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| **Karan Arora**  **R.L. Institute M: 9416974837**  **Class : IX**  **“GRAVITATION”** |

**Worksheet – 1**

Multiple Choice Questions :

1. What is represented by ‘G’?

|  |  |
| --- | --- |
| a) Acceleration due to gravity | b) Universal gravitational constant |
| c) Both (a) and (b) | d) Neither (a) and (b) |

1. What is the standard value of G?

|  |  |
| --- | --- |
| a) G = 6.67 x 10 – 11  Nm2/kg2 | b) G = 6.67 x 10 – 8  Nm2/kg2 |
| c) G = 7.76 x 10 – 11  Nm2/kg2 | d) None of these |

1. Which force is responsible for holding the solar system together?

|  |  |
| --- | --- |
| a) Gravitational pull between planets | b) Gravitational pull of sun on the Earth |
| c) Electromagnetic force between the planets | d) Nuclear force between the planets |

1. Which force is responsible for tides in the ocean at night?

|  |  |
| --- | --- |
| a) Gravitational pull of Sun | b) Gravitational pull of Moon |
| c) Gravitational pull of Earth | d) None of these |

1. ‘G’ is called as universal gravitational constant because :
2. Its value is too small.
3. Its value is too large.
4. Its value is absolute constant, does not depend upon any factor.
5. None of the above.
6. Flow of water in rivers is governed by :

|  |  |
| --- | --- |
| a) Universal law of gravitation | b) Acceleration due to gravity |
| c) Keplar’s law | d) None of the above |

1. When two bodies of mass 1 kg each are 1 m apart, the gravitational force of attraction between them is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 6.67 x 10 – 11  N | b) 6.67 x 10 11  N | c) 9.8 N | d) None |

1. When a body of mass 1 kg is held on the surface of the Earth, gravitational force of attraction between the body and Earth is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 6.67 x 10 – 11  N | b) 6.67 x 10 11  N | c) 9.8 N | d) None |

1. If the mass of the Earth and mass of the Moon are 6 x 1024 kg and 7.4 x 1022 kg respectively and distance between them is 3.84 x 108 m, the gravitational force between Earth and Moon is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 9.8 N | b) 9.8 x 103 N | c) 2.01 x 1020 N | d) None |

1. The gravitational force between two objects is ‘F’. How will the force change when distance between them is reduced to half?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 4 F | b) 2 F | c) F/4 | d) F/2 |

1. The gravitational force between two objects is ‘F’. How will the force change when mass of each object is quadrupled?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 4 F | b) 8 F | c) 16 F | d) F/16 |

1. The gravitational force between two objects is ‘F’. If masses of both objects are halved without changing distance between them, then the gravitational force would become :

|  |  |  |  |
| --- | --- | --- | --- |
| a) F/4 | b) F/2 | c) F | d) 2 F |

1. A boy is whirling a stone tied with a string in a horizontal circular path. When the string breaks, the stone :
2. Will continue to move in the circular path.
3. Will move along a straight line towards the center of the circular path.
4. Will move along a straight line tangential to the circular path.
5. Will move along a straight line perpendicular to the circular path.
6. In the relation ; F = GMm/d2, the quantity ‘G’ is :
7. Depends on the value of g at the place of observation.
8. Is used only when the Earth is one of the two masses.
9. Is greatest at the surface of the Earth.
10. Is universal constant of Nature.
11. Laws of gravitation gives the gravitational force between :

|  |  |
| --- | --- |
| a) The Earth and a point mass only | b) The Earth and Sun only |
| c) Any two bodies having some mass | d) Two charged bodies |

1. The value of quantity ‘G’ in the law of gravitation :
2. Depends on mass of Earth only.
3. Depends on radius of Earth only.
4. Depends on both mass and radius of Earth.
5. Is independent of both mass and radius of Earth.
6. Two particles are placed at some distance. If the mass of each of the two particles is doubled, keeping the distance between them unchanged, the value of gravitational force between them will be :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1/4 times | b) 4 times | c) 1/2 times | d) unchanged |

1. 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) Universal gravitational constant | d) Gravitational field |

1. If the radius of Earth were to shrink by 1 %, its mass remaining the same, the acceleration duem to gravity on Earth’s surface would :

|  |  |
| --- | --- |
| a) decreases | b) Increases |
| c) remain unchanged | d) Can’t be calculated |

1. The gravitational force between two bodies does not depend on :

|  |  |
| --- | --- |
| a) Their separation | b) Their masses |
| c) The product of their masses | d) The medium between the two bodies |

**Answers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. b | 1. a | 1. b | 1. b | 1. c | 1. a | 1. a |
| 1. c | 1. c | 1. a | 1. c | 1. a | 1. c | 1. d |
| 1. c | 1. d | 1. b | 1. c | 1. b | 1. d |  |

Problem For Practice :

**Based on Universal Gravitational Constant :**

1. A sphere of mass 40 kg is attracted by a second sphere of mass 15 kg when their centres are 20 cm apart, with a force of 0.1 milligram weight. Calculate the value of gravitational constant.
2. Two electrons each of mass 9.1 x 10 – 31 kg are at a distance of 10 . Calculate the gravitational force of attraction between them.
3. The mass of Sun is 2 x 1030 kg and mass of Earth is 6 x 1024 kg. If the distance between the centres of Sun and Earth is 1.5 x 108 km, calculate the force of gravitation between them.
4. The mass of Earth is 6 x 1024 kg and that of moon is 7.4 x 1022 kg. If the distance between the Earth and the moon is 3.84 x 105 km, calculate the force exerted by Earth on the Moon.
5. A sphere of mass 25 kg attracts another sphere of mass 24 kg with a force of 0.1 milligram weight. If the distance between the centres of two spheres is 20 cm, what is the value of G?
6. What is the magnitude of the gravitational force between the Earth and a 1 kg object on its surface? Mass of the Earth = 6 x 1024 kg and Radius of the Earth = 6.4 x 106 m.
7. An electron and proton of mass 9.1 x 10 – 31 kg and 1.67 x 10 – 27 kg respectively, is at a distance of 10 . Calculate the gravitational force of attraction between them.
8. Calculate the gravitational force between two objects of mass 10 kg and 20 kg at a separation of 5 m.
9. The gravitational force on a body of mass 60 kg is 588N. If mass of Earth is 6 x 1024 kg and radius of the Earth is 6.4 x 106 m , find value of ‘G’.
10. Find the gravitational force between two protons kept at a separation of 1 femtometer. The mass of proton is 1.67 x 10 – 27 kg.
11. Two bodies of mass 3 kg and 12 kg are placed at a distance of 12 m. A third body of mass 0.5 kg is placed at such a point that the force acting on this body is zero. Find the position of that point.
12. The gravitational force between two objects is 100 N. How should the distance between these objects be changed so that force between them becomes 50 N?
13. If the distance between two masses is increased by a factor of 4, by what factor would the mass of one of them have to be altered to maintain the same gravitational force?
14. If distance between two masses is quadrupled, what will be the new force of attraction between them? Given the initial gravitational pull is 9.8 N.
15. The gravitational force between two objects is ‘F’. How will this force change when :
16. The distance between them is reduced to half? (b) The mass of each object is quadrupled?
17. If the distance between two objects is increased four times, then by how many times will the mass of one of the objects be changed to maintain the same gravitation force?
18. How does the force of gravitation between two objects change when the distance between them is reduced to half?
19. What happens to the force between the two objects, if :
20. The mass of one object is doubled?
21. The distance between the two objects is doubled and tripled?
22. The masses of both objects are doubled?

**Answers**

1. 6.53 x 10 – 11 N m2/kg2 2. 5.52 x 10 – 53 N 3. 3.56 x 1022 N 4. 2 x 1020 N

5. 6.53 x 10 – 11 N m2/kg2  6. 9.8 N 7. 1.01 x 10 – 49 N 8. 5.33 x 10 – 10 N

9. 6.69 x 10 – 11 N m2/kg2  10. 1.87 x 10 – 34 N 11. 4 m 12. times

13. 16 times 14. 0.61 N 15. (a) 4 times (b) 16 times

16. 16 times 17. 4 times 18. (a) 2 F (b) 1/4 F , 1/9 F (c) 4 F

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**Worksheet – 2**

Multiple Choice Questions :

1. The value of acceleration due to gravity :

|  |  |
| --- | --- |
| a) is same on equator and poles | b) is least on poles |
| c) is least on equator | d) Increase from poles to equator |

1. The atmosphere is held to the Earth by :

|  |  |  |  |
| --- | --- | --- | --- |
| a) gravity | b) earth’s magnetic field | c) wind | d) clouds |

1. The weight of an object at centre of the Earth of Radius ‘R’ is :

|  |  |
| --- | --- |
| a) 1/R2 times the weight at the surface of the Earth | b) zero |
| c) R times the weight at the surface of the Earth | d) infinite |

1. An apple falls from a tree because of gravitational force between the Earth and the apple. If F1 is the magnitude of force exerted by the Earth on the apple and F2 is the magnitude of force exerted by apple on Earth, then :

|  |  |
| --- | --- |
| a) F1­ is very much greater than F2­ | b) F2­ is very much greater than F1 |
| c) F1­ is only a little greater than F2­ | d) F1­ and F2­ are equal |

1. What is represented by ‘g’?

|  |  |
| --- | --- |
| a) Universal gravitational constant | b) Acceleration due to gravity |
| c) Both (a) & (b) | d) Neither (a) & (b) |

1. The correct relation between g and G is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) g = | b) G = | c) g = G | d) g = |

1. What is the standard value of g on the surface of Earth?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 9.8 m/s2 | b) 10.8 m/s2 | c) 6.7 m/s2 | d) None |

1. Out of G and g, whose value is same on the surface of moon and surface of earth?

|  |  |  |  |
| --- | --- | --- | --- |
| a) g | b) G | c) both | d) None |

1. A body is just dropped from a height, its initial velocity (u) is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) zero | b) positive | c) negative | d) Cannot say |

1. A ball is thrown vertically upwards with a velocity of 98 m/s. The maximum height to which it rises is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 490 m | b) 245 m | c) 122.5 m | d) 980 m |

1. In the above question, total time taken by the body to return to earth is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 10 s | b) 20 s | c) 15 s | d) 40 s |

1. What is the value of acceleration of free fall?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 5 m/s2 | b) 10 m/s2 | c) 20 m/s2 | d) 9.8 m/s2 |

1. A body weighs 10 kg on earth. How much will it weigh on moon whose gravitational force is only 1/6th of that of earth?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 10 kg wt. | b) 60 kg wt. | c) 10/6 kg wt. | d) 10/36 kg wt. |

1. In the above question, what will be the mass of the body on surface of moon?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 10 kg | b) 60 kg | c) 10/6 kg | d) 10/36 kg |

1. A body weighs 20 kg on the surface of earth. How much will it weigh at the centre of earth?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 20 kg | b) zero | c) 10 kg | d) 40 kg |

1. SI unit of weight is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) Newton | b) kilogram | c) gram | d) none |

1. A body weighs 40 kg on the surface of earth. Its mass and weight at the centre of earth are :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 40 kg , 40 kg | b) 40 kg , zero | c) zero , zero | d) zero , 40 kg |

1. A body weighs 20 kg on the surface of moon. Its mass and weight at the centre of moon are :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 20 kg , 20 kg | b) 20 kg , zero | c) 40 kg , 20 kg | d) zero , 20 kg |

1. Value of g is maximum at :

|  |  |
| --- | --- |
| a) At the centre of the Earth | b) A height above the centre of Earth |
| c) A depth below the surface of Earth | d) The surface of Earth |

1. A body weigh one kg on moon. How much will it weigh on earth?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 kg | b) 9.8 kg | c) 6 kg | d) 10 kg |

1. With height and depth from the surface of earth, value of acceleration due to gravity is :

|  |  |
| --- | --- |
| a) decreases | b) increases |
| c) decrease with height and increase with depth | d) remain same |

1. If We is weight of body at equator, Wp is weight of body at poles, then :

|  |  |  |  |
| --- | --- | --- | --- |
| a) We = WP | b) We > WP | c) We = zero ; WP zero | d) We < WP |

**Answers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. c | 1. a | 1. b | 1. d | 1. b | 1. a | 1. a |
| 1. b | 1. a | 1. a | 1. b | 1. d | 1. c | 1. a |
| 1. b | 1. a | 1. b | 1. b | 1. d | 1. c | 1. a |
| 1. d |  |  |  |  |  |  |

Problem For Practice :

**Based on Acceleration Due to Gravity and Equations of Free fall:**

1. Calculate the force of gravity acting on your friend of mass 60 kg. Given mass of Earth = 6 x 1024 kg and radius of Earth = 6.4 x 106 m.
2. On the Moon’s surface, the acceleration due to gravity is 1.67 m/s2. If the radius of the Moon is 1.74 x 106 m, calculate the mass of the Moon.
3. A stone is dropped from the edge of a roof.

(a) How long it take to fall 4.9 m? (b) How fast does it move at the end of that fall?

(c) How fast does it move at the end of 7.9 m (d) What is its acceleration after 1 s and after 2 s?

1. What is the gravitation acceleration of a spaceship at a distance equal to twice of Earth’s radius from the centre of the Earth?
2. A particle is dropped from a tower 180 m high. How long does it take to reach the ground? What is the velocity when it touches the ground?
3. A car falls off a ledge and drops to the ground in 0.5 s.

(a) What is its speed on striking the ground? (b) How high is the ledge from the ground?

1. To estimate the height of a bridge over a river , a stone is dropped freely on the river from the bridge. The stone takes 2 s to touch the water surface in the river. Calculate the height of the bridge from the water level.
2. A ball is thrown up with a speed of 15 m/s. How high will it go before it begins to fall?
3. A stone is released from the top of a tower of height 19.6 m. Calculate its final velocity just before touching the ground.
4. A ball is thrown vertically upwards with a velocity of 49 m/s. Calculate :

(a) The maximum height to which it rises (b) The total time it takes to return to the surface.

1. A stone is thrown vertically upward with an initial velocity of 40 m/s. Find the maximum height reached by the stone. What is the net displacement and the total distance covered by the stone?
2. A stone is allowed to fall from the top of a tower 100 m high and at the same time another stone is projected vertically upwards from the ground with a velocity of 25 m/s. Calculate when and where the two stones will meet.
3. A stone is dropped from a cliff. What will be its speed when it has fallen 100 m?
4. A ball is thrown up vertically returns to the thrower after 6 s. find :

(a) The velocity with which it was thrown up (b) The maximum height it reaches

(c) Its position after 4 s.

1. 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.
2. A stone is dropped from the roof of a building takes 4 s to reach the ground. Calculate the height of the building.
3. A ball is thrown up with a speed of 0.5 m/s.

(a) How high will it go before it begins to fall? (b) How long will it takes to reach that height?

**Based on Mass And Weight :**

1. The weight of a man on the surface of Earth is 588 N. Find his mass. If the man were taken to Moon, his weight would be 98 N. What is his mass on Moon? Also, calculate acceleration due to gravity on the moon?
2. A body has a weight of 10 kg on the surface of Earth. What will be its mass and weight when taken to the centre of Earth?
3. A force 20 N acts upon a body whose weight is 9.8 N. What is the mass of the body and how much is its acceleration?
4. A man weighs 600 N on the Earth. What is its mass? If he were taken on Moon, his weight would be 100 N. What is his mass on Moon? What is acceleration due to gravity on Moon?
5. Mass of an object is 10 kg. What is its weight on Earth?
6. An object weighs 10 N when measured on the surface of the Earth. What would be its weight when measured on the surface of Moon?
7. Gravitational force on the surface of the Moon is only 1/6 as strong as gravitation force on the Earth. What is the weight in newton of a 10 kg object on the Moon and on the Earth?

**Answers**

1. 586.2 N 2. 7.6 x 1022 kg 3. (a) 1 s (b) 9.8 m/s (c) 12.4 m/s (d) 9.8 m/s2

4. 2.45 m/s2 5. 6 s , 60 m/s 6. (a) 5 m/s (b) 1.25 m 7. 19.6 m

8. 11.48 m 9. 19.6 m/s 10. (a) 122.5 m (b) 10 s 11. 80 m , 0 , 160 m

12. 4 s , 80m 13. 44.2 m/s 14. (a) 29.4 m/s (b) 44.1 m (c) 4.9 m

15. m/s 16. 78.4 m 17. (a) 1.27 cm (b) 0.05 s

18. 60 kg , 60 kg , 1.63 m/s2 19. 10 kg , 0 20. 1 kg , 20 m/s2

21. 60 kg , 60 kg , 1.67 m/s2 22. 98 N 23. 1.67 N

24. We = 98 N , Wm = 16.3 N