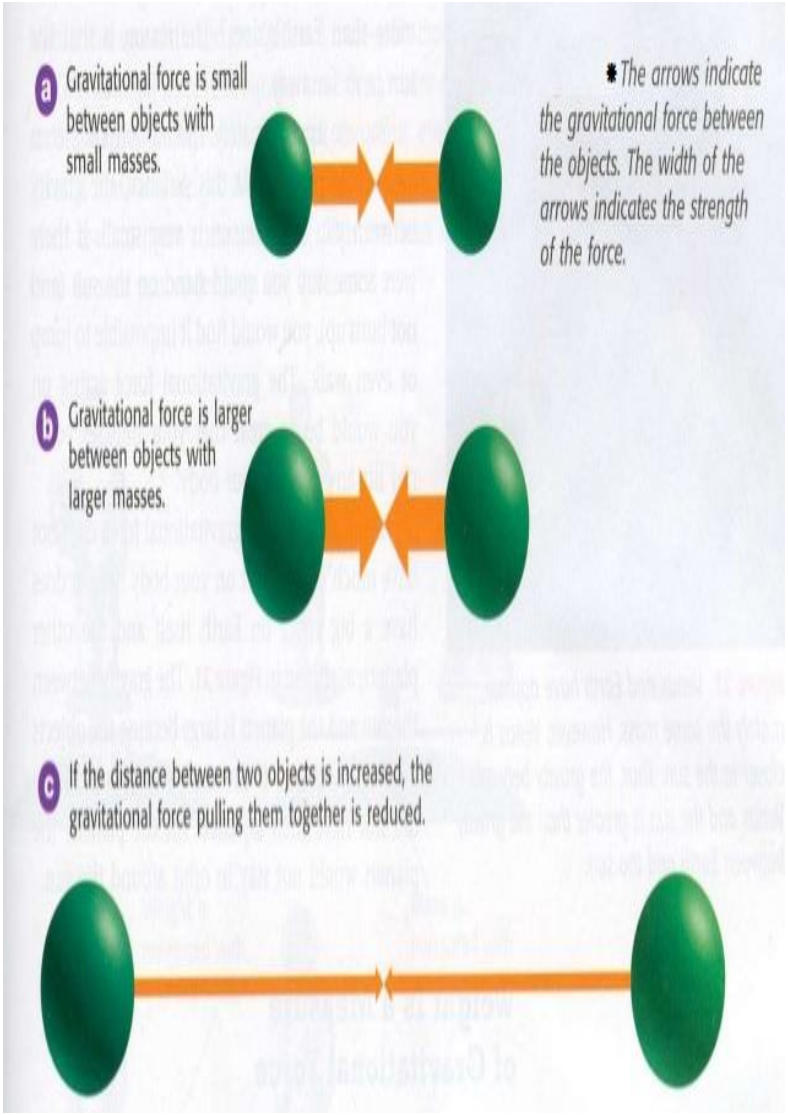
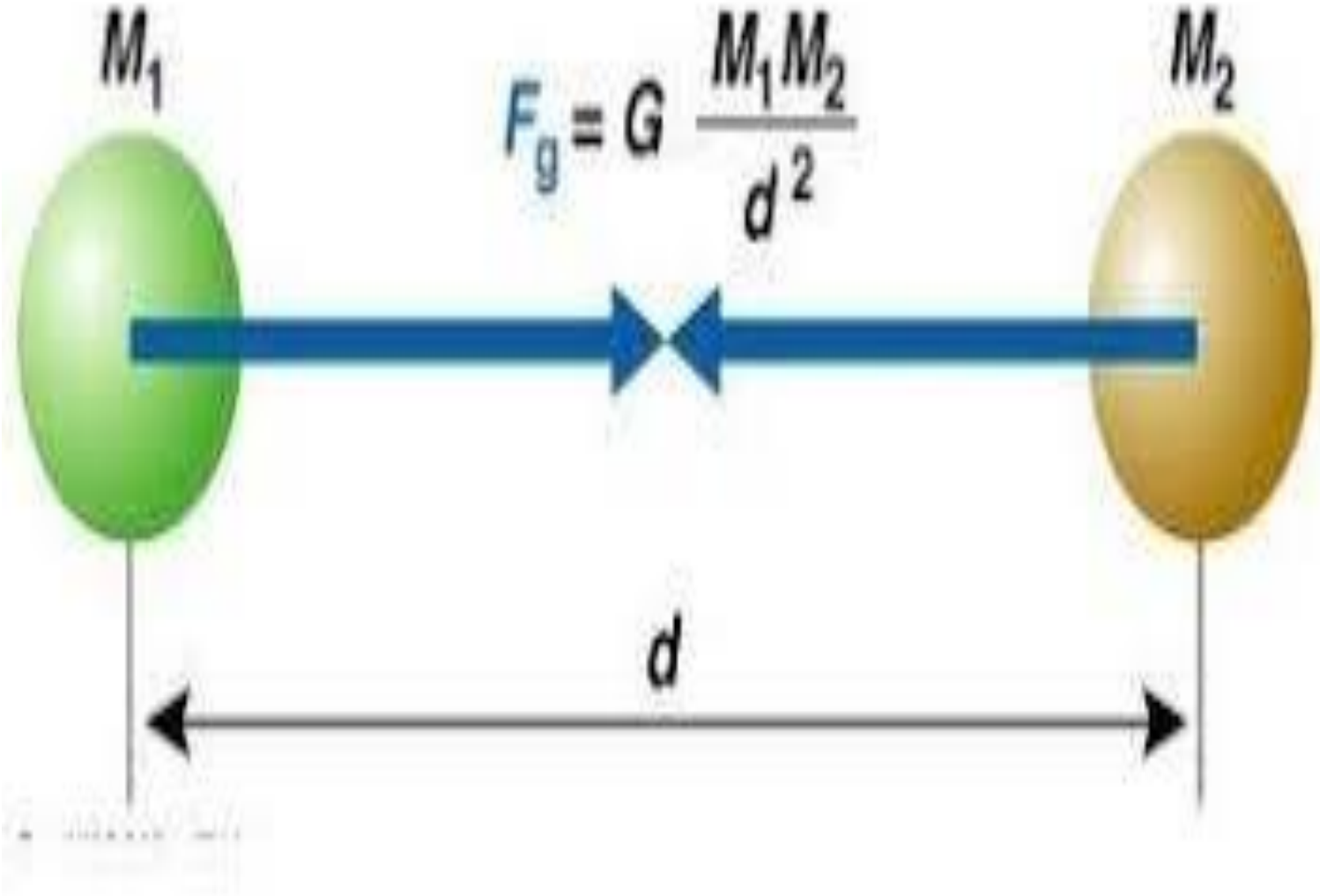
# CH-10
# GRAVITATION

## Gravitation




- All objects in the universe attract each other. This force of attraction between objects is called the gravitational force.
- Universal Law of gravitation- Every object in the universe attracts every other object with a force which is proportional to the product of their masses and inversely proportional to the square of the distance between them. The force is along the line joining the centres of two objects.


$M_1$
$F_g = G \frac{M_1 M_2}{d^2}$
$M_2$
$d$

# Importance of the universal law of gravitation

- The force that binds us to the earth
- The motion of the moon around the earth
- Motion of planets around the sun
- the tides due to the moon and the Sun.

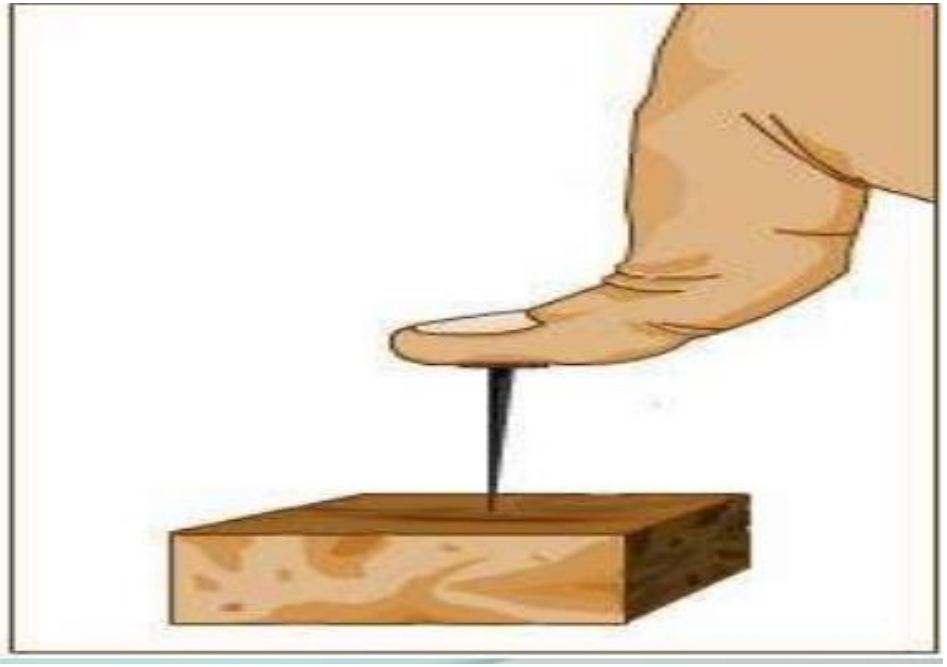
# Acceleration due to Gravity

- Whenever objects fall towards the earth under this Gravitational force alone it is termed as free fall.
- While falling, there is no change in the
- direction of motion of the objects. But due to the earth's attraction, there will be a change in the magnitude of the velocity. Any change in velocity involves acceleration. Whenever an object falls towards the earth, an acceleration is involved. This acceleration is due to the earth's gravitational force
- Acceleration due to gravity $g=GM/R2$

| Mass | Weight |
| --- | --- |
| • is measured in kilograms | • is measured in Newtons |
| • always remains the same | • can change with location |
| • is closely related to inertia | • is closely related to gravity |
| • can NOT be measured directly | • can be measured directly using a scale |

# Thrust

- The force applied on a surface perpendicular to the surface is called thrust.



# Pressure

- Pressure=Thrust/Area
- Its SI Unit is Pascal
- *THE SAME FORCE ACTING ON A SMALLER AREA EXERTS A LARGER PRESSURE, AND A SMALLER PRESSURE ON A LARGER AREA*

# Everyday Observation

- School Bags have wide straps- so that the area is increased and the pressure is reduced.
- Sharp knife is better than a blunt knife- so that when the same force is applied on smaller area it produces larger pressure.
- Tractor have broad tyres- force on larger area produces less pressure.

- ***ALL LIQUIDS AND GASES ARE FLUIDS.***
- ***A SOLID EXERTS PRESSURE ON A SURFACE DUE TO ITS WEIGHT. SIMILARLY, FLUIDS HAVE WEIGHT AND THEY ALSO EXERT PRESSURE ON THE BASE AND WALLS OF THE CONTAINER IN WHICH THEY ARE ENCLOSED***

# ARCHIMEDES' PRINCIPLE

- *When a body is immersed fully or partially in a fluid, it experiences an upward force that is equal to the weight of the fluid displaced by it.*

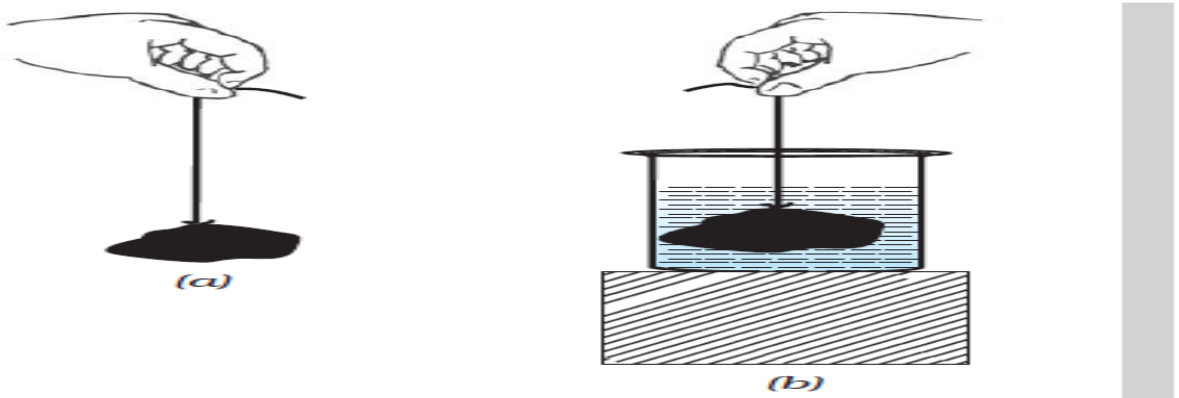



**Fig. 10.6:** *(a) Observe the elongation of the rubber string due to the weight of a piece of stone suspended from it in air. (b) The elongation decreases as the stone is immersed in water.*

# Applications of Archimedes Principle

- IT IS USED IN DESIGNING SHIPS ANS SUBMARINES
- LACTOMETERS, WHICH ARE USED TO DETERMINE THE PURITY OF MILK USES THIS PRINCIPLE
- HYDROMETERS USED FOR DETERMINING DENSITY OF LIQUIDS IS BASED ON THIS PRINCIPLE.

# Relative Density

- It is often convenient to express density of a substance in comparison with that of water. The relative density of a substance is the ratio of its density to that of
- Since the relative density is a ratio of similar quantities, it has no unit.

# *THANK YOU*