PHYSICS

BOOKS - MTG-WBJEE PHYSICS (HINGLISH)

GRAVITATION

Wb Jee Workout Single Option Correct Type

1. The largest and the shortest distance of the earth from the sun are r_1 and r_2. Its distance

from the sun when it is at perpendicular to the major -axis of the orbit drawn from the sun is

A. $\frac{\eta + \eta_2}{4}$

B. $\frac{\eta + \eta_2}{\eta_1 - \eta_2}$

C. $\frac{2\eta r_1 r_2}{r_1 + r_2}$

D. $\frac{r_1 + r_2}{3}$

Answer: C

View Text Solution

2. Imagine a new planet having the same density as that of earth but it is 3 times bigger than the earth in size. If the acceleration due to gravity on the surface of earth is g and that on the surface of the new planet is g', then

A. $g' = \frac{g}{9}$

B. g=27g

C. g'=9g

D. g'=3g

Answer: D

View Text Solution

3. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth R_e, the radius of the planet would be

A. $2R_e$

B. $4R_e$

C. $\frac{1}{4}R_e$

D. $\frac{1}{2}R_e$

Answer: D

View Text Solution

4. Sun is about 330 times heavier and 100 times bigger in radius than earth. The ratio of mean density of the sun to that of earth is

A. 3.3×10^{-6}

B. 3.3×10^{-4}

C. 3.3×10^{-2}

D. 1.3

Answer: B

View Text Solution

5. Two spheres of masses m and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 3. The gravitational force will now be

A. 3 F

B. F

C. $F/3$

D. $F/9$

Answer: B

View Text Solution

6. The acceleration due to gravity on the planet A is 9 times the acceleration due to gravity on planet B. A man jumps to a height

of 2 m on the surface of A. What is the height of jump by the same person on the planet B ?

A. $(2/9)$m

B. 18 m

C. 6 m

D. $(2/3)$m

Answer: B

View Text Solution

7. With what velocity should a particle be projected so that is height becomes equal to radius of earth ?

A. $\left(\frac{GM}{R}\right)^{3/2}$

B. $\left(\frac{8GM}{R}\right)^{1/2}$

C. $\left(\frac{2GM}{R}\right)^{1/2}$

D. $\left(\frac{4GM}{R}\right)^{1/2}$

Answer: A

View Text Solution

8. For a planet having mass equal to mass of the earth but radius is one fourth of radius of the earth. Then escape velocity for this planet will be

A. $11.2 \ \ \mathrm{km}/s$

B. $22.4 \ \ \mathrm{km}/s$

C. $5.6 \ \ \mathrm{km}/s$

D. $44.8 \ \ \mathrm{km}/s$

Answer: B

View Text Solution

9. If the earth of radius R, while rotating with angular velocity to become standstill, what will be the effect on the weight of a body of mass m at a latitude of 45°?

A. remains unchanged

B. decreases by $R\omega^2$

C. increases by $R\omega^2$

D. increases by $R\omega^2/2$

Answer: D

View Text Solution

10. The period of revolution of planet A around the sun is 8 times that of B. The distance of A from the sun is how many times greater than that of B from the sun ?

A. 4

B. 5

C. 2

D. 3

Answer: A

View Text Solution

11. What will be the formula of mass of the earth in terms of g, R and G ?

A. $\mathrm{G}\frac{R}{g}$

B. $\mathrm{g}\frac{R^2}{G}$

C. $\mathrm{g}^2\frac{R}{G}$

D. G $\frac{g}{R}$

Answer: B

View Text Solution

12. A ball is dropped from a spacecraft revolving around the earth at a height of 120 km. What will happen to the ball ?

A. it will fall down to the earth gradually

B. it will go very far in the space

C. it will continue to move with the same speed along the original orbit of spacecraft

D. it will move with the same speed, tangentially to the spacecraft.

Answer: C

View Text Solution

13. The acceleration due to gravity g and mean density of the earth ρ are related by which of the following relations ? (Where G is the gravitational constant and R is the radius of the earth .)

A. $\rho = \frac{3g}{4\pi GR}$

B. $\rho = \frac{3g}{4\pi GR^3}$

C. $\rho = \frac{4\pi gR^2}{3G}$

D. $\rho = \frac{4\pi gR^3}{3G}$

Answer: A

View Text Solution

14. The earth (mass $= 6 \times 10^4 kg$) revolves around the sun with an angular velocity of 2×10^{-2} rad/s in a circular orbit of radius 1.5×10^8 km. The force excerted by the sun on the earth in newton, is

A. 36×10^{21}

B. 27×10^{39}

C. zero

D. 18×10^{25}

Answer: A

View Text Solution

15. The radius of earth is about 6400 km and that of mars is 3200 km. The mass of the earth is about 10 times mass of mars. An object weighs 200 N on the surface of earth. Its weight on the surface of mars will be

A. 20 N

B. 8 h

C. 80 N

D. 40 N

Answer: C

View Text Solution

16. If the earth shrinks such that its mass does not change but radius decreases to one quarter of its original value then one complete day will take.

A. 96 h

B. 48 h

C. 6 h

D. 1.5 h

Answer: D

View Text Solution

17. If the gravitational force between two objects were proportional to $1/R$ (and not as $1/R^2$), where R is the distance between them,

then a particle in a circular path (under such a force) would have its orbital speed v, proportional to

A. remains unchanged

B. R_0 (independent of R)

C. $1/R^2$

D. $1/R$

Answer: B

View Text Solution

18. A satellite A of mass m is at a distance of r from the surface of the earth. Another satellite B of mass 2m is at a distance of 2r from the the earth's centre. Their time periods are in the ratio of

A. $1:2$

B. $1:16$

C. $1:32$

D. $1:2\sqrt{2}$

Answer: D

View Text Solution

19. The mean radius of earth is R, its angular speed on its own axis is ω and the acceleration due to gravity at earth's surface is g. What will be the radius of the orbit of a geostationary satellite ?

A. $\left(R^2 g\omega / \left(\omega^2\right)\right.^{1/3}$

B. $\left(Rg\omega / \left(\omega^2\right)\right.^{1/3}$

C. $\left(R^2\omega^2 / \omega^2\right)^{1/3}$

D. $\left(R^2 g / \omega\right)^{1/3}$

Answer: A

View Text Solution

20. The satellite of mass m is orbiting around the earth in a circular orbit with a velocity v.What will be its total energy ?

A. $(3/4)mv^2$

B. $(1/2)mv^2$

C. mv^2

D. $(1/2)mv^2$

Answer: D

View Text Solution

21. Orbit of a planet around a star is

A. an ellipse

B. a circle

C. a parabola

D. a byperbola

Answer: A

View Text Solution

22. The time period of a simple pendulum on a freely revolving artificial satellite is

A. Infinite

B. 24 hour

C. 27 day

D. Zero

Answer: A

View Text Solution

23. If the earth were to suddenly contract to $\frac{1}{n}$th of its present radius without any change in its mass, the duration of the new day will be nearly

A. $\frac{24}{n}h$

B. 24n b

C. $\frac{24}{n^2}h$

D. $24n^2h$

Answer: C

View Text Solution

24. The gravitational field due to a mass distribution is $E = \frac{K}{x^3}$ in the x-direction (K is a constant). Taking the gravitational potential to be zero at infinity, its value at a distance x is

A. $\frac{K}{x}$

B. $\frac{K}{x^2}$

C. $\frac{K}{2x^2}$

D. $\frac{K}{3x^2}$

Answer: C

View Text Solution

25. A small satellite is revolving near earth's surface. Its orbital velocity will be nearly

A. $11.2 km/s$

B. $8 \ \mathrm{km}/s$

C. $6 \ \mathrm{km}/s$

D. $4km/s$

Answer: B

View Text Solution

26. The distance of a geo-stationary satellite from the centre of the earth is nearest to (where R=6400 km)

A. 5R

B. 7 R

C. 10 R

D. 18 R

Answer: B

View Text Solution

27. The acceleration due to gravity near the surface of a planet of radius R and density d is proportional to

A. d / R^2

B. dR^2

C. dR

D. d/R

Answer: C

View Text Solution

28. The kinetic energy needed to project a body of mass m from the surface of earth (radius R) to infinity is

A. $\frac{mgR}{4}$

B. 2mgR

C. mgR

D. $\frac{mgR}{4}$

Answer: C

View Text Solution

29. A spherical planet far out in space has a mass M_0 and diameter D_0. A particle of mass m falling freely near the surface of this planet

will experience an acceleration due to gravity which is equal to

A. GM_0 / D^2

B. $4mGM_0 / D_0^2$

C. $4GM_0 / D_0^2$

D. GmM_0 / D_0^2

Answer: C

View Text Solution

30. 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

Answer: B

View Text Solution

View Text Solution

Wb Jee Workout Category 2 Single Option Correct Type

1. The earth is assumed to be a sphere of radius R. A platform is arranged at a height R from the surface of the earth. The escape velocity of a body from this platform is fv, where v is its escape velocity from the surface of the earth. The value of f is

A. $1/2$

B. $\sqrt{2}$

C. $1/\sqrt{2}$

D. $1/3$.

Answer: C

View Text Solution

2. For a satellite moving in an orbit around the earth, the ratio of kinetic energy to potential energy is

A. $1/2$

B. $1/\sqrt{2}$

C. 2

D. $\sqrt{2}$

Answer: A

View Text Solution

3. The escape velocity of a sphere of mass m is given by (G=Universal gravitational

constant,M=Mass of the earth and R_e=Radius of the earth)

A. $\sqrt{\frac{2GMm}{R_e}}$

B. $\sqrt{\frac{2GM}{R_e}}$

C. $\sqrt{\frac{GM}{R_e}}$

D. $\sqrt{\frac{2GMm+R_e}{R_e}}$

Answer: B

View Text Solution

4. The escape velocity of a body on the surface of the earth is $11.2 \ \mathrm{km}/s$ If the earth's mass increases to twice its present value and radius of the earth becomes half, the escape velocity becomes

A. $22.4 \ \mathrm{km}/s$

B. $44.8 \ \mathrm{km}/s$

C. $5.6 \ \mathrm{km}/s$

D. $11.2 \ \mathrm{km}/s$

Answer: A

View Text Solution

5. Two particles of equal mass go around a circle of radius R under the action of their mutual gravitational attraction. The speed v of earth particle is

A. $\frac{1}{3}\sqrt{\frac{Gm}{R}}$

B. $\frac{1}{2}\sqrt{\frac{Gm}{R}}$

C. $\frac{1}{2}\sqrt{\frac{R}{Gm}}$

D. $\sqrt{\frac{Gm}{R}}$

Answer: D

View Text Solution

6. A satellite in force free space sweeps stationary interplanetary dust at a rate of $dM/dt = \alpha v$, where M is mass and v is the speed of satellite and α is a constant. The acceleration of satellite is

A. $\frac{-\alpha v^2}{2M}$

B. $-\alpha v^2$

C. $\frac{-2\alpha v^2}{M}$

D. $\frac{-\alpha v^2}{M}$

Answer: D

View Text Solution

7. The weight of a body on surface of earth is 12.6N. When it is raised to a height half the radius of earth, its weight will be

A. 2.8N

B. $5.6\mathrm{N}$

C. $12.6\mathrm{N}$

D. $25.2\mathrm{N}$

Answer: B

View Text Solution

8. If g is the acceleration due to gravity on the surface of the earth, the gain in potential energy of an object of mass m raised from the

earth's surface to a height equal to the radius R of the earth is

A. $\frac{mgR}{4}$

B. $\frac{mgR}{2}$

C. mgR

D. 2mgR

Answer: B

View Text Solution

9. v_e and v_p denote the escape velocities from the earth and another planet having twice the radius and the same mean density as that of the earth. Then

A. $v_e v_p / 2$

B. $v_e = v_p$

C. $v_e = 2v_p$

D. $v_e = \frac{p}{4}$.

Answer: A

View Text Solution

View Text Solution

10. A planet moves around the sun. At a given point P, it is closest from the sun at a distance d_1 and has a speed v_1. At another point Q, when it is farther from the sun at a distance d_2, its speed will be

A. $\frac{d_1^2}{d_2^2}v_1$

B. $\frac{d_2}{d_1}v_1$

C. $\frac{d_2^2}{d_1^2}v_1$

D. $\frac{d_1 v_1}{d_2}$

Answer: D

View Text Solution

11. The ratio of radii of planets A and B in K_1 and ratio of accelerations due to gravity on them is K_2. The ratio of escape velocities from them will be

A. K_1K_2

B. $\sqrt{K_1K_2}$

C. $\sqrt{\frac{K_1}{K_2}}$

D. $\sqrt{\frac{K_2}{K_1}}$

Answer: B

View Text Solution

12. Two planets at mean distances d_1 and d_2 from the sun have their frequencies n_1 and n_2 respectively. Then

A. $n_1^2 d_1^2 = n_2^2 d_2^2$

B. $n_2^2 d_2^3 = n_1^2 d_1^3$

C. $n_1 d_1^2 = n_2 d_2^2$

D. $n_1^2 d_1 = n_2^2 d_2$.

Answer: B

View Text Solution

13. If the density of earth is doubled keeping its radius constant then acceleration due to gravity will be (g $= 9.8 \ \ \mathrm{m}/s^2$)

A. $19.6 \ \ \mathrm{m}/s^2$

B. $9.8 \ \mathrm{m}/s^2$

C. $4.9 \ \mathrm{m}/s^2$

D. $2.45 \ \mathrm{m}/s^2$

Answer: A

View Text Solution

14. A satellite of mass m revolves around the earth of radius R at a height x from its surface. If g is the acceleration due to gravity on the

surface of the earth, the orbital speed of the satellite is

A. gx

B. $\frac{gR}{R-x}$

C. $\frac{gR^2}{R+x}$

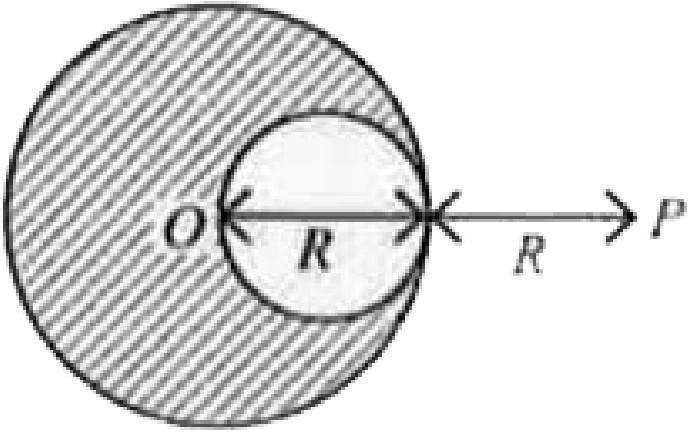
D. $\left(\frac{gR^2}{R+x}\right)^{1/2}$

Answer: D

View Text Solution

15. A solid sphere of uniform density and radius R applies a gravitational force of attraction equal to F_1 on a particle placed at P, distance 2R from the centre O of the sphere. A spherical cavity of radius $R/2$ is now made in the sphere as shown in given figure. The sphere with cavity now applies a gravitational force F_2 on same particle placed at P. The ratio

F_2 / F_1 will be



A. $1/2$

B. $7/9$

C. 3

D. 7

Answer: B

View Text Solution

Wb Jee Workout Category 3 One Or More Than One Option Correct Type

1. Two satellites of earth, S_1 and S_2 are moving in the same orbit. The mass of S_1 is four times the mass of S_2. Which one of the following stetements is true ?

A. The potential energies fo earth and satellite in the two cases are equal.

B. S_1 and S_2 are moving with the same speed.

C. The kinetic energies of the two satellites are equal.

D. The time period of S_1 is four times that of S_2.

Answer: B

View Text Solution

2. A body of mass m is placed on earth surface which is taken from earth surface to a height of h=3 R, then change in gravitational potential energy is

A. $\frac{mgR}{4}$

B. $\frac{2}{3}mgR$

C. $\frac{3}{4}mgR$

D. $\frac{3}{4}mgR$

Answer: C

View Text Solution

View Text Solution

3. 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. $\frac{mgR}{n}$

Answer: A

View Text Solution

4. A cavity of radius $R/2$ is made inside a solid sphere of radius R. The centre of the cavity is located at a distance $R/2$ from the centre of the sphere. The gravitational force on a particle of mass m at a distance $R/2$ from the centre of the sphere on the line joining both the centre of the cavity)

[Here g $= (GM)/R^2$, where M is the mass of the sphere

A. $\frac{mg}{2}$

B. $\frac{3mg}{8}$

C. $\frac{mg}{16}$

D. none of these

Answer: B

View Text Solution

5. Two astronauts have deserted their spaceship in a region of space far from the gravitational attraction of any other body. Each has a mass of 100 kg and they are 100 m apart. How long will it be before the relative to one another. How long will it be before the gravitational attraction brings them 1 cm closer together ?

A. 2.52 days

B. 1.41 days

C. 0.70 days

D. $1.41s$

Answer: B

View Text Solution

6. Which of the following statements are true about acceleration due to gravity ?

A. g decreases in moving away from the centre if $r > R$

B. g decreases in moving away from the centre if $< R$

C. g is zero at the centre of earth

D. g decreases if earth stops rotating on its axis

Answer: A::C

View Text Solution

7. If both the mass and radius of the earth decreases by 1%, the value of

A. acceleration due to gravity would decrease by nearly 1%

B. acceleration due to gravity would increase by 1%

C. escape velocity from the earth's surface would decrease by 1%

D. the gravitational potential energy of a body on earth's surface will remain unchanged.

Answer: B::D

View Text Solution

8. A small mass m is moved slowly from the surface of the earth to a height h above the surface. The work done (by an external agent) in doing this is

A. mgh, for all values of h

B. mgh, for $h < < R$

C. $1/2$ mgR for h=R

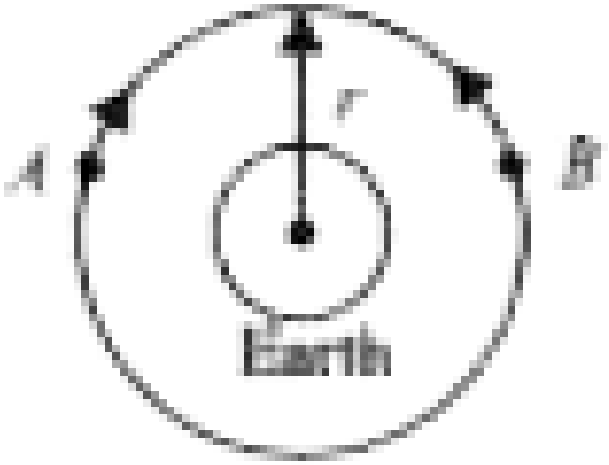
D. $-1/2$mgR for h=R

Answer: B::C

View Text Solution

9. Consider two satellites A and B of equal mass m, moving in the same circular orbit about the earth, but in opposite sense as

shown in figure. The orbital radius is R. The satellite undergo a collision which is perfectly inelastic. For this situation, mark out the correct statements. [Take mass of earth as M]



A. The total energy of the satellite plus earth's system before collision is $-(GMm)/r$.

B. The total energy of the two satellites plus earth system just after collision is $-(2GMm)/r$.

C. The total energy of the two satellites plus earth system just after collision $-(GMm)/2r$.

D. The combined mass (two satellites) will fall towards the earth just after collision.

Answer: A::B::D

View Text Solution

10. The height vertically above the earth's surface at which the acceleration due to gravity becomes 1% of its value at the surface is (R is the radius of the earth)

A. 8R

B. 9R

C. 10R

D. 20R

Answer: B

View Text Solution

Wb Jee Previous Years Questions Category 1 Single Option Correct Type

1. A mass M at rest is broken into two pieces having masses m and (M-m). The two masses are then separated by a distance r. The gravitational force between them will be maximum when the ratio of the masses [m : (M-m) of the two parts is

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: A

View Text Solution

2. A planet moves around the sun in an elliptical orbit with the sun at one of its foci. The physical quantity associated with the

motion of the planet that remains constant with time is

A. velocity

B. centripetal force

C. linear momentum

D. angular momentum

Answer: D

View Text Solution

3. An artificial satellite moves in a circular orbit around the earth. Total energy of the satellite is given by E. The potential energy of the satellite is

A. $-2E$

B. 2E

C. $2e/3$

D. $-2e/3$

Answer: B

View Text Solution

View Text Solution

4. Two particles of mass m_1 and m_2, approach each other due to their mutual gravitational attraction only. Then

A. acceleration of both the particles are equal.

B. acceleration of the particle of mass m_1 is proportional to m_1

C. acceleration the particle of mass m_1 is proportional to m_2.

D. accelaration of the particle of mass m_1 is inversely proportional to m_1.

Answer: C

View Text Solution

5. A satellite has kinetic energy K, potential energy V and total energy E. Which of the following statements is true ?

A. $K = -V/2$

B. $K = V/2$

C. $E = -K/2$

D. $E = -K/2$

Answer: A

View Text Solution

6. The ratio of accelerations due to gravity $g_1 : g_2$ on the surface of two planets is $5:2$ and the ratio of their respective average densities $\rho_1 : \rho_2$ is $2:1$. What is the ratio of respective

escape velocities $v_1 : v_2$ from the surface of the planets ?

A. $5 : 2$

B. $\sqrt{5} : \sqrt{2}$

C. $5 : 2\sqrt{2}$

D. $25 : 4$

Answer: C

View Text Solution

7. Assume that the earth moves around the sun in circular orbit of radius R and there exists a planet which also moves around the sun in a circular orbit with an radius of the orbit of the planet is

A. $2^{-2/3}R$

B. $2^{2/3}R$

C. $2^{-1/3}R$

D. $\frac{R}{\sqrt{2}}$

Answer: A

View Text Solution