J

The work done equation can be rearranged to calculate the distance an object moves when work is done on it.

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

A person applies a force of 35 N to move a box across a shelf. The work done to move the box is 21 J.

4. Calculate the distance the box is moved along the shelf.

distance = _____ m

A driving force of 2400 N is produced by the engine of a car. The work done to move the car from one set of traffic lights to another is 3600 kJ.

5. Calculate the distance between the traffic lights.

distance = _____ m

The work done equation can be rearranged to calculate the force applied to an object to move it along a distance.

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

A person pulls a sled 8 m along the snow. The work done to move the sled is 400 J.

6. Calculate the force the person applied to the sled.

force = _____ N

A person does 108 000 J of work to cycle along a street. They cycle a distance of 1200 m.

7. Calculate the force the person uses.

force = _____ N

Hooke's Law

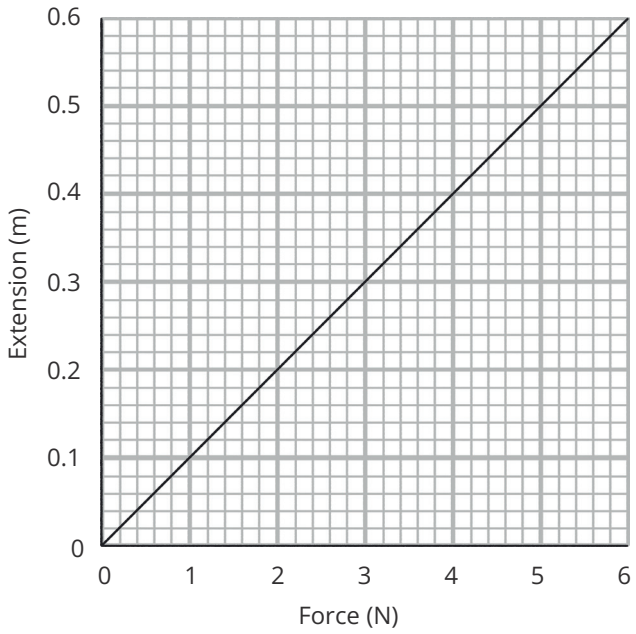
Homework 2

The extension of some elastic objects can be described by Hooke's law.

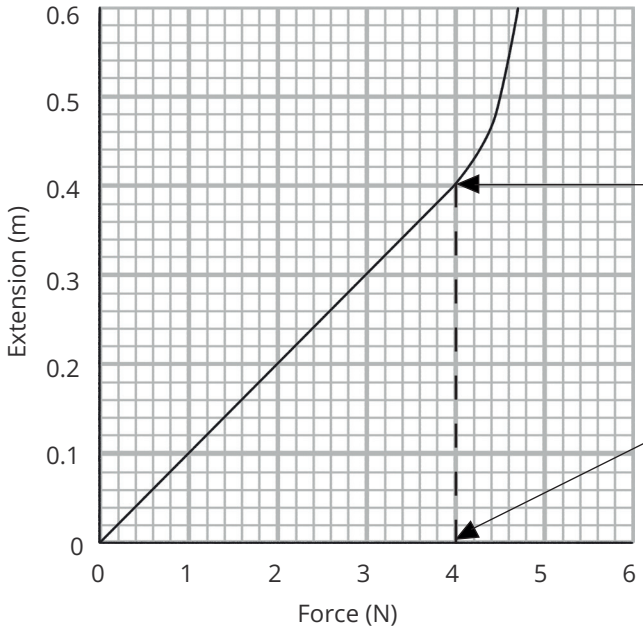
force = spring constant × extension

When a spring obeys Hooke's law, the extension of the spring is **directly proportional** to the force applied. This means that if you double the force, the extension also doubles.

On a graph, this is shown by a straight line through the origin.



At the elastic limit, the spring will no longer return to its original shape. Once a spring has reached its elastic limit, it no longer obeys Hooke's law.



This is the point at which the straight line starts to curve. You can place a ruler along the straight part of the graph to help you identify where this happens.

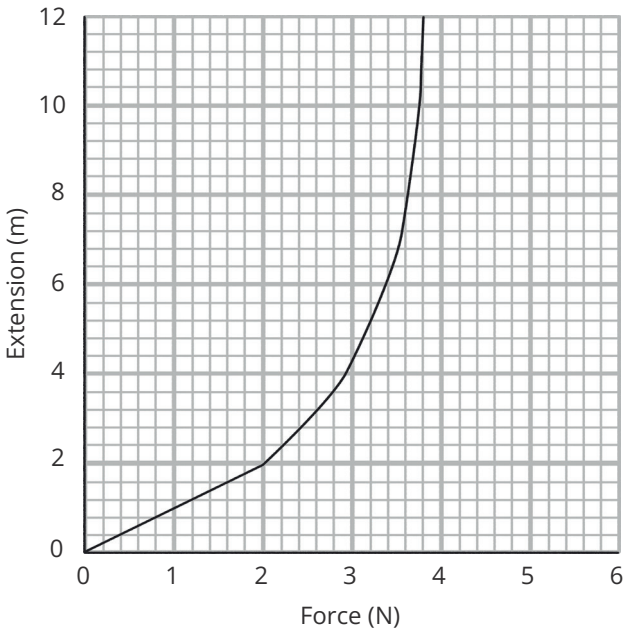
From this point the spring no longer obeys Hooke's law. It has reached its elastic limit.

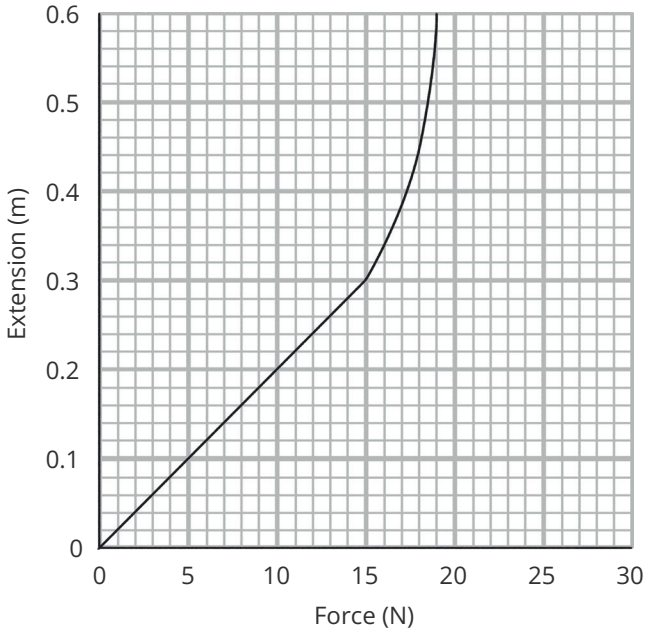
You can read the force at which the spring reaches its elastic limit from the x-axis.

The elastic limit is reached at 4N.

BEYOND SCIENCE

1. Label the elastic limit in each of the example graphs below and identify the maximum force that could be applied to the spring to ensure it can return to its original size.





maximum force = _____ maximum force = _____

2. A spring extends by 0.04m when a force of 3N is applied.

   Calculate the extension of the spring when a force of 6N is applied, assuming the spring has not reached its elastic limit.

_____

_____

_____m

3. A force of 7N is applied to a spring. The spring extends by 0.2m.

   Calculate the spring constant of the spring.

_____

_____

_____

_____N/m

Calculating Speed

Homework 3

Answer the questions below. Show your working out and remember to include units. Give each answer to **two** decimal places.

1. A man rides his bicycle to work each day. He lives 1700 metres from work, and it takes him 179 seconds. Calculate his average speed.

2. A horse takes 22 seconds to win a 2 furlong (402m) race. Calculate the average speed of the winning horse.

3. An aeroplane travels 2541 miles from the UK to Tenerife. The trip takes 4.5 hours. Calculate the average speed of the plane.

4. A snail travels 150m across a park. This takes the snail 4.5 hours. Calculate the average speed of the snail.

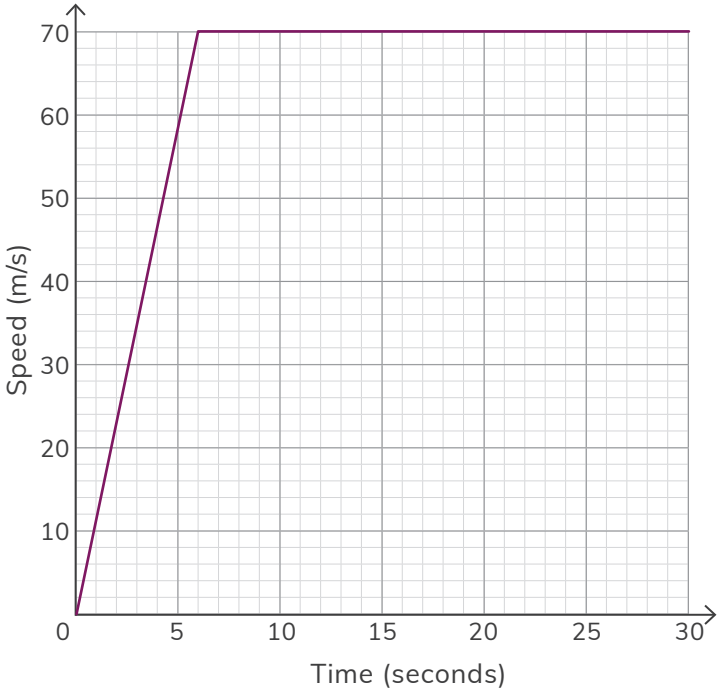
5. A tour boat travels 16 miles around an island. The trip takes 30 minutes. Calculate the average speed of the boat.

Speed-Time Graphs

Homework 3

Exam Style Questions

1. The diagram below shows the velocity of a train over a 30-second period.



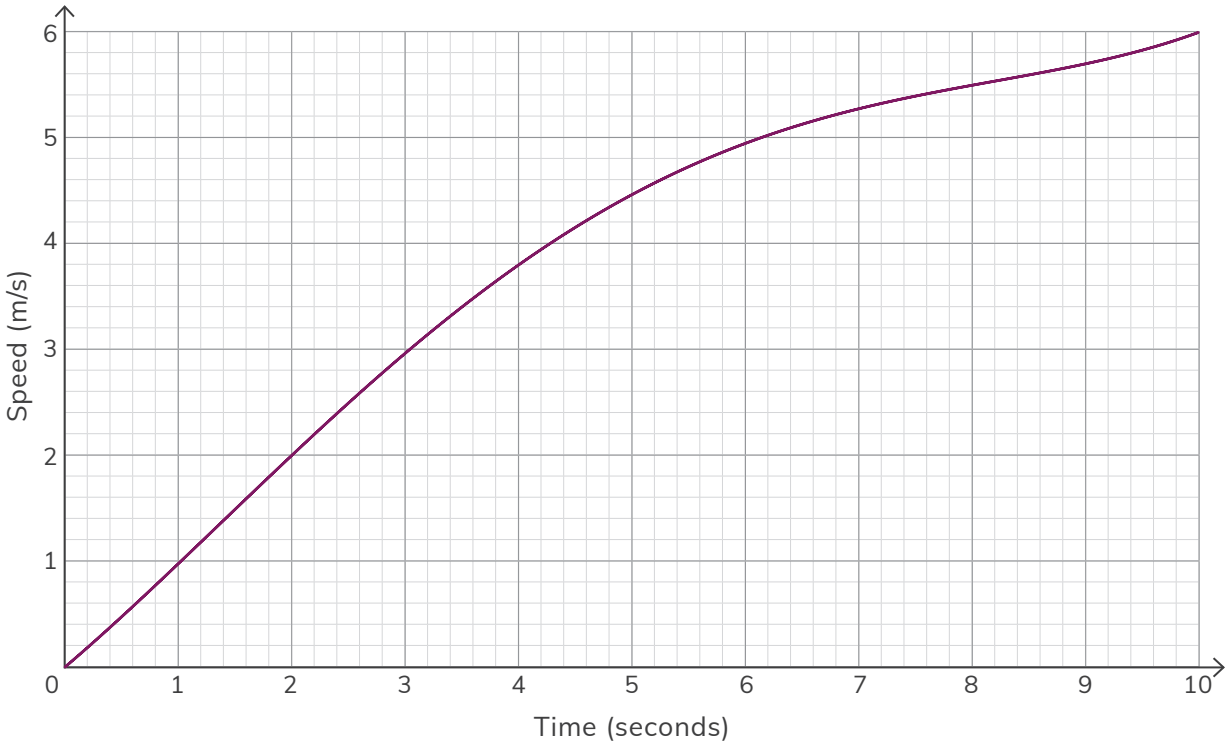
a. Find the acceleration of the train in the first 6 seconds. (1)

b. Find the total distance travelled by the train in the 30 seconds. (2)

c. Find the average speed of the train in this time. (2)

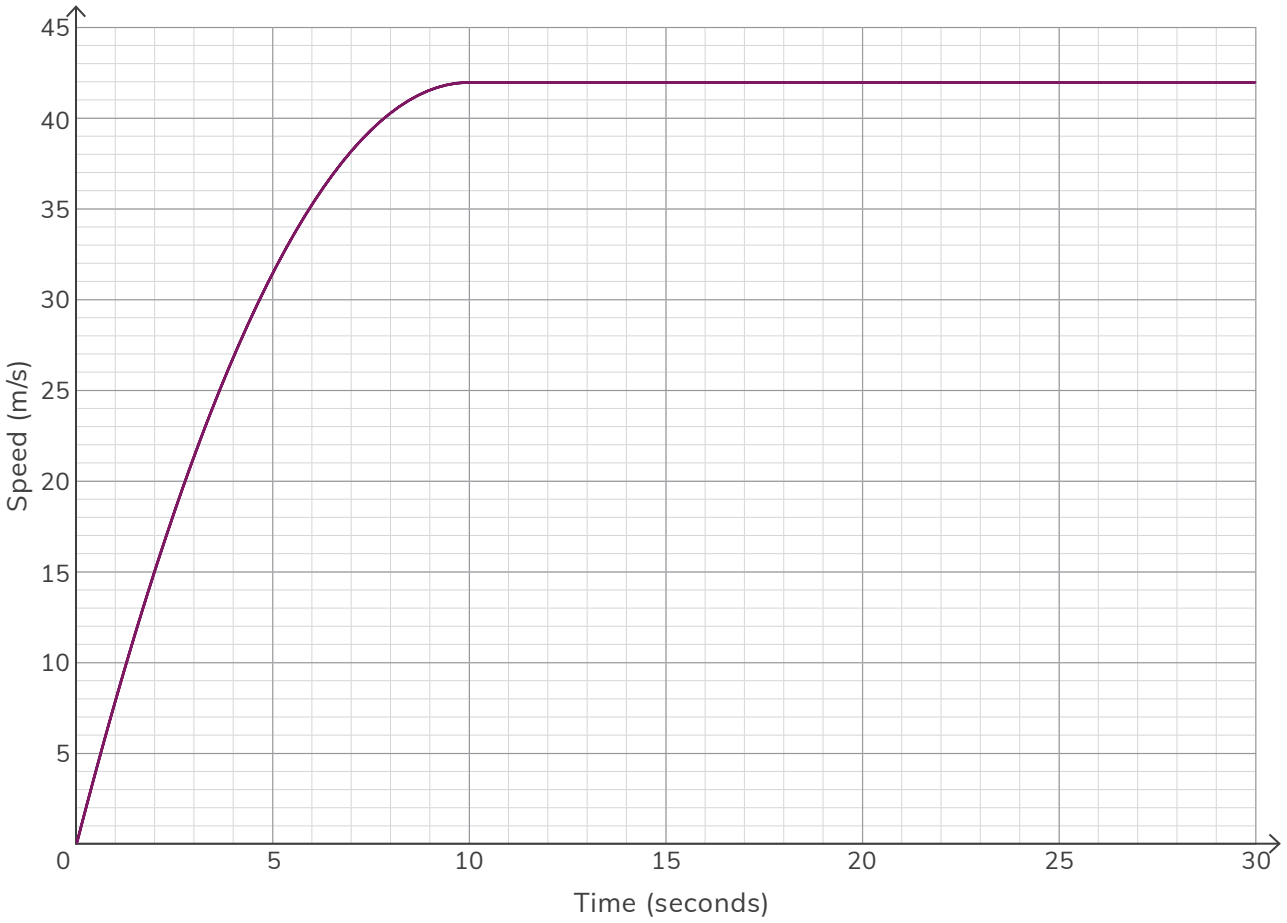
2. The graph below shows information about part of a skateboarder's journey.

Work out an estimate for the acceleration, in m/s^2, of the skateboarder at 6 seconds. (3)



Homework 3

3. The graph below shows information about the journey of a speed boat.

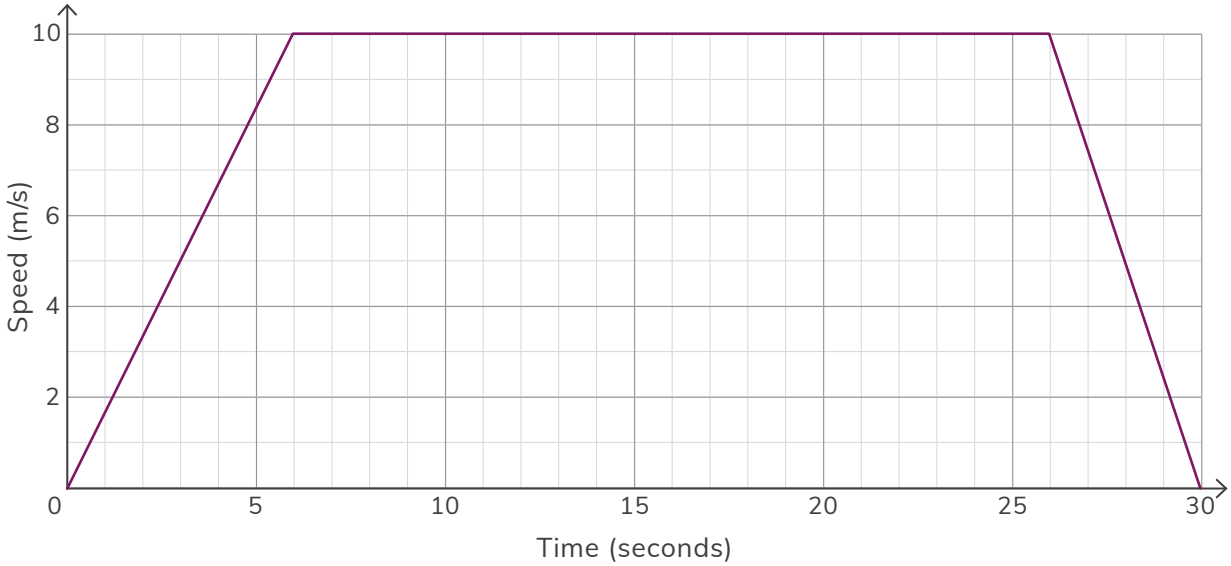


a. Work out an estimate for the distance travelled by the speed boat in the first 10 seconds. Use 5 strips of equal width. (3)

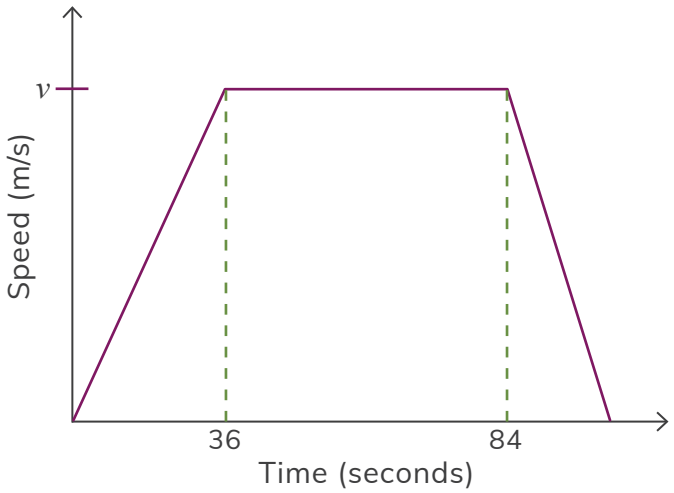
b. Is your answer to part a. an underestimate or overestimate? Give a reason for your answer. (1)

c. How could you make your estimate more accurate? (1)

4. Here is a speed-time graph for a cyclist between two checkpoints. The journey took 30 seconds. Calculate the time taken for the cyclist to travel half the distance between the two checkpoints.



5. Here is a speed-time graph for a car journey. The car travelled 2.1km in 120 seconds. Find the value of v.

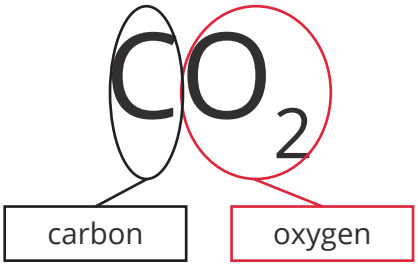


Chemical Formulae of Compounds

Homework 4

Carbon dioxide has the formula CO_2.

The chemical formula shows us that carbon dioxide is made up of 2 elements, carbon (C) and oxygen (O). Each capital letter indicates a new element. Some elements have symbols with two or three letters, the second and third letters will be lower case. For example, the symbol for sodium is Na.



Sometimes a symbol in a chemical formula is followed by a subscript number. The number tells us how many atoms of that element are present in the compound. The subscript 2 after the O in this formula tells us that there are two atoms of oxygen in a molecule of carbon dioxide. There is no subscript number after the C, so this tells us there is only one atom of carbon in a molecule of carbon dioxide. This means there are 3 atoms in one molecule of carbon dioxide.

For each compound, write down the number of elements and the number of atoms.

Compound	Formula	Number of Elements	Number of Atoms
carbon dioxide	CO_2	2	3
carbon monoxide	CO		
hydrochloric acid	HCl		
sulfur dioxide	SO_2		
water	H_2O		
ethane	C_2H_6		
iron oxide	Fe_2O_3		
sodium hydroxide	NaOH		
magnesium carbonate	$MgCO_3$		
nitric acid	HNO_3		
glucose	$C_6H_{12}O_6$		
caffeine	$C_8H_{10}N_4O_2$		
ethanol	C_2H_5OH		
ethyl acetate	$CH_3COOC_2H_5$		

Balancing Equations

Homework 4

1. Write the word equations below as symbol equations.

a. carbon + oxygen ⟶ carbon dioxide

b. magnesium + chlorine ⟶ magnesium chloride

c. iron + sulfur ⟶ iron sulfide

2. Rewrite the equations below so that they are balanced.

a. $Mg + O_2 \longrightarrow MgO$

b. $Na + Cl_2 \longrightarrow NaCl$

c. $Ca + HCl \longrightarrow CaCl_2 + H_2$

d. $H_2 + O_2 \longrightarrow H_2O$

e. $N_2 + H_2 \longrightarrow NH_3$

f. $Al_2O_3 \longrightarrow Al + O_2$

Balancing Equations

Homework 4

3. Write the word equation **and** balanced symbol equation for the following reactions.

   a. Sodium reacts with hydrochloric acid (HCl) to produce sodium chloride and hydrogen gas.

      Word equation: _____

      Symbol equation: _____

   b. Iron (III) oxide (Fe_2O_3) reacts with carbon to produce iron and carbon dioxide.

      Word equation: _____

      Symbol equation: _____

   c. Calcium carbonate ($CaCO_3$) thermally decomposes to produce calcium oxide and carbon dioxide.

      Word equation: _____

      Symbol equation: _____

Acids and Alkalis **Word Search**

Homework 5

Each of the words in the grid below relates to acids and alkalis. Work out the answer to each clue, then find the answers in the grid. The first and last letters of each answer have been given to help you. The words can be found horizontally, vertically and diagonally.

b j o w j u a d x a b u p f l j y w i g
z c c j x h k a z q r a p h f m i v o c
g f w v y w r y b a s e n g m l l e i e
i x s c s a l t f i e o e p f e i b r r
u j c o w l n e u t r a l i s a t i o n
w e p n q k g v t d p x v m q v m e h n
p r j c o a a x y q i u n j z a u i r j
p y p e c l x m u n w l o d c x s s o m
x m h n p i e p e h h i u e y h p o h u
u t s t i e l n t t d n j t h d a n r k
y p c r k l o g n a n d b u e e p e j w
z f a a r v t a w w l i g r v l e u l k
a v l t u u t r a r b c d w s t r t p h
v q e e e i h f c r j a j d f v w r y c
a h k d r g z k j m n t t l o v m a r b
k l t r a s k p z t u o l q g p h l u c
a g i k s f q y c o r r o s i v e k f q
x a m x o a n a j l k n m e l i b h f f
s x v m q i a c i d g v s v x w w i o r
i h a z a r d s y m b o l o z q h d x p

Clues

1. A substance with a pH value lower than 7

   a __ __ d

2. A soluble base with a pH value higher than 7.

   a __ __ __ __ i

Homework 5

3. A substance that reacts with an acid to neutralise it.

   b __ __ e

4. A solution with a large number of molecules of a substance in a given volume.

   c __ __ __ __ __ __ __ __ __ __ d

5. A substance that can react with other substances causing the destruction of materials. It could burn the skin or cause damage to eyes.

   c __ __ __ __ __ __ __ e

6. A solution with a small number of molecules of a substance in a given volume.

   d __ __ __ __ e

7. A recognisable icon that warns about the dangers of a substance.

   h __ __ __ __ d s __ __ __ __ l

8. A substance that changes colour when added to acidic or alkaline solutions.

   i __ __ __ __ __ __ __ r

9. A substance that may cause redness or blistering if it comes into contact with skin.

   i __ __ __ __ __ __ t

10. A type of indicator paper used to test pH. Red paper turns blue in alkaline solutions and blue paper turns red in acidic solutions.

    l __ __ __ __ s p __ __ __ r

11. A substance with a pH value of 7.

    n __ __ __ __ __ l

12. A reaction between an acid and a base or an acid and an alkali, forming a salt and water.

    n __ __ __ __ __ __ __ __ __ __ __ __ n

13. A piece of scientific equipment used to measure pH, that gives a numerical value.

    pH m __ __ __ r

14. An ordered series from 0 to 14 that is used to measure the acidity or alkalinity of a substance.

    pH s __ __ __ e

15. A compound formed by the neutralisation of an acid by a base.

    s __ __ t

Reactions of Acids

Homework 5

Name _____ Class _____

Acids react with many materials, including metals. When an acid reacts with a metal, it produces a salt and releases hydrogen gas.

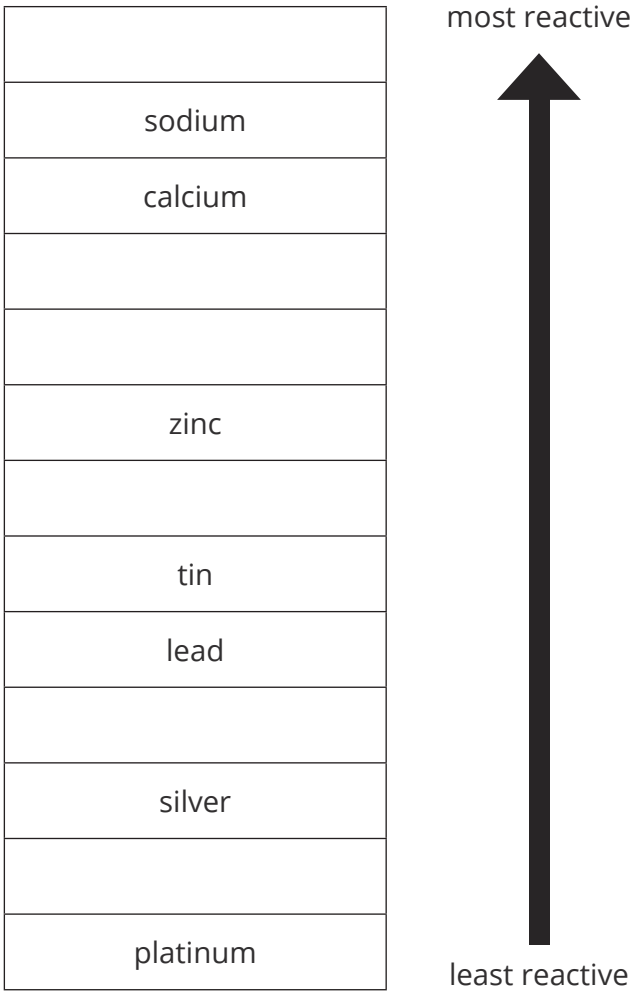
1. Complete the general word equation for the reaction between an acid and a metal.

   acid + metal → _____ + _____

Metals can be organised based on their reactivity. Part of the reactivity series for some common metals is shown below.

2. Complete the reactivity series by writing in the missing metals. Choose answers from the box.

aluminium	copper	gold
iron	magnesium	potassium



3. Describe how you would test for the presence of hydrogen gas.

_____

The name of the salt produced in a reaction between a metal and an acid depends on the metal and the acid involved in the reaction. The first part of the name comes from the metal, and the second part comes from the acid.

For example, **potassium** reacts with **sulfuric acid** to produce **potassium sulfate**.

4. Complete the table below to show the general name of the salt produced by each acid. The first one has been done for you.

Name of Acid	Name of Salt
sulfuric acid	sulfate
hydrochloric acid	
nitric acid	

5. Match the name of each acid to its chemical formula.

Name of Acid	Chemical Formula
hydrochloric acid	HNO_3
nitric acid	H_2SO_4
sulfuric acid	HCl

6. Complete the table to give the name of the salt produced in each reaction.

Metal	Acid	Salt
sodium	hydrochloric acid	
zinc	nitric acid	
magnesium	sulfuric acid	
aluminium	hydrochloric acid	
silver	nitric acid	
copper	sulfuric acid	

Naming Salts **Match and Draw**

Homework 6

Draw a line to match the reactants to the products, correctly naming the salt.

Magnesium oxide + sulfuric acid →	Silver nitrate
Calcium carbonate + hydrochloric acid →	Calcium chloride
Sodium carbonate + hydrochloric acid →	Iron sulfate
Iron oxide + sulfuric acid →	Magnesium sulfate
Silver + nitric acid →	Sodium chloride

Naming Salts **Match and Draw**

Homework 6

Draw a line to match the metal compound and acid used to produce each of the salts.
Hint: Using different colours for each salt makes it clearer to see the reactants.

Metal or compound	Acid	Salt
Iron oxide		Silver nitrate
Lead oxide	Hydrochloric acid (HCl)	Calcium chloride
Silver		Copper chloride
Calcium carbonate	Sulfuric acid (H_2SO_4)	Iron sulfate
Ammonia		Lead nitrate
Magnesium oxide	Nitric acid (HNO_3)	Magnesium sulfate
Sodium carbonate		Ammonium nitrate
Copper oxide		Sodium chloride

Naming Compounds

Homework 6

We can use a set of general rules to help name compounds.

- If a compound contains only **two elements**, its name usually ends in the suffix '**–ide**'.
- If a compound contains **three elements**, one of which is oxygen, its name ends in the suffix '**–ate**'.
- Hydroxide salts are common exceptions to these rules. These are made of **three elements** but have the suffix '**-ide**'.
- If a compound has both metal and non-metal elements, the metal is always named first.

The following formulae may be helpful:

- common ions: hydroxide (OH^-), sulfate (SO_4^{2-}), carbonate (CO_3^-)
- small molecules: water (H_2O)

1. Name the compounds made of the following elements:

elements	**compound name**
a. iron and oxygen	_____
b. iron and sulfur	_____
c. calcium, carbon and oxygen	_____
d. iron, sulfur and oxygen	_____
e. magnesium and oxygen	_____
f. chlorine and sodium	_____
g. carbon, oxygen and zinc	_____
h. copper, oxygen and sulfur	_____

2. Complete the word equations.

   Use your knowledge of Group 1 and Group 7 reactions to help you.

   a. iron + hydrochloric acid ⟶ _____ + hydrogen

   b. magnesium + sulfuric acid ⟶ _____ + hydrogen

   c. sodium + water ⟶ _____ + _____

   d. lithium + water ⟶ _____ + _____

   e. magnesium + copper sulfate ⟶ _____ + _____

   f. chlorine + sodium iodide ⟶ _____ + _____