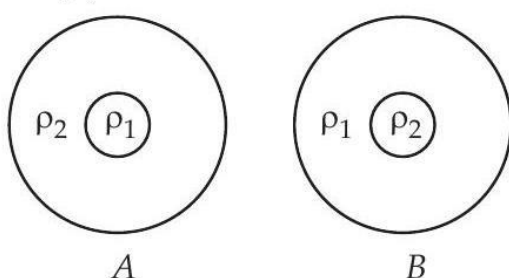


Gravitation

Multiple Choice Questions (MCQs)

- 1 When an object is thrown upward, the force of gravity is
 - (a) opposite to the direction of motion
 - (b) in the same direction as the direction of motion
 - (c) becomes zero at the highest point
 - (d) increases as it rises up.
- 2 The weight of a body of mass 5 kg is
 - (a) 69.0 N
 - (b) 79.0 N (c) 49.0 N
 - (d) 39.0 N
- 3 The value of G was first determined experimentally by
 - (a) Newton
 - (c) Kepler
 - (b) Henry Cavendish
 - (d) Galileo
- 4 Two planets A and B of same mass and same radius are shown in the figure. ρ_1 and ρ_2 are densities of the materials in the planets and $\rho_1 > \rho_2$. If the accelerations due to gravity on the surfaces of the planets A and B are g_A and g_B respectively, then

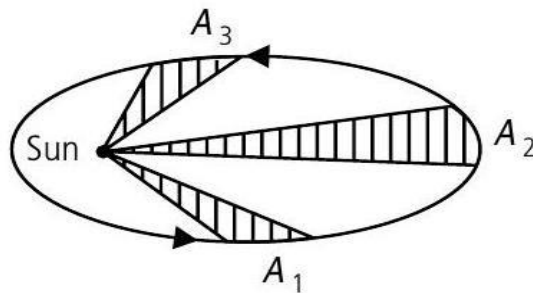


- (a) $g_A = g_B$
 - (b) $g_A < g_B$
 - (c) $g_A > g_B$
 - (d) Given information is not sufficient
- 5 Which of the following statements is/are correct?
 - I. Mass of an object is the measure of its inertia.
 - II. Heavier the object smaller is the inertia.

III. The mass of an object is variable.

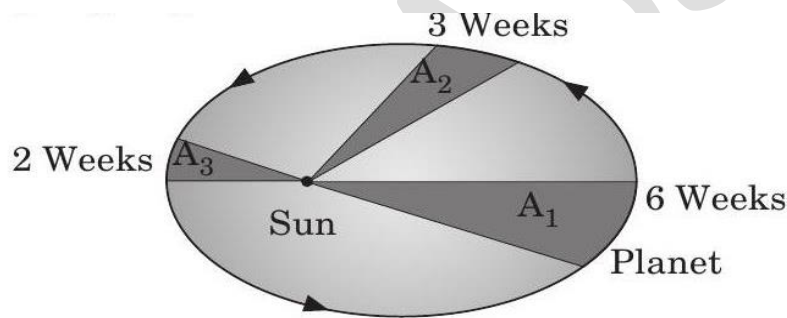
- (a) Only I
- (b) I and III
- (c) II and III
- (d) I and II

- 6 If a planet existed whose mass was twice that of Earth and whose radius 3 times greater, how much will a 1 kg mass weigh on the planet?
- (a) 25 N
 - (b) 2.17 N
 - (c) 1.1 N
 - (d) 5 N
- 7 If g_0 , g_h and g_d be the acceleration due to gravity at earth's surface, at height h and at a depth d respectively, then
- (a) $g_0 > g_h$ and $g_0 > g_d$
 - (b) $g_0 < g_h$ and $g_0 < g_d$
 - (c) $g_0 > g_h$ and $g_0 < g_d$
 - (d) $g_0 < g_h$ and $g_0 > g_d$.
- 8 A planet moving around sun sweeps out area A_1 in two days, A_2 in three days and A_3 in six days. Then the relation between A_1 , A_2 and A_3 is



- (a) $3A_1 = 2A_2 = A_3$
 - (b) $2A_1 = 3A_2 = 6A_3$
 - (c) $3A_1 = 2A_2 = 6A_3$
 - (d) $6A_1 = 3A_2 = 2A_3$.
- 9 The mass of a body is increased 4 fold and mass of other body is increased 16 fold. How should the distance between them be changed to keep the same gravitational force between them?
- (a) 4 times
 - (b) $\frac{1}{4}$ times
 - (c) 8 times
 - (d) $\frac{1}{8}$ times
- 10 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 the two stones will meet.
- (a) 4 s

- (b) 3.6 s
(c) 2 s
(d) 8 s
- 11 The mass of a body is measured to be 12 kg on the earth. If it is taken to the moon, its mass will be
(a) 12 kg
(b) 6 kg
(c) 2 kg
(d) 72 kg.
- 12 A balloon of mass m is rising with an acceleration a . A fraction of its mass is detached from the balloon. Its acceleration will
(a) decrease
(b) increase
(c) remain the same
(d) none of these
- 13 In figure, the line that joins a planet to the sun sweeps out areas A_1, A_2, A_3 in times intervals 6 weeks, 3 weeks and 2 weeks respectively. How are A_1, A_2, A_3 related?



- (a) $A_1 = 3A_2 = 2A_3$
(b) $A_1 = 2A_2 = 3A_3$
(c) $2A_1 = A_2 = A_3$
(d) $A_1 = 3A_2 = A_3$
- 14 If g_e is acceleration due to gravity on earth and g_m is acceleration due to gravity on moon, then
(a) $g_e = g_m$
(b) $g_e < g_m$
(c) $g_e = \frac{1}{6} g_m$
(d) $g_e = \frac{1}{6} g_m$
- 15 The unit of $\frac{G}{g}$ is
(a) kgm^{-1}
(c) $\text{m}^2 \text{kg}^{-1}$
(b) kgm^{-2}
(d) mkg^{-1}

16 Match the List-I and II and choose correct option below.

List-I

(P) $r^3 = T^2 \times \text{constant}$

(Q) $v = gt$

(R) $m \times g$

(S) $v^2 = u^2 + 2gh$

List-II

1. $u = 0$

2. Weight

3. Equation of motion

4. Kepler's law

(a) P – 4, Q – 1, R – 2, S – 3

(b) P – 4, Q – 2, R – 3, S – 1

(c) P – 2, Q – 4, R – 1, S – 3

(d) P – 1, Q – 4, R – 2, S – 3

17 If the mass of the body on the surface of the earth is 50 kg, its mass at the centre of the earth is

(a) zero

(b) more than 50 kg

(c) less than 50 kg

(d) equal to 50 kg

18 Two identical copper spheres of radius R are in contact with each other. If the gravitational attraction between them is F , find the relation between F and R .

(a) $F \propto R^4$

(c) $F \propto R^{-2}$

(b) $F \propto R^{3/2}$

(d) $F \propto R^{-4}$

19 Relation between mass of body and its weight is

(a) $w = mg$

(b) $w = \frac{m}{g}$

(c) $g = m - w$

(d) $w = m + g$

20 Choose the correct statement.

(a) Weight is a vector quantity.

(b) The weight of a body in interplanetary space is maximum.

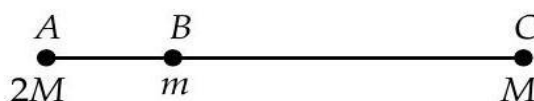
(c) Weight increases when the bodies go up.

(d) $1 \text{ N} = 1 \text{ kg m s}^{-1}$

21 Average distance of the earth from the sun is L_1 . If one year of the earth = D days, one year of another planet whose average distance from the sun is L_2 will be

- (a) $D \left(\frac{L_2}{L_1} \right)^{1/2}$ days
(b) $D \left(\frac{L_2}{L_1} \right)^{3/2}$ days
(c) $D \left(\frac{L_2}{L_1} \right)^{2/3}$ days
(d) $D \left(\frac{L_2}{L_1} \right)$ days.
- 22 A particle is dropped from a tower 180 m high. How long does it take to reach the ground? Take $g = 10 \text{ m/s}^2$.
(a) 2 s
(b) 6 s
(c) 5 s
(d) 8 s
- 23 The value of acceleration due to gravity is high if
(a) mass and radius both are small
(b) mass is small and radius is large
(c) mass is large and radius is small
(d) mass and radius both are large.
- 24 A person in a spaceship moving in space, experience weightlessness as the value of
(a) mass is zero
(b) acceleration due to gravity is zero
(c) gravitational force is zero
(d) none of these
- 25 Which of the following is correct for mass?
(a) It is a vector quantity.
(b) It is not a fundamental property of material body.
(c) It is the force with which the earth attracts a body.
(d) It is the quantity of matter contained in a body.
- 26 What happens to the acceleration due to gravity with the increase in altitude from the surface of the earth?
(a) Increases
(b) Decreases
(c) First decreases and then increases
(d) Remains same
- 27 An astronaut in the orbit in a spacecraft feels weightlessness
(a) due to the absence of gravity inside
(b) due to the fact that spacecraft has no energy

- (c) because acceleration in the orbit is equal to acceleration of gravity outside
- (d) there is no gravity outside
- 28 An apple falls towards the earth because the earth attracts it. The apple also attracts the earth by the same force. Why do we not see the earth rising towards the apple?
- (a) Acceleration of the earth is very large when compared to that of apple.
- (b) Acceleration of the earth is equal to that of apple.
- (c) Acceleration of the earth is neither high nor too low.
- (d) Acceleration of the earth is very small when compared to that of apple.
- 29 According to Kepler's law the relationship between T (time period of revolution of a planet) and r (the semi-major axis of ellipse) is
- (a) $T^2 \propto r$
- (b) $T^2 \propto r^2$
- (c) $T^2 \propto r^{-3}$
- (d) $T \propto r^{3/2}$
- 30 Particles of masses $2M, m$ and M are respectively at points A, B and C with $AB = 1/2(BC)$. m is much-much smaller than M and at time $t = 0$, they are all at rest. At subsequent times before any collision takes place



- (a) m will remain at rest.
- (b) m will move towards M .
- (c) m will move towards $2M$.
- (d) m will have oscillatory motion.

Case Based MCQs

Case I: Read the passage given below and answer the following questions from 31 to 35.

According to universal law of gravitation, the force between two particles or bodies is directly proportional to the product of their masses and inversely proportional to the square of the distance between these particles or bodies.

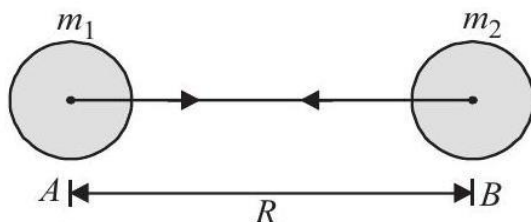
Consider two bodies A and B having masses m_1 and m_2 respectively. Let the distance between these bodies be R . The force of gravitation between these bodies is given by

$$F \propto m_1 m_2 \text{ and } F \propto \frac{1}{R^2}$$

$$F = G \frac{m_1 m_2}{R^2}$$

Where G is constant and is known as "universal gravitational constant".

31 Newton's law of gravitation is valid



- (a) in laboratory
 - (b) only on the earth
 - (c) only in our solar system
 - (d) everywhere
- 32 Gravitational force is a
- (a) repulsive force
 - (b) attractive force
 - (c) neither (a) nor (b)
 - (d) both (a) and (b)
- 33 Two particles of mass m_1 and m_2 , approach each other due to their mutual gravitational attraction only. Then
- (a) accelerations of both the particles are equal.
 - (b) acceleration of the particle of mass m_1 is proportional to m_1 .
 - (c) acceleration of the particle of mass m_1 is proportional to m_2 .
 - (d) acceleration of the particle of mass m_1 is inversely proportional to m_1 .
- 34 Gravitational force between two bodies is 1 N. If the distance between them is made half, what will be the force?
- (a) 2 N
 - (b) 4 N
 - (c) 6 N
 - (d) 7 N
- 35 How does the force of gravitation between two objects change when the distance between them is reduced to half?
- (a) Force of gravitation becomes 4 times
 - (b) Force of gravitation becomes 9 times
 - (c) Force of gravitation becomes 6 times
 - (d) Force of gravitation becomes 12 times

Case II: Read the passage given below and answer the following questions from 36 to 38.

There is no atmosphere on the moon. This is because gas molecules need a certain amount of force of attraction to be retained on a heavenly body. The force of attraction of the moon is less than the required force, hence no atmosphere can exist.

36 The value of g on moon is times that of earth

- (a) $\frac{1}{3}$
- (b) $\frac{1}{4}$
- (c) $\frac{1}{5}$
- (d) $\frac{1}{6}$

37 Mass of the moon is

- (a) more than
- (b) less than
- (c) equal to
- (d) can't say

38 If the weight of an object is 60 kgf on earth then, its weight on moon is

- (a) 10 kgf
- (b) 20 kgf
- (c) 30 kgf
- (d) 40 kgf

Case III: Read the passage given below and answer the following questions from 39 to 41.

All freely falling bodies fall with a uniform acceleration due to gravity. As a result, all the equations of motion for the uniformly accelerated bodies moving in a straight line are applicable to the freely falling bodies.

39 The value of g is taken as positive when a body is

- (a) dropped from a certain height
- (b) moving in horizontal direction
- (c) both (a) and (b)
- (d) none of these

40 Velocity of an object at maximum height in case it has been thrown vertically upward is

- (a) maximum
- (b) minimum
- (c) zero
- (d) 9.8 m s^{-1}

41 During free fall, the acceleration of the object is

- (a) zero
- (b) non-uniform
- (c) constant
- (d) none of these

Assertion & Reasoning Based MCQs

For question numbers 42-50, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (a) Both assertion and reason are true, and reason is correct explanation of the assertion.
- (b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.
- (c) Assertion is true, but reason is false.
- (d) Assertion is false, but reason is true.

42 Assertion : It is the gravitational force exerted by the sun and the moon on the sea water that causes to the formation of tides in the sea.

Reason : Gravitational force of attraction is a strong force.

43 Assertion : The value of acceleration due to gravity changes with the height, depth and shape of the earth.

Reason : Acceleration due to gravity is zero at the centre of the earth.

44 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, force is directly proportional to the product mass of bodies and inversely proportional to square of the distance between them.

45 Assertion : Any two objects in the universe attract each other by a force called gravitational force.

Reason : The force of gravitation exerted by the earth is called gravity.

46 Assertion : Universal gravitational constant G is a scalar quantity.

Reason : The value of G is same through out the universe.

47 Assertion : When a body is thrown up, the acceleration due to gravity at the topmost point is zero.

Reason : The acceleration due to gravity is always directed towards the centre of the earth for a freely falling body.

48 Assertion : If we drop a stone and a sheet of paper from a balcony of first floor, then stone will reach the ground first.

Reason : The resistance due to air depends on velocity only.

49 Assertion : Kepler's second law of planetary motion is also known as Kepler's law of areas.

Reason : The line joining the planet and the sun sweeps equal areas in equal intervals of time.

50 Assertion : A sheet of paper falls slower, than one that is crumpled in to a ball?

Reason : Sheet of paper has lesser weight than that is crumpled into a ball.

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