PHYSICS

BOOKS - BITSAT GUIDE PHYSICS (HINGLISH)

GRAVITATION

Practice Exercise

1. Calculate the gravitational force of attraction between two spherical bodies, each

of mass 1kg placed at 10m apart $\left(G = 6.67 \times 10^{-11} Nm^2 / kg^2\right).$

A. $6.67 \times 10^{-13} N$

B. $6.67 \times 10^{-11} N$

C. $6.67 \times 10^{-7} N$

D. None of these

Answer: A

Watch Video Solution

2. If the distance between two masses is doubled, then the gravitational attraction between them will be

A. decrease 6%

B. decreases 4%

C. increase 4%

D. increase 6%

Answer: B

Watch Video Solution

3. How the gravitational constant will change if a brass plate is introduced between two bodies ?

A. No change

B. Decreases

C. Increases

D. Insufficient data

Answer: A

 Watch Video Solution

4. Six particles each of mass$m$ are placed at the corners of a regular hexagon of edge length a. If a point mass m_0 is placed at the centre of the hexagon, then the net gravitational force on the point mass is

A. $\frac{6Gm^2}{a^2}$

B. $\frac{6Gmm_0}{a^2}$

C. zero

D. None

Answer: C

Watch Video Solution

5. Two particles each of mass 'm' are placed at A and C are such $AB = BC = L$. The gravitational force on the third particle placed at D at a distance L on the perpendicular bisector of the line AC is

A. $\frac{Gm^2}{\sqrt{2}L^2}$ along BD

B. $\frac{Gm^2}{\sqrt{2}L^2}$ along DB

C. $\frac{Gm^2}{L^2}$ along AC

D. None of these

Answer: B

Watch Video Solution

6. In a hypothetical concept, electron of mass m_e revolves around nucleus due to gravitational force of attraction between electron and proton of mass m_p. If the radius of circular path of electron is r, then the speed of electron is

A. $\sqrt{\left(\frac{Gm_pm_e}{4r}\right)}$

B. $\sqrt{\left(\frac{Gm_pm_e}{r}\right)}$

C. $\sqrt{\left(\frac{Gm_p}{r}\right)}$

D. None of these

Answer: C

Watch Video Solution

7. Three point masses each of mass m rotate in a circle of radius r with constant angular

velocity ω due to their mutual gravitational attraction. If at any instant, the masses are on the vertices of an equilateral triangle of side a, then the value of ω is

A. $\sqrt{\left(\frac{Gm}{a^3}\right)}$

B. $\sqrt{\left(\frac{3GM}{a^3}\right)}$

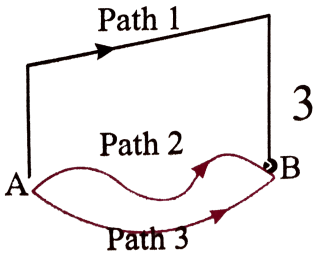
C. $\sqrt{\left(\frac{Gm}{3a^3}\right)}$

D. None

Answer: B

Watch Video Solution

8. A gravitational field is present in a region. A point mass is shifted from A to B, along different paths shown in the figure. If W_1, W_2 and W_3 represent the work done by gravitational force for respective paths, then



3) $W_1 > W_3 > W_2$ 4) none

A. $W_1 = W_2 = W_3$

B. $W_1 > W_2 > W_3$

C. $W_1 > W_3 > W_2$

D. None of the above

Answer: A

Watch Video Solution

9. A point mass m_0 is placed at distance $R/3$ from the centre of spherical shell of mass m and radius R. the gravitational force on the point mass m_0 is

A. $\frac{4Gmm_0}{R^2}$

B. zero

C. $\frac{9Gmm_0}{R^2}$

D. None of these

Answer: B

Watch Video Solution

10. A uniform ring of mass M and radius R is placed directly above a uniform sphere of mass 8M and of same radius R. The centre of

the ring is at a distance of $d = \sqrt{3}R$ from the centre of the sphere. The gravitational attraction between the sphere and the ring is

A. $\frac{GM^2}{R^2}$

B. $\frac{3GM^2}{2R^3}$

C. $\frac{2GM^2}{\sqrt{2}R^2}$

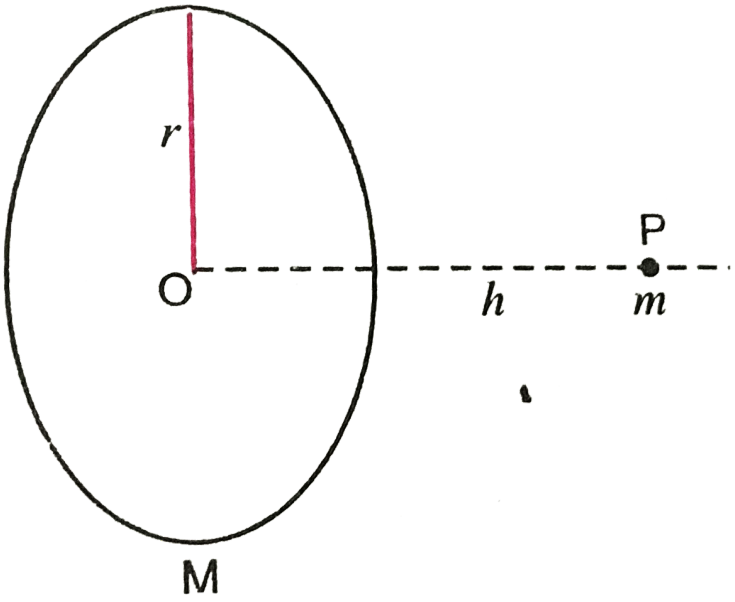
D. $\frac{\sqrt{3}GM^2}{R^2}$

Answer: D

Watch Video Solution

11. A mass m is placed at P a distance h along the normal through the centre O of a thin circular ring of mass M and radius r Fig.

If the mass is removed futher away such that OP becomes $2h$, by what factor the force of gravitational will decrease, if $h = r$?



A. $\frac{3\sqrt{2}}{4\sqrt{3}}$

B. $\frac{5\sqrt{2}}{\sqrt{3}}$

C. $\frac{4\sqrt{3}}{5}$

D. $\frac{4\sqrt{2}}{5\sqrt{5}}$

Answer: D

Watch Video Solution

12. A point mass of 10 kg is placed at the centre of earth. The weight of the point mass is

A. zero

B. 98N

C. 49N

D. 38N

Answer: A

 Watch Video Solution

13. How will you weight the sun, i.e. estimate its mass ? You will need to know the period of one of its planets and the radius of the

planetary orbit. The mean orbit radius of the earth around the sun is $1.5 \times 10^8 km$, then the mass of the sun would be calculated as

A. $2 \times 10^{15} kg$

B. $2 \times 10^{20} kg$

C. $2 \times 10^{27} kg$

D. $2 \times 10^{30} kg$

Answer: D

Watch Video Solution

14. A particle hanging from a massless spring stretches it by $2cm$ at the earth's surface. How much will the same particle stretch the spring at a height Of $2624Km$ from the surface of the earth? (Radius of the earth $= 6400km$)

A. 1cm

B. 2cm

C. 3cm

D. 4cm

Answer: A

Watch Video Solution

15. There is a mine of deoth 2km. The conditions as compared to those at the surface of the earth are

A. lower value of g

B. higher value of g

C. Both (a) and (b)

D. None of these

Answer: A

Watch Video Solution

16. In order to make the weight of a 5kg body to zero at the equator. The angular speed of the earth would must be (take, $g = 10m/s^2$ and radius of the earh, $R = 6400km$)

A. $0.00125rads^{-1}$

B. $0.0125rads^{-1}$

C. $0.125rads^{-1}$

D. $0.0325rads^{-1}$

Answer: A

Watch Video Solution

17. At what height, the weight of the body is same as that at same depth from the earth's surface (take, earth's radius = R)

A. $R/2$

B. $\frac{\left(\sqrt{5-1}\right)R}{2}$

C. $\frac{\left(\sqrt{3}R-1\right)}{2}$

D. $\frac{\sqrt{5}}{3}R$

Answer: B

Watch Video Solution

18. At the surface of a certain planet acceleration due to gravity is one - quarter of that on earth If a brass ball is transported to this planet , then which one of the following statements is not correct ? .

A. The brass ball has the same mass on the other planet as on the earth

B. The mass of the brass ball on this planet is a quarter of its mass as measured on the earth

C. The weight of the brass ball on this planet is a quarter of the weight as measured on the earth

D. The brass ball has the same volume on the other planet as on the earth

Answer: A

 Watch Video Solution

19. If both the mass and radius of the earth, each decreases by 50%, the acceleration due to gravity would

A. remain same

B. decrease by 50%

C. decrease by 100%

D. increase by 100%

Answer: D

Watch Video Solution

20. A body is suspended on a spring balance in a ship sailing along the equator with a speed v'. If ω is the angular speed of the earth and ω_0 is the scale reading when the ship is at rest, the scale reading when the ship is sailing is

A. ω_0

B. zero

C. $\omega_0\left(1 \pm \frac{2\omega v'}{g}\right)$

D. $\omega_0\left(1 - \frac{g}{2\omega}\right)$

Answer: C

Watch Video Solution

21. The maximum vertical distance through which a full dressed astronaut can jump on the earth is 0.5m. Estimate the maximum vertical distance through which he can jump on the motion, which has a mean density 2/3

rd that of the earth and radius one-quarter that of the earth.

A. 1.5m

B. 3m

C. 6m

D. 7.5m

Answer: B

 Watch Video Solution

22. Two stallites A and B revolve round the same planet in coplanar circular orbits lying in the same plane. Their periods of revolutions are 1h and 8h, respectively. The radius of the orbit of A is 10^4km. The speed of B relative to A when they are closed in kmh^{-1} is

A. $3\pi \times 10^4$

B. zero

C. $2\pi \times 10^4$

D. $\pi \times 10^4$

Answer: D

Watch Video Solution

23. A satellite is moving on a circular path of radius r around earth has a time period T. if its radius slightly increases by Δr, determine the change in its time period.

A. $\frac{3}{2}\left(\frac{T}{r}\right)\Delta r$

B. $\left(\frac{T}{r}\right)\Delta r$

C. $\frac{3}{2}\left(\frac{T^2}{r^2}\right)\Delta r$

D. None of these

Answer: A

Watch Video Solution

24. The gravitational field in a region is $10N/kg\left(\hat{i}-\hat{j}\right)$. Find the work done by gravitational force to shift slowly a particle of mass 1kg from point (1m, 1m) to a point (2m,-2m).

A. 10J

B. $-10J$

C. $-40J$

D. $+40J$

Answer: D

Watch Video Solution

25. In previous problem, find the work done by external agent.

A. $40J$

B. $-40J$

C. zero

D. $+10J$

Answer: B

Watch Video Solution

26. The gravitational force in a region is given by, $\overrightarrow{F} = may\hat{i} + \max\ \hat{j}$ The work done by gravitational force to shift a point mass m from $(0, 0, 0)$ is (x_0, y_0, z_0) is

A. $\max_0 y_0 z_0$

B. to (x_0, y_0, z_0)

C. $-\max_0 y_0$

D. zero

Answer: B

Watch Video Solution

27. The work done by an external agent to shift a point mass from infinity to the centre of the earth is W. Then choose the correct relation.

A. $= 0$

B. > 0

C. < 0

D. ≤ 0

Answer: C

Watch Video Solution

28. The work done liftting a particle of mass 'm' from the centre of the earth to the surface of the earth is

A. $-mgR$

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

C. zero

D. None of these

Answer: B

Watch Video Solution

29. The change in the gravitational potential energy when a body of a mass m is raised to a

height nR above the surface of the earth is (here R is the radius of the earth)

A. nmgR

B. $mgR = \left(\frac{n^2+1}{n^2}\right)$

C. $mgR\left(\frac{n-1}{n}\right)$

D. $mgR\left(\frac{n+1}{n}\right)$

Answer: C

Watch Video Solution

30. Suppose the gravitational force varies inversely as the nth power of distance. Then the time period of a planet in circular orbit of radius 'R' around the sun will be proportional to

A. R^n

B. $R^{(n+1)/2}$

C. $R^{(n-1)/2}$

D. R^{-n}

Answer: B

Watch Video Solution

31. The time period of a simple pendulum at the centre of the earth is

A. zero

B. infinity

C. less than zero

D. None of these

Answer: B

Watch Video Solution

32. If a rocket is fired with a velocity, $V = 2\sqrt{gR}$ near the earth's surface and goes upwards, its speed in the inter-stellar space is

A. $4\sqrt{gR}$

B. $\sqrt{2gR}$

C. $\sqrt{gR}$

D. $\sqrt{4gR}$

Answer: B

Watch Video Solution

33. If the satellite is stopped suddenly in its orbit which is at a distnace = radius of earth from earth's surface and allowed to fall freely into the earth, the speed with which it hits the surface of earth will be -

A. $4km/s$

B. $8km/s$

C. $2km/s$

D. $6km/s$

Answer: B

Watch Video Solution

34. A projectile is fired vertically upwards from the surface of the earth with a velocity Kv_e, where v_e is the escape velocity and $K < 1$.If R is the radius of the earth, the maximum height to which it will rise measured from the centre of the earth will be (neglect air resistance)

A. $\frac{1-k^2}{R}$

B. $\frac{R}{1-k^2}$

C. $R\left(1-k^2\right)$

D. $\frac{R}{1+k^2}$

Answer: B

Watch Video Solution

35. A satellite of mass M revolving in a circular orbit of radius r_s around the earth of mass M has a total energy E. then, its angular momentum will be

A. $\sqrt{\frac{E}{m_s r_s^2}}$

B. $\frac{E}{2m_s r_s^2}$

C. $\left(2Em_s r_s^2\right)^{1/2}$

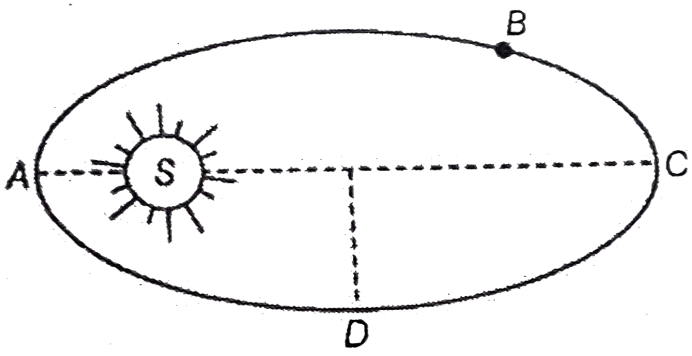
D. $\sqrt{2Em_s r_s}$

Answer: C

Watch Video Solution

36. A planet revolves in elliptical orbit around the sun. (see figure). The linear speed of the

planet will be maximum at



A. A

B. B

C. C

D. D

Answer: A

Watch Video Solution

37. Two bodies each of mass 1kg are at a distance of 1m. The escape velocity of a body of mass 1 kg which is midway between them is

A. $8 \times 10^{-5} m/s$

B. $2.31 \times 10^{-5} m/s$

C. $4.2 \times 10^{-5} m/s$

D. zero

Answer: B

Watch Video Solution

38. The artifical satellite is moving in a circular around the earth with a speed equal to half the magnitude of escape velocity from the earth. (i) Determine the height of the satellite above the earth's surface, (ii) If the satellite is stopped suddenly in its orbit and allowed to fall freely on to the earth , find the speed with which it hits surface of the earth. Take $g = 9.8ms^{-2}$, radius of the earth =6400km.

A. 2R

B. $R/2$

C. R

D. $R/4$

Answer: C

Watch Video Solution

39. A particle of mass m is projected from the surface of earth with a speed $V_0(V_0 <$ escape velocity). Find the speed of particle at height

$h = R$ (radius of earth). (Take, $R = 6400km$ and $g = 9.8m/s^2$)

A. $\sqrt{gR}$

B. $\sqrt{v_0^2 - 2gR}$

C. $\sqrt{v_0^2 - gR}$

D. None of these

Answer: C

Watch Video Solution

40. The binding energy of earth-sun system is (neglecting the other planets)

A. $2.60 \times 10^{33} J$

B. $6.33 \times 10^{6} J$

C. $3.40 \times 10^{33} J$

D. $8.60 \times 10^{24} J$

Answer: A

Watch Video Solution

41. One of the satellite of jupiter, has an orbital period of 1.769 days and the radius of the orbit is $4.22 \times 10^8 m$. Show that mass of jupiter is about one thousandth times that of the mass of the sun. (Take 1 year $= 365.15$ mean solar day).

A. one thousandth that of the sun

B. one hundredth that of the sun

C. one tenth that of the sun

D. half of that of the sun

Answer: A

 Watch Video Solution

42. A satellite is orbiting closely to earth and having kinetic energy K. the kinetic energy required by it to just overcome the gravitational pull of the earth, is

A. 2K

B. $\sqrt{2}K$

C. $\sqrt{3}K$

D. $2\sqrt{2}K$

Answer: A

Watch Video Solution

Bitsat Archives

1. The total energy of a revolving satellite around the earth is $-KJ$. The minimum energy required to throw it out of earth's gravitational fields is

A. KJ

B. $\frac{K}{2}J$

C. $2KJ$

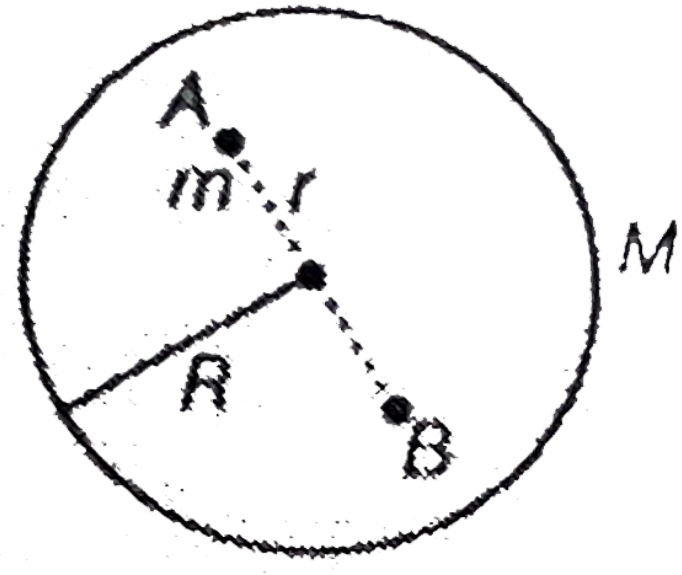
D. None of these

Answer: A

Watch Video Solution

2. There is a shell of mass M and density of shell is uniform. The work done to take a point

mass from point A to B is $(AB = r)$



A. $\frac{GmM}{r}$

B. $\frac{GmM}{R}$

C. $-\frac{GmM}{r}$

D. zero

Answer: D

Watch Video Solution

3. A satellite is in a circular orbit round the earth at an altitude R above the earth's surface, where R is the radius of the earth. If g is the acceleration due to gravity on the surface of the earth, the speed of the satellite is

A. $\sqrt{2Rg}$

B. $\sqrt{Rg}$

C. $\sqrt{\frac{Rg}{2}}$

D. $\frac{\sqrt{Rg}}{4}$

Answer: C

Watch Video Solution

4. Which is constant, the earth revolving around the sun ?

A. Angular momentum

B. Linear momentum

C. Rotational kinetic energy

D. Kinetic energy

Answer: A

Watch Video Solution

5. Suppose the gravitational force varies inversely as the nth power of distance. Then the time period of a planet in circular orbit of

radius 'R' around the sun will be proportional to

A. $R^{(n+1)/2}$

B. $R^{(n-1)/2}$

C. R^{n}

D. $R^{(n-2)/2}$

Answer: A

 Watch Video Solution

6. The satellite of mass m revolving in a circular orbit of radius r around the earth has kinetic energy E. then, its angular momentum will be

A. $\sqrt{\frac{E}{mr^2}}$

B. $\frac{E}{2mr^2}$

C. $sqt\left(2Emr^2\right)$

D. $\sqrt{2Emr}$

Answer: C

Watch Video Solution

Watch video solution

7. If a new planet is discovered rotating around Sun with the orbital radius double that of earth, then what will be its time period (in earth's days)

A. 1032

B. 1023

C. 1024

D. 1043

Answer: A

Watch Video Solution

8. If the radius of the earth were to shrink by 1% its mass remaining the same, the acceleration due to gravity on the earth's surface would

A. increase by $0.5\ \%$

B. increase by $2\ \%$

C. decrease by $0.5\ \%$

D. decrease by 2%

Answer: B

Watch Video Solution

9. The mean radius of the earth's orbit around the sun is $1.5 \times 10^{11} m$ and that of the orbit of mercury is $6 \times 10^{10} m$. The mercury will revolve around the sun is nearly

A. $\sqrt{\frac{2}{5}} yr$

B. $\frac{2}{5}yr$

C. $\left(\frac{2}{5}\right)^{2}yr$

D. $\left(\frac{2}{5}\right)^{3/2}yr$

Answer: D

Watch Video Solution

10. A satellite of mass m is orbiting around the earth at a height equal to twice the radius of the earth (R). Its potential energy is given by

A. $-2mgR$

B. $-mg.\ \frac{R}{2}$

C. $\frac{-2}{3}mgR$

D. $-mg.\ \frac{R}{2}$

Answer: C

Watch Video Solution

11. 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. $-mgR$ for $h << R$

B. mgh for all values of h

C. $-\frac{1}{2}mgR$ for $h = R$

D. $\frac{1}{2}mgR$ for $h = R$

Answer: D

Watch Video Solution

12. The orbit of geostationary satellite is circular, the time period of satellite depeds on (i) mass of the satellite, (ii) mass of earth, (iii) readius of the orbit and (iv) height of the satellite from the surface of the earth

A. mass of the satellite

B. mass of the earth

C. radius of the orbit

D. height of the satellite from the surface of earth

Answer: A

Watch Video Solution

13. There are two planets. The ratio of radius of two planets is k but ratio of acceleration due to gravity of both planets is g. What will be the ratio of their escape velocity ?

A. $(Kg)^{1/2}$

B. $(Kg)^{-1/2}$

C. $(Kg)^{2}$

D. $(Kg)^{-2}$

Answer: A

Watch Video Solution

14. A satellite of mass m is placed at a distance r from the centre of earth (mass M). The mechanical energy of the satellite is

A. $-\frac{GMm}{r}$

B. $\frac{GMm}{r}$

C. $\frac{GMm}{2r}$

D. $-\frac{GMm}{2r}$

Answer: D

Watch Video Solution

15. If M is the mass of the earth and R its radius, the ratio of the gravitational acceleration and the gravitational constant is

A. $\frac{R^2}{M}$

B. $\frac{M}{R^2}$

C. MR^2

D. $\frac{M}{R}$

Answer: B

Watch Video Solution