**CBSE Test Paper 04**

**Chapter 10 gravitation**

1. What is ratio of the force of gravitation between two mases $m^1$ and $m^2$ kept at a distance R on the Earth and on the moon? **(1)**
   a. 1:1
   b. none of these
   c. 1:6
   d. 6:1

2. What is the force of gravitation between two point masses of 1kg and 2kg kept 1 m apart? **(1)**

   a. $12.6 \times 10^{-11}\text{N}$
   b. $12.6 \times 10^{-10}\text{N}$
   c. $13.34 \times 10^{-10}\text{N}$
   d. $13.34 \times 10^{-11}\text{N}$

3. Match the following with correct response. **(1)**

| Column A | Column B |
|---|---|
| (1) Mass is measured by | (A) Spring balance |
| (2) Weight is measured by | (B) Hydrometer |
| (3) Purity of milk | (C) Lactometer |
| (4) Density of liquid | (D) Beam balance |

   a. 1-A, 2-C, 3-B, 4-D
   b. 1-B, 2-D, 3-A, 4-C
   c. 1-D, 2-A, 3-C, 4-B
   d. 1-C, 2-B, 3-D, 4-A

4. While determining the density of a copper piece using a spring balance and a measuring cylinder, Seema carried out the following procedure.

   i. Noted the water level in the measuring cylinder without the copper piece.

ii. Immersed copper piece in water
iii. Noted the water level in the measuring cylinder
iv. Removed the copper piece from the water and immediately weighted it using a spring balance.

The wrong step in the procedure is: **(1)**

a. (iv)
b. (ii)
c. (iii)
d. (i)

5. Even though stone also attracts earth towards itself, earth does not move :- **(1)**

a. Force exerted by stone is less
b. Because of lesser mass of stone
c. Because of greater mass of earth
d. Force exerted earth is large

6. Match the following with correct response. **(1)**

| **Column A** | **Column B** |
|---|---|
| (1) Universal law of gravitation | (A) Weight |
| (2) Gravitation force between the earth and an object | (B) density |
| (3) Thrust per unit area | (C) Pressure |
| (4) Mass per unit volume | (D) Motion of moon around the earth |

a. 1-C, 2-B, 3-D, 4-A
b. 1-B, 2-D, 3-A, 4-C
c. 1-D, 2-A, 3-C, 4-B
d. 1-A, 2-C, 3-B, 4-D

7. If cross - sectional area of an object is more than the pressure applied by the external force is :- **(1)**

a. Less
b. More
c. None of the above.
d. Remains same

8. What is weightlessness? **(1)**

9. State Archimedes Principle? **(1)**

10. Explain the universal law of gravitation. **(1)**

11. If the mass of one object is doubled and mass of other remains the same and if distance between them is halved then how does the gravitational force change? **(3)**

12. A boy on a cliff 49 m high drops a stone. One second later, he throws a second stone after the first. They both hit the ground at the same time. With what speed did he throw the second stone? **(3)**

13. Why is the weight of an object on the moon $1/6^{th}$ its weight on the earth? **(3)**

14. Why is it difficult to hold a school bag having a strap made of a thin and strong string? **(3)**

15. What is the magnitude of the gravitational force between the earth and a 1 kg object on its surface? (Mass of the earth is $6 \times 10^{24}$ kg and radius of the earth is$6.4 \times 10^{6}$ m). **(5)**

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**Answers**

1. a. 1:1

   **Explanation:** Force of gravitation is equal to product of masses divided by square of the distance between them. So, force of gravitation between two bodies will be same irrespective of their place. Ratio will be 1:1.

2. d. $13.34 \times 10^{-11}\text{N}$

   **Explanation:** Gravitational force = $G.m_1 x m_2/d^2$

   =$= \frac{6.67\times10^{-11}\times1\times2}{1^2}$

   = $13.34 \times 10^{-11} N.$

3. c. 1-D, 2-A, 3-C, 4-B

   **Explanation:** Column B is paired in accordance with the instruments for the measurement of quantities in column A

4. a. (iv)

   **Explanation:** Water drops left out will show more weight.

5. c. Because of greater mass of earth

   **Explanation:** Acceleration is inversely proportional to mass according to Newtons 3rd law of motion.

   So a small stone produces large acceleration.Due to large acceleration of stone, it falls towards Earth.

6. c. 1-D, 2-A, 3-C, 4-B

   **Explanation:**

   i. The universal law of gravitation successfully explained several phenomena which were believed to be unconnected: the force that binds us to the earth; the motion of the moon around the earth; the motion of planets around the Sun; and the tides due to the moon and the Sun.

   ii. The weight of an object is the gravitational force between the object and the Earth.

   iii. The force acting (thrust) per unit area is called pressure.

iv. The density of a liquid is the ratio of the mass per unit volume of the material on the water mass per unit volume.

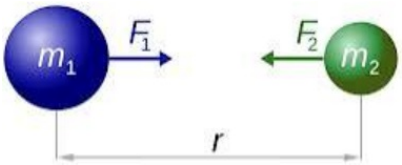
7. a. Less

   **Explanation:** Pressure is inversely proportional to cross- sectional area.

8. It is a state when objects do not weigh anything. This occurs when bodies are in a state of free fall under the effect of gravity.

9. According to Archimedes Principle when a body is partially or completely immersed in a fluid at rest is acted upon by an upward, or buoyant, force the magnitude of which is equal to the weight of the fluid .

10. Everybody in this 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 distance between their centres.




$F_1 = F_2 = G\frac{m_1 \times m_2}{r^2}$

11. Let $M_1$ = Mass of first object

    $M_2$ = Mass of second object

    R = Distance between the two objects

    G = Universal Gravitational constant

    F = Gravitational force.

    $F_1 = \frac{GM_1M_2}{R^2} \rightarrow 1)$

    $\text{Now}, \text{M}_1^1 = 2M_1$

    $M_1^1, M_2^1 \rightarrow \text{NewMasses}$

    $\text{R}^1 \rightarrow \text{NewDistance}$

    $\text{M}_2^1 = M_2$

    $R^1 = \frac{R}{2}$

    $So, F_2 = G \times 2$

    $\text{F}_2 = \text{Newforce}$

    $\text{F}_2 = \frac{GM_1^1M_2^1}{R^{12}}$

$$F_2 = \frac{G2M_1M_2}{\left(\frac{R}{2}\right)^2}$$

$$F_2 = \frac{8GM_1M_2}{R^2}$$

Using equal 1)

$$F_2 = 8F_1$$

12. For the first stone, we are given,

    u = 0 $ms^{-1}$, h = 49 m

    Using the relation, S = ut + $\frac{1}{2}$ $at^2$ we have

    49 = 0 $\times$ t + $\frac{1}{2}$ $\times$ 9.8 $\times$ $t^2$ $\Rightarrow$ $t^2$ = $\frac{98}{9.8}$ = 10 $\Rightarrow$ t = $\sqrt{10}$ = 3.16 s

    So, the first stone would take 3.16 s to reach the ground.

    For the motion of the second stone: The second stone was thrown one second after the first stone. But, both the stones reach the ground at the same time. Thus, the time taken by the second stone to reach the ground is one second less than that taken by the first stone. So,

    $t_2$ = t - 1 = (3.16 - 1) s = 2.16 s

    Hence for the second stone, we have

    U =? $ms^{-1}$, g = 9.8 $ms^{-2}$, h = 49, t = 2.16 s

    Using S = ut + $\frac{1}{2}$ $at^2$ we have

    49 = u $\times$2.16 + $\frac{1}{2}$ $\times$ 9.8 $\times$ $(2.16)^2$ $\Rightarrow$ 49 - 22.86 = 2.16 u

    or 26.14 = 2.16 u $\Rightarrow$ $\frac{26.14}{2.16}$ = 12.10 $ms^{-1}$

    Thus, the second stone was thrown downward with a speed of 12.1 $ms^{-1}$.

13. Gravity is directly related to mass. The more mass an object has, the more gravitational pull it has.

    Now, the moon is significantly smaller than the earth (in fact, it is about the size of the earth's core). Gravity is dependent on the size of the object. Your weight on the moon is 1/6 of that on earth because the moon has 1/6 the mass of the earth.

    Since we know

    $$W = m \times g$$

    Mass of object remains the same whether on earth or moon but the value of acceleration on moon is $1/6^{th}$ of the value of acceleration on earth. Because of this

weight of an object on moon is $1/6^{th}$ its weight on the earth.

14. It is difficult to hold a school bag having a thin strap because the pressure on the shoulders is quite large. This is because the pressure is inversely proportional to the surface area on which the force acts. The smaller is the surface area the larger wold be the pressure on the surface. In the case of a thin strap, the contact surface area is very small. Hence pressure exerted on the shoulder is very large.

15. $F_{gravitation} = \frac{G \times M_e \times m_o}{r^2}$

$= \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 1}{(6.4 \times 10^6)^2}$
$= \frac{6.67 \times 6 \times 10^{-11+24}}{6.4 \times 6.4 \times 10^{12}}$
$= \frac{6.67 \times 6}{6.4 \times 6.4} \times 10^{-11+24-12}$
$= 0.9770 \times 10N = 9.770N$