



## Rosary School / Marj El Hamam

Name : \_\_\_\_\_

Date :    /    / 2025

Subject : Science

Grade: 6 (    )

### Study Sheet (5)

### 7K Forces

#### 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)

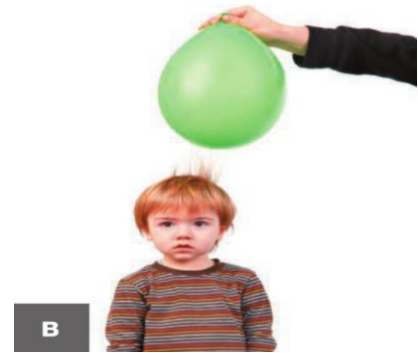
Examples of non-contact forces:

- gravity: A force that pulls objects downwards.



A

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



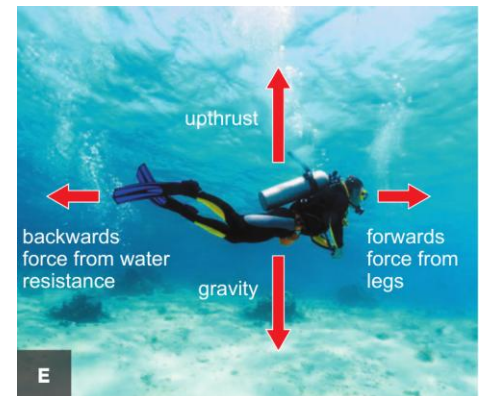
- magnetism: A force that attracts objects made of iron or other magnetic materials.



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)  $\times 10$  (N/Kg)                      Mass = weight(N)  $\div 10$  (N/kg)

convert g to Kg by dividing by 1000

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

$$\text{Weight} = \text{mass} \times 10$$

$$= 40 \times 10$$

$$= 400 \text{ N}$$

### Questions:

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

$$\text{Mass} = \text{weight} / 10$$

$$= 10000 / 10$$

$$= 1000 \text{ N}$$

- 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 page 124 + 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?

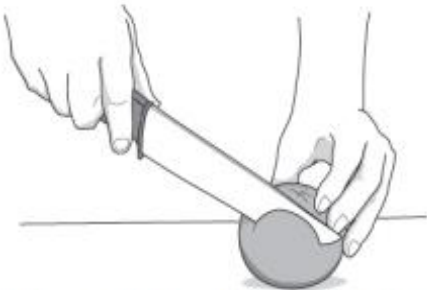
They are used at faster speeds, so wear away faster.

3) Workbook pages 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 snowshoes. Explain how the pressure under her feet will change

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

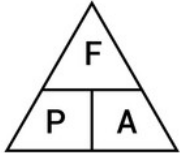


- We use this formula to calculate pressure:

Pressure = force  $\div$  area

Force is measured in newtons (N) and area is measured in square meters ( $\text{m}^2$ ).

So the unit of pressure is ( $\text{N}/\text{m}^2$ ) which is also called a **pascal (Pa)**.  $1\text{Pa} = 1\text{ N}/\text{m}^2$

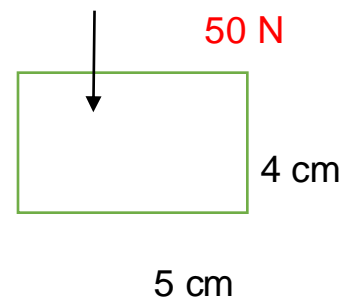
$$F = P \times A$$

$$P = \frac{F}{A} \quad A = \frac{F}{P}$$

Example :

- a) Calculate the pressure produced by the force.

$$\begin{aligned} P &= F / A \\ &= 50 / 20 \\ &= 2.5 \text{ N} / \text{cm}^2 \end{aligned}$$

**Note :  $A = 5 \times 4$  ,  $A = 20 \text{ cm}^2$**



- b) Calculate the pressure in Pa.

$$5/100 = 0.05 \text{ m}$$

$$4/100 = 0.04 \text{ m}$$

$$A = 0.04 \times 0.05$$

$$A = 0.002 \text{ m}^2$$

$$P = F / A , P = 50 / 0.002 , P = 25000 \text{ Pa}$$

### Questions

- 1) Calculate the force necessary to produce a pressure of  $80 \text{ N/m}^2$  when acting on a surface of  $5 \text{ m}^2$ .

$$\begin{aligned} F &= P * A \\ &= 80 * 5 \\ &= 400 \text{ N} \end{aligned}$$

- 2) Calculate the area on which a force of  $500 \text{ N}$  is acting to produce a pressure of  $25 \text{ N/m}^2$ .

$$\begin{aligned} A &= F / P \\ &= 500 / 25 \\ &= 20 \text{ m}^2 \end{aligned}$$

- 3) Workbook pages 128

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

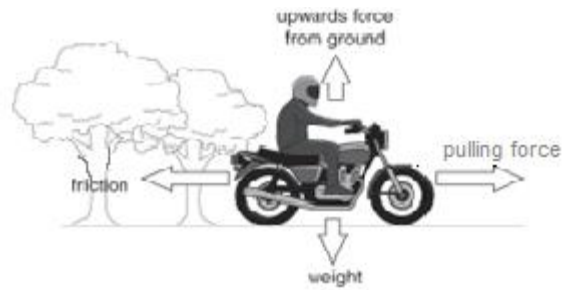
### 7Ke Balance and unbalanced:

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

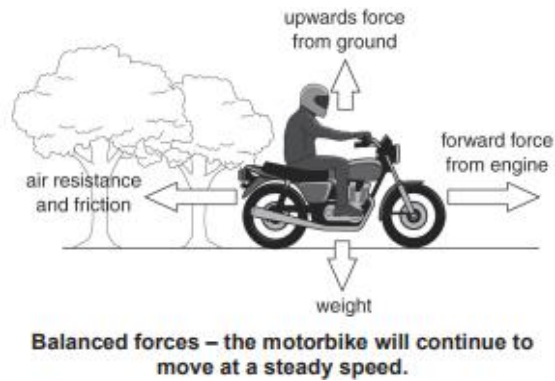
If forces are balanced:

- 1- a stationary object stays stationary.

(Forces are equal in size and opposite in direction)



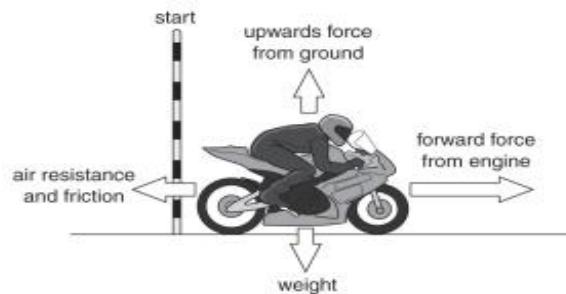
2- a moving object continues to move at the same speed and in the same direction.  
(steady /constant speed)



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

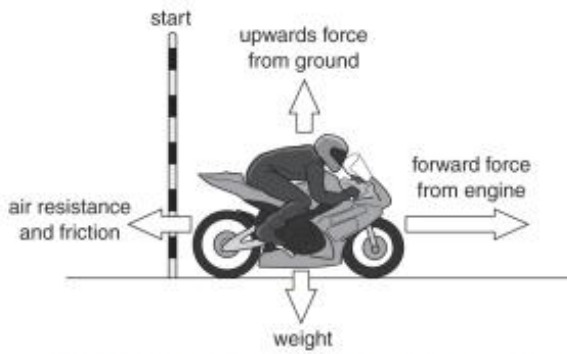
If forces are unbalanced:

1- a stationary object will start to move.

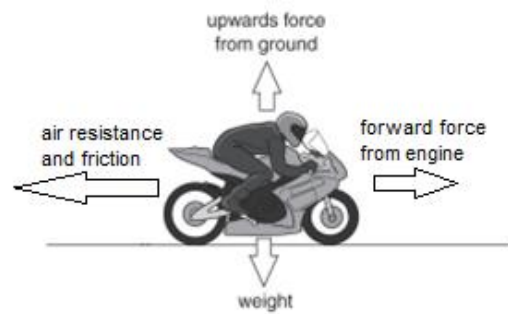


**The motorbike will move to the right in the direction of the bigger force**

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



Unbalanced forces – the motorbike will speed up.



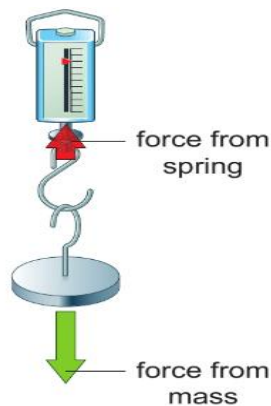
Unbalanced forces- The motorbike will slow down (decelerate)

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.



When you first hang something on a force meter, the forces are not balanced, so the spring begins to stretch.



As the spring stretches, it produces a bigger force.



Eventually the forces are balanced. The force meter is showing the weight of the object.

## Questions

1) Look the photo below.



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

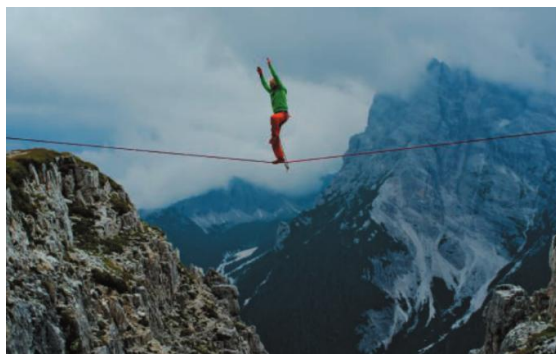
2) Look at the photo below.



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

4) 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:**

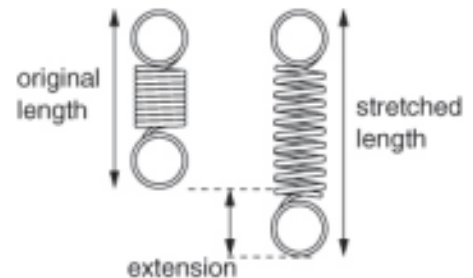
A weight hanged in a spring that has an original length of 16 cm.

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

Extension = Stretched length – original length

= 21 – 16

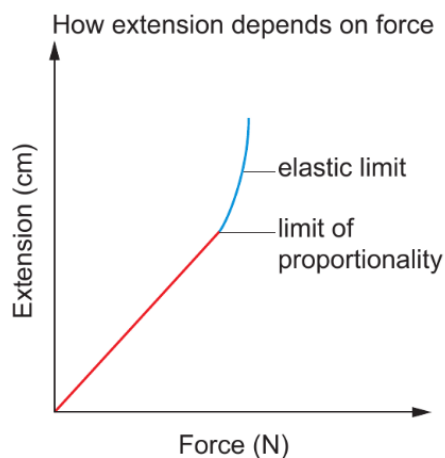
= 5 cm



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

**Question** : 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.

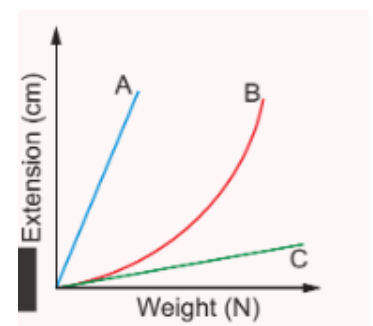
a) Which material stretches the most for certain weight? **A**

b) Which material(s) could be used for making a force meter? Explain your reasoning.

**A and C, the graphs are straight lines / the extension 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? **4 cm**.

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.