

### 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 b/w them.  
 $6.673 \cdot 10^{-11} \text{Nm}^2\text{kg}^{-2}$ ; Henry Cavendish using a sensitive balance.

### IMPORTANCE

force that binds us to earth; motion of moon around earth; motion of planets around sun; tides due to moon and sun.

### ACCELERATION DUE TO GRAVITY

acceleration experienced by a freely falling object towards the centre of the earth.  $9.8 \text{ m/s}^2$ .  
 $E^R > P^R = E^g < P^g$

**free fall:** it is the object falling towards the earth under the influence of attraction force earth/gravity.

### MASS ^ WEIGHT

quantity/amount of matter present in an object	force by which earth attracts an object
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scalar quantity	vector quantity
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SI unit: kg	SI unit: N
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remains constant everywhere	changes as gravity changes
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can never be 0	0 at the centre of earth
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$$W^M = 1/6 W^E$$

### CELESTIAL BODIES: MASS & RADIUS

earth	$5.98 \cdot 10^{24} \text{kg}$	$6.37 \cdot 10^6 \text{m}$
moon	$7.36 \cdot 10^{22} \text{kg}$	$1.74 \cdot 10^6 \text{m}$

### THRUST

force acting on an object perpendicular to the surface.

### PRESSURE

thrust on unit area. SI unit: Pa or  $\text{N/m}^2$

### BUOYANT FORCE OR UPTHURST

tendency of fluids to exert upward force on an immersed object.

#### factors affecting buoyant force

volume of the object immersed in fluid

density of fluid

acceleration due to gravity

temperature of fluid<sup>inversely proportional</sup>

#### FLOAT:

upthrust > weight of object

$$d_{\text{fluid}} > d_{\text{object}}$$

#### SINK:

upthrust < weight of object

$$d_{\text{fluid}} < d_{\text{object}}$$

density of substance is the mass per unit volume.

### 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. used in designing submarines & ships, lactometers & hydrometers.

lactometers: determine the purity if a sample of milk.

hydrometers: determine the density of liquids.



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Not published yet.  
 Last updated 24th January, 2023.  
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