Rosary School / Marj El Hamam

Name : _____ Date : / / 2025

Subject :Science Grade: 6 ( )

Study Sheet (2)

7K Forces

Lesson	Learning Objectives
7Ka Different forces	- Describe what a force is. - Recall the names of simple forces and state what is meant by contact and non-contact forces. - Recall the effects of forces on an object. - Classify forces as contact and non-contact and identify situations and places where different forces are likely to be found. - Represent sizes and directions of forces using arrows. - Explain the difference between mass and weight and recall the units for measuring these. - Compare the way in which force meters and balances that compare masses work.
7Kc Friction	- Describe how friction forces affect movement. - Describe some ways in which friction can be changed. - Identify simple situations in which friction is helpful or not helpful. - Recall some effects of frictional forces. - Explain some ways in which friction can be changed. - Suggest how and why friction has been reduced or increased in unfamiliar situations. - Draw lines of best fit on scatter graphs.

7Kd Pressure	- State what is meant by pressure and recall its units. - Describe how the pressure depends on force and area. - Describe the effects of high or low pressure in simple situations. - Recall some common units for measuring pressures. - Use the formula relating force, pressure and area. - Explain applications of pressure in different situations.
7Ke Balanced and unbalanced	- State what is meant by: balanced forces, unbalanced forces. - Explain the effects of balanced and unbalanced forces in simple situations. - Explain why a vehicle needs a force from the engine to keep moving at a constant speed. - Describe how new evidence changed scientific ideas. - Explain the effects of balanced and unbalanced forces in unfamiliar situations
7Kb Springs	-Recall the effects of forces on an object. - Explain how a force has caused certain effects on an object. - State what is meant by extension, compress, stretch, elastic, plastic. - Describe how the extension of a spring depends on the force applied. Explain how a force meter works and how to use one. - Explain what is meant by elastic limit, limit of proportionality. - Students analyse new situations involving springs.

7Ka Different forces:

- Forces are **pushes** or **pulls**.

-Forces can affect on an object by:

1) changing **the shape or size** of an object.

2) changing **the speed** things are moving (make them move faster or slower).

3) changing the **direction** of a moving object.

*Types of forces:

1) **Contact forces**: only act when two objects or materials are **touching** before the force can affect.

Examples of contact forces are:

● friction: is a force caused by two things rubbing together.

● air resistance (kind of friction)

● water resistance (kind of friction)

● upthrust. Upwards forces from water or air are called upthrust.

(The force that makes things float).

2) **Non-contact forces**: forces that can affect an object from a distance (without touching)

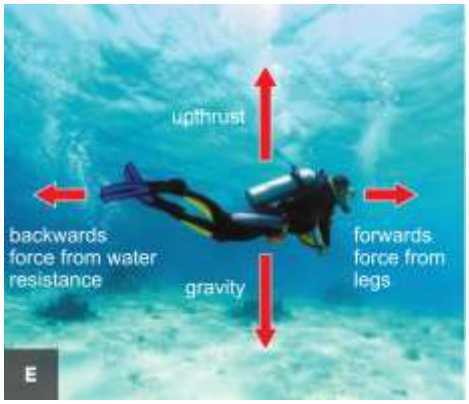
Examples of non-contact forces:

● gravity: A force that pulls objects downwards.

● static electricity: A force that can attract or repel things. It is caused when certain materials rub together.

● magnetism: A force that attracts objects made of iron or other magnetic materials.

The unit for measuring force is the ***newton (N).***



-Notes:

- The direction in which the force is acting is important so we use ***arrows*** to show forces.
- The direction of the arrow shows the direction of the force; a bigger arrow shows a bigger force.

Question:

Look at photo D.

a) Which bike has the biggest force on it?
The motorcycle

b) How do you know this from the photo?

It has a bigger force arrow

c) What will happen to the two bikes as a result of these forces?

They will start to move / speed up, the motorbike will accelerate/ speed up faster than the bicycle

Weight and mass

- *Mass* is the amount of matter that makes up an object.

The units for measuring mass are ***kilograms (kg)*** and ***grams (g)***.

- *Weight* is the force of gravity pulling on you. 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.

Notes: Weight = mass (kg) ×10 (N/Kg) Mass = weight(N) ÷ 10 (N/kg)

convert g to Kg by dividing by 1000

Example: What is the weight of a 40 kg child on Earth?

Weight = mass ×10

= 40 × 10

= 400 N

Questions:

1) A car has a weight of 10000 N. What is the mass of the car on Earth?

Mass = weight / 10

= 10000 / 10

= 1000 N

2) Why would you weigh less on the Moon than you do on the Earth?

Gravity is not as strong on the Moon as it is on the Earth

3) Workbook page124 + 125

7Kc Friction:

Friction is a contact force (between two touching objects)

Friction can:

- slow things down
- produce heat
- wear things away
- cause a noise

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

Friction is helpful in:

- The tyres of a Formula One racing car as they stop the car from sliding off the road as it speeds round sharp corners.

- Rock climbing shoes are made from special rubber that increases friction to give a good grip.

- Abseiling helps the abseilers control how fast they go down the cliff.

Friction can be reduced by using smooth surfaces, or by lubrication. Oil and grease are examples of lubricants, and help things to move past each other easily.

Friction is not helpful in:

- The brake pads on a bicycle eventually wear away, and so do car tyres.
- Parts of your clothes get thinner as friction wears them away.
- If a car engine runs without any oil, the large amount of friction between the moving parts causes it to overheat and stop working.
- Rusty door hinges squeak and make a door difficult to open.

*__Note__:

Friction due to gases (air resistant) and liquids (water resistant) can also cause things to slow down. And it can be reduced by having smooth surfaces and smooth shapes.

Questions

1) The tread on bicycle and car tyres is designed to allow water to escape from under the tyre on wet roads. Explain why this is important.

Cars need high friction between the tyres and the road, to allow the tyres to grip the road for moving the car, steering and breaking. Water can act as a lubricant between the tyres and the road, reducing the friction and allowing the wheels to spin or to skid.

2) a- Why do car owners have to replace their car tyres regularly?

Rubber tyres wear away due to friction between them and the road.

b- Suggest why racing car tyres do not last as long the tyres on normal cars?

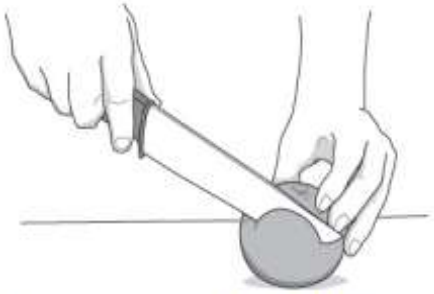
They are used at faster speeds, so wear away faster.

2) Workbook page 127.

7Kd Pressure:

Pressure is the amount of **force** pushing on a certain **area.**

- The size of the pressure depends on the size of the force and the size of the area it is pushed on.
- For a certain area, the bigger the force, the bigger the pressure. For a certain force, the bigger the area, the smaller the pressure.



Sharp knife – a small area giving a large pressure.

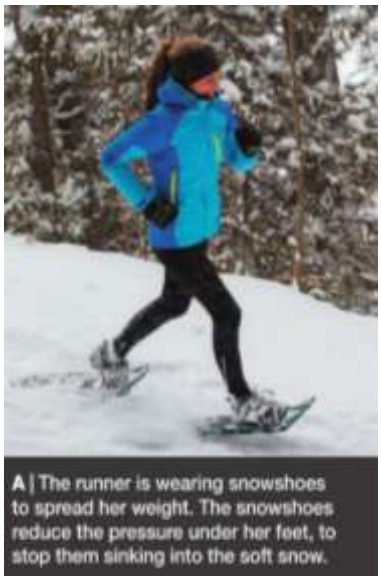
Snow shoes – a large area giving a small pressure.

Note: Explain pressure situations by relating the force, the area, and the pressure produced.

Questions:

1) Look at the vehicle in photo C.
Should a car like this have a wide or narrow tyres?
Explain your answer.
It should have wider tyres. The greater area of the tyres makes the pressure lower, so the car is less likely to sink into road.

2) The person on photo A puts on a large pair of snow snowshoes. Explain how the pressure under her feet will change.



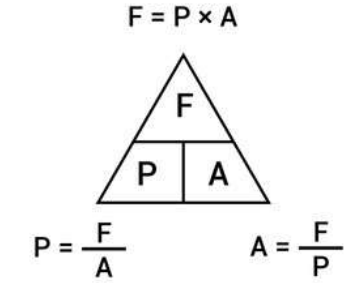
A | The runner is wearing snowshoes to spread her weight. The snowshoes reduce the pressure under her feet, to stop them sinking into the soft snow.

It will get less, because the same force with larger area gives a lower pressure

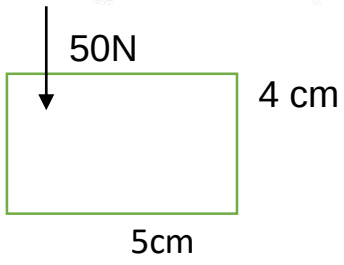
- We use this formula to calculate pressure:

Pressure= force ÷area

Force is measured in newtons (N) and area is measured in square meters (**m**^{2}).
So the unit of pressure is (N/**m**^{2}) which is also called a **pascal (Pa)**. 1Pa =1 N/m^2



Example:
a) Calculate the pressure produced by the force.



P = F / A
= 50 /20
= 2.5 N/ cm2
Note : A = 5*4 , A = 20 cm2

b) Calculate the pressure in Pa.
5/100 = 0.05 cm
4/100 = 0.04 cm
A = W x L , A = 0.04 * 0.05
A = 0.002 m^2
P = F / A , P = 50/0.002 , P = 25000 Pa

Questions

1) Calculate the force necessary to produce a pressure of 80 N/m^2 when acting on a surface of 5 m^2**.**

F = P * A
= 80 * 5
= 400 N

2) Calculate the area on which a force of 500 N is acting to produce a pressure of 25 N/m^2**.**

A = F / P

= 500 / 25

= 20 m^2

3) Workbook page 128

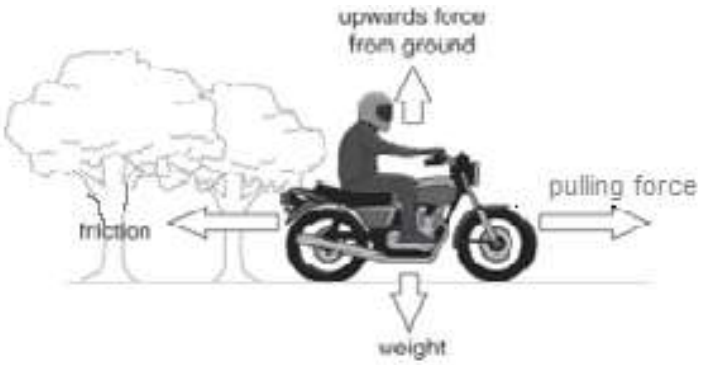
*__**Homework**__: Coursebook Q5 p. 173

7Ke Balance and unbalanced:

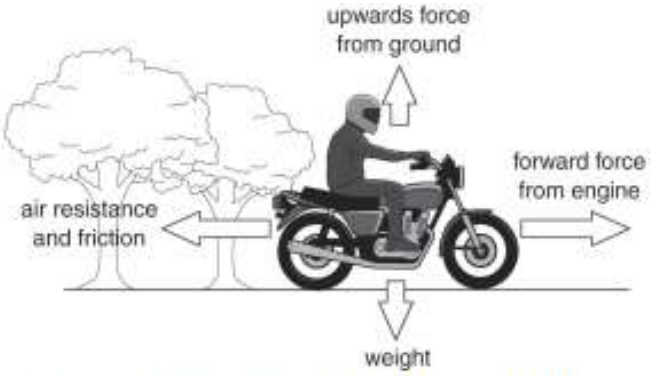
- **Balanced forces:** forces on an object that are the **same size** but work in **opposite directions**.

If forces are balanced:

1- a stationary object stays stationary.
(Forces are equal in size and opposite in direction)



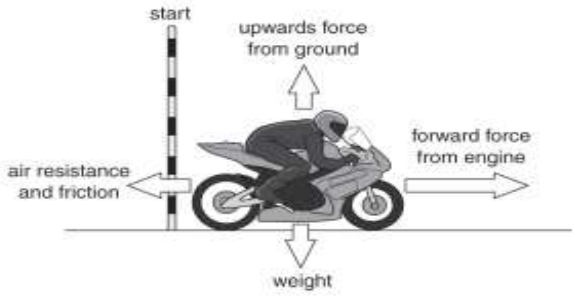
2- a moving object continues to move at the same speed and in the same direction.
(steady /constant speed)



Balanced forces – the motorbike will continue to move at a steady speed.

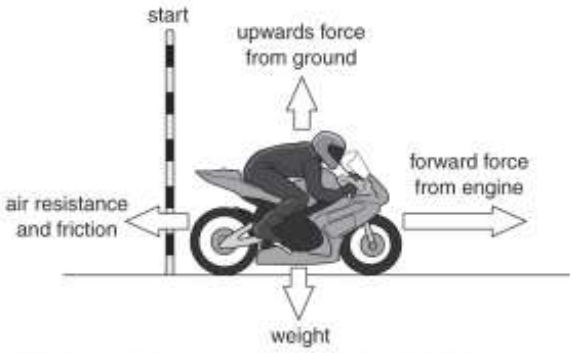
- **Unbalanced forces:** forces on an object are not the same size (one force is stronger than the other) but work in opposite directions.

If forces are unbalanced:
1- a stationary object will start to move.

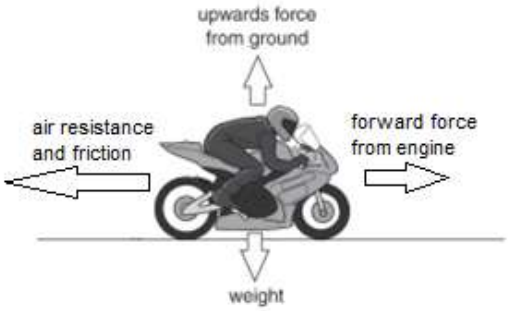


The motorbike will move to the right in the direction of the bigger force

2- a moving object will change its speed or direction.



Unbalanced forces – the motorbike will speed up.

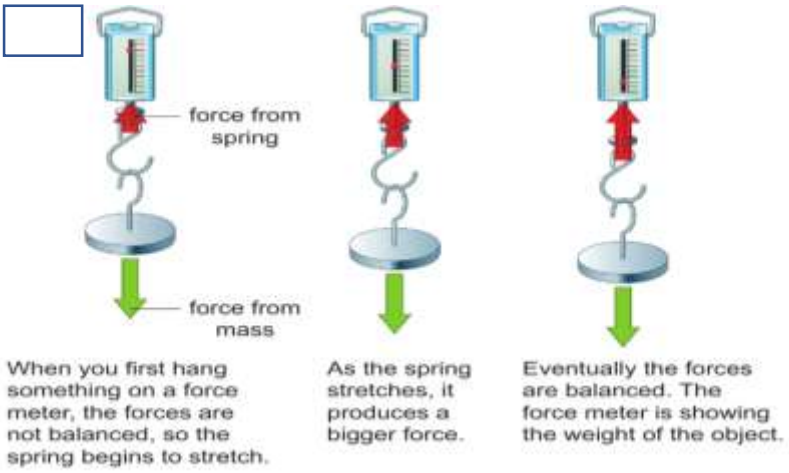


Unbalanced forces- The motorbike will slow down (decelerate)

The forward force is bigger.

The backward forces are bigger.

- How force meter works?
  When you stretch a spring it gets harder and harder to pull it because the spring pulls back.



Questions

1) Look the photo.

a- Why isn't the rope moving?

The pulling force from the man is the same size as the

force from the mule

b- What will happen if the mule pulls harder?

It will start to move backwards

2) Look at the photo below.

What will happen when the dogs get tired and cannot pull as strongly?

The friction forces will then be bigger than the pulling force, so the sled will begin to slow down

3) Look at the photo below.

a- Why is the man not moving?

The forces are balanced

b- How will the forces be different if a lighter man uses the tightrope?

The weight of the man will be less, so the tight rope will not stretch as much and will push up with a smaller force

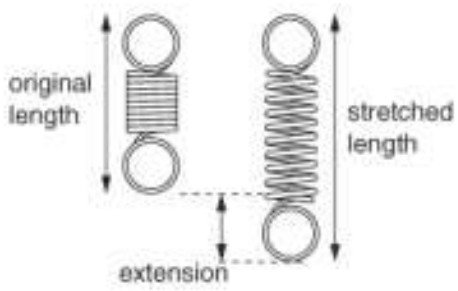
Workbook pages 131+132

7Kb Springs:

- Materials and objects can be stretched (made longer) or compressed (made shorter).
- The amount of stretch or compress depends on
  1- the type of the material
  2- the size of the force.

- Elastic materials (like a spring) will stretch with a force and then **return to their original shape** when the force is removed.
- The extension of a spring is the difference between its original length and its stretched length.

  (Extension = stretched length – original length)



Example:

A weight hanged in a spring that has an original length of 16 cm.

The spring stretched to be 21 cm. Calculate the extension of this spring.

Extension = Stretched length – original length

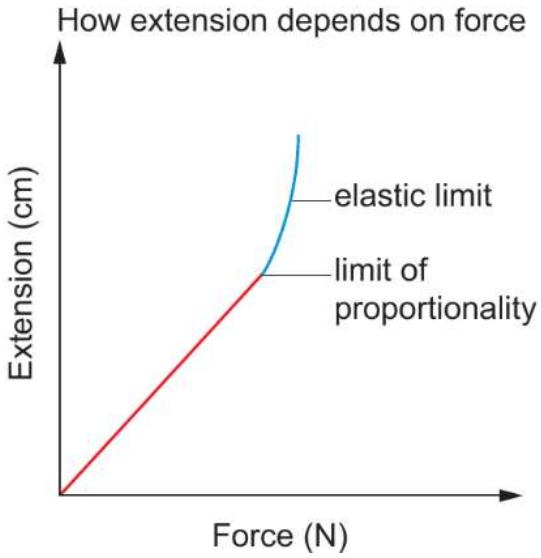
= 21 – 16

= 5 cm

The apparatus below is being used to investigate the extention of a spring.

<u>Question</u> : Explain how you would use this apparatus to find out how much the spring stretches with different forces on it.

Set up the apparatus so that the zero on the ruler is next to the bottom of the unstretched spring, add a mass to the spring and measure the extension, add further masses, measuring extension each time.

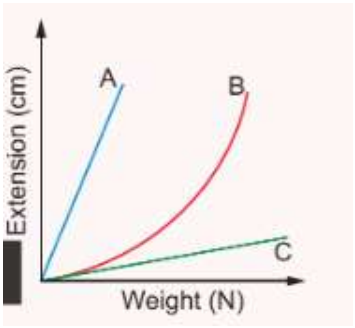


The graph shows that extension is proportional to the force up to a certain point, called the limit of proportionality. This means that for every 1N increase in the force, the spring stretches by the same amount.

Hook's law:** The ***extension of some elastic materials is ***proportional*** to ***the force*** to a certain limit called limit of proportionality.

Example:

The graph below shows how far different materials stretch when a weight is hung on them.



a) Which material stretches the most for certain weight?
   A.

b) Which material(s) could be used for making a force meter? Explain your reasoning.
   A and C, the graphs are straight lines / the extention is proportional to the force

c) Explain which material would be best for making a force meter to measure small weights?
   A, as it stretches the most for a small weight. This would make the scale easier to read/ make it possible to detect small differences in forces.

If the spring is stretched too far, the extension stops being proportional to the force. If it is stretched even further, it goes beyond its elastic limit. The spring will no longer return to its original length when the force is removed.

- Materials that do not return to their original shape when a force is removed are **plastic materials**.

Questions:

1) A spring stretches 2 cm when a 10N weight hangs on it. How far will it stretch with a weight of 20N? 4cm

2) a-What is the difference between an elastic and plastic material?

Both materials change shape when a force is applied, an elastic material returns to its original shape when the force is removed but plastic material does not

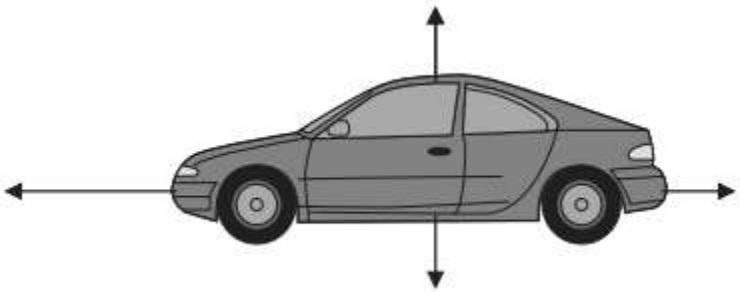
b-Name one plastic material. Clay, modelling clay.

3) Workbook page 126.

Achievement test questions:

Question 1:

a) The diagram shows the forces acting on a car as it travels along a road.



Which one of these describes how the car is moving?

A it is accelerating backwards

B it is accelerating forwards

C it is decelerating

D it is moving at a steady speed

b) A car has a mass of 1200kg.
What is the weight of the car on Earth?

A 120N

B 1200kg

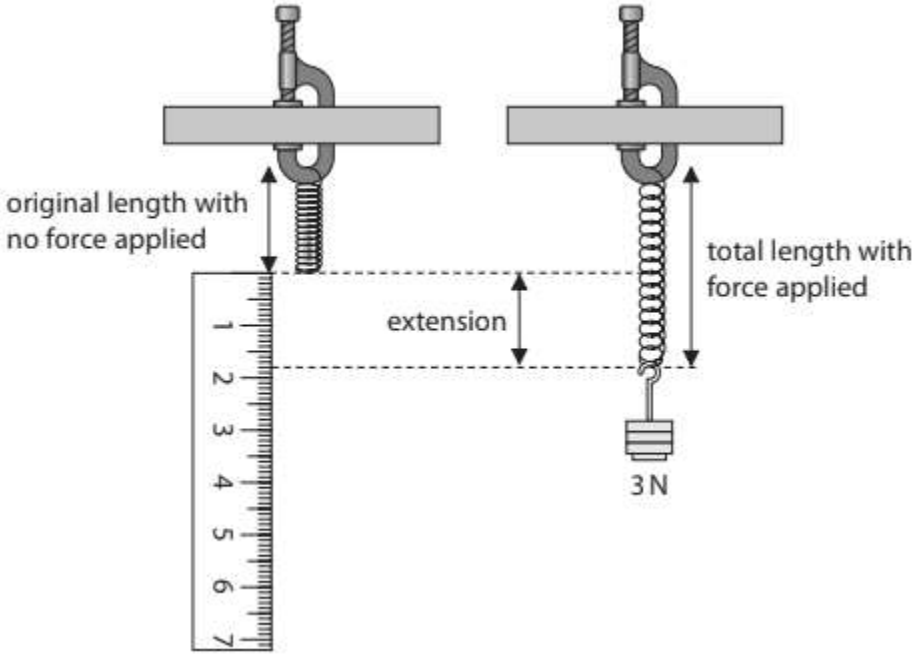
C 1200N

D 12000N

Question 2:

A student investigates how the extension of a spring is affected by force.

She uses the apparatus shown in the diagram.
The diagram shows the extension produced by a 3N force.



Force in newtons (N)	Extension in centimetres (cm)
0	0.0
1	0.6
2	1.2
3	.....
4	2.7
5	3.0
6	3.6

(a) Use the information in the diagram to complete her table of results.

1.8

(b) (i) Plot the results from the table on the grid below.
Use suitable scales for the vertical and horizontal axes.

(ii) Join the points with a line of best fit.

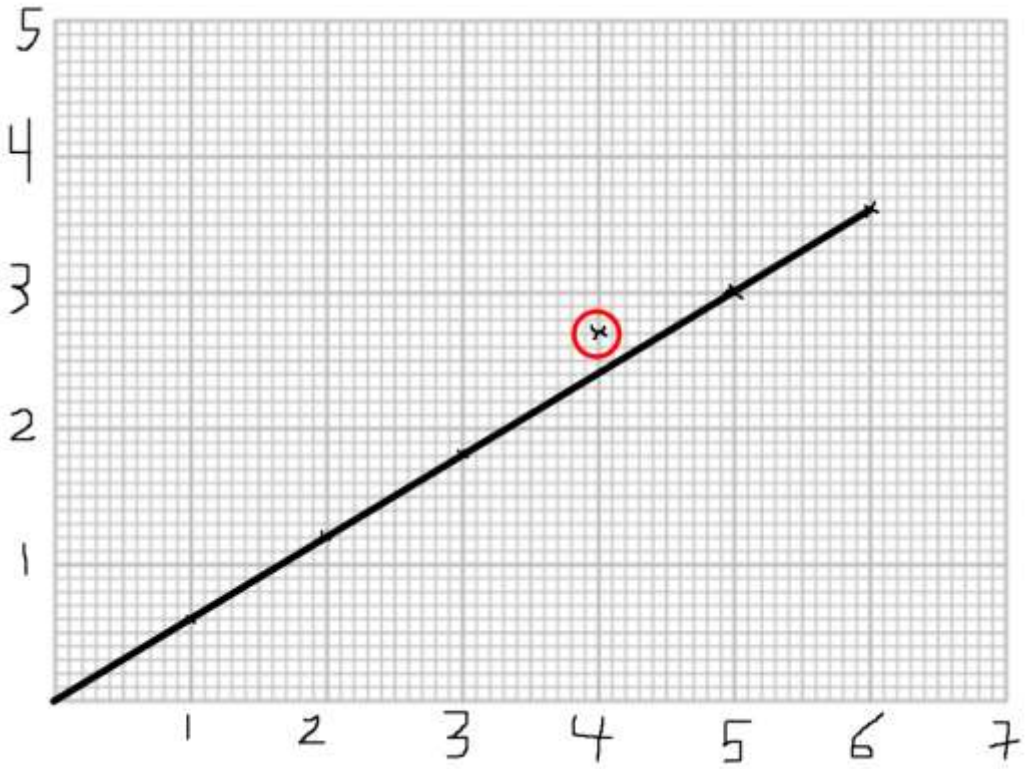
(iii) Circle any anomalous results on your graph.

(c) Tick two conclusions that can be drawn from this investigation.

As the force increases the extension decreases	
The spring stretches 1 cm per newton of force	
As the force increases the extension increases	✓
The unstretched spring is 5 cm in length	
There is a linear relationship between the force and the extension	✓

(d) State how the student could make her results more reliable.

Repeat the test

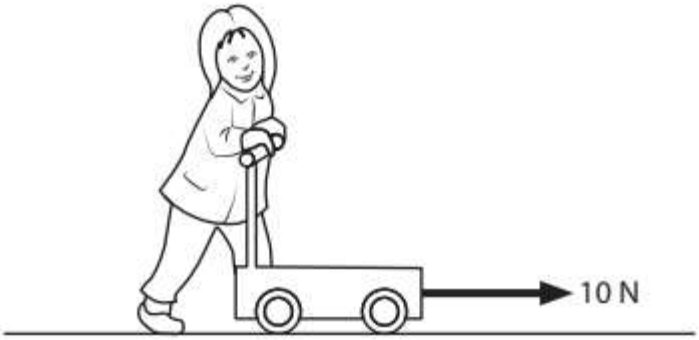


Question 3:

A young child pushes a cart with a forward force of 10 N. This is shown in the diagram.

The cart does not move because of friction acting on the cart.

The cart has a mass of 2 kg.



Draw one straight line from each force to its correct size and direction.

Force	Size and direction of the force
friction force acting on the cart	10 N
resultant force acting on the cart	10 N ←
	0 N
	20 N
	20 N ←