Name:	
Science Class:	
Teacher:	
Hand in day:	

Y9 Science

Term 1 Homework Booklet

Physics

	Hand in Date	Parents Signature
Forces		
Homework 1		
Homework 2		
Homework 3		
Homework 4		

Y9 Forces 2 Homework 1 – Speed and Acceleration

Task 1

Complete these sentences using the words in the box. You may need to use some words more than once.

distance	fast	metres	metres/second	speed
		time		

Speed is a way of saying how ___________________ something is moving. To work out a speed we need to measure a ___________________ and a ___________________.

The formula is:_____________________________ = distance ÷ ___________________.

If the units for the distance are ___________________ and the units for the _______________ are seconds, the units for speed will be ___________________.

The units for speed depend on the units for the distance and the time. Fill in the table.

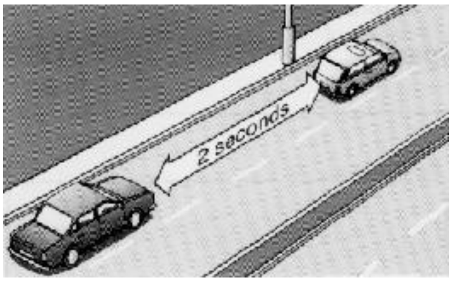
Units for distance	Units for time	Units for speed	
miles	hours		mph
kilometres		kilometres per hour	
	seconds		m/s

Task 2

(a) The 'two second rule' is a rule for car drivers. The rule is as follows:

'Leave enough space between you and the vehicle in front so that you can pull up safely if it suddenly slows down or stops. . . A two second time gap may be sufficient. . . Use stationary objects (eg lamp-posts) to help you keep a two second gap.'

(The Highway Code, 1993)



(i) The traffic is moving at 20 m/s, and a driver is keeping to the 'two second rule'.
What is the distance between the driver and the car in front?

....

1 mark

(ii) The traffic increases its speed to 25 m/s, but the driver stays the same distance from the car in front.
She sees the car in front pass a lamp post.
How long will it take her to reach the same lamp post?

....

....s

1 mark

(b) The driver decides to check her speedometer while driving along a motorway.
She measures how long it takes her to travel 6 km. It takes her exactly 4 minutes.
What was her speed in **km/h**? Show your working.

....

....

....km/h

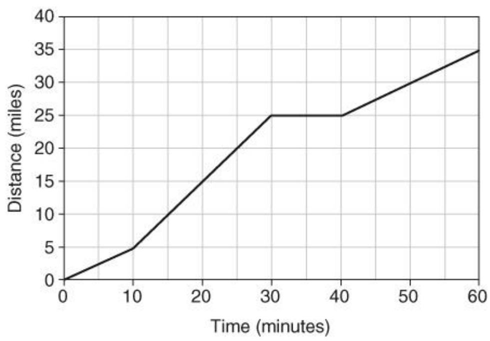
2 marks

Maximum 4 marks

Y9 Forces 2 Homework 2 – Distance-time graphs

Complete the questions below about distance-time graphs

1. The distance–time graph shows a journey by car.



a Write an F on the graph next to the part of the journey with the fastest speed.

b Write an S on the graph where the car stopped.

c How long did the car stop for?

____

d What was the total distance travelled?

____

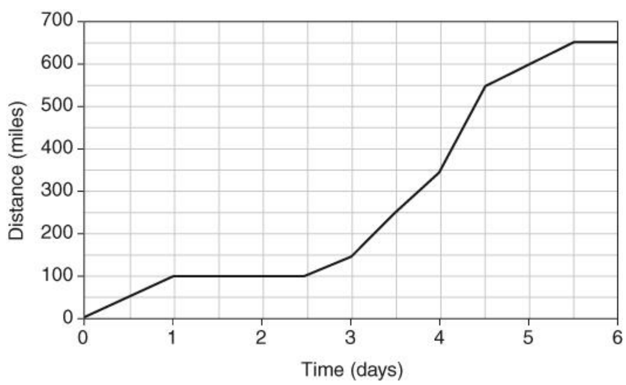
e The car travels 25 miles in the first 0.5 hours of the journey. Calculate its mean speed for this part of the journey.

speed =

2 Work out which letter describes part of the journey. Write the correct letter to the correct part of the graph.

3 Calculate the speed for each different part of the line on the graph and write it next to each letter. You can use information from the descriptions or from the graph.

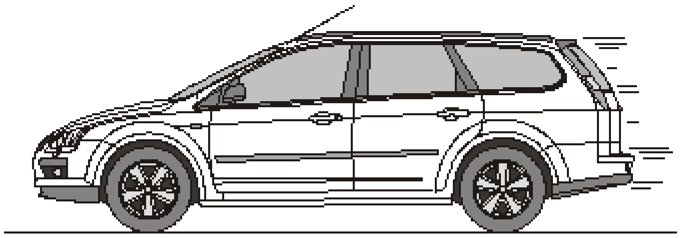
A Light breeze in the morning, dropped to calm at midday. Only 50 miles covered in total.	**B** Strong wind in the morning, covered 200 miles. Dropped to light breeze in afternoon – total distance 250 for the day.
C No wind until midday, then a light breeze all afternoon. 50 miles covered.	**D** Calm – no wind at all.
E Light breeze all day. 100 miles run.	**F** Fresh breeze all day. Speed about 8 mph all day.



Y9 Forces 2 Homework 3 – Momentum

Answer the questions below about momentum

a) The diagram shows a car travelling at a speed of 12 m/s along a straight road.



(i) Calculate the momentum of the car.

Mass of the car = 900 kg

Show clearly how you work out your answer.

____

____

____

____

Momentum = _______________ kg m/s

(ii) Momentum has direction.

Draw an arrow on the diagram to show the direction of the car's momentum.

(b) The car stops at a set of traffic lights.

How much momentum does the car have when it is stopped at the traffic lights?

____

Give a reason for your answer.

____

____

____

Y9 Forces 2 Homework 4 - Moments and levers.

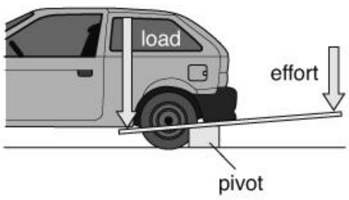
Complete the tasks below about moments and levers

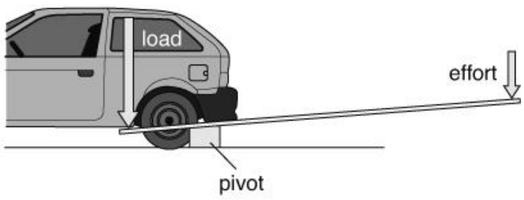
Task 1

1 Draw lines to match up the words and their meanings.

lever	a force put on a lever
pivot	a lever that can be used to take the tops from bottles
effort	a lever that makes a force bigger
load	a lever that makes something move further
force multiplier	the point that the lever turns around
distance multiplier	a long bar that can be used to increase the size of a force (or how far it moves)
bottle opener	the weight or force on something

2 **a** Which lever should Viv use to lift the car? Tick (✓) *one* box.

☐ 

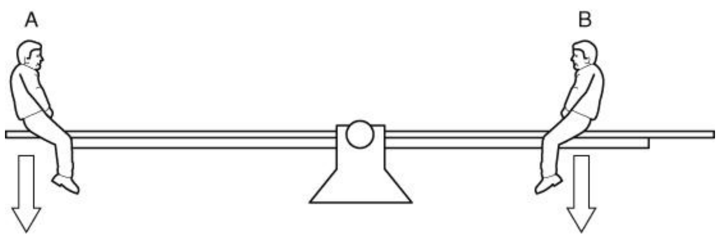
☐ 

b Explain your answer to part **a**.

____

____

3 This seesaw will not balance.



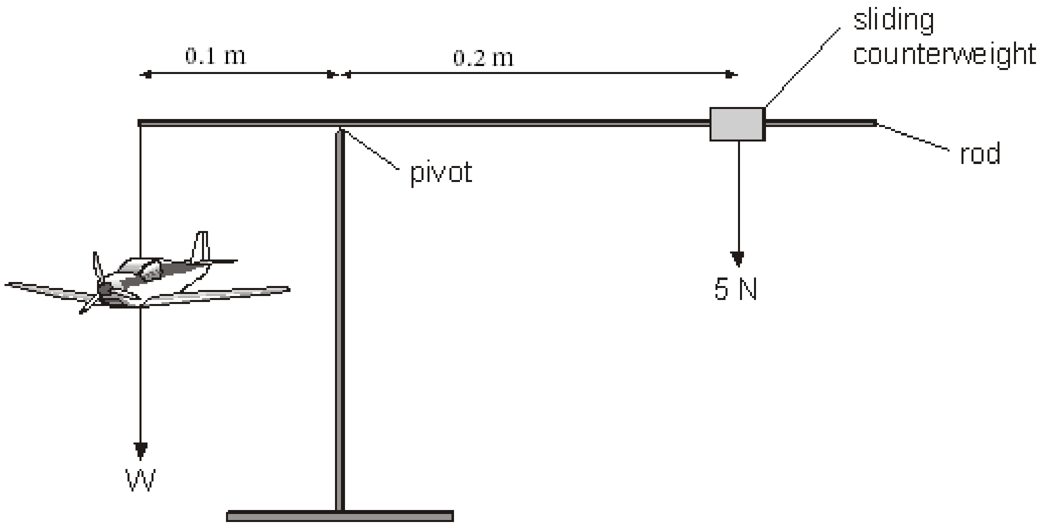
a Draw an arrow to show which way it will move.

b Explain what the boys have to do to make the see-saw balance.

____

Task 2

Zena has a model plane attached to a rod as shown below.
The plane is balanced by a sliding counterweight.



not to scale

(a) The rod is balanced horizontally.

(i) Calculate the moment produced by the counterweight.

Give the unit.

....

....

2 marks

(ii) What is the moment produced by the plane?

....

1 mark

(iii) Calculate the weight, W, of the plane.

....

....N

1 mark

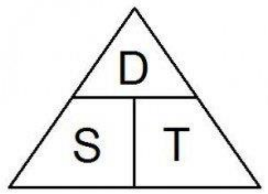
Knowledge Organiser: Forces 2

Speed

To measure how fast something is travelling, you need to measure the distance it travels and the time taken. Units for **speed** are **km/h** or **m/s** or **mph**. The unit for speed depends on the units you have used to measure the distance and the time.

Speed is calculated using this formula:

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

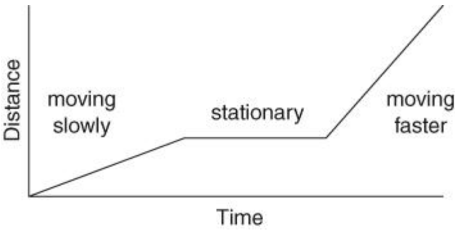


The **mean (average) speed** is the total distance travelled divided by the total time taken. Actual speeds during a journey can be faster or slower than the mean speed.

A car travelling at 50 km/h overtakes one travelling at 30 km/h. The **relative speed** of the faster car compared to the slower car is 20 km/h.

Distance–time graphs

A journey can be shown on a **distance–time graph**. This graph shows Kieron's journey to school. The steeper the line on the graph, the faster the object or person is moving.



Gradients

The **gradient** of a line on a graph is a measure of how steep the line is. On a distance-time graph, the gradient of a line gives the speed that the object is moving.

Example

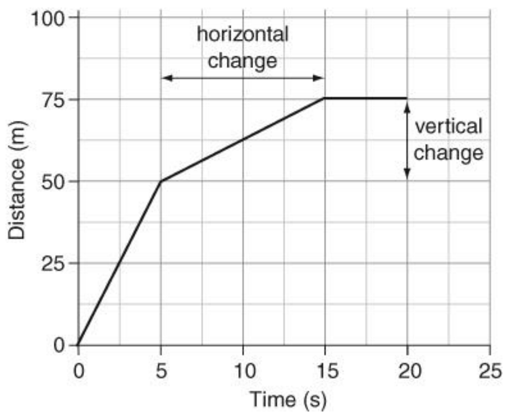
Calculate the speed of the object between 5 and 15 seconds.

$$\text{gradient} = \frac{\text{vertical change (distance moved)}}{\text{horizontal change (time taken)}}$$

$$= \frac{(75\,\text{m} - 50\,\text{m})}{(15\,\text{s} - 5\,\text{s})}$$

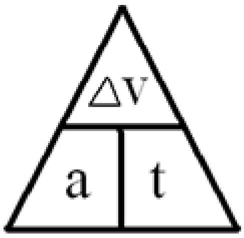
$$= \frac{25\,\text{m}}{10\,\text{s}}$$

$$= 2.5\ \text{m/s}$$



Acceleration

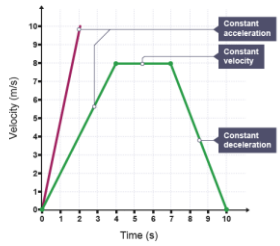
$$\textbf{\textit{Acceleration}} = \frac{\text{change in velocity}}{\text{time taken}}$$



An object that slows down is decelerating. Near the Earth's surface any object falling freely under gravity has an acceleration of about 9.8 m/s^2.

Velocity-time graphs

The acceleration of an object can be calculated from the gradient of a velocity–time graph.



Momentum

"Momentum is the property of a moving object that quantifies how difficult it is to be stopped".

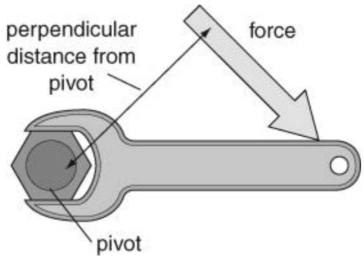
Momentum is calculated using the equation:

Momentum (kgm/s^2) = mass (kg) x velocity (m/s^2)

Moments

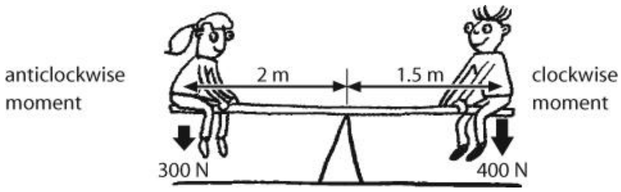
A turning force is called a **moment**. Moments are measured in **newton metres** (**N m**).

moment (in N m) = force (in N) × perpendicular distance from the pivot (m).



The longer the distance the greater the moment. This is why it is easier to turn a long spanner than a short one.

When an object is balanced, the anticlockwise moment is equal to the clockwise moment.



For the seesaw:

the anticlockwise moment	= 300 N × 2 m
	= 600 N m
the clockwise moment	= 400 N × 1.5 m
	= 600 N m

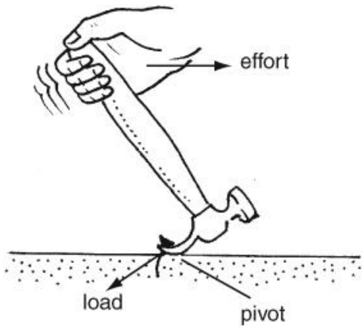
The clockwise and anticlockwise moments are the same, so the seesaw is balanced, or **in equilibrium**.

Scholar's Pathway

Levers

Forces can be used to turn objects around **pivots**. A pivot is also known as a **fulcrum**.

Levers can be **force multipliers**, when they increase the force that is put in (the **effort**). They can be **distance multipliers** if they make the **load** move further than the effort. The amount the force or distance is multiplied depends on the distances between the load and the pivot, and the effort and the pivot.



The hammer is acting as a force multiplier.

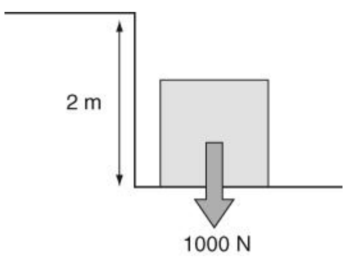
Simple machines

A lever is an example of a simple **machine**. **Ramps** and **pulleys** are simple machines that act as force multipliers.

If a machine makes it possible to lift or move a load using a smaller force, the force has to move through a greater distance. The total amount of energy needed is the same.

The **work done** by moving a load is the same as the energy transferred. Work is done when a force moves through a distance. Work is measured in joules (J).

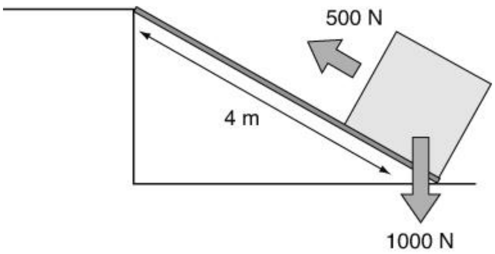
work = force × distance moved in the direction of the force.



The work done to lift the box 2 m is:

work = 1000 N × 2 m

= 2000 J



The ramp makes it possible to move the box using a force of only 500 N, but the box has to be moved 4 m.

work = 500 N × 4 m

= 2000 J.

The box stores the same amount of gravitational potential energy when it is in its final position whichever method is used to lift it. The **law of conservation of energy** means that only this amount of energy is used to lift it.