

Class: 9
Subject: Physics
Topic: Gravitation
No. of Questions: 19

Q1. When we move from the poles to the equator. Hence, the value of 'g' decrease. Why

Ans. The shape of earth is an ellipse so when we move from the poles to the equator the radius of the earth R increase. Hence, the value of 'g' decrease because value 'g' is inversely proportional to the radius of earth $g = \frac{GM}{R^2}$

Q2. What is the difference between centrifugal force and centripetal force?

Ans. Centripetal Force

- (i) It is the force that keeps a body in circular path.
- (ii) It acts toward the centre

Centrifugal Force

- (i) It is the pseudo force that tries to make a body fly off the circular path.
- (ii) It acts outward from the centre.

Q3. Explain: Centrifugal force and Centripetal force?

Ans. A force which is required to move a body uniformly in a circle is known as centripetal force. This force acts along the radius and towards the centre of the circle,

Centrifugal force arises when a body is moving actually along a circular path, by virtue of tendency of the body to regain its natural straight line path. This force acts along the radius and away from the centre of the circle.

Q4. An astronaut has 80 kg mass on earth (a) What is his weight on earth? (b) What will be his mass and weight on Mars where $g = 3.7 \text{ m/s}^2$

Ans. Mass of astronaut = 80 kg

Weight on earth = $mg = (80)(9.8) \text{ N} = 784 \text{ N}$ Weight on Mars = $mg' = (80)(3.7) \text{ N} = 296 \text{ N}$

Q5. A certain particle has a weight of 30 N at a place where the acceleration due to gravity is 9.8 m/s^2

(a) What are its mass and weight at a place where acceleration due to gravity is 3.5 m/s^2

(b) What are its mass and weight at a place where acceleration due to gravity is 0

Ans. (a) weight of the body, $W = 30 \text{ N} = mg$ Mass of the body, $m = W/g = 30/9.8 = 3.06 \text{ kg}$

New weight of the body, $W = mg' = (3.06)(3.5)\text{N} = 10.71\text{N}$

(b) Mass remains the same but weight become zero.

Q6. What is the difference between gravity and gravitation?

Ans. Gravity is defined as the ability of earth to attract another body by virtue of their masses. Gravitation is the phenomenon which explains the force of attraction between two masses separated by a certain distance. This force is known as Gravitational Force

Q7. Two bodies of mass 10 kg and 12 kg are falling freely. What is the acceleration produced in the bodies due to force of gravity?

Ans. 9.8 m/s^2 as the acceleration due to gravity produced in both the bodies is the same as it is independent of the mass of the body.

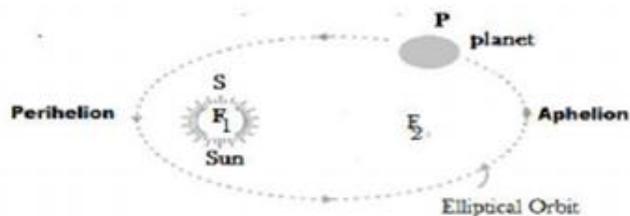
Q8. What will happen to the force of gravitation between two objects A and B if the distance them is reduced to half?

Ans. We know that, $F = \frac{1}{r^2}$ then, $F' = \frac{1}{(1/2r)^2} = 4(F)$

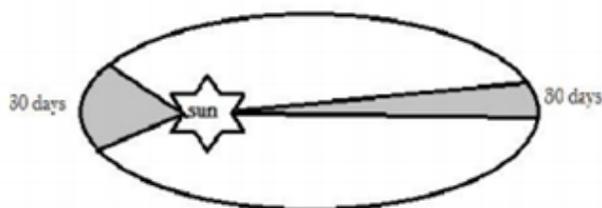
Hence, if the distance between two objects A and B is reduced to half the force of gravitation between two objects A and B increases 4 times.

Q9. What are the Kepler's laws of motions?

Ans. First law: The orbit of a planet is an ellipse with the Sun at one of the two foci.



Second law: A line segment joining a planet and the sun sweeps out equal areas during equal intervals of time



10. What are these (i) Product Rule (ii) Inverse square rule (iii) Universal gravitational constant (iv) Universal law of gravitation?

Ans. (i) Product rule: Force between two mass separated by a distance is directly proportional to the product of the two masses; $F \propto m_1 \times m_2$

(ii) Inverse Square law: Means that the force is inversely proportional to the square of the distance between two objects. Gravitational force is an example of inverse square law. The relation between the force of gravitation and distance is; $F \propto \frac{1}{r^2}$

$$\text{From (i) and (ii) } F \propto \frac{m_1 m_2}{r^2} \Rightarrow F = G \frac{m_1 m_2}{r^2}$$

(iii) Universal gravitational constant (G): The constant of proportionality is called the universal gravitational constant. Gravitational constant is defined as the forces of attraction between two Unit masses kept at unit distance. For example if we choose $m_1 = m_2 = 1$ and keep them at a unit distance ($r=1$), gravitational constant is equal to gravitation force of attraction between them

(iv) Universal law of gravitation: A force of attraction between two masses separated by some distance. The gravitational force between two bodies is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

Q11. What will happen to the force of gravitation between two objects A and B if the mass of the object A is doubled.

Ans. $F = m_1 \times m_2$

$F' = 2m_1 \times m_2 = 2(m_1 \times m_2) = 2F$. Thus, the force of gravitation between two objects A and B increase 2 times.

Q12. Show that universal gravitational constant is nothing but force of gravitation between two unit masses separated by unit distance.

Ans. We know that, $F = GMr^{-2}$

If $m = M = 1 \text{ kg}$ and $r = 1 \text{ m}$ Then, $F = G$, i.e. gravitational constant is equal to the force of gravitation.

Q13. A boy drops a stone from a cliff, which the ground in 20 seconds, Calculate the height of the cliff.

Ans. The height of the cliff = S

$$S = ut + \frac{1}{2}gt^2 = 0 + \frac{1}{2} \times 10 \times 20 \times 20 = 2000m = 2 \text{ km}$$

Q14. The gravitational force acts on all objects in proportion to their masses. Why. Then, a heavy object does not fall faster than a light object?

Ans. Acceleration due to gravity does not depend on mass of object. Hence, all bodies fall with the same acceleration provided there is no air or other resistance

Q15. 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?

Ans. According to Newton's 3rd law of motion every action has equal reaction in opposite direction. The earth surface attracts the moon with the same force with which the moons attracts the earth.

Q16. If the moon attracts the earth, why does the earth not move towards the moon?

Ans. The earth's mass is much larger than the moon so, the acceleration produced on the earth surface cannot be noticed.

Q17. What is the importance of Universal Law of Gravitation?

Ans. There are many importances of Universal Law of Gravitation

- (i) The force of attraction that binds us to the earth.
- (ii) The motion of planets moving around the sun.
- (iii) The motion of moon around the earth
- (iv) The occurring of tides due to sun and moon.

Q18. What is Gravitation?

Ans. Gravitation is the force of attraction between two objects in the universe.

- (i) Gravitation may be the attraction of objects by the earth eg :- If a body is dropped from a certain height, it falls downwards due to earth's gravity. If a body is thrown upwards. It reaches certain height and then falls downwards due to the earth's gravity.
- (ii) Gravitation may be the attraction between objects in outer spacemen : - Attention between the earth and moon, attraction between the sun and planets etc.

Q19. What is Centripetal force?

Ans. When a body moves in a circular path, it changes its direction at every point. The force which keeps the body in the circular path, acts towards the centre of the circle. This force is called centripetal forces. If there is no centripetal force, the body will move in a straight line tangent to the circular path.