



SUBJECT

BASIC SCIENCE

TOPIC

FORCES

CLASS

J.S.S 1



BEHAVIORAL OBJECTIVE

By the end of today's class, you should be able to

- Define Forces.
- List and explain the types of forces.
- Solve calculation problems on gravitation forces.
- Define friction and give some of its applications.

WHAT IS FORCE

Force can be defined as that which changes the speed, shape, or direction of a moving body. Force is described as a push or pull on an object. It is any influence that causes a body to undergo a any form of change in it's movement or direction.

The force of a body can also be defined as the product of the mass of that same body and it's acceleration.



Force is represented using the symbol “F”, and the unit used in measuring the force of an object or body is known as Newton (N).

Mathematically,

Force of an object (F) = Ma , where M = Mass of object measure in kilograms(kg), a = Acceleration measured in Meter per square second (m/s^2).

TYPES OF FORCES

There are two types of forces which are:

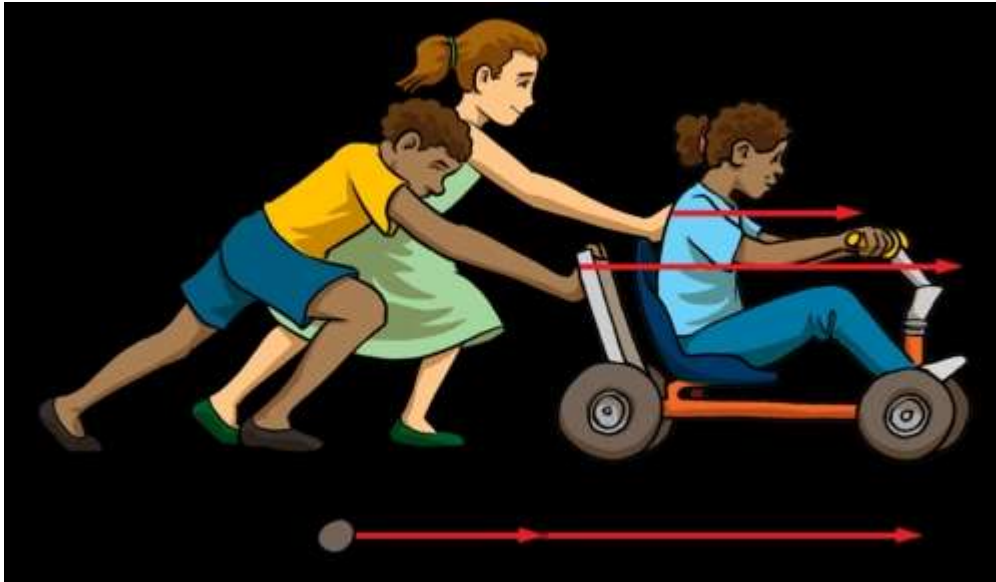
1. Contact forces
2. Non-contact forces

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CONTACT FORCES

These are forces exerted when the object is in contact with the source of the force., I.e, both bodies touch each other. We have several types of contact forces and they can either occur due to a push and friction. (direct contact forces), or a pull and tension (indirect contact forces)





TYPES OF CONTACT FORCES

1. Frictional forces: This is a force released by a surface as an object moves across it or makes an effort to move across it. There are two types of friction forces which are sliding and static friction. The main purpose of a frictional force is to create resistance to the motion of one surface over the other surface.

2. Normal forces: This is the supporting force which is applied upon an object that is in contact with another stable object. For example if a book is resting upon a surface, then the surface is applying an upward force upon the book in order to support the weight of the book. Another example is the push force any a wall on the person resting on it
3. Air resistance forces: The air resistance force is a special type of frictional force that acts upon objects as they travel through the air. This type of force usually opposes the motion of an object and is hardly noticeable, except for objects moving at high speed.

4. Applied forces: An applied force is a force that is applied to an object by a person or another object. A good example is a person pushing a desk across the room; He/she is applying a force on the desk.
5. Tensional forces: This is the force that is transmitted through a string, rope, cable or wire, when it is pulled tight by forces acting from opposite ends. The tension force is directly along the wire and pulls equally on the object on the opposite ends of the wire.



NON CONTACT FORCES

These are the forces whose sources do not require contact to the body to which they are applied. The two interacting objects are not physically in touch with each other, but are able to apply push or pull despite the separation.



TYPES OF NON CONTACT FORCES

1. Gravitational force: This is the force with which the earth, the moon or any other large object, attracts another object towards itself. It is also referred to as the weight of the object, and is calculated by obtaining the product of the given mass of the body (m) and acceleration due to gravity (g)

$$F = mg$$

Unit of Force (F) is Newton (N)

2. Magnetic Force: This is defined as a force of attraction between magnetic and non-magnetic objects. It is also referred to as an attractive force between electrically charged particles because of their motion



3. Electrical Force: Electric force is the pull or push that an electric charge will experience. It is also referred to as the repulsive or attractive interaction between any two charged bodies



DIFFERENCES BETWEEN GRAVITATIONAL FORCES AND MAGNETIC FORCES

The table below shows differences between gravitational and magnetic forces.



Gravitational Force vs Magnetic Force

More Information Online WWW.DIFFERENCEBETWEEN.COM

	Gravitational Force	Magnetic Force
DEFINITION	Gravitational force is the force that acts on an object due to gravity	Magnetic force is an attraction force that occurs between two charged particles or iron-containing objects
OBJECTS	Act on any object that has a mass	Act on either charged particles or iron-containing objects
STRENGTH	Usually weak	Strong
EXAMPLE	Gravity on Earth that helps us walk on Earth's surface	Action of an electric motor

MEASUREMENTS AND CALCULATIONS OF GRAVITATIONAL FORCES

The value of universal acceleration on the Earth's surface due to gravity (g) is 9.8m/s^2 or 10m/s^2

To calculate gravitational force (F), we have

$$F = Mg,$$

Where “ M ”= Mass of object, “ g ”= acceleration due to gravity

WORKING EXAMPLES

1. Calculate the gravitational force needed to pull down an object of 25kg.

(take $g = 10\text{m/s}^2$)

Solution.

Given $F = Mg$, where $M = 25\text{kg}$ and $g = 10\text{m/s}^2$

$F = ?$

Therefore,

$$F = 25\text{kg} \times 10\text{m/s}^2$$

$$= 250\text{N}$$

2. Calculate the gravitational force required to pull down a mango fruit of 10kg falling with an acceleration of 5m/s^2

Solution

$F = mg$, where F is unknown,

$m = 10\text{kg}$, $a = 5\text{m/s}^2$

Therefore, $F = 10 \times 5 = 50\text{N}$

3. Calculate the gravitational force of an object of mass 60kg, which produces an acceleration of 15m/s^2

Solution

$$F = m \times g$$

$$F = 60\text{kg} \times 15\text{m/s}^2$$

$$F = 900\text{N}$$

The gravitational force on the object is 900N



BALANCED AND UNBALANCED FORCES



BALANCED FORCES

Balanced forces do not cause any change in the motion of an object or a force which acts on a body at rest. If the body is at rest it means that all the forces acting upon it are equal and opposite. It follows Newton's third law of motion which states that for every action there is an equal and opposite reaction



In the image above, the forces are balanced because both groups of people are pulling with a force of 300N

The resultant force will be “Zero” Newton ($300\text{N} - 300\text{N}$), so no group will pull the other and they will remain in the same position.



UNBALANCED FORCES

Unbalanced forces are responsible for motion because the acting are not equal and the body will move in the direction of this unbalanced force.



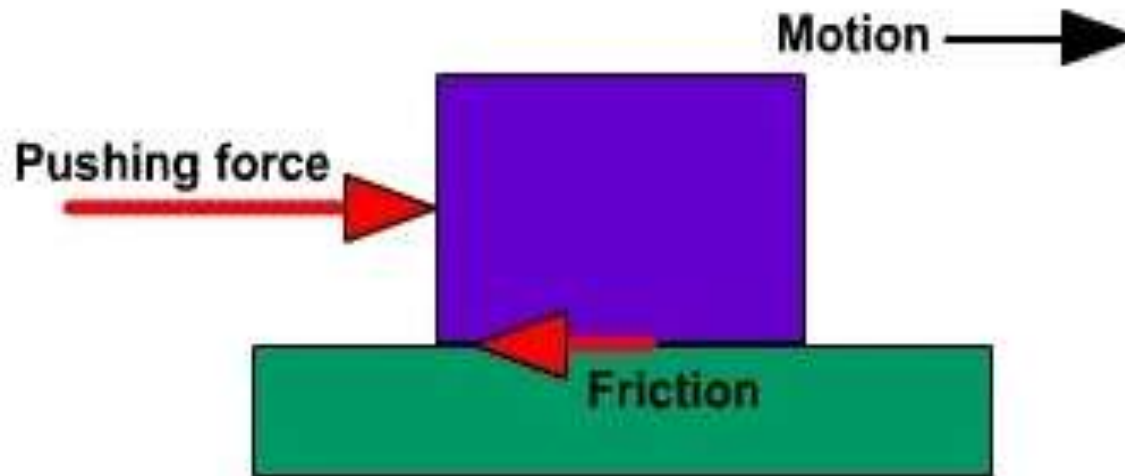
Here in the second image, you can see that the group on the left is now pulling with a force of 400N, greater than the group on the right who are pulling with a force of 300N. The resultant force will be 100N ($400\text{N} - 300\text{N}$),

Therefore the group on the right will move in the left direction.



MEANING OF FRICTION

Friction is a force that resists the motion of an object that is in contact with another object or material. This force opposes the relative motion between two surfaces that are in contact.



Try and move your Hand over your desk. Now move it in air, which one is easier? Or in which do you use less force? It will be noticed that your hand has contact with your desk therefore; its motion is more difficult than when in the air where there is no contact with your hand.

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ADVANTAGES OF FRICTION

1. Walking (locomotion): It is difficult to walk on slippery ground floor, the friction on it is very small. Therefore, one can walk on the ground easily because there is friction between one's feet and the ground. Smooth surfaces such as a tiled polished floor and plastic carpets are slippery because of low friction. Rough surfaces like rough cement floors have high frictional force and hence are not slippery. They are easy to walk on. Compare the movement of a car on wet slippery road and on a dry road.



2. Friction belt: It is easy to derive a mechanism with the help of friction between the belt and the part of machine affected. For example, the friction that exists between the fan belt and fan allows the fan to operate in order to cool the radiator of a car.
3. Grindstone: A cutlass, knife or any other sharp edge can be sharpened by the use of a grindstone. The friction between the grindstone and these tools will allow the tools to be sharpened. Another example of this is a file used to smoothen or cut through hard surfaces. The file can operate by the use of friction.



4. Ladder: A ladder positioned against a vertical wall will not slide because of the friction between the floor on which it stands and the foot of the ladder.
5. Tyre: The grip of the tyre on the road allows a car to move without skidding and this is caused by the friction between the tyre and the road.
6. Brake: Friction between the brake drum and the brake lining of an automobile brings the automobile to a halt when they come in contact.



7. Bolt and nut: Two pieces of metal can stay together when bolts and nuts are used because of the friction built up between the bolts and nuts when they are tightened. The same principle applies to two pieces of wood which can be held together by nails, the friction between the nail and the pieces of wood allows for that.



DISADVANTAGES OF FRICTION

1. It produces heat in various parts of machines and causes useful energy to waste in form of heat energy.
2. Due to friction, we have to apply more power in machines.
3. It opposes the motion.
4. Due to friction noise is also produces in machines.
5. Friction causes automobile engines to consume more fuel, which leads to loss of money.



EVALUATION

1. List and define any three type of contact force.
2. Define gravitational forces.
3. What is friction?
4. What is the condition required for forces to be balanced?
5. Give two uses of friction.



**THANK YOU
FOR WATCHING**