Name: Form:

MYP 1
Year 7
Forces and Motion

Statement of Inquiry:	By exploring the **laws of motion** and **relationships** we can describe the **movement** and **interactions** of objects.
Key Concept:	Relationships
Related Concepts:	Movement and Interactions

(2024-2025)

Statement of inquiry
Exploring the **laws of motion** and **relationships** which describe the **movement** and **interactions** of objects.
Inquiry questions
Factual (what) • What are main types of forces? • What are the effects of a force on an object? **Conceptual** (how/why) • How are the laws motion used to solve problems? • How can our understanding of the laws of motion be applied in a number of different contexts? • How distance-time graphs are used to describe an objects motion. **Debatable** (is/do) • Is it essential to understand the laws of motion in order to understand the natural world?
Approaches to learning (ATL)
1. **Information Literacy Skills** - Process data and report results. 2. **Collaboration Skills -** Give and receive meaningful feedback.

7P MYP Command Terms

Term	Definition
Analyse	Break down in order to bring out the essential elements or structure. To identify parts and relationships, and to interpret information to reach conclusions.
Apply	Use knowledge and understanding in response to a given situation or real circumstances
Describe	Give a detailed account or picture of a situation, event, pattern or process
Design	Produce a plan, simulation or model
Discuss	Offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence
Document	Credit sources of information used by referencing (or citing), following one recognized referencing system. References should be included in the text and also at the end of the piece of work in a reference list or bibliography
Evaluate	Make an appraisal by weighing up the strengths and limitations
Explain	Give a detailed account
Formulate	Express precisely and systematically the relevant concept(s) or argument(s)
Interpret	Use knowledge and understanding to recognize trends and draw conclusions from given information
Outline	Give a brief account
Present	Offer for display, observation, examination or consideration
Recall	Remember or recognize from prior learning experiences
Select	Choose from a list or group
Solve	Obtain the answer(s) using appropriate methods
State	Give a specific name, value or other brief answer without explanation or calculation
Suggest	Propose a solution, hypothesis or other possible answer
Summarize	Abstract a general theme or major point(s)

7P MYP Glossary Forces and Motion

Forces

Word	Meaning
air resistance	A force that tries to slow things down that are moving through air. It is a type of friction.
contact force	A force that needs to touch an object before it can affect it (e.g. friction).
drag	Air resistance and water resistance are both sometimes called drag.
force	A push or a pull.
force meter	Piece of equipment containing a spring, used to measure forces.
friction	A force that tries to slow things down when two things rub against each other.
gravity	The force of attraction between any two objects. The Earth is very big and so has strong gravity that pulls everything down towards it.
magnetic attraction	A force that attracts objects made out of iron.
magnetic repulsion	A force that pushes two similar magnetic poles apart
Newton (N)	The unit of force.
Newton meter	Another name for a force meter.
non-contact force	A force that can affect something from a distance (e.g. gravity).
speed	How fast something is moving. Often measured in metres per second (m/s).
static electricity	A force which attracts things with extra electrical charges on them.
upthrust	A force that pushes things up when in water.
water resistance	A force that tries to slow things down that are moving through water. It is a type of friction.

Balancing act / Stretching / Weight

Word	Meaning
balanced forces	When two forces are the same strength, but working in opposite directions.
elastic	Any substance that will return to its original shape and size after it has been stretched or squashed.
gram	A unit for measuring mass (g).
kilogram	A unit for measuring mass (kg). There are 1000 g in 1 kg.
mass	The amount of matter that something is made of. Measured in grams (g) and kilograms (kg). Your mass does not change if you go into space or to another planet.
newton	The unit of force (N).
stationary	Not moving.
unbalanced forces	When two forces working in opposite directions are not the same strength.
weight	The amount of force with which gravity pulls something towards the Earth. It is measured in newtons (N).

Friction

Word	Meaning
air resistance	A force that tries to slow things down that are moving through the air. It is a type of friction.
friction	A force that tries to slow things down when two things rub against each other.
lubricant	A substance (normally a liquid) used to reduce friction.
lubrication	Adding a lubricant to something.
water resistance	A force that tries to slow things down that are moving through water. It is a type of friction.

Density, upthrust and floating

Word	Meaning
density	The amount of mass that $1cm^3$ of a substance has. Measured in g/cm^3.
displacement	The volume of water pushed out of the way by an object.
upthrust	A force that pushes thing up when in water.

Speed

Word	Meaning
distance/time graph	A graph that shows how far and how fast something travels during a journey.
kilometres per hour (km/h)	Units for speed when the distance is measured in kilometres and the time is measured in hours.
metres per second (m/s)	Units for speed when the distance is measured in metres and the time is measured in seconds.
miles per hour (mph)	Units for speed when the distance is measured in miles and the time is measured in hours.
speed	How fast something is moving. Often measured in metres per second (m/s).

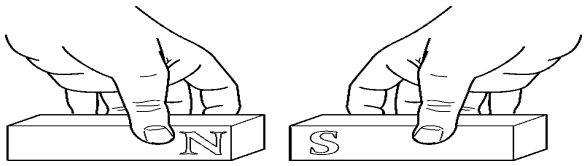
Air Resistance

Word	Meaning
air resistance	A force that tries to slow things down that are moving through the air. It is a type of friction.
streamlined	When an object has a shape that reduces friction and allows it to travel faster.
Accelerate	Gets faster
Decelerate	Gets slower

7P 1a Practical Investigation: Forces in Action

Carry out the following activities and fill in the gaps on this sheet with your results. Some of the words you need are given in the brackets.

1.



The magnets are _____ (attracting/repelling) each other.

The force is strongest when the magnets are _____ (close together/far apart).

The name of this force is _____ (friction/gravity/magnetism).

What will happen if you turn one of the magnets round? _____

_____.

What do 2 North poles do to each other? Two North poles _____

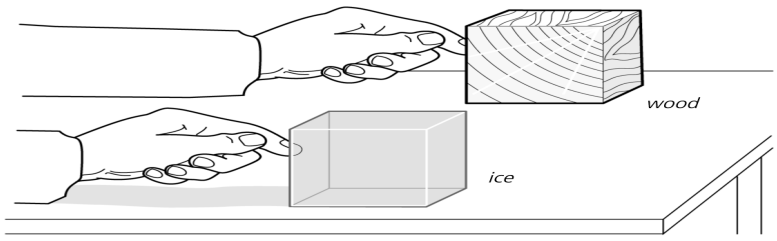
What do 2 South poles do to each other? Two South poles _____

What does a North pole do to a South pole? Two different poles _____

This force acts at a distant and the magnets do not need to touch. It is called a _____

(contact/non-contact) force.

2.



The force of _____ (friction/gravity/magnetism) tries to stop the blocks moving

across the desk. It is _____ (easier/harder) to push the block of wood,

because the wood is _____ (smoother/rougher).

Since the blocks need to touch the desk, this force is called a _____ (contact/non-contact) force.

Using the tray, tilt the tray until one of the blocks slides. Which block slides first?

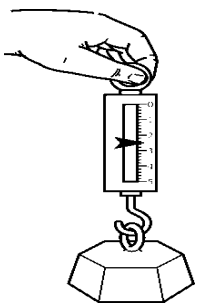
The _____ block slides first because it has _____ (more/less) friction than the other block.

3. Get a plastic rod and some small pieces of tissue paper. Rub the plastic rod with a cloth and hold them close to the tissue paper. Explain or draw what happens in the space below.

The plastic rod _____ (attracts/repels) the small pieces of paper. This type of force is called _____ _____ . Is this a contact or a non-contact force?_____

Extension: Can you explain why this happens?

4.



Weigh the object using a Newton meter. What is a Newton meter used for?

A Newton meter is used to measure _____ .

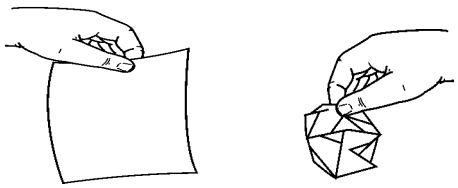
How much does your object weigh? _____

What is the mass of the object? _____ The force of _____ is pulling the object downwards towards the Earth. What is the size of this force that acts on 1 kg? _____ N.

Extension:
The force of gravity is much weaker on the moon. Why?

If you had a mass of 1 kg, find how much it would weigh on the moon?

5



The paper takes _____ (less time/more time) to fall if it is crumpled up.

The force trying to slow down the paper is called _____ _____. Is this a contact or a non-contact force? It is a _____ force because the paper is falling and pushing through the air.

Extension: This force is slowing down the paper. Which bit of paper is experiencing more of this force and why?

6 Get a plastic bowl and half fill it with water. Put a ping pong ball and a marble in the water. Draw a diagram or explain in the space below, what happens.

The force of the water pushing upwards is called _____, if this force is equal or larger than the force due to _____ then the object in the water will _____.

Extension: Explain what water resistance is? Does this get greater or smaller if a speed boat goes faster?

Check your understanding:

Consider the six practical's you have just completed and tick the correct box to show the level of your understanding so far – be honest!

I can…..	**Expert**	**Good**	**Reasonable**	**Novice**
Describe what forces do.				
Recall the names of contact and non-contact forces.				
Explain how to measure forces.				
Explain the difference between mass and weight				

7P 1b Examples of Forces

Card Matching Activity:

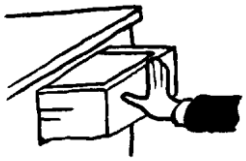
You will be given some cards. You must match up the name of force, the description and the photographs of the examples.

Record the information in the table below:

Force	Description	Examples
Gravitational		
Magnetic		
Friction		
Upthrust		
Air Resistance		
Static Electricity		

7P 1c: Types of Forces (Lesson 1 Plenary)

1 Which forces are pushes and which ones are pulls? Write the correct words in the spaces.



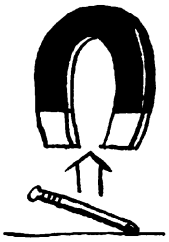

_____ _____ _____ _____

2 Look at the pictures below. Write the names of the forces next to the arrows.

A

_____

B

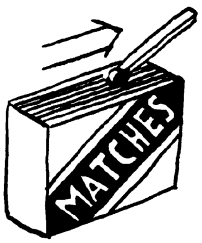


_____

C

_____

D



_____

E

_____

F

_____

3 Which pictures above are examples of non-contact forces? _____

Which pictures above are examples of contact forces? _____

Home-work Assignment:

Extension: What happens to an object when 2 forces are balanced? Draw a diagram below of a car and use arrows to represent the forces and explain what is happening to the car.

7P 2a Investigating Weight using a Newton Meter

Aim:

You will experimentally investigate the relationship between the weight of an object and it's mass.

Method:

1. Set up a Newton-Meter (also called a Force-Meter) as per teacher guidance using a clamp stand, and G-clamp.
2. Using slotted masses you choose 6 different masses to hang, and using the Newton Force Meter measure the corresponding force of weight exerted by each mass in Newton's. Each slotted mass has a mass of 0.1kg.
3. Construct an appropriate table to record your results below.
4. Add the name and units to the headings.
5. To make your data more **reliable**, measure the weight twice and take an average.

Table of Results:

Mass added to Newton-Meter			
/ Kilograms			

Analysis of Results and Conclusion:

1. **Construct a graph** to show the relationship between the force of weight and mass. This should be done on graph paper and the following *criteria addressed*;

- *Title of graph included*
- *Label the x and y axis with correct units*
- *Scales should be appropriate*
- *Points plots accurately and connect using curve/straight line of best fit*

2. How are mass and weight related?

_____

_____

_____

3. What happens when you increase the mass of an object in relation to the weight of the object? Support your answer with data from the inquiry.

_____

_____

_____

Reflection/Evaluation:

Write a short paragraph below describing the experiment, what you learned from the experiment and how it affects your everyday life. What does a well-organized scientist always do when they take measurements?

_____

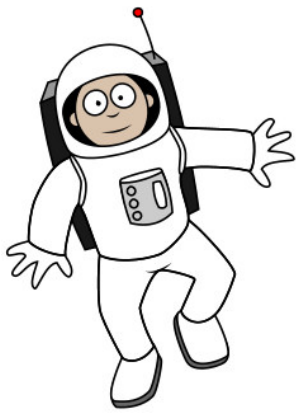
_____

_____

_____

_____

Extension



An astronaut has a mass of 70kg and a weight of 700N here on Earth.

The astronaut flies far away from the Earth.

The mass of the astronauts is now greater / less / the same but the

weight of the astronaut far from Earth is greater / less / the same.

In space we say the astronaut is _____ .

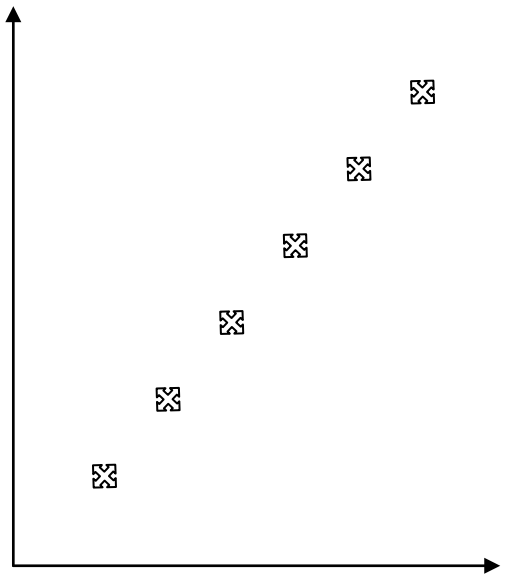
7P 2b Lines of Best Fit – Extra Help

Aim:
Choosing the most appropriate Line of Best Fit.

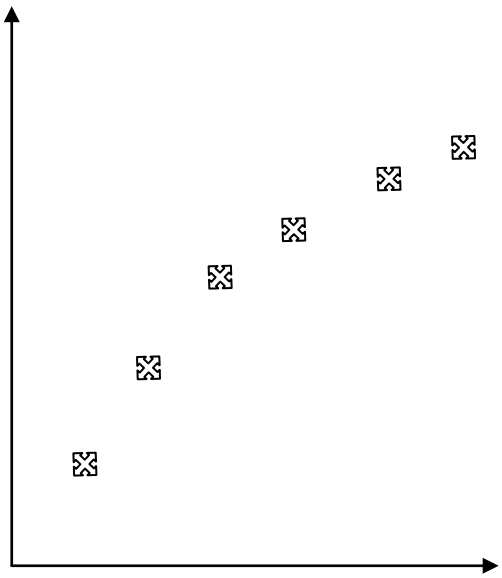
Method:
Draw the Line of Best fit for each graph. Use a ruler where needed.

Check your graphs with your teacher.

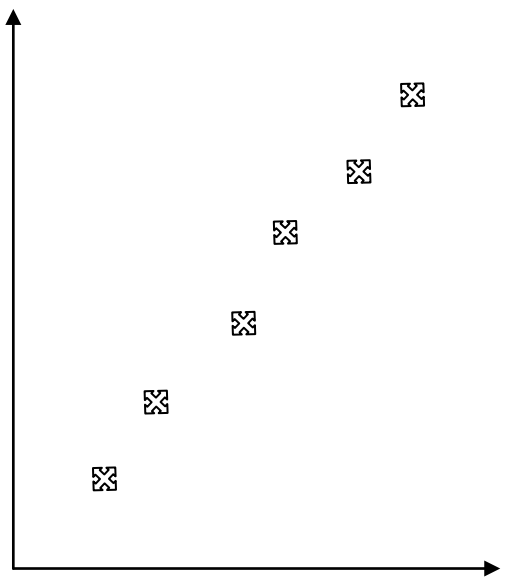
Graph A



Graph B



Graph C



Graph D

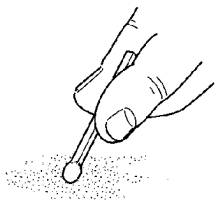
7P 2c Weight, Gravity and Mass - Review

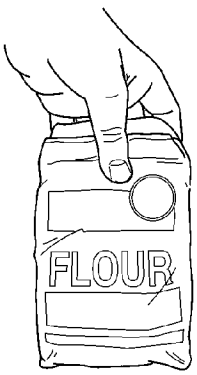
1a The unit of force is called the _____.

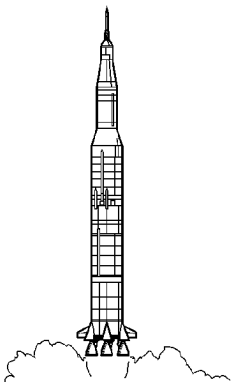
1b The unit is given a capital letter because it is named after a _____ .

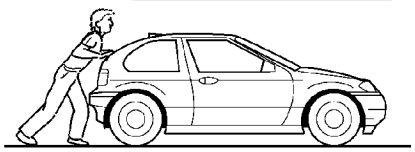
2 The pictures below show examples of forces. Write the likely size of each force in the space below each picture. Choose numbers from the box.

50 000 000 N
0.5N
650N
10N









_____ _____ _____ _____

3 Fill in the missing words:

The Earth _____ all objects towards it. This is because of

_____ . It is this effect which gives us our _____ .

4 Complete these sentences using words from the box:

The weight of a 2 kg mass on Earth is _____.

The typical mass of a man on Earth is about _____ .

The unit of mass is the _____ .

The unit of weight is the _____.

The mass of a 2 kg bag of apples on the Moon is _____ .

The weight of a 2kg bag of apples on the moon is _____ .

kilogram	**Newton**	**20 N**
2 kg	**80 kg**	**3.2 N**

5 Explain in your own words, the difference between **mass** and **weight**.

_____

_____

_____

6 If an astronauts leaves the Earth and flies into space describe what happens to their **mass** and **weight**. How does an astronaut feel when they are far from the Earth?

_____

_____

_____

Extension: Find out about the force due to gravity on other planets or the moon. How is the gravitational force related to the mass of the planet?

7P 2d Balanced and Unbalanced Forces

Use these words to fill the gaps.

water	opposite	float	upthrust	balanced

a If the forces are _____ an object will not move.

b Balanced forces are the same size and pull in _____ directions.

c When you put an object in water, the _____ pushes upwards on the object. This push is called _____.

d If the upthrust on an object is the same size as its weight, the object will _____.

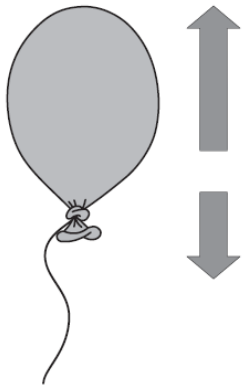
2 This balloon is floating in the air. Look carefully at the diagram.

Which arrow shows the upthrust?

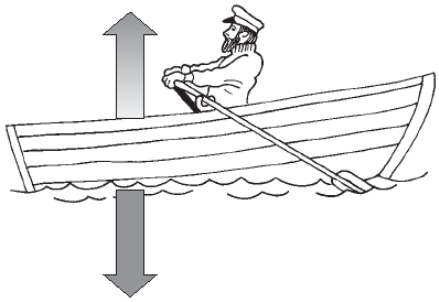
Circle the arrow.

3 Look at these diagrams. The arrows show the size and direction of the forces.

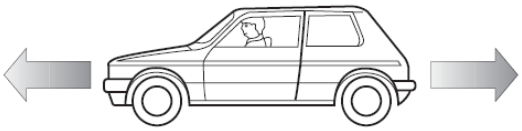
A



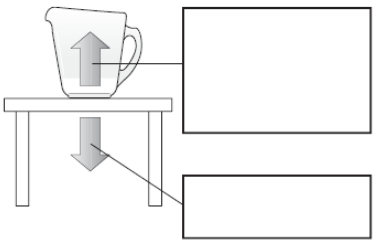
B



C



D



a In which diagrams are the forces balanced? _____

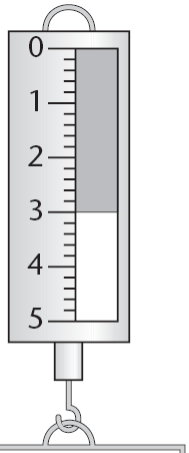
b Will the boat float or sink? _____

c The jug is standing on a table. The *weight* of the jug is the same size as the *reaction force* of the table. Label the forces in diagram **D.**

7P 2e Weight and Gravity

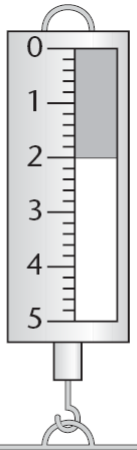
1 Look at these Force-Meters (Newton-Meters). Each is measuring a different force. Forces are measured in Newtons (N).

A



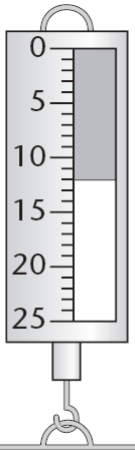
Force = ____ N

B



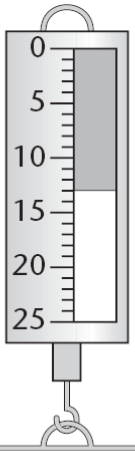
Force = ____ N

C



Force = ____ N

D



Force = ____ N

b Which of these forces is the biggest? _____ N

c Which of these forces is the smallest? _____ N

2 Match the words to the descriptions.

force	How much material something is made of.
weight	The pull of the Earth's gravity on something.
mass	A push or a pull.
gravity	Weight is measured in these.
Newtons (N)	The units of mass.
kilograms (kg)	The effect that keeps the earth orbiting the sun.

3 Look at this table. It contains information about the weight and mass of some items.

Item	**Mass** in kg	**Weight** in N
James	47	470
large book	1	10
bag of sugar	2	20
bag of potatoes	10	100
Janine	53	530

Write *true* or *false* for each sentence.

a Mass is measured in kilograms. _____

b Weight is measured in kilograms. _____

c Weight is caused by gravity pulling down on a mass. _____

d 1 kilogram has a weight of Newtons. _____

Look at the table.

e Which item has a mass of 10 kg? _____

f Which item has a weight of 100 N? _____

g Which item has the smallest mass? _____

h Which item has the smallest weight? _____

i Which item has the largest weight? _____

j Which item has the largest mass? _____

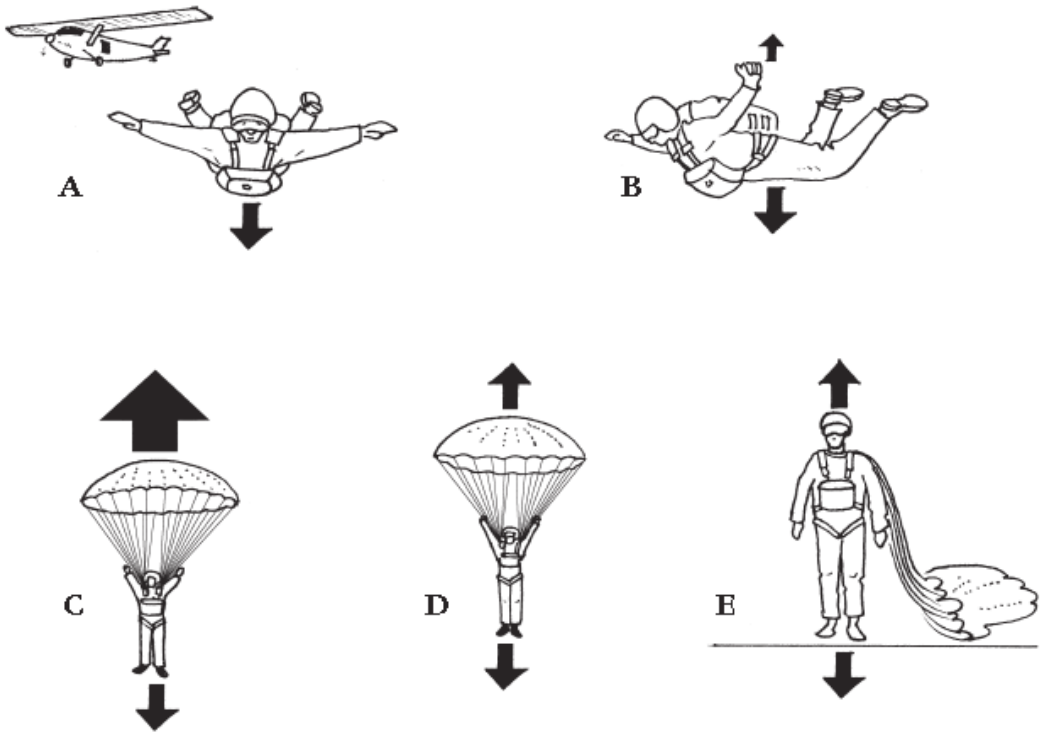
k James has a *smaller* / *larger* mass than Janine.

l Janine weighs *more than* / *less than* James.

Underline the right words. Cross out the wrong words.

7P 2f Parachute Jump

These pictures show different stages in a parachute jump.



1 What is causing the downwards forces shown in the pictures?
2 What is causing the upwards force in pictures B to D?
3 What is causing the upwards force in picture E?
4 In which pictures is the skydiver gaining speed?
5 a Which picture shows that her air resistance has suddenly increased?
b What has caused the sudden increase in her air resistance?
c What will happen to her speed?
6 Which two pictures show balanced forces?

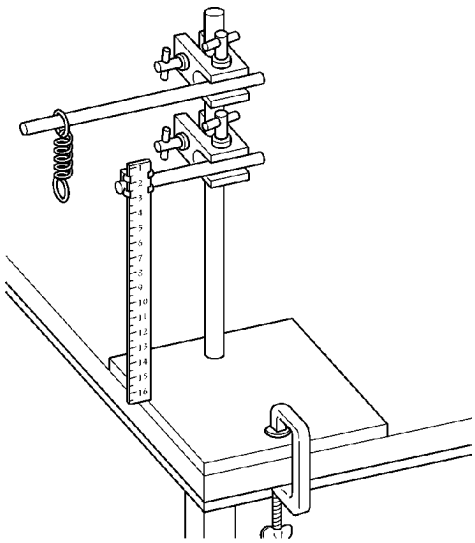
7P 3a Investigating Stretching

Apparatus:

- Stand and 2 clamps
- Weight holder and 1N weights
- Metre rule
- G clamp
- Spring
- Objects A, B and C with unknown masses

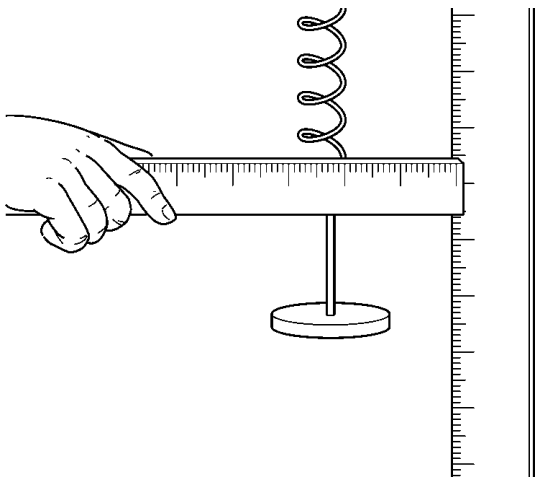
Method:

1. Set up your apparatus like this:



2. Measure the position of the bottom of the spring. You can use another ruler to help you. Write your result in the table.

3. Hang the holder on the spring and measure the length again. The holder has a weight of 1N. Write your result in the table.



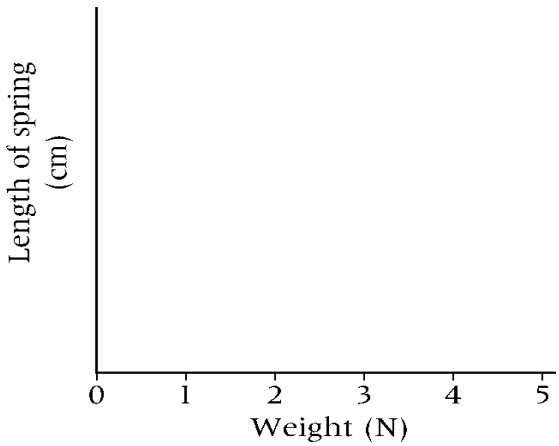
4. Add another weight on the spring and measure its length. Continue up to 5 weights.

Results:

Weight (N)	Length of spring repeat 1 (cm)	Length of spring repeat 2 (cm)	Average length of spring (cm)
0			
1			
2			
3			
4			
5			

Graph:

Plot a graph of your results on graph paper. You will need to use axes like these:



Conclusion:

What happens to the length of the spring when you increase the weight? (Extension: What about when you double the weight?)

_____

_____

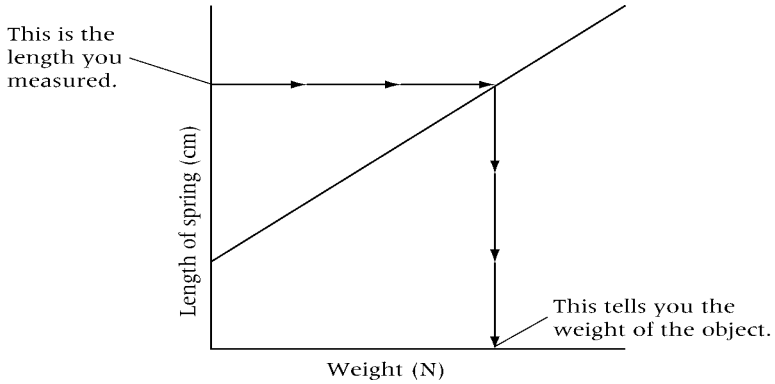
_____

_____

_____

Using your Graph to find Unknown Weights:

Now you can use your force meter to weigh other things. There are 3 objects to measure A, B and C. Hang an object on the spring and measure its length. Then use your graph to find its weight, like this:



Unknown Object	Length (cm)	Weight (N)	Actual Weight measured using a Newton-meter (N)
A			
B			
C			

Conclusion:

Did this technique get a reasonably accurate value for the weight of the unknown objects?

Do we use springs to measure weights?

Extension Activities:

Sketch a diagram and label the forces on the mass using arrows. Are they balanced or unbalanced? (Hint: Label one of them 'Pull of the spring').

Find out about Hooke's Law. Does it apply to all materials that can be stretched? Does this experiment obey Hooke's Law?

7P 4a Which Shoes Have the Most Friction?

Predict:

What type of shoes has the most grip or friction? Is it the shape or material of the shoe? Predict and explain whose shoe in your group you think would have most friction and why?

_____

_____

_____

Apparatus:

- 2 or 3 different types of shoes (if someone in your group has a training shoe it would be good to compare)
- Force meter and string.

Method:

1. Attach the Newton meter to the first shoe (use the laces or attach using a loop of string around the base of the shoe.
2. Choose a surface that you are going to pull the shoes along. You could use the bench or the floor, but you need to use the same surface for each test.
3. Gently pull the shoe along the surface. Try to pull it at a constant speed. Read the force meter, and write down the force needed to pull it.
4. Repeat your measurements 2 more times, and write the results in the table. Calculate the mean (average) force needed.
5. Repeat each step for other types of shoe.

Results:

Shoe description	**Force needed to pull shoe (N)**			**Mean force**
	1st pull	**2nd pull**	**3rd pull**	**(N)**

Analysing Your Results:

Find the mean (average) by adding up all three results and then divide your answer by 3. Show your results in a **bar chart** and ensure that you address the following criteria:

- *Title of graph included*
- *Label on x and y axis with correct units*
- *Scales should be appropriate*
- *Points plots accurately and connect using curve/straight line of best fit*

Conclusions

1. Which shoe had the most friction? Can you explain why?

_____

_____

_____

2. Which shoe had the least friction? Can you explain why?

_____

_____

_____

Evaluation

Please justify and explain the points you make. Here are a few points to consider:

- Was this a fair test?
- Was it reliable?
- Were there any problems carrying out the experiment?
- How could this practical be improved?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Friction Summary Questions

1. Complete the following sentence:

Friction is a force which _____ motion.

2. Outline what causes friction. You may wish to include a diagram.

_____

_____

_____

_____

3. Give some examples of when it is useful to have lots of friction and when it is a nuisance. Add examples to the table below.

Useful Friction	Nuisance Friction

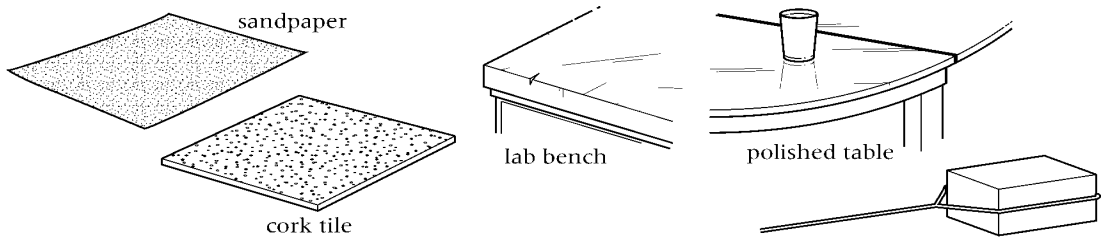
Extension Questions

Draw a diagram of your shoe and label the forces acting on it, call the forward force ‘pull’. (don’t forget the up and down forces as well as the forward and backward ones)

If you were designing a new sports shoe, what type of material would you use and what type of grip would you design?

7P 4b Friction around Us

1 Look at these pictures.



You pull the block along all of these surfaces.

It will be easiest to pull the block along the _____ .

This is because it has the _____ (smoothest/roughest) surface, so there will be the _____ (most/least) friction.

It will be hardest to pull the block along the _____.

This is because it has the _____ (smoothest/roughest) surface, so there will be the _____ (most/least) friction.

2. Complete these sentences and fill in the gaps.

Friction is a _____ caused by two _____ moving over each other. _____ surfaces produce more friction than _____ surfaces.

Friction can be helpful, because it stops us _____ when we walk, and _____ that slow down cars or bicycles could not work without friction.

Friction is not always useful. It can cause _____ and _____ , and _____ away things that rub against each other.

Oil can reduce the amount of _____. Oil stops the surfaces touching each other.

Liquids that reduce friction are called _____ .

Extension Activities:

Find out why Formula 1 teams need to change the tires on the cars depending on if the race track is wet or dry.

What has this got to do with friction and the speed of the cars? Why is it dangerous to use dry weather tires when the race track is wet?

7P 5a Static Electricity

Introduction:

Static charge can build up when two surfaces rub against each other. A simple experiment can show this effect When you rub a balloon on your jumper, electrons move from the jumper onto the balloon. These extra electrons make the balloon negatively charged. The jumper is now positively charged. The static charge on the balloon can allow you to stick it to a wall!

Questions:

1. When does static charge build up?

_____

_____

2. What are the two types of electric charge?

_____

_____

3. What particles move to transfer static charge?

_____

_____

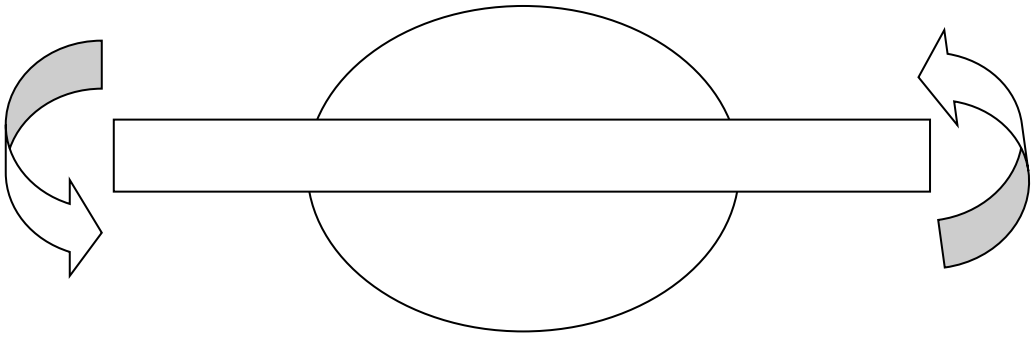
7P 5b Investigating Static Electricity

Aim:

To investigate the behaviour of electrically charged polythene and acetate strips.

Method:

1. Charge the white polythene strip by rubbing with a cloth.
2. Hold the strip close to some small pieces of paper to check that it has a static charge.
3. Now place the charged strip on a watchglass.
4. Charge another white strip and bring it up to the end of the strip on the watchglass. Watch what happens.



5. Next, charge an acetate strip and bring it close to the white strip on the watchglass. Again, watch what happens.

The polythene and acetate strips have opposite charges on them.

- Describe the experiment with the charged strips and watchglass under the following headings: Diagram, Method, Results and Conclusion. Your teacher may give you some guidance.

- What do you think would happen if you repeated the experiment with two acetate strips? If time allows, try this out!

The electric ray possesses two large electric organs on each side of its head!
It can deliver over 300 volts

Diagram:

Method:

_____

_____

_____

_____

_____

_____

_____

Results:

Conclusion:

_____

_____

_____

_____

_____

7P 5c Van der Graaf Generator Demonstration

Your teacher will demonstrate the Van der Graaf generator in action.

Make some notes describing the demonstrations. Try to include an explanation of the Science behind each. There is space at the bottom of the page to include some diagrams and sketches.

7P 6a Practical Investigation: Magnetism

Part 1: Magnetic Materials

1 Test the materials using the magnets provided and fill your results into the following table.

wood	**iron**	**plastic**	**aluminium**	**copper**	**steel**	**nickel**	**paper**

Magnetic materials	Non-magnetic materials

2 **a** What does ‘attract’ mean when with reference to magnets?

_____

b What does repel mean?

_____

c Do magnetic materials attract or repel a magnet? How can you get a magnet to repel an object?

_____

_____

3 Write true or false next to each of these sentences.

a Magnets only attract magnetic materials. _____

b Magnets can attract or repel other magnets. _____

c Magnets repel non-magnetic materials. _____

d Magnetism goes through paper. _____

e Magnetism goes through iron. _____

f The two ends of a magnet are called the east and the west poles.

_____

4 **a** If you put two north poles together, will they attract or repel?

b If you put two south poles together, will they attract or repel?

c If you put a north and a south pole together, will they attract or repel?

Extension: Research and find out if there are any other materials that are magnetic. Why are only these certain materials magnetic?

Part 2: Making a Magnet

Method:

1. Straighten a paper clip and stroke it, in one direction, about 20 times with one pole of a bar magnet.
2. Label one end of the paperclip A and the other end B.
3. Straighten out a second paper clip and repeat step 1 and 2..
4. Pick up one of the paper clips and leave the other on the bench.
5. Touch an end A of one paper clip to the other end A of the other paper clip. Then try an end B touching another end B. Finally touch an end A to an end B.
6. Record your results in the table below.

End of paper clip	Force of attraction?
A + A	
B + B	
A + B	

Conclusion:

1. Which ends attracted each other?

_____

2. Why do you think the other ends didn't repel?

_____

_____

_____

3. Are the paper clips acting as magnets? How do you know?

_____

_____

4. Can you think of a way to make the papers clips into stronger magnets?

_____

_____

_____

5. Using diagrams, explain what is meant by a magnetic domain?

6. Can magnetism be removed from a magnetised object? And if so, how?

_____

_____

_____

Part 3: Magnetic Field Lines

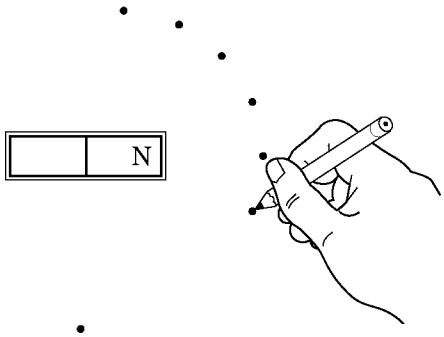
A magnetic field is the space around a magnet where it has an effect. The magnetic field of a bar magnet will make compass needles point in different directions. Magnetic field lines can be identified using a plotting compass, or iron filings as your teacher will demonstrate to you. If time permits you can complete this practical in student groups.

Apparatus:

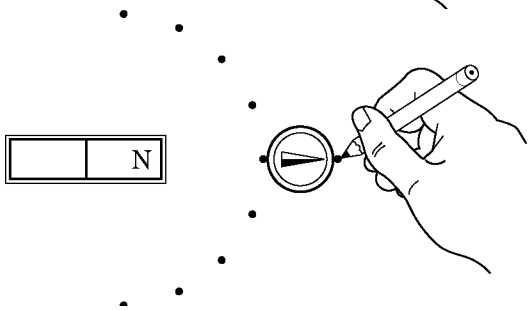
- Bar magnet
- Plotting compass/iron filings
- Sheet of paper
- Pencil

Method:

1 Put the magnet in the middle of the piece of paper and draw around it. Draw nine dots around the north end of the magnet, like this:

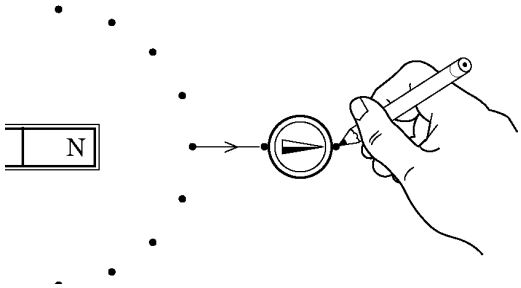


2 Do not move the magnet while you are doing this practical work.
Put a plotting compass on the paper so that its tail is over one of the dots. Draw a dot on the paper near to the point of the compass.



3 Join the two dots and mark the line with an arrow. Then move the compass so that its tail is over your new dot. Make another dot next to the point.

4 Repeat step 3 until you come to the edge of the paper.



5 Now repeat steps 2 to 4 for the other dots that you drew around one end of the magnet.

The arrows on your lines show which way a north pole would move. They point away from the north pole of the magnet. The magnetic field goes from north to south.

Extension: Conduct independent research and discuss applications of magnetism – for example in electric bells and replay switches.

Check your understanding:

Consider the three practical's you have just completed and tick the correct box to show the level of your understanding so far – be honest!

I can…..	**Expert**	**Good**	**Reasonable**	**Novice**
Describe the force of magnetism				
Recall examples of magnetic materials				
Explain what a magnetic domain is				
Explain what magnetic field lines represent.				

Are there any further questions you have on magnetism that you would like answered?

7P 7a Floating, Sinking and Density

Research Question:

Is there a connection between the density of an object and whether it floats or sinks?

Density measures how much mass there is in 1 cm^3 of something. You have to work it out from a mass and a volume.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

E.g. An object has a mass of 36g. It has a length of 4cm, a height of 2 cm and a width of 3cm.

Volume = 4 cm x 2 cm x 3 cm = 24 cm^3

Density = mass / volume = 36 g / 24 cm^3
= 1.5 g / cm^3

Apparatus:

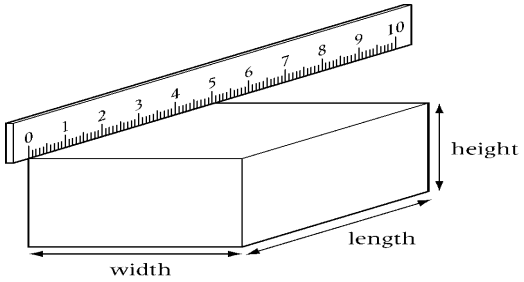
- Different materials that regular and irregular shapes.
- Bowl, displacement can and measuring cylinder.
- Ruler, Calculator & Electronic Balance

Method:

1. Make a table for your results, like this:

Material	Mass (g)	Length (cm)	Height (cm)	Width (cm)	Volume (cm^3)	Density (g/cm^3)	Floats or Sinks?

2. Choose a material, and write its name in your table.
3. Use a balance to find its mass, and write it in your table.
4. If the object is a regular cuboid, measure the length, height and width of your material, like this:



Write the measurements in your table.

5. Multiply the three measurements to find the volume of your material.

6. Divide the mass by the volume you have just worked out. This is the density. Write it in the correct column.
7. If the material has an irregular shape, your teacher will show you how to use the displacement can and a small measuring cylinder to find the volume.
8. Now see if your material floats or sinks. Write F or S in the last column.
9. Repeat steps 2 to 8 for other materials.

Conclusion:

What did you find out? Do materials with high densities float or sink?

_____

_____

_____

Complete these sentences. Choose from the words in the brackets.

Density is a way of saying how much _____ (mass/volume) there is in 1 cm^3 of a material.

A material with a high density feels_____ (lighter/heavier) than a material with a low density.

Materials with a high density_____ (float/sink) when you put them in water.

Materials with a _____ (high/low) density float. The density of water is 1 g/cm^3.

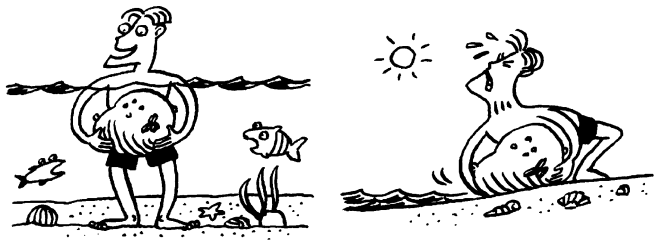
If a material has a density_____ (less/greater) than the density of water, it will float.

Extension Questions: (Complete these on some paper and add them to your notes)

1. What is upthrust?
2. If an object floats what is the relationship between the force of upthrust and the weight (the force due to gravity). Use a diagram to help explain.
3. If an object sinks what is the relationship between upthrust and weight? Draw another diagram to help explain.
4. If ships are often made of a metal, such as iron, which has a density far greater than water, why do they float? Draw a diagram to help explain.

7P 7b Floating questions

1 Josh was in the sea at high tide when he came across a large stone under the water. He tried to lift the stone and was surprised to find that he could move it easily. He returned at low tide and found the stone out of the water. This time he could hardly move it.



Use the words in the box to complete these sentences. Some words can be used more than once.

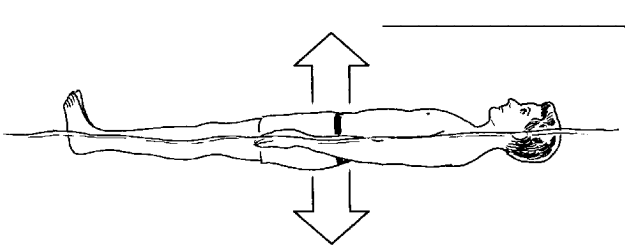
gravity	**upthrust**	**water**
	weight	

a The stone felt lighter when it was under _____ . This is because _____ was helping to push it up.

b The stone does not float because its _____ is greater than the _____ .

c The two forces which affect the stone are _____ and _____

2 This is Danny floating in the water. Label the two forces.



_____

_____

If Danny weighs 850N, what is the upthrust if he floats? _____ .

3 Your weight is 600 N and you have just finished building a raft which weighs 1000 N.

a What is the total weight of you and the raft? _____

b The upthrust from the water is 1200 N. Will the raft sink or float? _____

c Will the raft sink or float when you get on it? _____ Why?

_____

_____

_____

Extension: Is there a way to change the design of the raft, without changing the mass, which will help it float better?

7P 7c Floating (Extension)

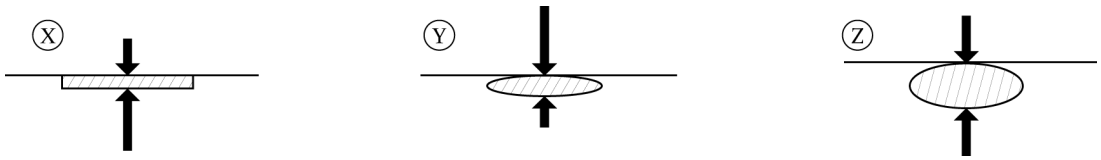
1 What force holds a hot air balloon in the air?

2 Your weight is 600 N and you have just finished building a raft which weighs 1000 N.

a What is the total weight of you and the raft?

b What is the smallest upthrust force needed so that it will just float with you on it.

3 The pictures below show objects that have just been placed below the surface of the water. The arrows show the direction and size of the forces affecting each object.



a Which object will sink?

b Which object will just float in the water?

c Which object will float well and be able to carry a small load?

4 The table shows the masses and volumes of pieces of different materials.

Copy the table, and complete the last column.

Remember the formula for calculating density is:

$$\textbf{Density} = \frac{\textbf{mass}}{\textbf{volume}}$$

Material	Mass (g)	Volume (cm^3)	Density
Copper	1800	200	
Wood	900	1500	
Lead	567	50	
Iron	790	100	
Water	1000	1000	
Polythene	690	750	
Glass	197	80	
Plasticine	26	20	
Bone china	42	15	
Brick	3200	2000	

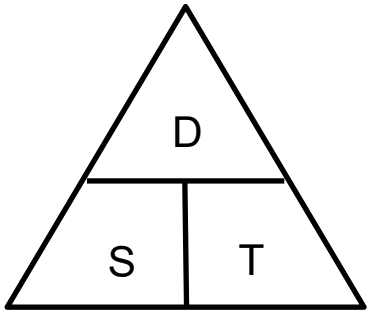
5 Make a list of all the materials in the table that will float.

7P 8a Speed

Introduction:

- Speed is simply a measure of how quickly distance is covered.
- There are many different units for speed. The most common ones are metres per second (m/s), kilometres per hour (km/h) and miles per hour (mph).
- It can be calculated using the following equation:

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



Examples:

1. A car travels a distance of 2 000 metres in a time of 160 seconds. Calculate the average speed of the car in metres per second.

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

$$speed = \frac{2000}{160}$$

$$speed = 12.5\ m/s$$

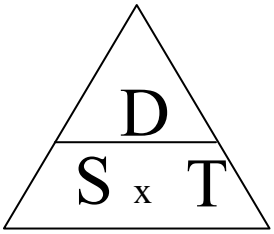
2. How far will a cyclist travel in 60 seconds if he is travelling at an average speed of 13 metres per second?

$$distance = speed \times time$$

$$distance = 13 \times 60$$

$$distance = 780\ m$$

7P 8b Calculating Speed



Speed can be calculated from the formula speed = distance/time.
The magic triangle can be remembered as "demented Science Teacher"

Units
If the distance is measured in metres and the time in seconds, speed will be calculated in metres per second (m/s).
If the distance is measured in kilometers and the time in hours, the speed will be calculated in kilometers per hour (km/h).

You may sometimes have to change units (for example, if you want a speed in kilometers per hour you may have to change 30 minutes into half an hour (0.5).

Use the above formula to answer the following questions. (don't forget to include units)

Easy questions

1. Mr Robertson's Ferrari (ROAR) goes a distance of 350 km in a time of 2 hours. What was his average speed in km/h?

2. Mr Windle and Kirsten Dunst are walking down the road. They walk a distance of 250 metres in 30 seconds. What was their average speed in m/s?

Medium questions

3. Mr Bayne, Mr Windle and Mr Robertson have robbed a bank. Their getaway car (the Ferrari) drives a distance of 45 kilometres at a speed of 15 km/h. How long did their journey take?

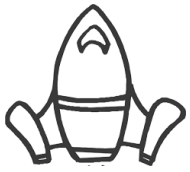
4. Jonny and James are going to a party together. They walk at a speed of 3.4 m/s for 63 seconds. How far away is the party? (in **metres**)

Hard questions

5. Jonathan and Madeleine have got married. On their honeymoon they drive 30 km in 15 minutes. What was their average speed in **km/h**?

6. Derek, Malene and Janne are walking to 7-11 to buy some soft drinks. They walk 3000 metres in 900 seconds. What was their average speed in **km/h**?

Very difficult question



7. A space ship travels 234500000 kilometres to planet Marit in 15 hours. Captain Angus wants to know the average speed of the space ship in m/s? What can you say about this speed?

7P 8c Measuring Average Speed Demonstration

Your teacher will demonstrate how to measure the average speed of a toy car down a slope.

Record the measurements and calculate the speed in the table below:

Distance (m)	Time 1 (s)	Time 2 (s)	Time 3 (s)	Average Time (S)	Average Speed (m/s)

Questions:

Answer the following questions about the demonstration.

1. To calculate average speed, the _____ and the

   _____ must be measured.

2. What pieces of equipment were used to take these measurements?

_____

_____

_____

3. How was the reliability of the measurement improved?

_____

_____

_____

_____

7P 8d Practical Activities

You will now complete one or more of the following activities.

- Measuring the average speed of pupil moving in the playground.
- Measuring the average speed of a car as it travels along the road.
- Using a racing car game and measuring the average speed over one lap.

In the space on the next page, outline what you did and demonstrate the calculations that you used. Here are some possible things to include:

- A diagram of the set-up and apparatus.
- A description of the measurements that were taken.
- The equipment that was used to take the measurements.
- Any equations that were used to calculate average speed.

Extension:

- What the difference is between average and instantaneous speed? What is the difference in how they are measured?

MYP 1: Year 7 Science

Criterion B Assessment – Inquiring and Designing

Criterion C Assessment – Processing and Evaluating

UNIT:	**Forces and Motion**
ASSESSMENT TITLE:	Investigating factors which affect the **time taken for the helicopter to fall.**
Statement of Inquiry:	By exploring the **laws of motion** and **relationships** we can describe the **movement** and **interactions** of objects.
Key Concept:	**Relationships**
Related Concepts:	**Movement** and **Interactions**
ATL Focus:	**Information Literacy Skills** **Collaboration Skills**
Key Scientific Vocabulary:	

Data	Measurement of a parameter that can be quantitative (volume, temperature, pH and so on) or qualitative (colour, shape, texture and so on).
Dependent variable	The variable in which values are measured in the experiment.
Prediction	Give an expected result of an upcoming action or event.
Hypothesis	A tentative explanation for an observation or phenomenon that requires experimental confirmation; can take the form of a question or a statement.
Independent variable	The variable that is selected and manipulated by the investigator in an experiment.
Qualitative data	Refers to non-numerical data or information that is difficult to measure in a numerical way.
Quantitative data	Refers to numerical measurements of the variables associated with the investigation.
Validity of the method	Refers to whether the method allows for the collection of sufficient valid data to answer the question. This includes factors such as whether the measuring instrument measures what it is supposed to measure, the conditions of the experiment and the manipulation of variables (fair testing).

Command Terms:

Design	Produce a plan, simulation or model.
Evaluate	Make an appraisal by weighing up the strengths and limitations.
Interpret	Use knowledge and understanding to recognize trends and draw conclusions from given information
Analyse	Break down in order to bring out the essential elements or structure. To identify parts and relationships, and to interpret information to reach conclusions.

Assignment Instructions (GRASPS)

Goal	You are required to determine how a named factor affects the **time taken for the helicopter to fall.**
Role	You are an aeronautical engineer who works in the field of helicopter design. You have been asked to ***investigate how a named factor affects the ability of the helicopter to fly.*** Is there an optimum length of blade? Is there an optimum weight? Cost is also an important consideration.
Audience	You will complete a ***scientific report*** on the findings of your investigation and submit it to the Head Engineer (your teacher!) for inspection.
Situation	You will work ***collaboratively*** in ***groups of twos or threes***. You are required to ***design an organized practical investigation*** that will assist you in addressing the goal above. You may refer to the practical work that has been completed already in the Forces and Motion unit. You must then ***perform the practical*** you have designed so that you can collect results that will help you determine the relationship between the **named factor** and the **time taken to fall/average falling speed**? You will be given the following ***equipment to conduct your investigation***: helicopter template, scissors , paper clips , meter Stick, tape measure and a stopwatch.
Product	A ***scientific report*** should be completed to include a ***design, analysis and evaluation*** section. This report will be an electronic document that will be submitted via Google classroom for marking and will ***communicate*** the science of your investigation. Your teacher will advise you of the due date for the report.
Success Criteria for Assessment	The ***final scientific report MUST include*** (see MYP Practical Report Checklist for Students in your booklet): - Title - Research Question - Background information - Hypothesis - Variables - Apparatus - Method - Safety considerations - Results table - Observations - Calculations - Graph - Conclusion - Strengths and Weaknesses - Improvements

Level Descriptors and Task Specific Clarifications for Criterion B:

Level	Level Descriptor	Task Specific Clarification
0	The student does not reach a standard described by any of the descriptors below.	i. No research question stated. ii. No prediction stated. iii. Variables not identified. iv. Method and safety precautions not stated.
1-2	The student is able to: i. **select** a problem or question to be tested by a scientific investigation ii. **select** a testable prediction iii. **state** a variable iv. design a **method with limited success**.	i. A research question is stated but not relevant to the investigation. ii. A prediction with limited reference to forces. iii. Independent, dependent and controlled variables identified but with inaccuracies. Method of data collection not indicated. iv. A method is presented but incomplete or not relevant to the investigation. Safety precautions not mentioned.
3-4	The student is able to: i. **state** a problem or question to be tested by a scientific investigation ii. **state** a testable prediction iii. **state** how to manipulate the variables, and **state** how **data** will be collected iv. design a **safe method** in which he or she **selects materials and equipment**.	i. A relevant research question is stated, but is not too clear or focused. ii. A prediction with some reference to the variables is made. iii. Independent, dependent and controlled variables identified but incomplete. Basic method of data collection is stated. iv. Method is presented in steps but does not clearly show how the experiment is conducted and/or how data is collected. Safety precautions stated but are not specific to the experiment.
5-6	The student is able to: i. **state** a problem or question to be tested by a scientific investigation ii. **outline** a testable prediction. iii. **outline** how to manipulate the variables, and **state** how **relevant data** will be collected iv. design a **complete and safe method** in which he or she **selects appropriate materials and equipment**.	i. A research question is stated with reference to some correct variables. ii. A prediction with reference to the relationship between the independent and dependent variables is outlined (ie. the relationship between the named factor and the time taken for the helicopter to fall). iii. Independent, dependent and controlled variables correctly identified, with an outline of how relevant data is collected. iv. Method is presented in clear steps with relevant details, with suitable materials and apparatus chosen. A labelled diagram to show how the apparatus is set up. Relevant safety precautions discussed.

7-8	The student is able to: i. **outline** a problem or question to be tested by a scientific investigation ii. **outline** a testable hypothesis **using scientific reasoning** iii. **outline** how to manipulate the variables, and **outline** how **sufficient, relevant data** will be collected iv. Design a **logical, complete and safe method** in which he or she **selects appropriate materials and equipment**	i. A research question clearly and explicitly identifies the independent and dependent variables with reference ii. A prediction with reference to the relationship between the independent and dependent variables is outlined and explained using relevant scientific reasoning. The explanation should mention the size and direction of specific forces. iii. Independent, dependent and controlled variables correctly identified, outlining how they are manipulated, measured or controlled. Values of variables stated where appropriate. Outline how sufficient, relevant data is collected. iv. A complete method is presented in clear steps with all relevant details, stating values and measuring equipment used. A fully labelled diagram to show how the apparatus is set up. Safety precautions discussed and are relevant to this investigation.

Level Descriptors and Task Specific Clarifications for Criterion C:

Level	Level Descriptor	Task Specific Clarification
0	The student does not reach a standard described by any of the descriptors below.	i. No data presented. No graph plotted. ii. Trend not stated. iii. No conclusion on whether the prediction is supported by data. iv. No strengths or limitations relevant to the investigation stated. v. No improvement or extension stated.
1-2	The student is able to: i. **collect and present** data in numerical and/or visual forms ii. **interpret** data iii. **state** the validity of a prediction based on the outcome of a scientific investigation **with limited success.** iv. **state** the validity of the method based on the outcome of a scientific investigation **with limited success.** v. **state** improvements or extensions to the method that would benefit the scientific investigation, **with limited success.**	i. Raw, quantitative data is presented in a table. A graph is attempted. ii. A trend is stated but is not supported by data. No scientific explanation given to explain the trend. iii. A conclusion is attempted , but with inaccuracies. iv. At least one limitation relating to the investigation is stated, but not relevant to the investigation. v. At least one improvement or extension stated but is not relevant to the limitation identified.
3-4	The student is able to: i. **correctly collect and present** data in numerical and/or visual forms ii. **accurately interpret** data and **outline** results iii. **state** the validity of a prediction based on the outcome of a scientific investigation iv. **state** the validity of the method based on the outcome of a scientific investigation v. **state** improvements or extensions to the method that would benefit the scientific investigation.	i. Raw, quantitative data is neatly presented in a table with headings. A graph is plotted with labelled axes. ii. Trend shown in the graph is outlined by stating a basic relationship between variables. iii. A correct conclusion is drawn with reference to the prediction. iv. At least one limitation relating to the validity of the investigation is stated. v. At least one improvement relating to each limitation raised is stated.
5-6	The student is able to: i. **correctly collect, organize and present** data in numerical and/or visual forms ii. **accurately interpret** data and **outline** results **using scientific reasoning** iii. **outline** the validity of a prediction based on the outcome of a scientific investigation iv. **outline** the validity of the method based on the outcome of a scientific investigation v. **outline** improvements or extensions to the method that would benefit the scientific investigation.	i. Raw, quantitative data from multiple trials are neatly presented in a table with headings and relevant units. An attempt has been made to calculate averages. A correct type of graph is plotted. The graph has correctly labelled axes including units and suitable scales. Some observations are recorded. ii. Trend shown in the graph is correctly outlined and explained using some correct scientific knowledge relating to forces. Anomalies/outliers are identified.

		iii. A conclusion is drawn. Student states if the data supports the prediction. iv. At least two limitations relating to the validity of the investigation are outlined. v. At least one improvement relating to each limitation is outlined. Extensions of investigation outlined.
7-8	The student is able to: i. **correctly collect, organize, transform and present** data in numerical and/ or visual forms ii. **accurately interpret data** and **outline** results **using correct scientific reasoning** iii. **discuss** the validity of a prediction based on the outcome of a scientific investigation iv. **discuss** the validity of the method based on the outcome of a scientific investigation v. **describe** improvements or extensions to the method that would benefit the scientific investigation.	i. Raw, quantitative data from multiple trials are neatly presented in a table with informative headings and relevant units. Averages are correctly calculated and presented in the table. A correct type of graph is accurately plotted. The graph has correctly labelled axes including units and suitable scales. A line of best fit is included. Meaningful observations are recorded. ii. Trend shown in the graph relating to the factor investigated is correctly outlined with reference to specific data points. Trend is explained using correct scientific knowledge relating to forces. Anomalies/outliers are correctly identified. iii. Correct conclusion is drawn as to how well the data supports the prediction, with reliability of the data discussed. iv. One strength and three limitations relating to the validity of the investigation are discussed. Consider how the limitations affected the data and how well the research question could be answered. v. At least one improvement relating to each limitation raised is described. Relevant extensions of investigation described.

Student Task Planning Notes:

MYP Science
Practical Report Template

Name:	Form:

UNIT:	
Statement of Inquiry:	
Key Concept:	
Related Concepts:	
Investigation Title:	

Criterion B - Inquiring and Designing

Research Question

(What are you trying to find out?)

Background Scientific Information and Hypothesis

(What do you think will happen and why?)

Variables

Independent *(What will change and how will you change it?)*	
Dependent *(What will you measure to gather result?)*	
Control *(What variables will you keep the same to make it a fair test? How will you keep the variables constant?)*	

Apparatus Set-up

(Draw a labelled diagram of the assembled apparatus that you will use. Write the name of any equipment not shown in the diagram)

Method

(Write a step by step account of how you conduct your experiment – the method must be DETAILED)

1.

2.

3.

4.

5.

Safety

(How will you make sure your method is safe?)

Reliability

(What will you do to ensure your results are reliable?)

Criterion C - Processing and Evaluating

Results

Raw Data

(A neat, organized table of results should be drawn, with headings, units, repeats and averages include)

Observations

(What changes did you notice as the experiment was conducted, e.g. colour change, bubbles, heat change?)

Graphing Results

You should draw a graph of your results and attach it to this report.

Analysis of Graph

(What did your results show? Are there any trends or patterns in your results? Can you give an example of a pattern or trend from your results?

Conclusion and Evaluation

Scientific Conclusion and Explanation of Results

(Summarize what your results show. Does this support your prediction? Can you explain your results using scientific knowledge?)

Evaluation of Scientific Method and Results

How reliable were your results? How well did your investigation answer the research question? What went well with your method?)

(Were there any problems or parts of your investigation that were not very accurate or could have been done better?)

Issue with justification	Suggested SCIENTIFIC Improvement

7P 11a Investigating Distance-Time Graphs

Aim:

Constructing and interpreting simple distance/time graphs.

Apparatus:

- Stop watches
- Measuring tape / trundle wheel.

Method:

1. Measure out a course on the playground with a start position and then every 5 metres position someone with a stop watch. Ideally this should be about 40 or 50 metres long.
2. When the 'starter' shouts 'go', everybody starts their stop watch.
3. The first volunteer **walks** from the starting line to the finish line. When they pass the person with the stop watch, they stop the stop watch and record the time taken.
4. This is repeated but this time the second volunteer **jogs** slowly.
5. Finally, if you have time, the third volunteer can **run** quickly.
6. Record your results as a class.

Results:

Distance (m)	**0**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
Walk (s)	0										
Jog (s)	0										
Run (s)	0										

Analysis/Conclusion:

1. Draw a graph of distance (y axis/up) against time (x axis/across).
2. Plot on the same axis for the walk, jog and run graphs. Use different colours or label these.
3. What do you notice about the shapes of these graphs? Are they straight or curved? What does this mean?

_____

_____

_____

4. What do you notice about the slopes of these graphs? Which was steepest? How does the steepness relate to the speed?

_____

_____

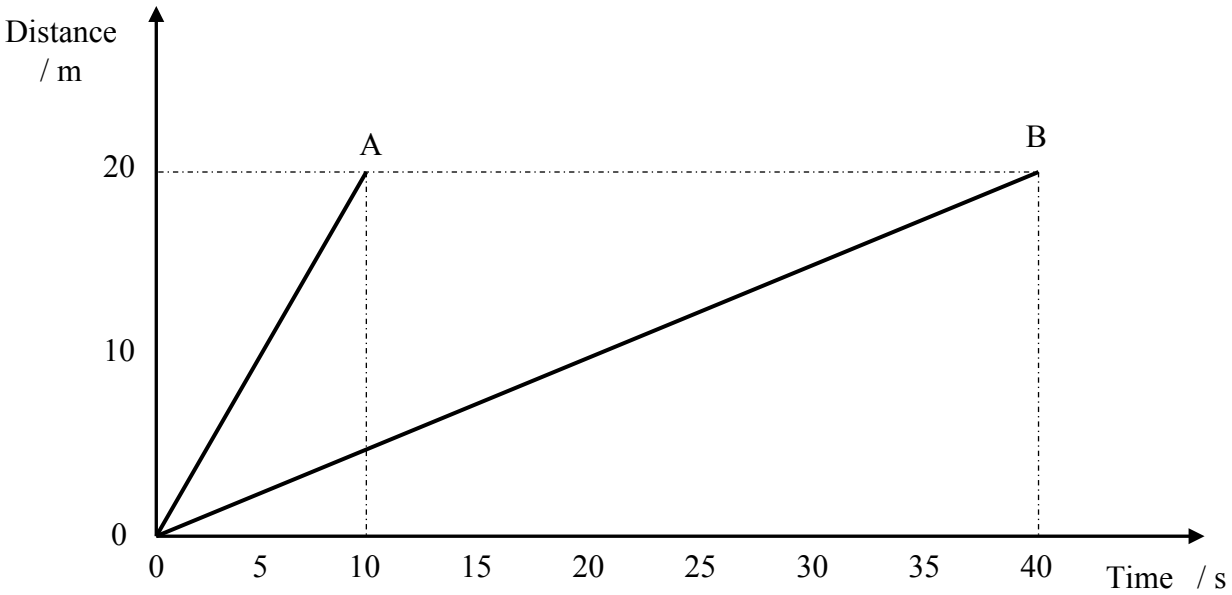
_____

Extension:

Work out the speed of each of the volunteers from the graph. Can you do this from the gradient?

Practice Question:

Two dogs A and B walk 20m down the road.



Which dog is fastest and how can you tell from the graph?

_____

_____

_____

Calculate the speeds of both dogs.

7P 12a – Moments

Introduction:

- A moment is a turning effect**.**
- A moment can also be called a TORQUE. (Torque is referred to when measuring car engines)
- The two things that affect the size of a moment are the sizes of the force and the perpendicular distance to the pivot.
- The pivot or axis of rotation is the point about which the object turns (eg the hinges of a door or the axle of a wheel)

The formula for moments is:

moment = force x perpendicular distance to the pivot

The unit of moment is (Nm)**,** but sometimes in the lab we may use (Ncm)

Examples of Moments:

- List some example of moments in everyday life:

Example Calculation:

A door handle is opened by applying a force of 5N at a distance of 0.1m from the pivot. Calculate the Moment.

moment = force x perpendicular distance to the pivot

moment = 5 x 0.1

moment = 0.5 Nm

7P 12b - Experimenting with Moments

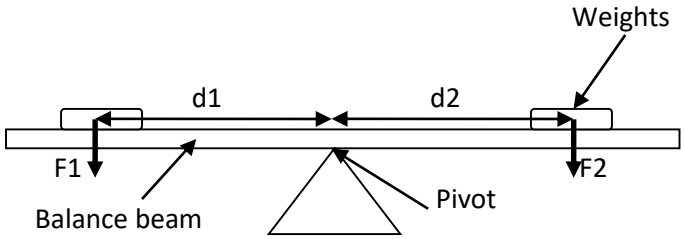
Part 1 – Establishing the Principle of Moments

Aim:

- By balancing different massed on a beam, on either side of the pivot, establish the principle of moments.

Apparatus:

- Balance beam
- 1N Weights
- Pivot



Method:

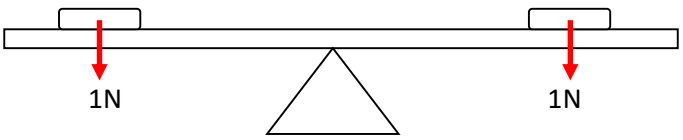
1. For each combination of weights, try to balance them on either side of the pivot. Record the weight of each (see 'F1' and 'F2' on the above diagram).
2. Measure the perpendicular distance from the pivot to the center of each weight (see labels 'd1' and 'd2' on the above diagram).
3. Calculate the moment on both the left hand side and right hand side of the pivot using the following equation:

   moment = weight x perpendicular distance from pivot

4. Compare the moment on the left hand side with the moment on the right hand side.

Weight Combinations:

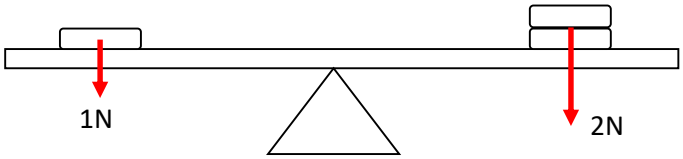
1. Balance 1N and 1N on the balance beam.



distance l.h.s = _____ distance r.h.s = _____

moment l.h.s = _____ moment r.h.s = _____

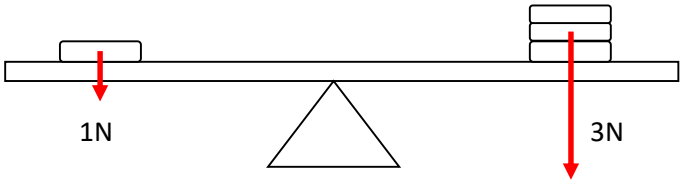
2. Balance 1N and 2N on the balance beam.



distance l.h.s = _____ distance r.h.s = _____

moment l.h.s = _____ moment r.h.s = _____

3. Balance 1N and 3N on the balance beam.



distance l.h.s = _____ distance r.h.s = _____

moment l.h.s = _____ moment r.h.s = _____

Conclusion

What do you notice about the moment on the left hand side and the moment on the right hand side? Can this be written mathematically?

_____

_____

Evaluation:

Were there any problems in establishing your conclusion? What could be done to improve this experiment?

_____

_____

Part 2 – Using the Principle of Moments to Make Predictions

Aim:

You will use the principle of moments to predict where the place weights to balance the beam.

Method:

- Your teacher will give you the weight and distance to the pivot for the weight on the left hand side. The weight on the right hand side will also be given.
- Use the principle of moments to calculate where to position the weight on the right hand side. In other words, its distance from the pivot.
- Place the object there to see if it balances. You may have to move it slightly.

Results:

- Use the space below to show your calculations and to record your results. Take note of the actual distance you had to place the weight on the right hand side for the beam to balance.

Conclusion

1. Did the calculated distance exactly match the actual distance required to balance the beam? Yes/No.
2. If not, can you explain why?

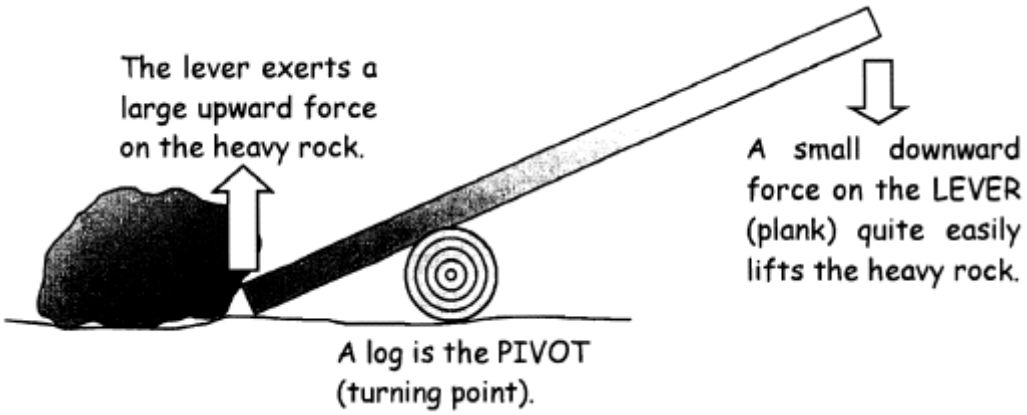
_____

_____

_____

7P 12c Levers

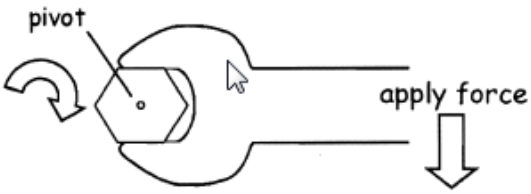
Forces can cause objects to turn around a pivot.



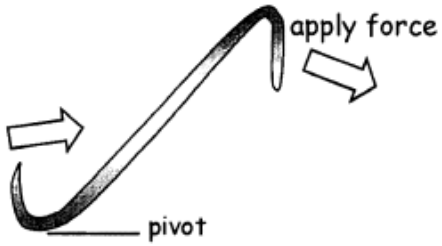
Important Rule:

<u>The size of the turning force can be increased by increasing the length of the lever.</u>

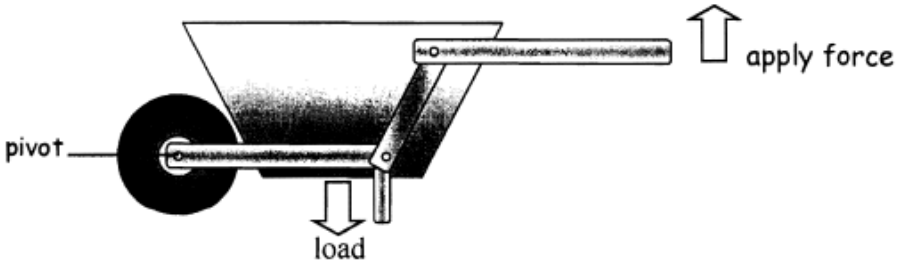
Examples:



Using a spanner to loosen a nut.



Using a crowbar to force objects apart.



Using a wheelbarrow to carry heavy loads.

Demonstrations:

- You teacher will demonstate some other levers in action. Draw a diagram of each demonstation and include an explanation of what is happening. Please use the space below:

Questions:

1. A _____ is the turning point.
2. A longer _____ makes it easier to move a heavy object.
3. The longer the lever the greater the _____ it can exert about the pivot and also the greater the _____ it exerts on the load**.**
4. A _____ can be used to lever open a locked door.
5. A tight nut can be loosened more easily if a _____ spanner is used.

7P 13a Pressure

Introduction:

Pressure is the amount of force that is put onto a certain area.

$$\text{PRESSURE (N/m}^2\text{)} = \frac{\text{FORCE (N)}}{\text{AREA (m}^2\text{)}}$$

- The units for pressure are the newtons per square metre (N/m^2)
- Another unit for pressure is the pascal (Pa)
- $1\ N/m^2 = 1$ Pa

Question:

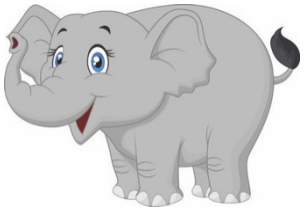
Does the lady in stilettoes or the elephant cause most damage to floor? Please explain your answer?

_____

_____

_____

_____



Pressure can be made higher if the force is concentrated over a small area. A high pressure can cause an object to cut into a surface:

Pressure can be made lower if the force is spread over a large area. A low pressure will stop an object sinking into a surface.

Example Problems:

1. A table weighs 300N. The total area in contact with ground is 0.05m^2. Calculate the pressure the table exerts on the floor.

$$pressure = \frac{force}{area}$$

$$pressure = \frac{300}{0.05}$$

$$pressure = 6000\ N/m^2$$

2. An iceskater exerts a total pressure of 250,000 N/m^2 over an area of 0.002m^2. Calculate the weight of the the skater.

$$force = pressure \times area$$

$$force = 250000 \times 0.002$$

$$force = 500\ N$$

Questions:

Work out the answer to the questions below. Try to layout your answer as in the example problems above.

1. A man weighs 800N. The area of BOTH of his boots is 0.08 m^2 . What pressure does he place on the ground when he stands still?

2. A woman weighs 500N. The area of ONE of her stiletto heels is 0.0002m^2. What pressure does she place on the ground when she puts her weight onto one heel?

3. The base of a suitcase has an area of 0.2m^2. It places a pressure of 700N/m^2 on the ground. What must the weight of the suitcase be?

7P 13b Calculating the Pressure you Exert on the Floor

Aim:

Calculate the pressure you exert on the floor by using the pressure equation. You will also need to use the 'counting the squares' method to find the area.

Apparatus:

- scales
- graph paper

Method:

1. Measure your weight using the scales. This should be recorded in Newtons.
    - (or by calculating weight = mass x g ; using g = 10 N/kg)
2. Students draw around one foot on graph paper and count 1cm squares to estimate area of foot.
3. The total area can be found by multiply the area of one foot by 2.
4. The total pressure the student is exerting on the floor can be calculated using:

$$pressure = \frac{force}{area}$$

Conclusion and Analysis:

1. What was the total pressure that you exerted on the ground?

_____

_____

2. How could you decrease the pressure you exert on the floor?

_____

_____

_____

Evaluation:

1. Suggest how you could improve the accuracy of your pressure calculation?

_____

_____

_____

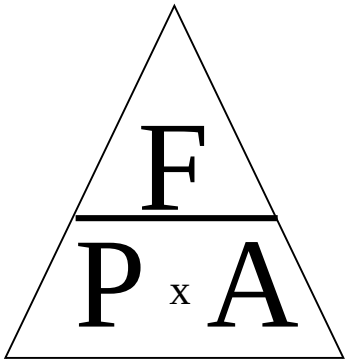
_____

_____

_____

_____

7P 13c Calculating Pressure



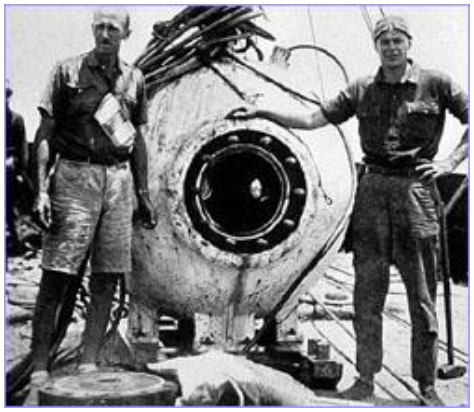
Pressure = $\frac{\text{Force}}{\text{Area}}$

"football players argue"
(when under pressure)

The unit of pressure is **N/m^2** (called a **Pascal**)

(Sometimes we use N/cm^2 as it can be more convenient)

Remember; Weight on earth (N) = mass (kg) x 10 (N/kg)



Did you know that the pressure at the deepest part of the Pacific ocean is about 110 million Pascals?!

The pressure of the atmosphere at sea level is approximately 101 000 Pa (it varies) and 100km in the air it is 1 Pa.

1. What is the pressure exerted by a student weighing 400N standing on one "stiletto" heel with an area of 1 cm^2? If an elephant weighs 9000N and each of its feet has an area of 200cm will it exert a greater pressure?

2. If atmospheric pressure is 101 000 N/m^2, what force is exerted on a door of area 2 m^2?

3. Explain why bulldozers use “caterpillar” tracks.

_____

_____

_____

_____

4. Explain why it hurts to hold a heavy parcel by one piece of string.

_____

_____

_____

_____

5. A rectangular block measures 8cm x 5 cm x 4cm and has a mass of 1.2 kg.

   a. What is the weight of the block?

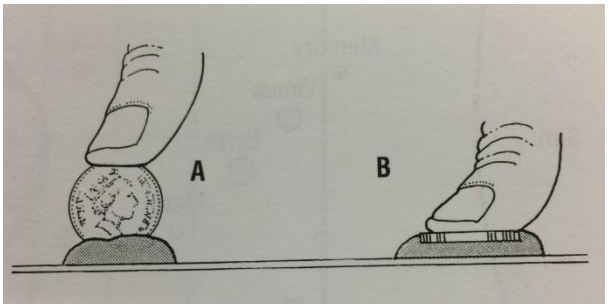
   b. What is the area of the smallest face of the block?

   c. What pressure will the block exert if it is resting on its smallest face?

   d. What is the least pressure the block would exert when resting on a table?

6. A coin is being pushed into plasticine in two ways as shown:

   a. Explain why it is easier in diagram A to push the coin into the plasticine.



_____

_____

_____

_____

_____

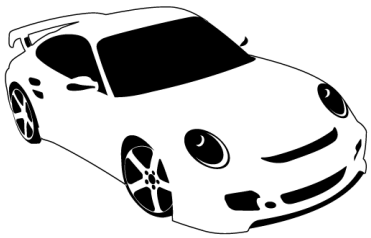
   b. In diagram B, the area of the face of the coin is 2cm^2. The finger is pushing with a force of 10N. What pressure is exerted on the plasticine? Give the unit.

7. A man weighs 800N. Each foot has an area of 200cm^2. What is the pressure exerted on the ground when he stands on:

   a. One foot?

   b. Both feet?

8. A car weighs 8000N. It has 4 wheels. Each tyre has a pressure of 20N/cm^2.



   a. If the weight of the car is spread evenly, what is the weight supported by each tyre?

   b. Calculate the area of each tyre in contact with the road.

   c. When some people get in the car, the area of contact for each tyre increases to 125cm^2. If the pressure of each tyre is still 20N/cm^2, what is the total weight of the car and passengers now?

9. A man is struggling to walk over soft snow. Explain why it is difficult to walk over soft snow.

This lady has invested in a pair of snow shoes. Explain why it is easier for her to walk over soft snow.

7P 14a Forces and Motion Quick Quiz

On your answer sheet, circle the correct letter for each question.

Section A

1 A force is:

A a spring. **B** an engine.
C a movement. **D** a push or a pull.

2 Which answer shows three non-contact forces?

A magnetism, gravity, friction
B gravity, friction, upthrust
C gravity, static electricity, magnetism
D upthrust, static electricity, friction

3 The unit of force is the:

A newton. **B** kilogram.
C gram. **D** metre.

4 A force can be measured using:

A a stop clock. **B** a ruler.
C a thermometer. **D** a force meter.

Section B

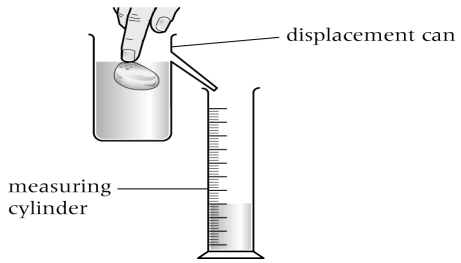
1 A boat will float because:

A gravity does not work over water.
B it is built out of light materials.
C upthrust pushes against its weight.
D it has air inside it.

2 Density is:

A the weight of a fixed mass of something.
B the volume of a fixed weight of something.
C the weight of a fixed volume of something.
D the mass of a fixed volume of something.

3



You can find the volume of the object in the can by:

A measuring the object and multiplying the numbers.
B measuring the volume of water it displaces.
C weighing the object.
D using a thermometer.

4 The density of water is 1 g/cm^3. Which of these objects will float in water?

A density = 2 g/cm^3

B weight = 2 N

C density = 0.5 g/cm^3

D mass = 1 g

Section C

1 An elastic material:

A does not stretch.

B stretches and stays in its new shape.

C stretches and then goes back to its original shape.

D cannot be squashed.

2 What are the units for weight and mass?

A weight – newtons;
mass – kilograms

B weight – kilograms;
mass – newtons

C weight – kilograms;
mass – kilograms

D weight – newtons;
mass – newtons

3 Which is true?

A Your weight would be the same on the Earth and on the Moon.

B Your mass would be the same on the Earth and on the Moon.

C Your weight would be more on the Moon than on the Earth.

D Your mass would be less on the Moon than on the Earth.

4 What do most force meters have inside them?

A a light bulb **B** a spring

C wires **D** a battery

Section D

1 Which of the following sentences about friction is **not** correct?

A Friction can make an object get hotter.

B Friction wears car tyres away.

C Friction slows down a ball rolling in grass.

D Friction can speed up a falling object.

2 Which of these would produce the most friction when they rub together?

A a rough surface and a smooth one

B two smooth surfaces

C two rough surfaces

D two smooth surfaces with oil between them

3 Which example shows unhelpful friction?

A friction between a tyre and the road

B friction in the wheel axles of a bicycle

C friction between paper and the point of a pencil

D friction between your shoes and the floor

4 Which of the following is **not** an example of a lubricant?

A grease for bicycle chains

B rubber on car tyres

C water on swimming pool tiles

D oil in a car engine

Section E

1 The speed of a car is a measure of how _____ it is travelling. Which is the missing word?

A far **B** fast

C long **D** high

2 Air resistance increases if the _____ of an object increases.

A mass.

B surface area.

C density.

D cost.

3 What does ‘streamlined’ mean?

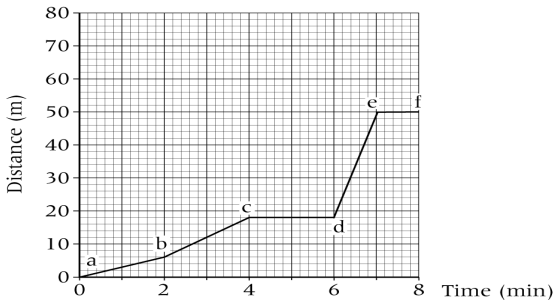
A able to find the answer quicker

B has a shape that reduces air resistance and helps it travel faster

C has a really small mass some can move with a greater speed.

D is very intelligent and able to find their way to a location.

4 This graph shows the distance moved by someone catching a bus.



Which part of the graph shows the person waiting at the bus stop?

A a to b **B** b to c

C c to d **D** d to e

Section F

1 The speed of a car is a measure of how:

A far it is travelling.
B fast it is travelling.
C long it is travelling.
D high it is travelling.

2 A bus travelled a distance of 20 km in 2 hours. Its speed was:

A 0.1 km/h. **B** 40 km/h.
C 20 km/h. **D** 10 km/h.

3 The mean speed of something is:

A its fastest speed.
B the total distance it travels divided by the time taken.
C its slowest speed.
D its speed limit.

4 If a car travels at 50 mph, how long will it take to travel 75 miles?

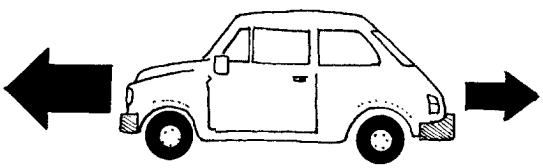
A 1.5 hours **B** 0.5 hours
C 0.67 hours **D** 67 minutes

Section G

1 Balanced forces:

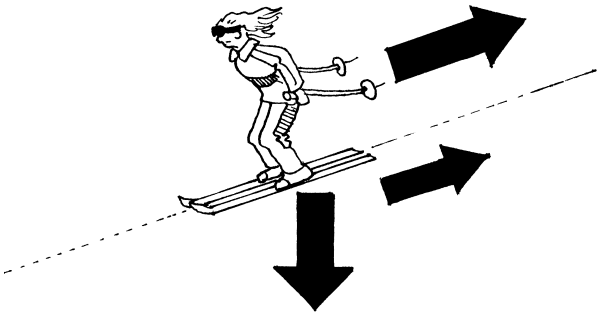
A make objects speed up.
B make objects slow down.
C do not change the speed of moving objects.
D only affect stationary objects.

2 This drawing shows two forces on a car. What will happen to the speed of the car?



A It will accelerate.
B It will slow down.
C It will decelerate.
D It will stay the same.

3 What are forces X and Y?



A X is air resistance, Y is gravity.
B X is air resistance, Y is friction.
C X is gravity, Y is air resistance.
D X is friction, Y is air resistance.

4 An object will accelerate quickly if it has:
A a large force and a small mass.
B a large force and a large mass.
C a small force and a large mass.
D a small force and a small mass.

Section H

1 The air resistance of a car can be reduced by:
A making the car bigger.
B making the car heavier.
C giving it a streamlined shape.
D putting a roof rack on it.

2 Which statement about air resistance is true?
A If speed increases, air resistance decreases.
B If speed increases, air resistance increases.
C If speed decreases, air resistance increases.
D Speed has no effect on air resistance.

3 A car needs energy to keep moving because:
A everything needs a force to keep moving.
B gravity is trying to slow it down.
C it needs a force to balance friction and air resistance.
D weight balances friction.

4 Air resistance on a moving object is caused by:
A air being attracted to the object.
B air particles moving around the object.
C the wind.
D air particles hitting the object.

Section I

1 There are changing forces on a skydiver during a jump. Which of these statements is **not** true?

A Her weight stays the same.

B Her air resistance stays the same.

C Her air resistance is very small at the beginning of the jump.

D Her air resistance increases as her speed increases.

2 A skydiver reaches a maximum speed when:

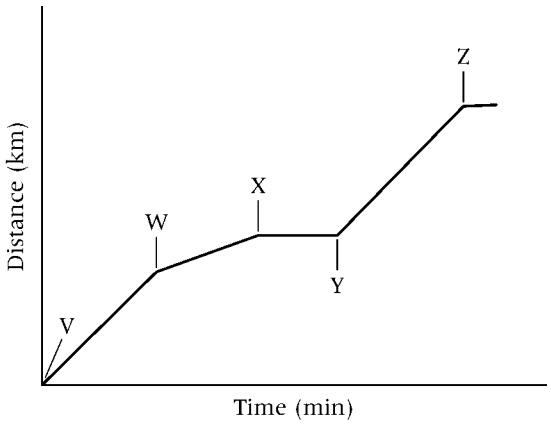
A his air resistance has increased to balance his weight.

B his air resistance has decreased to balance his weight.

C his weight has increased to balance the air resistance.

D his parachute opens.

3 This distance–time graph shows Mrs Martin driving her children to the cinema. Which part of the graph shows where she stopped at some traffic lights?



A V to W

B W to X

C X to Y

D Y to Z

Section J

1 Why is it easier to cut something with a sharp knife than with a blunt one?

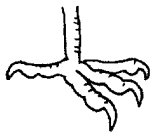
A The area of the knife edge is large so pressure is greater.

B The area of the knife edge is small so pressure is greater.

C The area of the knife edge is large so pressure is smaller.

D The area of the knife edge is small so pressure is smaller.

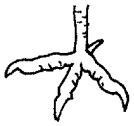
2 If all these birds are the same weight, which bird has the lowest pressure under its feet?



A crow

B seagull

C raven



D chicken

3 Which is **not** a unit for pressure?

A pascals

B newtons per square metre

C kilograms

D newtons per square millimetre

4 A basketball player weighs 500 N. The area of one of his trainers is 250 cm^2. When he puts all his weight on one foot, how much pressure does he put on the ground?

A 0.5 N/cm^2 **B** 2 N/cm^2

C 250 N/cm^2 **D** 125 000 N/cm^2

Section K

1 In science, a lever is:

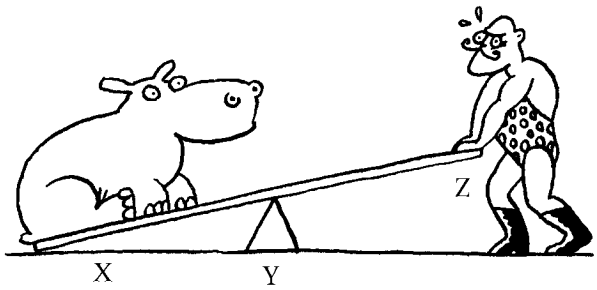
A a complex machine which keeps the size of force you put in the same.

B a simple machine which changes the size of force you put in.

C a simple machine which changes the area of force you put in.

D someone about to finish school.

2 Which are the correct labels for the lever shown below?



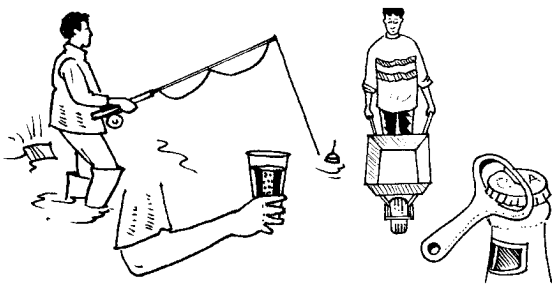
A X = effort, Y = pivot, Z = load

B X = pivot, Y = effort, Z = load

C X = load, Y = pivot, Z = effort

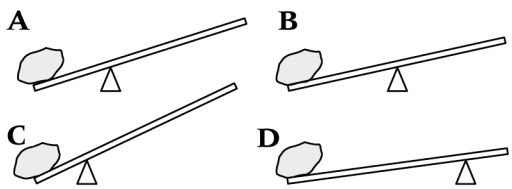
D X = load, Y = effort, Z = pivot

3 How many diagrams show levers in action?



A 1 **B** 2 **C** 3 **D** 4

4 Which lever will make it easiest to move the rock?



Section L

1 The moment of a force is:

A its turning effect.

B how long it takes to work.

C how far it moves.

D the distance of a force from a pivot.

2 You are opening a can of paint with a screwdriver. You apply a force of 10 N, 20 cm from the pivot. What is the moment of the force?

A 2 Nm **B** 20 Nm

C 200 Nm **D** 2000 Nm

3 What is a seesaw that is 'in equilibrium'?

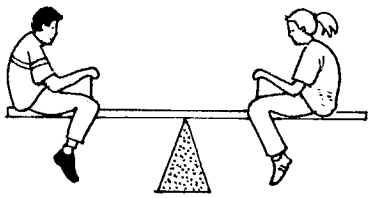
A a balanced seesaw

B a seesaw with the same weight on each side

C a seesaw with both people the same distance from the middle

D a wooden seesaw

4 What is the distance from the pivot of the boy on the seesaw?



Boy: 300 N ☐ ? m Girl: 450 N ☐ 2 m

A 1 m **B** 2 m **C** 3 m **D** 4 m

Section M

1 Acceleration is:

A how much the speed changes each second
B how long it takes an object to reach top speed
C when something is staying the same speed
D the distance it moves each second

2 The acceleration of an object depends on:

A the size of the object
B the force acting.
C the speed of the object.
D the unbalanced force and mass.

3 A force of 45N is exerted on an object of 9kg. What is the resultant acceleration?

A 405 m/s^2 **B** 0.2 m/s^2
C 5 m/s^2 **D** 54 m/s^2

4 An object of mass 4kg accelerates at 2m/s^2. What is the size of the unbalanced force causing this acceleration.

A 0.5N **B** 8N
C 2N **D** 6N

7P Forces and Motion Summary Sheets

Forces and their effects

Forces are **pushes**, **pulls or twists**.

Forces can:

- change the **shape** or **size** of an object
- change the **speed** things are moving (make them move faster or slower)
- change the **direction** of a moving object.

The units for measuring force are **newtons** (**N**).

Friction is a force caused by two things rubbing together. **Air resistance** and **water resistance** are kinds of friction. They are sometimes called **drag**.

Upthrust pushes things up. Solid things, like your chair, give you upthrust. Things float in water because of upthrust.

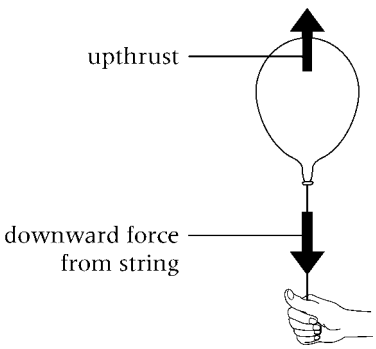
Contact forces need to touch the thing that they are affecting. Examples of contact forces are:

- friction
- air resistance
- water resistance
- upthrust.

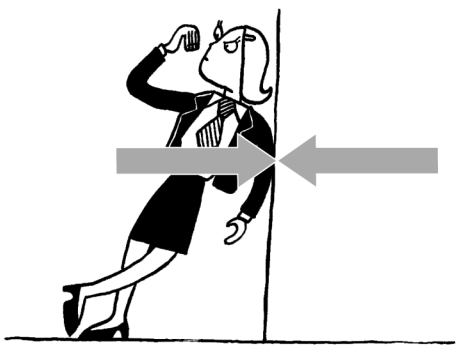
Some forces do not need to touch the thing that they are affecting. They are called **non-contact** forces. There are three non-contact forces:

- **magnetism**
- **gravity**
- **static electricity.**

Balanced forces



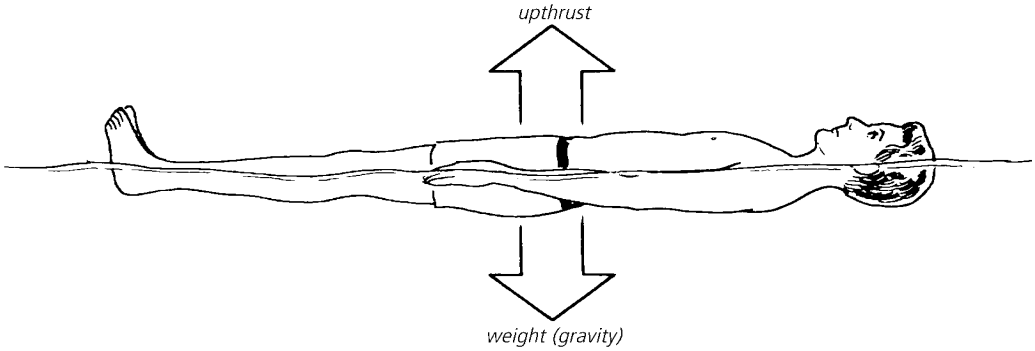
*The upwards and downwards forces on this balloon are **balanced**. The balloon will not move.*



The forces here are balanced. The girl will not move, and neither will the wall!

A rocket in space does not need to use its engine to keep moving. There is no air in space, so there is no air resistance to slow it down.

If you are floating in a swimming pool, your weight and the upthrust are balanced.



Density and floating

You can decide if something will float by working out its **density**. Density is the mass of a certain volume of something, and it can be calculated using this formula:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

The units for density are g/cm^3.

The density of water is $1g/cm^3$. If an object has a density less than $1g/cm^3$ it will float. If its density is greater it will sink.

Newton's 1st Law

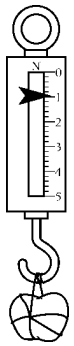
An object will continue to move in a **straight line** at a **constant speed** unless acted upon by an **unbalanced force**. In other words:
Balanced forces: constant speed
Unbalanced forces: acceleration.

Measuring forces

Elastic materials will stretch with a force and then return to their original shape when the force is taken away.

Materials like Plasticine will stretch with a force but they will not return to their original shape afterwards. Plasticine is not elastic.

Springs are used to measure the size of a force because they are elastic. A big force stretches a spring further than a small force. **Force meters** have springs inside them.



This force meter is measuring a force of 1 N.

Weight and mass

Your **mass** is the amount of substance in your body. Your mass is measured in **kilograms** (**kg**).

Your weight is a force caused by gravity pulling on your body. The **newton** (**N**) is the scientific unit used to measure forces, and so it is also used as the unit for weight.

Wherever you take an object, its mass will not change but its weight depends on the force of gravity. An object on the Moon would have a smaller weight than on Earth, because the Moon's gravity is not as strong as Earth's.
On Earth, gravity pulls on every kilogram of mass with a force of 10 N.
The equation is **weight = mass x 10**

Friction: Friction **is a contact force. Friction can:**

- slow things down
- wear things away
- produce heat
- make a noise.

Friction is sometimes helpful, for instance:

- your shoes grip the floor because of friction
- tyres and brakes use friction
- pencils write because of friction.

Friction is not always helpful:

- parts of engines wear away because of friction
- friction makes bicycles harder to pedal.

Friction can be increased by using rough surfaces, or by using materials like rubber that have a lot of friction.

Friction can be reduced by using smooth surfaces, or by **lubrication**. Things like oil or grease are **lubricants**, and help things to move past each other easily.

Static friction exists when two surfaces are in contact, but not sliding.
Sliding friction exists when two touching surfaces are sliding over one another.
Static friction is higher than sliding friction.

Static Electricity

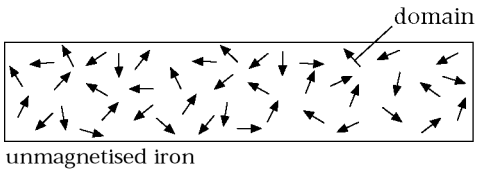
Static charge can build up when two surfaces rub against each other. **Electrons move from one object to another**. These extra electrons make the object negatively charged. The other object is now positively charged.

Object with the same type of charge will repel. Objects with opposite charge will attract each other.

Magnetism

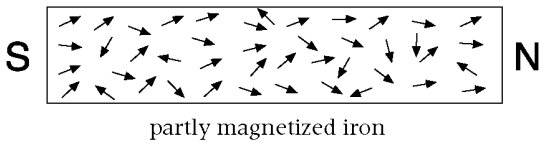
Magnetism is a property of the atoms in iron, nickel and cobalt. Little groups of atoms act like tiny magnets. Each little group of atoms is called a **domain**.

A normal piece of iron does not seem to be magnetic, because all the **domains** are **magnetised in different directions**. They cancel each other out.



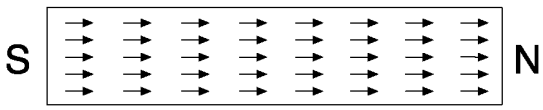
unmagnetised iron

When a piece of iron is magnetised all the **domains line up**. They do not cancel each other out any more.



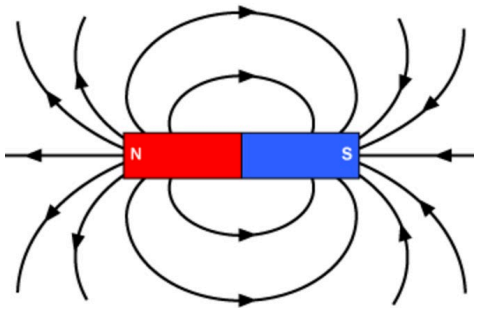
partly magnetized iron

You can **magnetise** a piece of iron by **stroking** it. You always have to stroke in the same direction. You can also magnetise a piece of iron by leaving it next to another magnet.



fully magnetized iron

Magnetic field lines show the **direction** and indicate the **strength** of the magnetic force. The **closer the lines** are together, the **stronger the force**.



Air Resistance

The larger the surface area, the larger the air resistance.
This is what happens when a sky diver, pull their parachute. The increase in air resistance is larger than the force due to gravity. This causes the sky diver to slow down, so they can land safely.

Certain cars, aero planes and many animals are adapted to allow them to reduce their air resistance by having a shape with a low surface area. We say that they have a **streamlined** shape.

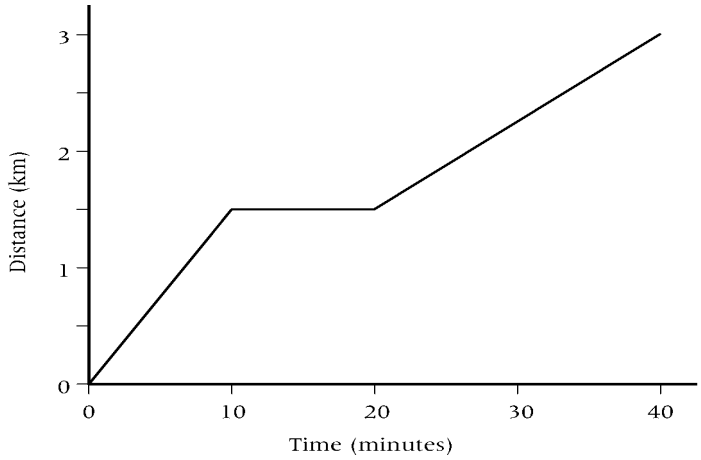
Speed

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

Speed = distance (m) / time (s)

Distance/time graphs

A journey can be shown on a distance/time graph. This graph shows a person running, then stopping for a rest, then walking slowly. The **steeper the line** on the graph, **the faster they are moving**.



Moments

A moment is a **turning effect.** A moment can also be called a **TORQUE**.

The two things that affect the size of a **moment** are the sizes of the **force** and the **perpendicular distance** to the pivot.

The **pivot** or **axis of rotation** is the point about which the object turns (eg the hinges of a door or the axle of a wheel)

The formula for moments is:

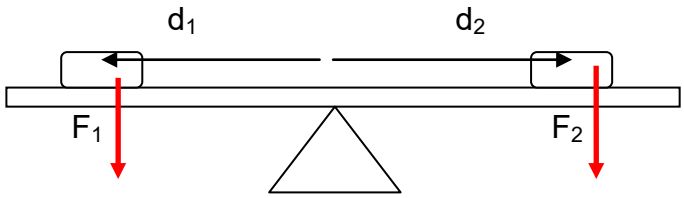
moment = force x perpendicular distance to the pivot

The unit of moment is Nm.

Principle of Moments

If an object is balanced:

Moments left hand side of the pivot balance the moments right hand side of the pivot



As an equation this becomes:

$$F_1 \times d_1 = F_2 \times d_2$$

The size of the turning force can be increased by increasing the length of the lever.

Pressure

Pressure is the amount of force that is put onto a certain area. The equation is:

Pressure = force / area. The units are **N/m^2** or **Pa**.

Pressure can be made **higher** if the force is concentrated over a **small area**:

Pressure can be made **lower** if the force is spread over a **large area**.

Newton's 2nd Law

An object will have a **greater acceleration** if there is a **larger unbalanced force** or a **smaller mass**. The equation is:

unbalanced force = mass x acceleration

The units for acceleration are **m/s^2**.

7P 17a Forces Group Research and Presentation – Student Instruction Sheet

Aim:

You are required, in a group, to prepare a presentation on one of the forces being studied in the Forces and Motion unit. This presentation will be an assessed piece of scientific work.

Topics:

Your group may choose **one** from the following list of forces to research and present on;

1. Weight/Gravity
2. Friction
3. Magnetic Force
4. Buoyancy
5. Static Electricity
6. Turning Forces

Guidelines:

- Student groups will consist of **3, 4 or 5** members.
- You can choose any **ICT based method of presentation** that you are comfortable with (e.g. PowerPoint, web based, prezzie etc.)
- You should try and embed some pictures or video clips into your presentation that **reflect the application** of your chosen.
- You need to be prepared to present your project to the rest of the class. The maximum time for your presentation is **5 mins**.
- You will be assessed on your **teamwork/collaboration skills** as well as the quality of your presentation and how you **discuss the application of your chosen force to solve real life problems.**

Hints for Productive Teamwork:

1. Organise your team, make sure everyone knows what they need to do and when they need to be ready.
2. Elect a team leader who takes responsibility to ensure everyone on the group is involved in completion of the task
3. Discuss ideas, try to listen to other opinions. If you don't agree try to find some middle ground or a compromise when you make decisions.
4. Make sure you find a good way to communicate or share ideas. If someone is needs help, make sure they can get some support and encouragement.

Hints for a Good Quality Presentation:

1. **Research the force chosen thoroughly** by considering some of the following:
    - Describe the force. What causes it to happen? Give some examples of where/when we may have experienced it. How is it measured?
    - Identify 3 uses/applications of your chosen force? Explain the science behind each application.
    - For each use/application, describe the impact it has on the environment and humanity.

2. Make sure you **organise your presentation into relevant sections**. Try and use pictures/diagrams/short videos/links to help explain.

3. You need to make some **research notes by hand or on your computer**. It is really important that you do not cut and paste sections from the internet. You need to explain the concepts in your **own words**. Try to use **scientific language accurately.**

4. Ensure that you are using **multiple reliable sources**, and document the sources by including a **bibliography.**

5. When you have completed your presentation, try and **evaluate and reflect** on how well you and your team worked together.