INDIAN SCHOOL AL WADI AL KABIR		
Class: IX	**Department: SCIENCE 2021 - 22**	**Date: 30.11.2021**
Worksheet No.: 3 **With answers**	**Topic:** GRAVITATION	**Note: A4 FILE FORMAT**
NAME OF THE STUDENT:	**CLASS & SEC:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS (1 MARK)

1. If we move from equator to pole , value of ‘g’ is
   a) Increases
   b) Decreases
   c) Remains same
   d) First increase and then decrease
2. The weight of an object at the centre of the Earth of radius R is (NCERT Exemplar)
   a) zero
   b) infinite
   c) R times the weight at the surface of the Earth
   d) $1/R^2$ times the weight at surface of the Earth
3. The ball is thrown up, the value of ‘g’ will be
   a) Zero
   b) positive
   c) negative
   d) negligible
4. The gravitational force between two objects is F. If masses of both the objects are halved without altering the distance between them, then the gravitational force would become
   a) F/4
   b) F/2
   c) F
   d) 2F
5. In the relation $F = GM\ m/r^2$, the quantity G
   (a) depends on the value of g at the place of observation
   (b) is used only when the Earth is one of the two masses
   (c) is greatest at the surface of the Earth
   (d) is universal constant of nature
6. What holds the atmosphere to earth?
   a) Gravity.
   b) Clouds.
   c) Winds.
   d) None of the above.

7. The SI unit of G

a) $Nm^2 kg^{-2}$
b) Nm
c) Nkg
d) kgm/s

8. The mass of the body on moon is 40kg, what is the weight on the earth.

a) 240kg
b) 392N
c) 240N
e) 400kg

VERY SHORT ASWER QUESTIONS (1 MARK)

9. Who formulated the universal law of gravitation ?
10. What is freefall?
11. If the mass of a body is 9.8 kg on the earth, what would be its mass on the moon?
12. What keeps the moon in uniform circular motion around the earth?
13. When a body is dropped from a height, what is its initial velocity?
14. Suppose that the radius of the earth becomes twice of its original radius without any change in its mass. Then what will happen to your weight?
15. Amit buys few grams of gold at the poles as per the instruction of one of his friends. He hands over the same when he meets him at the equator. Will the friend agree with the weight of gold bought? If not, why?
16. State any two natural phenomena explained by universal law of Gravitation.

SHORT ANSWER QUESTIONS (2 MARK)

17. A stone is dropped from the top of a 40 m high tower. Calculate its speed after 2 s. Also find the speed with which the stone strikes the ground.
18. The earth attracts an apple. Does the apple also attract the earth? If it does, why does the earth not move towards the apple?
19. Give three differences between acceleration due to gravity (g) and universal gravitational constant (G).
20. The Weight of the body at a certain place is 30 N. The acceleration due to gravity at that point is 10 m/s^2. Find out the mass and weight of the object at the place where acceleration due to gravity is zero?

PREVIOUS YEAR QUESTION AND ANSWER

21. Write the difference between ma and weight. (CBSE2012/2013).
22. A ball thrown up vertically returns to the thrower after 6s. Find
    i) the velocity with which it was thrown up ii) the maximum height it reaches.
23. A stone dropped from the roof of a building takes 4s to reach the ground. Calculate the height of the building.
24. The gravitational force between two identical bodies is 200 N. Mass of both bodies becomes twice and separation becomes half. What will be a new force between them?

25. What is the distance covered by a freely falling body during the first three seconds of its motion? ($g = 10\ m/s^2$) (CBSE 2010)
26. A toy car falls to the ground in 0.4 s .Calculate its speed just before striking the ground . ($g = 10\ m/s^2$) (CBSE 2010)

CASE STUDY BASED QUESTIONS

The universe has a lot of forces, a lot of pushes and pulls. We're always pushing or pulling something, even if only the ground. But it turns out that in physics, there are really only four fundamental forces from which everything else is derived: the strong force, the weak force, the electromagnetic force, and the gravitational force. The gravitational force is a force that attracts any two objects with mass. We call the gravitational force attractive because it always tries to pull masses together, it never pushes them apart. In fact, every object, including you, is pulling on every other object in the entire universe! This is called Newton's Universal Law of Gravitation.

27. A body of mass 1kg on the surface of earth is attracted by the earth with a force which is equal to
    a. 9.8N
    b. 6.67x 1011
    c. 1 N
    d. 9.8m/s
28. What is the gravitational force between two objects?
    a. attractive at large distances only
    b. attractive at small distances only
    c. attractive at all distances
    d. attractive at large distances but repulsive at small distances
29. The force of attraction between two unit point masses separated by a unit distance is called
    (a) gravitational potential
    (b) acceleration due to gravity
    (c) gravitational field
    (d) universal gravitational constant

ASSERTION REASON TYPE QUESTIONS

Directions: In each of the following questions, a statement of Assertion is given and a corresponding statement of Reason is given just below it. Of the statements, given below, mark the correct answer as:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both Assertion and Reason are false.

30. **Assertion :** Universal gravitational constant G is a scalar quantity.
    Reason : The value of G is same throughout the universe.
31. **Assertion :** When distance between two bodies is doubled and also mass of each body is doubled, then
    the gravitational force between them remains the same.
    Reason : According to Newton's law of gravitation, product of force is directly proportional to the product
    mass of bodies and inversely proportional to square of the distance between them.

Q. No.	ANSWERS
1.	a) Increases
2.	a) zero
3.	c) negative
4.	a) F/4
5.	d) is universal constant of nature
6.	a) Gravity.
7.	a) $Nm^2 kg^{-2}$
8.	b) 392N
9	Isaac Newton
10	When an object falls from any height under the influence of gravitational force only .
11	It will remain the same on the moon, i.e., 9.8 kg.
12	Gravitational force between moon and the earth keeps moon in uniform circular motion around the earth.
13	Zero
14	We know that $F = GMm/r^2$ as weight of a body is the force with which a body is attracted towards the earth, $W = GMm/(2r)^2$ $= GMm/4r^2 = W/4$ i.e., weight will be reduced to one-fourth of the original.
15	The value of g is greater at the poles than at the equator
16	The force which binds us to the Earth. The revolution of the Moon around the Earth.
17	(i) As $v = u + gt$ $\therefore v = 0 + (-10) \times 2 = -20\ ms^{-1}$ (ii) As $v = u^2 + 2gs$ or, $v^2 - 0^2 = 2(-10) \times (-40)$ or, $v = \sqrt{800}$ $= 20\sqrt{2}\ ms^{-1}$
18	According to Newton's third law of motion, action and reaction are equal and opposite. It means that the force on the apple due to earth's attraction is equal to that on the earth due to

<table>
<tr><td></td><td>apple's attraction. But we know, acceleration ∝ 1/m.
As the mass of the earth is very large as compared to that of the apple, the acceleration experienced by the earth will be so small that it will not be noticeable.</td></tr>
<tr><td>19</td><td>
<table>
<tr><th>Acceleration due to gravity (g)</th><th>Universal gravitational constant (G)</th></tr>
<tr><td>1. Acceleration due to gravity is the acceleration acquired by a body due to the earth's gravitational pull on it.

2. g is a vector quantity.

3. It is different at different places on the surface of the earth. Its value also varies from one celestial body to another.</td><td>1. Gravitational constant is numerically equal to the force of attraction between two masses of 1 kg that are separated by a distance of 1 m.

2. G is a scalar quantity.

3. The 'G' is a universal constant, i.e., its value is the same (i.e. 6.7×10^{-11} Nm^2 kg^{-2}) everywhere in the universe.</td></tr>
</table>
</td></tr>
<tr><td>20</td><td>Mass of the body=30/10=3Kg
Since Mass remains same everywhere, Weight varies as per acceleration due to gravity.</td></tr>
<tr><td>21</td><td>
<table>
<tr><th>Sl. No.</th><th>Mass</th><th>Weight</th></tr>
<tr><td>1.</td><td>The mass is a scalar quantity.</td><td>The weight is a vector quantity.</td></tr>
<tr><td>2.</td><td>Mass of a rigid body is regular everywhere in the universe.</td><td>The weight of a rigid body alters from place to place and inclines zero at the center of the earth.</td></tr>
<tr><td>3.</td><td>Mass can be resulted by a traditional balance.</td><td>Weight can be defined as spring balance</td></tr>
<tr><td>4.</td><td>The unit of mass is kg or g.</td><td>The unit of weight is Newton.</td></tr>
<tr><td>5.</td><td>Mass can never be zero.</td><td>Weight can be zero based on the gravity acting upon it.</td></tr>
<tr><td>6.</td><td>Mass does not change based on location.</td><td>Weight changes based on location, depending on the gravity it experiences.</td></tr>
<tr><td>7.</td><td>Mass is measured using an ordinary weighing scale.</td><td>Weight is measured using spring balance.</td></tr>
</table>
</td></tr>
<tr><td>22</td><td>i) v=u+gt, u=29.4m/s ii) $s=ut+1/2gt^2$ = 44.1m</td></tr>
<tr><td>23</td><td>Here, initial velocity, u = 0
Time taken to reach the ground, t = 4 s
Acceleration, a = g = 9.8 m/s^2
Height of the building, h = ?</td></tr>
</table>

	Using the equation of motion, $h = ut + \frac{1}{2} gt^2 = 0 + \frac{1}{2} gt^2$ $h = \frac{1}{2} \times 9.8\ m/s^2 \times (4s)^2$ $= \frac{1}{2} \times 9.8 \times 16\ m = 78.4\ m$ $h = \mathbf{78.4\ m}$
24	Given, Force between two bodies, F = 200 N Force between two identical bodies, $F = Gm^2/r^2$ $F = Gm_1m_2/r^2$ Now the mass of both bodies becomes twice and separation becomes half, New force $F' = G(2m)(2m)/(r/2)^2 = Gm^2/r^2 = 16\ F$ Force becomes sixteen times. New force, F' = 16 x 200 = 3200 N
25	$S = ut + ½\ at^2$ $S = 0 + ½ \times 10 \times (3)^2$ $= 45$ m
26	t= 0.4 s , u= 0 v= u + gt = 0+10 x 0.4 = 4 m/s
27	a. 9.8N
28	c. attractive at all distances
29	(d) universal gravitational constant
30	(a) Both assertion and reason are true and reason is the correct explanation of assertion.
31	(a) Both assertion and reason are true and reason is the correct explanation of assertion.

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