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www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

Class: XI
Subject: Physics
Topic: Gravitation
No. of Questions: 20

Q1. The acceleration due to gravity g on earth is 9.8 ms^{-2}. What would be the value of g for a planet whose size is the same as that of the earth but the density is twice that of the earth?

a. 19.6 ms^{-2}
b. 9.8 ms^{-2}
c. 4.9 ms^{-2}
d. 2.45 ms^{-2}

Q2. If the radius of the earth suddenly decreases to 80% of its present value (the mass of the earth remaining the same), then the value of acceleration due to gravity will

a. remain unchanged
b. become (9.8 × 0.8) ms^{-2}
c. increase by 36%
d. increase by about 56%

Q3. A small planet is revolving around a massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force between the planet and the star is proportional to $R^{-5/2}$, then T will be proportional to

a. $R^{3/2}$
b. $R^{3/5}$
c. $R^{7/2}$
d. $R^{7/4}$

Q4. A satellite is orbiting the earth in a circular orbit of radius r. Its period of revolution varies as

a. $\sqrt{r}$
b. r
c. $r^{3/2}$
d. r^2

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Q5. The angular momentum of the earth revolving around the sun is proportional to R^n, where R is the distance between the earth and the sun. The value of n is

a. 0.5
b. 1.0
c. 1.5
d. 2.0

Q6. A satellite orbiting the earth is kept moving by the centripetal force provided by
a. the burning of fuel in its engine
b. the ejection of hot gases from its exhaust
c. the gravitational attraction of the sun
d. the gravitational attraction of the earth

Q7. Two satellites A and B are orbiting around the earth in circular orbits of the same radius. The mass of A is 16 times that of B. The ratio of the period of revolution of B to that of A is
a. 1 : 16
b. 1 : 4
c. 1 : 2
d. 1 : 1

Q8. A satellite is moving around the earth in a stable circular orbit. Which one of the following statements will be wrong for such a satellite?
a. It is moving at a constant speed.
b. Its angular momentum remains constant.
c. It is acted upon by a force directed away from the centre of the earth which counter-balances the gravitational pull of the earth.
d. It behaves as if it were a freely falling body.

Q9. The escape velocity from Earth is v_e. What is the escape velocity from a planet whose radius is twice that of the Earth and mean density is the same as that of Earth?

a. $v_e/2$
b. v_e
c. $2v_e$
d. $4v_e$

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Q10. Choose the wrong statement. The escape velocity of a body from a planet depends upon

a. the mass of the body
b. the mass of the planet
c. the average radius of the planet
d. the average density of the planet

Q11. A rocket is fired from the earth to the moon. The distance between the earth and the moon is r and the mass of the earth is 81 times the mass of the moon. The gravitational force on the rocket will be zero, when its distance from the moon is

a. $\frac{r}{20}$
b. $\frac{r}{15}$
c. $\frac{r}{10}$
d. $\frac{r}{5}$

Q12. Two spheres, each of mass M, are placed at a distance r apart on a horizontal surface. The gravitational field intensity at the midpoint of the line joining the centres of the spheres is

a. zero
b. $\frac{GM^2}{r^2}$
c. $\frac{GM^2}{2r^2}$
d. $\frac{GM^2}{4r^2}$

Q13. The escape velocity of a body on the earth's surface is v_e. A body is thrown with a speed 3 v_e. Assuming that the sun and the planets do not influence the motion of the body, its speed at infinity will be

a. zero
b. v_e
c. $\sqrt{2}\, v_e$
d. $2\sqrt{2}\, v_e$

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Q14. The radius of the earth is R. For a satellite to appear stationary, it must be placed in orbit around the earth at a height of about (given R = 6380 km)

a. 5.6 R
b. 6.6 R
c. 7.6 R
d. 8.6 R

Q15. Choose the only incorrect statement from the following

a. The equivalence of inertial and gravitational mass has provided a clue to the deeper understanding of gravitation.
b. At poles, the effect of rotation of the earth on the value of g is the minimum.
c. Massive rockets and extremely tiny particles, such as the molecules of a gas, require the same initial velocity to escape from the earth.
d. A geostationary satellite, if imparted the necessary velocity, can be put in orbit at any height above the earth.

Q16. Infinite number of masses, each of mass m, are placed along a straight line at distances of r, 2r, 4r, 8r, etc. from a reference point O. The gravitational field intensity at point O will be

a. $\frac{5\ Gm}{4r^2}$
b. $\frac{4\ Gm}{3r^2}$
c. $\frac{3\ Gm}{2r^2}$
d. $\frac{2\ Gm}{r^2}$

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Q17. A body of mass m is raised to a height h above the surface of the earth of mass M and radius R until its gravitational potential energy increases by $\frac{1}{3}$ mgR.
The value of h is

a. $\frac{R}{3}$
b. $\frac{R}{2}$
c. $\frac{mR}{(M+m)}$
d. $\frac{mR}{M}$

Q18. The change in the gravitational potential energy when a body of mass m is raised to a height nR above the surface of the earth is (here R is the radius of the earth)

a. $\left(\frac{n}{n+1}\right)mgR$
b. $\left(\frac{n}{n-1}\right)mgR$
c. nmgR
d. $\frac{mgR}{n}$

Q19. Two solid spheres of radii r and 2r, made of the same material are kept in contact. The mutual gravitational force of attraction between them is proportional to

a. $\frac{1}{r^4}$
b. $\frac{1}{r^2}$
c. r^2
d. r^4

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Q20. A comet is moving in a highly elliptical orbit around the sun. When it is closest to the sun, its distance from the sun is r and its speed is v. When it is farthest from the sun, its distance from the sun is R and its speed will be

a. $v\left(\frac{r}{R}\right)^{1/2}$

b. $v\left(\frac{r}{R}\right)$

c. $v\left(\frac{r}{R}\right)^{3/2}$

d. $v\left(\frac{r}{R}\right)^{2}$