



**Physics**  
**Gravitation**

1. Two persons having mass 50 kg each are standing such that the centres of gravity are 1 m apart. Calculate the force of gravitation and also calculate the force of gravity on each. (Take  $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$ , mass of earth  $M = 6 \times 10^{24} \text{ kg}$ , Radius of earth  $R = 6.4 \times 10^6 \text{ m}$ )
2. The mass of the planet Jupiter is  $1.9 \times 10^{27} \text{ kg}$  and that of the sun is  $1.99 \times 10^{30} \text{ kg}$ . The mean distance of the Jupiter from the sun is  $7.8 \times 10^{11} \text{ m}$ . Calculate the gravitational force which the sun exerts on Jupiter.  $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$ .
3. A body whose volume is  $100 \text{ cm}^3$  weighs 1 kg in air. Find its weight in water.
4. Calculate the value of acceleration due to gravity on the surface of the moon. (Given: Mass of the moon =  $7.4 \times 10^{22} \text{ kg}$ , Radius of moon = 1740 m,  $G = 6.7 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$ ).
5. A body has a weight  $W$  on the surface of earth. What is its weight on a planet which has mass 10 times that of the earth and a radius of 4 times that of the earth?
6. Find the mass of an object whose weight is 49 N.
7. A sphere of mass 40 kg is attracted by a second sphere of mass 60 kg with a force equal to  $4 \times 10^{-5} \text{ N}$ . If  $G = 6 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$ , calculate the distance between the two spheres.
8. Write down the expression for the acceleration experienced by a particle on the surface of the moon due to the gravitational force of the moon. Find the ratio of this acceleration to that experienced by the same particle on the surface of the earth. If the acceleration of a particle due to gravity on the earth is  $9.82 \text{ m/s}^2$ , what is the acceleration of a particle on the moon's surface?

OR

Calculate the acceleration due to gravity on the moon's surface using the following data.

Mass of earth =  $6 \times 10^{24} \text{ kg}$ .

Mass of moon =  $7.3 \times 10^{22} \text{ kg}$ .

Radius of earth = 6400 km

Radius of moon = 1740 km

'g' on earth's surface =  $9.82 \text{ m/s}^2$

9. 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.
10. A ball is dropped from the top of a tower 40 m high. What is its velocity when it has covered 20 m? What would be its velocity when it hits the ground? (Take  $g = 10 \text{ m/s}^2$ ).
11. A coconut is hanging on a tree at a height of 15 m from the ground. A boy launches a projectile vertically upwards with a velocity of 20 m/s. After what time will the projectile pass by the coconut? Explain the two answers that you get in this problem.

### Fill in the Blanks

1. The force of ..... is the centripetal force on the moon.
2. The force of gravity between two objects is inversely proportional to the square of the .....
3. The constant of gravitation  $G$  is related to  $g$  by .....
4. Every object inside the satellite is .....
5. The acceleration due to gravity of the moon is ..... that of the earth.
6. The SI unit of weight is .....
7. All bodies fall towards the earth with the same .....

### True / False

8. Copernicus discovered that the earth moves around the sun.
9. Weightlessness experienced while orbiting the earth in a spaceship is the result of zero gravity.
10. An astronaut cannot use a straw to sip a drink on the surface of the moon.
11. The S.I. unit of weight is kilogram.
12. All freely falling bodies are weightless.
13. The acceleration due to gravity of moon is equal to that of the earth.
14. The value of  $G$  is independent of the nature, size and mass of the interacting bodies.

### Match the Column

15. Match the items of column A against the items of column B:

Column A		Column B	
(A)	Acceleration due to gravity	(p)	kg
(B)	Mass	(q)	$\text{ms}^{-2}$
(C)	Weight	(r)	$\text{Nm}^2 \text{kg}^{-2}$
(D)	Gravitational constant	(s)	$\text{Nm}^{-2}$
(E)	Pressure	(t)	Newton

### Multiple Choice Questions

16. The force of gravitation between two bodies does not depend on:  
(a) their separation  
(b) the product of their masses  
(c) the sum of their masses  
(d) the gravitational constant
17. The acceleration due to gravity  
(a) has the same values everywhere in space  
(b) has the same value everywhere on the earth  
(c) varies with the latitude on the earth  
(d) is greater on the moon due to its smaller diameter
18. Newton's law of gravitation is applicable to  
(a) bodies of the solar system only  
(b) bodies on the earth  
(c) planets only  
(d) all bodies of the universe
19. All bodies whether large or small fall with the

- (a) same force (b) same acceleration  
(c) same velocity (d) same momentum
20. Weightlessness experienced while orbiting the earth in a spaceship is the result of  
(a) zero gravity (b) inertia (c) acceleration (d) centre of gravity
21. When an object falls freely to the earth, the force of the gravity is  
(a) opposite to the direction of motion  
(b) in the same direction as that of motion  
(c) zero  
(d) constant
22. The weight of a body at the centre of the earth is  
(a) zero (b) infinite  
(c) same as at other places (d) slightly greater than that at poles
23. The weight of an object  
(a) is the gravity of the matter it contains (b) refers to its inertia  
(c) is the same as its mass but expressed in different units  
(d) is the force with which it is attracted to the earth.
24. In vacuum all freely falling objects  
(a) have the same speed (b) have the same velocity  
(c) have the same acceleration (d) have the same
25. At which of the following locations, the value of  $g$  is the largest?  
(a) On top of the Mount Everest (b) On top of Qutub Minar  
(c) have the same acceleration (d) have the same force
26. A ball is thrown vertically upwards. The acceleration due to gravity.  
(a) is in the direction opposite to the direction of its motion.  
(b) is in the same direction as the direction of its motion.  
(c) increases as it comes down  
(d) becomes zero at the highest point.

### Subjective Questions

#### VERY SHORT QUESTIONS:

27. Give the formula to calculate the gravitational force of attraction.
28. The earth attracts falling apple, but do you think, that the apple also attract the earth? If it is, why the earth does not move towards apple?
29. In what sense does the moon fall towards the earth. Why does it not actually fall on the earth's surface?
30. Define centre of mass of a body.
31. A man can jump six times as high on the moon as that on the earth. Why?
32. What is the effect of altitude (height) on acceleration due to gravity?

#### SHORT QUESTIONS:

33. Write the differences between mass and weight.
34. Define the centre of gravity and the centre of mass. Can the centre of mass of a body lie outside the body also?
35. What is the gravitational constant? What is its value in SI units? How do 'g' and 'G' differ from each other?
36. How will the force of gravitation between two objects change if the distance between them is:  
(a) halved, (b) doubled, (c) made four times, (d) infinite, (e) almost zero.

37. Give two reasons for the variation of  $g$  at the equator and at the poles?
38. Find the height at which the acceleration due to gravity becomes  $(1/4)$ th of its value on the surface of the earth.
39. Discuss the various factors on which the value of  $g$  depends.

OR

Discuss the variation of weight of a body with altitude and latitude.

40. What is the effect of the distribution of mass inside the earth on the value of  $g$ ? What is its utility.

**LONG QUESTIONS:**

41. State Newton's law of gravitation. In what sense is the law universal? Obtain the SI units of the gravitational constant ( $G$ ).
42. A ball thrown up vertically returns to the thrower after 6s. Find
  - (a) the velocity with which it was thrown up.
  - (b) the maximum height it reaches, and
  - (c) its position after 4 s.

**Numerical Problems:**

43. A particle weighs 120 N on the surface of the earth. At what height above the earth's surface will its weight be 30N?
44. How much less will a mass of 1.000 kg weigh as a ceiling of height  $h = 3.00$  m compared to its weight on the floor? Assume that the local gravitational strength at floor level has standard value of 9.80665 N/kg. ( $R_{earth} = 6400$  km)
45. At what height above the surface, the value of the gravity would be half of what it is on the surface of the earth. Take radius of the earth as  $R_e = 6400$  km.
46. A stone drops from the edge of the roof. It passes a window 2 m high in 0.1 s. How far is the roof above the top of the window?
47. Imagine that you are visiting planet Mars. You want to record your weight in a notebook on this planet. If your weight on the earth is 450 N, what would you record as your weight on the Mars? Take mass of Mars =  $6 \times 10^{23}$  kg and  $g = 10$  m/s<sup>2</sup>.
48. If your weight is 60 kg on earth, how far must you go from the centre of the earth so that you weight 30 kg?
49. A body weight 63 N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the earth?
50. Calculate the force of gravitation between the earth and the sun, given that the mass of the earth =  $6 \times 10^{24}$  kg and of the sun  $2 \times 10^{30}$ . The average distance between the two is  $1.5 \times 10^{11}$  m.

**Maths**

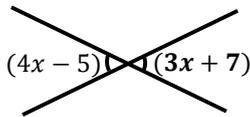
**Lines and Angles**

1. How many least number of distinct points determine a unique line?
 

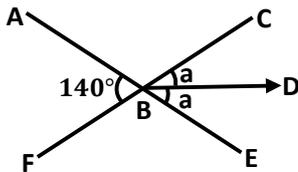
(a) One	(b) Two	(c) Three	(d) Infinite
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2. Which one of the following determines a plane?
 

(a) A line and a point on it	(b) Two points
(c) Three non-collinear points	(d) None of the above
3. Which of the following statements is false?
  - (a) A line segment can be produced to any desired length
  - (b) Through a given point, only one straight line can be drawn

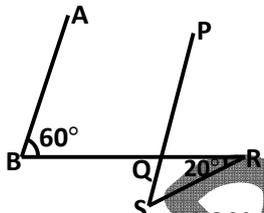
- (c) Through two given points, it is possible to draw one and only one straight line  
 (d) two straight line can intersect in only point
4. Number of pairs of vertical angles formed when two lines intersect is/are  
 (a) one pair (b) two pairs (c) four pairs (d) None of these
5. Find the value of  $x$  in the figure shown.



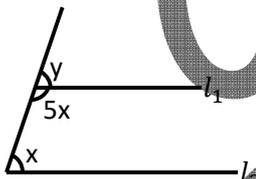
- (a)  $12^\circ$  (b)  $14^\circ$  (c)  $16^\circ$  (d)  $18^\circ$
6. In the figure given, find the value of  $a$ .



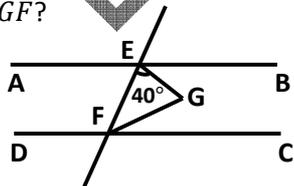
- (a)  $60^\circ$  (b)  $70^\circ$  (c)  $90^\circ$  (d) None of these
7. In the figure shown  $AB \parallel PQ$ , then  $\angle RSQ$  is



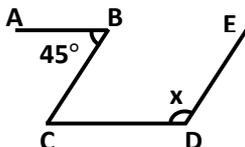
- (a)  $20^\circ$  (b)  $30^\circ$  (c)  $40^\circ$  (d)  $50^\circ$
8. In the figure shown, if  $l_1 \parallel l_2$ , then  $y$  is



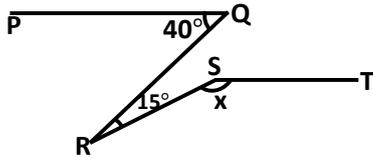
- (a)  $30^\circ$  (b)  $45^\circ$  (c)  $50^\circ$  (d)  $60^\circ$
9. If an angle is increase 25% more than its supplementary angle, the angles are  
 (a)  $80^\circ$  and  $40^\circ$  (b)  $80^\circ$  and  $100^\circ$  (c)  $25^\circ$  and  $75^\circ$  (d) None of these
10. In the figure, if  $AB \parallel CD$  and  $EG$  and  $GF$  are the angle bisectors of  $\angle EBF$  and  $\angle CFE$ , respectively. What is the value of  $\angle EGF$ ?



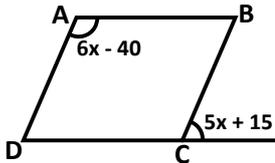
- (a)  $60^\circ$  (b)  $90^\circ$  (c)  $120^\circ$  (d)  $150^\circ$
11. If  $AB \parallel CD$  and  $BC \parallel DE$ , what is the value of  $x$ ?



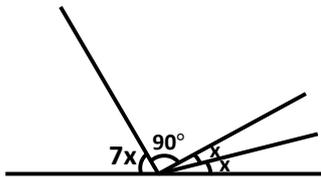
- (a)  $35^\circ$                       (b)  $105^\circ$                       (c)  $145^\circ$                       (d) None of these
12. If  $PQ \parallel ST$ , the value of  $x$  is



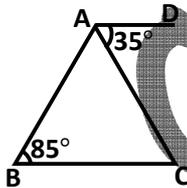
- (a)  $25^\circ$                       (b)  $55^\circ$                       (c)  $65^\circ$                       (d)  $105^\circ$
13. If ABCD is a parallelogram, then the value of  $x$  is



- (a)  $55^\circ$                       (b)  $135^\circ$                       (c)  $85^\circ$                       (d) None of these
14. In the figure shown, the value of  $x$  is



- (a)  $10^\circ$                       (b)  $20^\circ$                       (c)  $30^\circ$                       (d)  $40^\circ$
15. If  $AD \parallel BC$ , then  $\angle BAC$  is equal to



- (a)  $30^\circ$                       (b)  $60^\circ$                       (c)  $40^\circ$                       (d)  $80^\circ$