

Chapter 11

FORCES AND THEIR EFFECTS

11.1 WHAT IS FORCE ?

- **Force:**
- A **force** is a push or pull upon an object resulting from the object's interaction with another object. Whenever there is an interaction between two objects, there is a **force** upon each of the objects. When the interaction ceases, the two objects no longer experience the **force**.
- Push or pull of an object is considered a force. Push and pull come from the objects interacting with one another. Terms like stretch and squeeze can also be used to denote force.

<https://www.youtube.com/watch?v=IJWEtCRWGvI>



Effects and unit of forces

Effects :

In physics, motion is defined as the change in position with respect to time. In simpler words, motion refers to the movement of a body.

Typically, motion can either be described as:

- 1.Change in speed
- 2.Change in direction

The Force has different effects and here are some of them.

- Force can make a body which is at rest to move.
- It can stop a moving body or slow it down.
- It can accelerate the speed of a moving body.
- It can also change the direction of a moving body along with its shape and size.

ACTIVITY
SEARCH CRUMPLED
ZONES OF CARS.

11.2 MEASURING FORCE

The **newton** (symbol: **N**) is the [International System of Units](#) (SI) derived unit of force. It is named after Isaac Newton .

Eg: Place an object with the mass of 100g n your palm. The force of apple acting on your palm is 1N.

A **spring scale** or **spring balance** or **newton meter** is a type of mechanical force gauge or weighing scale. It consists of a spring fixed at one end with a hook to attach an object at the other. It works by [Hooke's Law](#), which states that the force needed to extend a spring is proportional to the distance that spring is extended from its rest position. Therefore, the scale markings on the spring balance are equally spaced. A spring scale cannot measure mass, only weight.

<https://study.com/academy/practice/quiz-worksheet-characteristics-of-a-newton.html>



11.2 MEASURING FORCE

The force applied is always in a direction and it is represented by arrows known as vectors.

Example 1: Two forces applied in the same direction, with force B stronger than force A

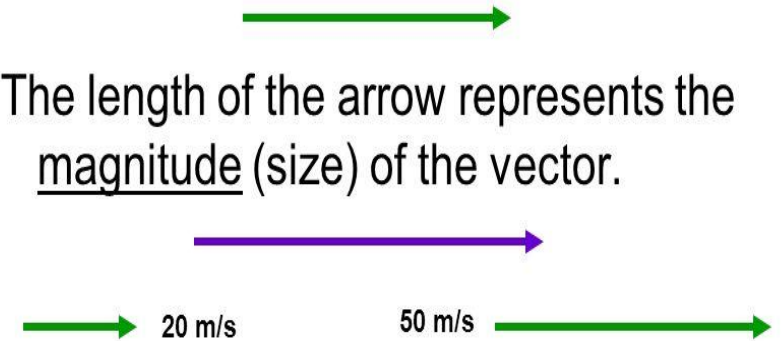


Example 2: Two forces applied in opposite directions, with force B equal to force A



Vectors are represented by arrows.

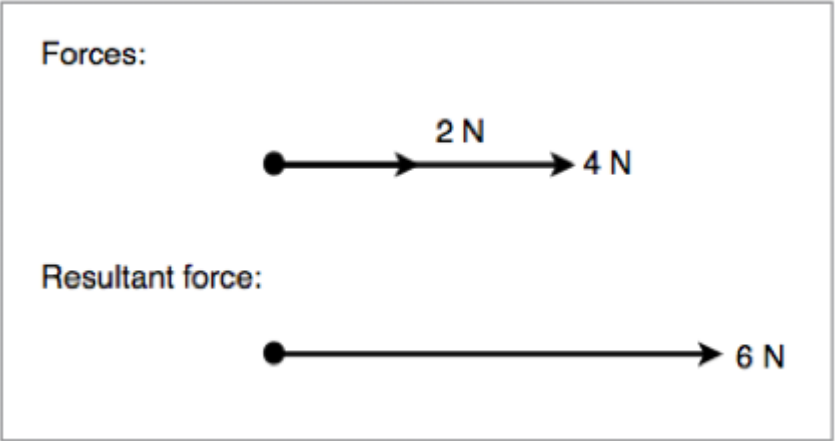
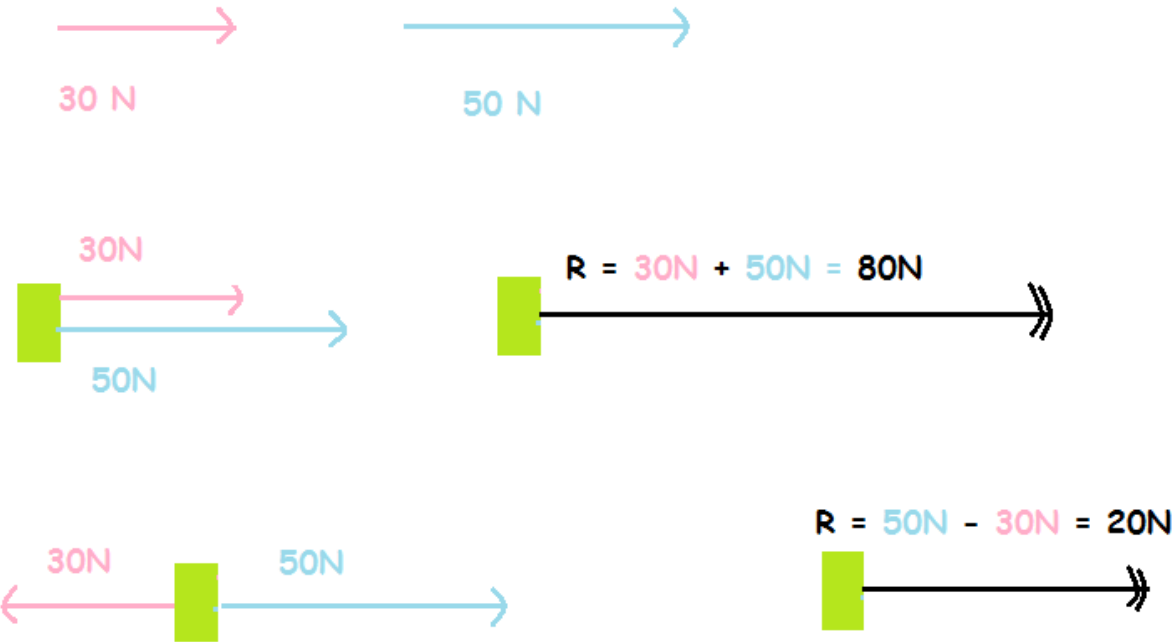
The length of the arrow represents the magnitude (size) of the vector.



And, the arrow points in the appropriate direction.



If two forces act in the same direction the resultant force is the sum of each individual force acting in the same direction



How much force is acting on the object and it will move to which direction?

Left or right ?

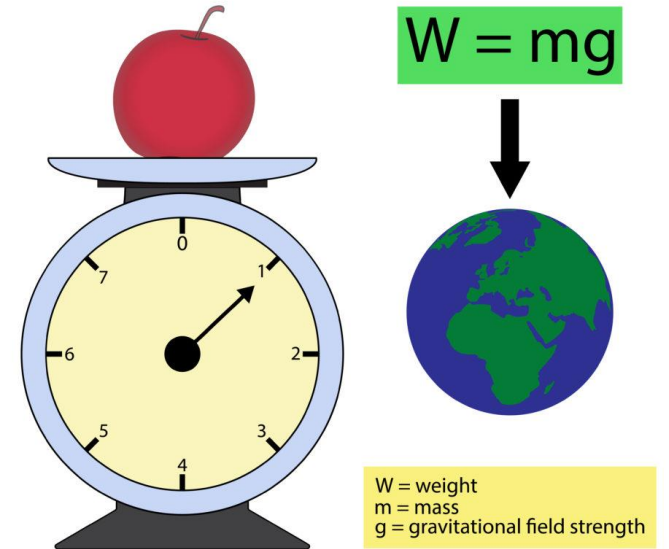


11.3 GRAVITATIONAL FORCES AND WEIGHT

Gravity is the force by which a planet or other body draws objects toward its center. The force of gravity keeps all of the planets in orbit around the sun. Gravity of Earth is 10 m/sec^2 .

Weight : The weight of an object is defined as the force of gravity on the object and may be calculated as the mass times the acceleration of gravity, $w = mg$. Since the weight is a force, its SI unit is the newton.

Mass is a measurement of how much matter is in an object. It is measured in kg



If an object has a mass of 1 kg on the earth, it would have a mass of 1 kg on the moon, even though it would weigh only one-sixth as much.

Weight
Calculation

<https://spaceplace.nasa.gov/what-is-gravity/en/>

Difference between the mass and weight:

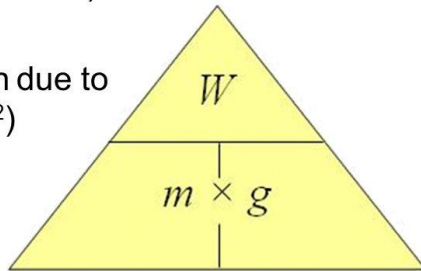
Mass:	Weight:
<ol style="list-style-type: none"><i>1. The quantity of matter in a body is called mass</i><i>2. Mass is scalar quantity.</i> <i>3. Mass of a body is always constant everywhere in the universe.</i> <i>4. Mass of a moving body is $m = F/a$</i><i>5. Mass can be determined by ordinary balance.</i><i>6. Unit of mass in S.I system Kilogram (Kg)</i>	<ol style="list-style-type: none"><i>1. Weight is the force by which the Earth attracts towards its center</i><i>2. Weight is vector quantity and is always directed towards the center of the earth.</i><i>3. Weight of a body vary place to place and become zero on the center of the earth and far away from the earth surface</i><i>4. Weight of a body is $W=mg$</i><i>5. Weight of a body is measured by spring balanced.</i><i>6. Unit of weight in S.I system Newton (N)</i>

<https://www.youtube.com/watch?v=Y8-T8RouhPA>

Relation between weight mass and gravity

Weight, Mass and Gravity

- $w = m \times g$
- w – Weight (Newtons)
- m – Mass (kg)
- g – acceleration due to gravity (10 m/s^2)



Q: Alina is doing her business calculations she needs the estimate of the weight of a box of 5000 g after including the pull of gravity of 10 N.

DATA :

$$m = 5000/1000 \quad (1000\text{g}=1\text{kg})$$

$$= 5\text{kg}$$

(Changing the grams to kilograms as mass is measured in kgs)

$$g = 10$$

$$W = ?$$

SOLUTION

$$W = mg$$

$$W = 5 \times 10$$

$$= 50 \text{ N}$$

ANS: 50 N

11.4 UPTHRUST AND DENSITY

Upthrust

the upward force that a liquid or gas exerts on a body floating in it.

Density is a measurement that compares the amount of matter an object has to its volume. An object with much matter in a certain volume has high **density**. An object with little matter in the same amount of volume has a low **density**. **Density** is found by dividing the mass of an object by its volume.

$$\rho = \frac{m}{v}$$

density mass
volume

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

<https://www.youtube.com/watch?v=nMIXU97E-uQ>

<https://www.youtube.com/watch?v=vSXTBnnx4OA>

11.5 frictional forces

Friction

Friction is a force **between two surfaces** that are sliding, or trying to slide, across each other. For example, when you try to push a book along the floor, friction makes this difficult.

Friction always works in the direction **opposite** to the direction in which the object is moving, or trying to move.
Friction always **slows** a moving object down.



Ice causes very little friction, which is why it is easy to slip over on an icy day. However, this is a good thing for ice skating and sledging

<https://www.bbc.co.uk/bitesize/topics/zsxxsbk/articles/zxqrdxs>

Reducing friction

There are a number of ways to reduce friction:

- Make the surfaces smoother. Rough surfaces produce more friction and smooth surfaces reduce friction.
- Lubrication is another way to make a surface smoother.
- Make the object more streamlined.
- Reduce the forces acting on the surfaces.
- Reduce the contact between the surfaces.
- Roll the bodies instead of sliding them. If they are flat attach wheels on them.

QUIZ

<https://www.bbc.co.uk/bitesize/guides/z3w3h39/test>

THANK YOU

<https://www.youtube.com/watch?v=05WkCPORlj4>