CBSE Test Paper 01

Chapter 10 Gravitation

1. If the distance between two objects is doubled, the gravitational force between them **(1)**

   a. remains the same
   b. gets doubled
   c. becomes one fourth
   d. gets halved

2. A stone is dropped from a cliff. Its speed after it has fallen 100 m is **(1)**

   a. 98 ms^{-1}
   b. 19.69 ms^{-1}
   c. 9.8 ms^{-1}
   d. 44.2 ms^{-1}

3. The value of acceleration due to gravity **(1)**

   a. increases from pole to equator
   b. is least on equator
   c. is same on equator and poles
   d. is least on poles

4. An object weights 10 N in air. When immersed fully in water, it weighs only 8 N. The weight of the liquid displaced by the object will be (**1**

   a. 12 N
   b. 8 N
   c. 2 N
   d. 10 N

5. Variation of acceleration due to gravity g with distance r from the centre of earth with

($r > R_e$) is best given as **(1)**

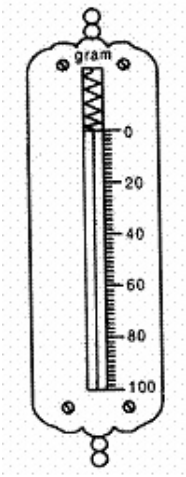
a. $g \propto r^2$
b. $g \propto r$
c. $g \propto \frac{1}{r}$
d. $g \propto \frac{1}{r^2}$

6. 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 and B
b. A, B and D
c. All of these
d. A and C

7. The least count of the spring balance shown in the diagram is: **(1)**



a. 1 g
b. 2 g
c. 0.5 g
d. 5 g

8. What do you mean by buoyancy? **(1)**

9. What is the acceleration of free fall? **(1)**

10. The weight of a man on the earth is 100 kg. Does this weight on the moon increase or decrease? **(1)**

11. How does weight of a rocket change as it moves from earth to moon? **(3)**

12. State the universal law of gravitation. **(3)**

13. How does a force of gravitation between two objects change when the distance between them is reduced to half? **(3)**

14. The earth and the moon are attracted to each other by gravitational force. Does the earth attract the moon with a force that is greater or smaller or the same as the force with which the moon attracts the earth? Why? **(3)**

15. From a cliff of 49 m high, a man drops a stone. One second later, he throws another stone. They both hit the ground at the same time. Find out the speed with which he threw the second stone. **(5)**

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Answers

1. c. becomes one fourth

   Explanation: We know $G = \frac{Mm}{r^2}$

   Where r is distance between two object.

   So If the distance between two objects is doubled, the gravitational force between them becomes one fourth because G is inversely proportional to the square of the distance between the two bodies.

2. d. 44.2 ms^{-1}

   Explanation: Intial Velocity u = 0 m/s

   Final Velocity v = ?

   Distance covered S = 100 m

   Acceleration a = $10m/s^2$

   As we know,

   $v^2 - u^2 = 2aS$

   $\Rightarrow v^2 - 0 = 2 \times 10 \times 100$

   $\Rightarrow v^2 = 2000$

   $\Rightarrow v = 44.2\ m/s$

3. b. is least on equator

   Explanation: the value of g on earth is maximum at poles and decreases as we go from poles to the equator and is minimum at the equator.

4. c. 2 N

   Explanation: Weighs of air = 10 N

   When immersed fully in water = 8N

   The weight displaced = 10N – 8N = 2N

5. d. $g \propto \frac{1}{r^2}$

   Explanation: $g = \frac{GM}{r^2}$

   So, g ∝ M and g ∝ $\frac{1}{r^2}$

6. c. All of these

   Explanation: Earth's gravitational force is highly influential to motion made by moon thus tide formation as well. It holds all the bodies with a strong force of attraction including the atmosphere of earth.

7. b. 2 g

   Explanation: $L.C. = \frac{20 - 0}{10} = \frac{20}{10} = 2\ g$

8. When an object is immersed partially or fully in a liquid, it experiences an upward force. This upward force is known as buoyant force and this phenomenon is known as buoyancy. Buoyancy is also known as up thrust

9. The average acceleration of free fall on the surface of earth is 9.81 ms^{-2}.

10. As the acceleration due to gravity on the moon is one-sixth that on the earth, hence the weight of the man will decrease on the surface of moon by 100/6 i.e. it becomes 16.66.

11. Weight of an object= Mass X Acceleration due to gravity.
    The acceleration due to gravity decreases while going away from the surface of earth and becomes zero at a point during the path. Later the acceleration due to gravity acts on the object due to the moon and starts increasing until it reaches the surface of the moon.
    so, the weight of the rocket decreases upto the point where the acceleration due to gravity is zero. Later the weight of the rocket starts increasing until it reaches the surface of the moon.
    Note: As the acceleration due to gravity is less than that of the earth, it can be concluded that the weight of the rocket on the moon is less than that of the earth.

12. Universal law of gravitation: The universal law of gravitation states that every object in the universe attracts every other object with a force called the gravitational force. The force acting between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres.

13. When all other variables remain constant, the force of gravitation is inversely

proportional to the square of distance between the two objects.

$F \propto \frac{1}{r^2} \Rightarrow F \propto \frac{1}{(1/2)^2} = 4$

$\therefore$ the force of gravitation increases 4 times.

14. According to universal law of gravitation, two objects attract each other with equal force, but in opposite direction.

    The earth and the moon are attracted to each other by same gravitational force because for both of them formula to calculate force of attraction is the same $F = G\frac{Me \times Mm}{d^2}$ d is also same for both.

15. **For the first stone :**

    Initial velocity, u = 0 ms^{-1}, Height of cliff, h = 49 m, g= 9.8m/s^2

    As we know, S = ut + $\frac{1}{2}$ at^2.

    We, have, h = ut + $\frac{1}{2}$ gt^2

    $\therefore$ 49 = 0 $\times$ t + $\frac{1}{2}$ $\times$ 9.8 $\times t^2$

    $\Rightarrow t^2 = \frac{9.8}{9.8}$ = 10

    $\Rightarrow t = \sqrt{10}$ = 3.16 s

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

    For the second stone:

    The time taken by the second stone to reach the ground is one second less than that taken by the first stone as both the stones reach the ground from the same height, h= 49m.

    That is, for the second stone, time, t = (3.16 - 1) s = 2.16 s

    $\therefore$ For the second stone,

    g = 9.8 ms^{-2}, h = 49 m, t = 2.16 s, u = ?

    Using, S = ut + $\frac{1}{2}$ at^2.

    We have, h = ut + $\frac{1}{2}$ gt^2

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

    $\Rightarrow$ 49 - 22.86 = 2.16u or 26.14 = 2.16u

    $\Rightarrow$ u = $\frac{26.14}{2.16}$ = 12.1 ms^{-1}

    Therefore, the speed with which he threw the second stone = 12.1 ms^{-1}