# WORKSHEET 1

## CHAPTER 4 – GRAVITATION

### A. Tick (✓) the correct option.

1. Every planet revolves around the sun in a/an
   a. spherical orbit. b. square orbit. c. rectangular orbit. d. elliptical orbit.
2. The atmosphere is held to the earth by
   a. gravity. b. wind. c. clouds. d. earth's magnetic field.
3. The gravitational force between two bodies is
   a. always repulsive. b. always attractive.
   c. attractive only at large distances. d. repulsive only at large distances.
4. While climbing up a hill, a man should
   a. remain straight. b. lean backward. c. lean forward. d. keep feet wide apart.
5. The value of acceleration due to gravity on the earth is $g$, then the corresponding value on the moon is
   a. $g$. b. $g/6$ c. $6g$. d. $g/3$

### B. Fill in the blanks.

1. Universal Gravitational Constant ($G$) is a _____ quantity.
2. _____ showed that all bodies, whether light or heavy, fall at the same speed towards the earth.
3. 1 kilogram force = _____ gram force
4. Acceleration due to gravity ($g$) is _____ at the centre of the earth.
5. Acceleration due to gravity, $g$ is taken as _____ when a body is thrown vertically upwards.

### C. State whether the following statements are true or false.

1. The force which is needed to make an object travel in a circular path is called electrostatic force.
2. Average value of 1 kgf is taken as 9.8 N.
3. Mass and weight are the same physical quantities and can be measured either with a physical balance or a spring balance.
4. When a body is thrown vertically upwards its final velocity, $v$ becomes zero.
5. Any two objects in the universe attract each other with a force called gravitation.

### D. Match the following.

| | |
|---|---|
| 1. SI unit of mass | newton |
| 2. CGS unit of mass | kilogram |
| 3. SI unit of weight | gram |
| 4. Gravitational unit of force | m $s^{-2}$ |
| 5. SI unit of acceleration due to gravity | kilogram force |

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Class: IX Date: .....

## E. Answer the following questions.

### Very short answer questions

1. On which place of the earth, the weight of body is zero?
2. In which direction the force of gravitational attraction acts?

### Short answer questions

1. State three characteristics of weight.
2. State three characteristics of mass.

### Long answer questions

1. What is universal law of gravitation? Explain briefly.
2. What is free fall? Explain briefly.

# ANSWERS

## WORKSHEET 1

### A. Tick (✓) the correct option.

1. d
2. a
3. b
4. c
5. b

### B. Fill in the blanks.

1. scalar
2. Galileo
3. 1000
4. zero
5. negative

### C. State whether the following statements are true or false.

1. F
2. T
3. F
4. T
5. T

### D. Match the following.

| | |
|---|---|
| 1. SI unit of mass | kilogram |
| 2. CGS unit of mass | gram |
| 3. SI unit of weight | newton |
| 4. Gravitational unit of force | kilogram force |
| 5. SI unit of acceleration due to gravity | $m\ s^{-2}$ |

### E. Answer the following questions.

**Very short answer questions**

1. At the centre of earth, the weight of body is zero because at the centre of earth acceleration due to gravity is zero.
2. The force of gravitation acts along the line joining the centres of the two bodies.

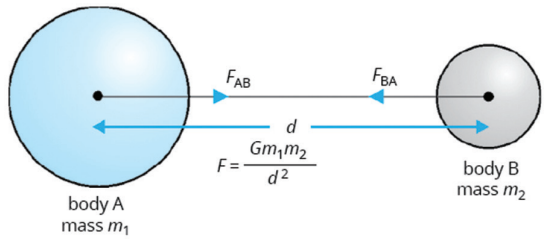
**Short answer questions**

1. Three characteristics of weight are as follows:
   i. Weight is a vector quantity.
   ii. Weight is the force with which the earth attracts the body.
   iii. Weight changes from place to place on the surface of the earth and its value is maximum at the poles.
2. Three characteristics of mass are as follows:
   i. Mass is a scalar quantity.
   ii. Mass is a measure of the quantity of matter contained in the body.
   iii. Mass remains constant at all the places. There is no place where mass of the body is zero.

**Long answer questions**

1. **Every body in the universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. The force acts along the line joining the centres of the two bodies.**

Consider two bodies A and B of masses $m_1$ and $m_2$ respectively that have a distance $d$ between their centres as shown in Figure. Let the force of attraction between the two bodies be $F$.




The gravitational force acts along the line joining the centres of the two bodies A and B.

According to Newton's Universal Law of Gravitation, the magnitude of force between the two bodies is directly proportional to the product of their masses, i.e.

$$F \propto m_1 m_2 \quad \ldots (1)$$

and also the magnitude of force between the two bodies is inversely proportional to the square of the distance between them, i.e.

$$F \propto \frac{1}{d^2} \quad \ldots (2)$$

Combining equations (1) and (2), we get

$$F \propto \frac{m_1 m_2}{d^2} \quad \ldots (3)$$

or

$$F = G\frac{m_1 m_2}{d^2} \quad \ldots (4)$$

where $G$ is a constant of proportionality and is called the **Universal Gravitational Constant**.

2. Whenever objects fall towards the earth only under the gravitational force of the earth (with no other forces acting on it), we say the objects are in the state of free fall.

Suppose we drop a coin and a feather from the same height simultaneously, which of the two will reach the ground earlier? We will see that coin reaches the ground earlier than feather. Coin is heavier than the feather, so we may conclude that heavier objects fall faster than lighter ones. Such a conclusion is not correct. Galileo showed that all bodies, whether light or heavy, fall at the same speed towards the earth. Galileo dropped two stones of different masses simultaneously from the Leaning Tower of Pisa (Italy) and found that they reached the ground simultaneously.

Galileo argued that air offers resistance to the objects travelling through it. If the material is dense and its surface area is small, the resistance due to air is quite small compared to a material having larger surface area.