CBSE Test Paper 02

Chapter 10 Gravitation

1. Which of the following is an application of Earth's gravitation **(1)**

   A It holds atmosphere around our globe.

   B It holds us firmly on the surface of the Earth.

   C It is responsible for motion of moon.

   D It is responsible for sea tides due to the moon.

   a. (a), (b) and (c) are correct
   b. (a) and (b) are correct
   c. All of these
   d. (b) and (c) are correct

2. The formula for finding the volume of a spherical body is : **(1)**

   a. $\frac{4}{3}\pi r^3$
   b. $\frac{3}{4}\pi r^2$
   c. $\frac{3}{4}\pi r^3$
   d. $\frac{4}{3}\pi r^2$

3. The density of salty solution of water as compared to the density of pure water is always **(1)**

   a. less
   b. same
   c. dependent upon amount of salt added
   d. more

4. If Ge is the value of universal gravitational constant at the Earth and Gm is the value of universal gravitational constant on the moon then **(1)**

   a. Ge > Gm
   b. Ge < Gm
   c. Ge = 6Gm
   d. Ge = Gm

5. Drop an iron nail and a sheet of paper from the roof of your house. Which of the two will reach the ground first? **(1)**

   a. an iron nail

b. both simultaneously
c. sheet of paper
d. neither sheet of paper nor iron nail

6. While determining the density of the material of metallic sphere using a spring balance and measuring cylinder a student noted the following readings. **(1)**
   1. Mass of the sphere = 81g
   2. i. Reading of water level in the cylinder without sphere = 54 mL
      ii. Reading of water level in the cylinder with sphere = 63 mL
   3. On the basis of these observations the density of the material of the sphere is :

   a. 9000 kg m-3
   b. 6000 kg m-3
   c. 7000 kg m-3
   d. 1500 kg m-3
7. If we want to determine the volume of a solid by immersing it in water, the solid should be **(1)**
   a. heavier than water and insoluble in it
   b. lighter than water
   c. heavier than water
   d. insoluble in water
8. If the moon attracts the earth, why does the earth not move towards the moon? **(1)**
9. A man's weight when taken at the poles is 600N. Will is weight remain the same when measured at the equator? Will there be an increase or decrease is his weight? Explain.**(1)**
10. What do you understand by the gravitational force of earth and weight? **(1)**
11. The volume of 50 g of a substance is $20cm^3$. If the density of water is $1gcm^{-3}$, will the substance float or sink? **(3)**
12. Show that if mass of two bodies are equal, their weights will be same in whichever part of universe it may be measured? **(3)**
13. Define Pressure? How is thrust different from Pressure? **(3)**
14. Camels can walk easily on a desert sand but we are not comfortable on walking on the desert sand. State the reason. **(3)**
15. Derive an expression for the force of attraction between two bodies and then define gravitational constant. **(5)**

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Answers

1. c. All of these

   Explanation: Gravitational force although invisible or rarely felt but it holds all the bodies and earth atmosphere firmly. It is also responsible for the revolution of the moon around the earth. Gravity is also the cause of tides.

2. a. $\frac{4}{3}\pi r^3$

   Explanation: Volume of a spherical body is $\frac{4}{3}\pi r^3$

3. d. more

   Explanation: Because it has more mass in a given volume.

4. d. Ge = Gm

   Explanation: As Universal gravitational constant remain same throughout the universe. The value of Gm and Ge will be same. So, Ge= Gm.

5. a. an iron nail

   Explanation:

   Although the force by which iron nail and a sheet of paper is attracted towards the earth is equal. The more air friction is faced by sheet of paper due to larger size. So, iron nail will reach the ground first.

6. a. 9000 kg m^{-3}

   Explanation: Density = $\frac{Mass}{volume} = \frac{81}{63-54} = \frac{81}{9}$ = 9 gcm^3 = 9000 kg m^{-3}

7. a. heavier than water and insoluble in it

   Explanation: It should be heavier than water and insoluble in it, so that it sinks and displaces the water and also it does not mix in the water.

8. The Earth and the Moon experience equal gravitational forces from each other.However the mass of the Earth is much larger than the mass of the moon.Hence it accelerates at a rate lesser than the acceleration rate of the moon towards the Earth.For this reason Earth does not move towards the moon.
9. No, his weight will not remain same as that at the poles. There will be a decrease in his

weight at the equator. As the radius of the earth increase from the poles to the equator, the value of 'g' becomes greater at poles decreasing towards equator. Also, the force of gravity decrease from poles to the equator.

10. Gravitational force of earth is the force by which earth exerts on any object towards itself.
    Weight is the force which the object exerts on the earth.
11. If the density of the object is more than the density of the liquid,then it sinks in the liquid.On the other hand,if the density if less than the density of the liquid than it floats.
    Density of that substance (d) = mass/volume = 50/20 = $2.5g/cm^3$
    Since the density of substance (2.5) is greater than the density of water (1) therefore it will sink.
12. Consider two bodies of masses m_1 and m_2. Let them be taken to a planet whose mass is m_p and the radius to be r_p. The gravitational force of attraction exerted by the planet on the mass will be:-
    Force between planet and m_1 = $\frac{Gm_pm_1}{(r_p)^2} = F_1$
    Force between planet and m_2 = $\frac{Gm_pm_2}{(r_p)^2} = F_2$
    If two bodies have the same mass, that is if $m_1 = m_2$ then $F_1 = F_2$
    F_1 and F_2 are the weights of the bodies on that planet. Therefore, if the mass of two bodies are equal, their weights will be same.
13. Pressure (symbol: p or P) is the force applied perpendicular to the surface of an object per unit area over which that force is distributed.
    Pressure (P) = $\frac{Force(F)}{Area(A)}$ .A unit of Pressure is N/m^2 ..

    Thrust:

    i. Thrust is the force that a body exerts perpendicularly on a surface.
    ii. Its SI unit is newton (N).
    iii. It is numerically equal to the weight of the object.

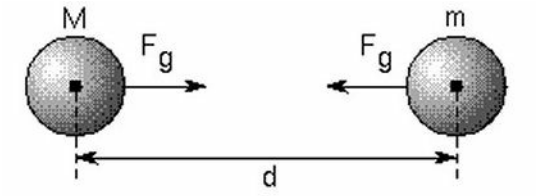
    Pressure:

    i. The thrust on an unit area of surface is called pressure.
    ii. Thus, pressure is ratio of thrust/force to the area.
    iii. Its SI unit is newton per metre squared or pascal (Pa)
14. Camels feet are broad and the larger area of the feet reduces the force/pressure exerted

by the body on the sand.But when we walk on the same sand we sink,because the pressure exerted by our body is not distributed but directional.

15. **Newton's Law of universal gravitation:** Everybody 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.

Let us consider two bodies A and B of masses m_1 and m_2 which are separated by a distance d.



Then the force of gravitation (F) acting on the two bodies is given by

$F \propto m_1 \times m_2$ .....(1)

and $F \propto \frac{1}{d^2}$ .....(2)

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

$F \propto \frac{m_1 \times m_2}{d^2}$

$F = k \frac{m_1 \times m_2}{d^2}$

Where, k= proportionality constant, known as universal gravitational constant, G having value = 6.67×10^{-11} $Nm^2 kg^{-2}$.

Therefore, $F = G \times \frac{m_1 m_2}{d^2}$, Which is required expression for force of attraction between two bodies.

Here, if the masses m_1 and m_2 of the two bodies are of 1 kg and the distance (d) between them is 1 m, then putting m_1 = 1 kg, m_2 = 1 kg and d = 1m in the above formula, we get

$F = G \times \frac{1}{1^2}$,

G = F

Definition of the gravitational constant G: Gravitational constant, G is numerically equal to the force of gravitation which exists between two bodies of unit masses kept at a unit distance from each other.