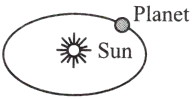
PHYSICS

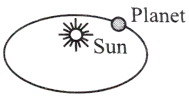
BOOKS - MTG PHYSICS (ENGLISH)

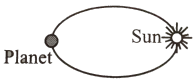
GRAVITATION

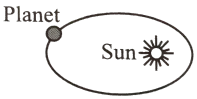
Kepler S Laws

1. Which of the following orbits is a possible orbit for a planet?

A. (a) 

B. (b) 

C. (c) 

(d) 

D.

Answer: D

Watch Video Solution

2. Kepler's second law is a consequenc of

A. conservation of energy

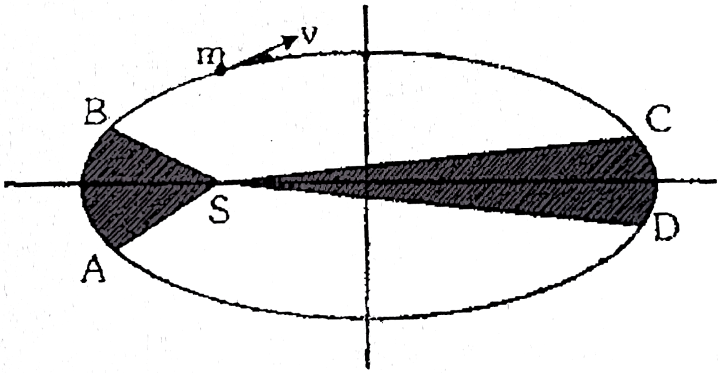
B. conservation of linear momentum

C. conservation of angular momentum

D. conservation of mass

Answer: C

Watch Video Solution



3.

The figure shows elliptical orbit of a planet m about the sun S. the shaded area SCD is twice the shaded area SAB. If t_1 be the time for the planet to move from C to D and t_2 is the time to move from A to B, then:

A. $t_1 = t_2$

B. $t_1 = 2t_2$

C. $t_1 = 4t_2$

D. $t_1 > t_2$

Answer: B

Watch Video Solution

4. The aeral velocity and the angular moementum of the planet are related by which of the following relationos? (where m_p is the same mass of the planet)

A. $\frac{\Delta \vec{t}}{\Delta t} = \frac{\vec{L}}{2m_p}$

B. $\frac{\Delta \vec{t}}{\Delta t} = \frac{\vec{L}}{m_p}$

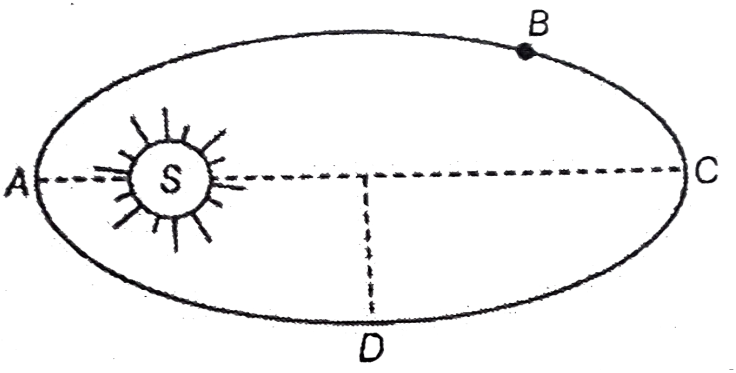
C. $\frac{\Delta \vec{t}}{\Delta t} = \frac{2\vec{L}}{m_p}$

D. $\frac{\Delta \vec{t}}{\Delta t} = \frac{\vec{L}}{\sqrt{2}m_p}$

Answer: A

Watch Video Solution

5. 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

6. Which of the following Kepler's laws is also known as harmonic law?

A. A. First law

B. B. Second law

C. C. Third law

D. D. None of these

Answer: C

Watch Video Solution

7. If a graph is plotted between T^2 and r^3 for a planet, then its slope will be be (where M_S is the mass of the sun)

A. A. $\frac{4\pi^2}{GM_S}$

B. B. $\frac{GM_S}{4\pi}$

C. C. $4\pi GM_S$

D. $D.\ GM_S$

Answer: A

Watch Video Solution

Watch Video Solution

8. A geostationary satellite is orbiting the earth at a height of 6R above the surface of the earth, where R is the radius of the earth. The time period of another satellite at a height of 2.5 R from the surface of the earth is ..... hours.

A. $3\sqrt{2}h$

B. $1.5\sqrt{2}h$

C. $6\sqrt{2}h$

D. $12\sqrt{2}h$

Answer: C

Watch Video Solution

9. Assuming that earth and mars move in circular orbits around the sun, with the martian orbit being 1.52 times the orbital radius of the

earth. The length of the martian year is days is

A. $(1.52)^{2/3} \times 365$

B. $(1.52)^{3/2} \times 365$

C. $(1.52)^{2} \times 365$

D. $(1.52)^{3} \times 365$

Answer: B

Watch Video Solution

10. A saturn year is 29.5 times the earth year. How far is the saturn from the sun if the earth is 1.5×10^8 away from the sun?

A. 1.4×10^6 km

B. 1.4×10^7 km

C. 1.4×10^8 km

D. 1.4×10^9 km

Answer: D

Watch Video Solution

11. The period of moon's rotation around the earth is approx. 29 days. IF moon's mass were 2 fold its present value and all other things remain unchanged, the period of Moon's rotation would be nearly

A. $29\sqrt{2}$ days

B. $\frac{29}{\sqrt{2}}$ days

C. 29×2 days

D. 29 days

Answer: D

Watch Video Solution

12. 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

Watch Video Solution

13. A planet revolves around the sun in elliptical orbit of eccentricity 'e'. If 'T' is the time period of the planet then the time spent by the planet between the ends of the minor axis and major axis close to the sun is

A. 1. $\frac{T\pi}{2e}$

B. 2. $T\left(\frac{2e}{\pi}-1\right)$

C. 2. $\frac{Te}{2\pi}$

D. 4. $T\left(\frac{1}{4}-\frac{e}{2\pi}\right)$

Answer: D

Watch Video Solution

14. A planet revolves around the sun in an elliptical orbit. If v_p and v_a are the velocities of the planet at the perigee and apogee respectively, then the eccentricity of the elliptical orbit is given by :

A. $\frac{v_p}{v_a}$

B. $\frac{v_a-v_p}{v_a+v_p}$

C. $\frac{v_p+v_a}{v_p-v_a}$

D. $\frac{v_p-v_a}{v_p+v_a}$

Answer: D

Watch Video Solution

15. An artificial satellite is in an elliptical orbit around the earth with aphelion of $6R$ and perihelion of $2R$ where R is radius of the earth $= 6400km$. Calculate the eccentricity of the elliptical orbit.

A. $\frac{1}{2}$

B. $\frac{1}{3}$

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

D. $\frac{1}{6}$

Answer: A

Watch Video Solution

16. In the question number 15, the ratio of the velocity of the satellite at apogee and perigee is

A. $\frac{1}{2}$

B. $\frac{1}{3}$

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

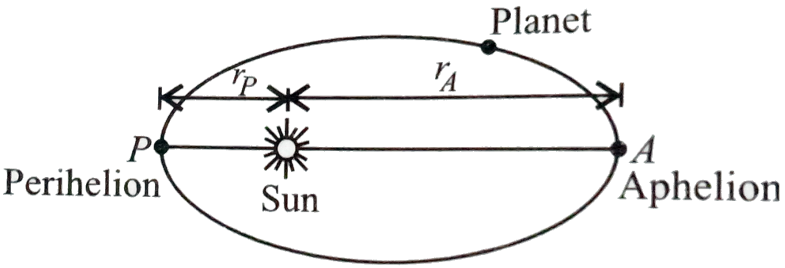
D. $\frac{1}{6}$

Answer: B

Watch Video Solution

17. A planet orbits the sun in an elliptical path as shown in the figure. Let v_p and v_A be spped of the planet when at perohelion and

aphelion respectively. Which of the following relations is correct ?



A. $\frac{r_p}{r_A} = \frac{v_A}{v_p}$

B. $\frac{r_p}{r_A} = \frac{v_p}{v_A}$

C. $\frac{r_p}{r_A} = \sqrt{\frac{v_p}{v_A}}$

D. $\frac{r_p}{r_A} = \sqrt{\frac{v_A}{v_p}}$

Answer: A

Watch Video Solution

Universal Law Of Gravitations

1. Which of the following statements is correct regarding the gravitational force?

A. The gravitational force is dependent on the intervening medium.

B. The gravitational force is a non-consevative force.

C. The gravitational force forms action- reaction pair.

D. The gravitational force is a non-central force.

Answer: C

2. Match the Column I with Column II

Column I		Column II	
(A)	Kepler's first law	(p)	$T^2 \propto a^3$
(B)	Kepler's second law	(q)	Inverse square law
(C)	Kepler's third law	(r)	Orbit of planet is elliptical
(D)	Newton's law of gravitation	(s)	Law of conservation of angular momentum

A. A-s,B-p,C-q,D-r

B. A-p,B-q,C-r,D-s

C. A-r,B-s,C-p,D-q

D. A-s,B-p,C-q,D-s

Answer: C

Watch Video Solution

3. A mass m is placed at point P lies on the axis of a ring of mass M and radius R at a distance R from its centre. The gravitational force on mass m is

A. $\frac{GMm}{\sqrt{2}R^2}$

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

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

D. $\frac{GMm}{4R^2}$

Answer: C

Watch Video Solution

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

A. 3F

B. F

C. $\frac{F}{3}$

D. $\frac{F}{9}$

Answer: B

Watch Video Solution

5. A point mass m is placed inside a spherical shell of radius R and mass M at a distance $\frac{R}{2}$ form the centre of the shell. The gravitational force exerted by the shell on the point mass is

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

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

C. zero

D. $\frac{4Mm}{R^2}$

Answer: C

Watch Video Solution

6. Two stars of mass m_1 and m_2 are parts of a binary star system. The radii of their orbits are r_1 and r_2 respectivey, measured from the centre of mass of the system. The magnitude of gravitational force m_1 exerts on m_2 is

A. 1. $\frac{m_1 m_2 G}{(r_1 + r_2)^2}$

B. 2. $\frac{m_1 G}{(r_1 + r_2)^2}$

C. 3. $\frac{m_2 G}{(r_1 + r_2)^2}$

D. 4. $\frac{G(m_1 + m_2)}{(r_1 + r_2)^2}$

Answer: A

Watch Video Solution

7. Two identical spheres each of mass M and Radius R are separated by a distance 10R. The gravitational force on mass m placed at the midpoint of the line joining the centres of the spheres is

A. zero

B. $\frac{2GMm}{25R^2}$

C. $\frac{GMm}{25R^2}$

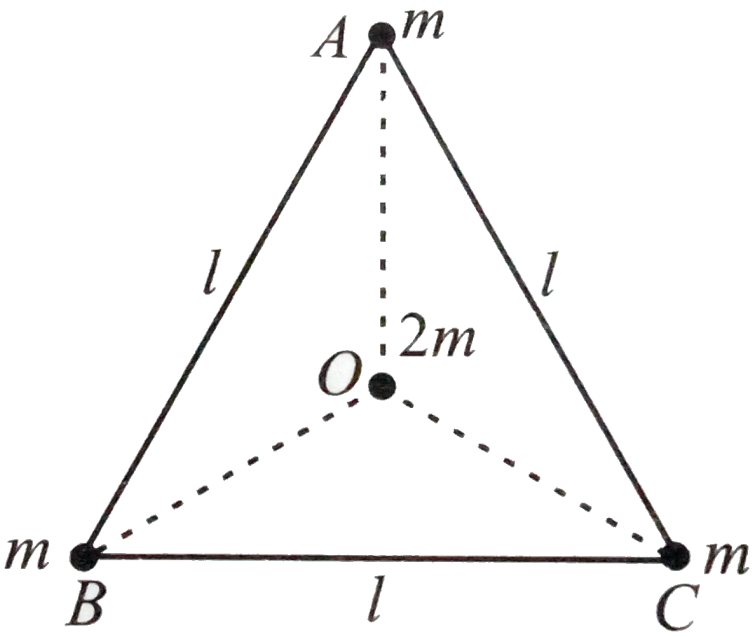
D. $\frac{GMm}{100R^2}$

Answer: A

Watch Video Solution

8. Three masses each of mass m are palced at the vertices of an equilateral triangles ABC of side l as shown in figure. The force acting

on a mass 2m placed at the centroid O of the triangle is



A. zero

B. $\frac{3Gm^2}{l^2}$

C. $\frac{5Gm^2}{l^2}$

D. $\frac{7Gm^2}{l^2}$

Answer: A

Watch Video Solution

9. In the question number 25, if the mass placed at vertex A is doubled, then the force acting on the mass 2m placed at the centroid O is

A. zero

B. $\frac{2Gm^2}{l^2}$

C. $\frac{5Gm^2}{l^2}$

D. $\frac{6Gm^2}{l^2}$

Answer: D

Watch Video Solution

10. Six point masses of mass m each are at the vertices of a regular hexagon of side l. Calculate the force on any of the masses.

A. $\frac{Gm^2}{l^2}\left[\frac{5}{4}+\frac{1}{\sqrt{3}}\right]$

B. $\frac{Gm^2}{l^2}\left[\frac{3}{4}+\frac{1}{\sqrt{3}}\right]$

C. $\frac{Gm^2}{l^2}\left[\frac{5}{4}-\frac{1}{\sqrt{3}}\right]$

D. $\frac{Gm^2}{l^2}\left[\frac{3}{4}-\frac{1}{\sqrt{3}}\right]$

Answer: A

Watch Video Solution

11. Two point masses A and B having masses in the ratio $4:3$ are separated by a distance of 1m. When another point mass C of mass M is placed in between A and B, the force between A and C is $\left(\frac{1}{3}\right)^{rd}$ of the force between B and C. Then the distance C from A is

A. $\frac{2}{3}m$

B. $\frac{1}{3}m$

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

D. $\frac{2}{7}m$

Answer: A

Watch Video Solution

12. A research satellite of mass $200kg$ circles the earth in an orbit of average radius $3R/2$, where R is the radius of the earth. Assuming the gravitational pull on the mass of $1kg$ on the earth's surface to be $10N$, the pull on the satellite will be

A. 890 N

B. 889 N

C. 885 N

D. 892 N

Answer: B

Watch Video Solution

13. The mass of moon 1% of mass of earth. The ratio of gravitational pull of earth on moon and that of moon on earth will be

A. $1:1$

B. $1:10$

C. $1:100$

D. $1:1$

Answer: A

Watch Video Solution

14. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. if the gravitational force of attraction between the planet and the star is proportational to $R^{-5/2}$, then

(a) T^2 is proportional to R^2

(b) T^2 is proportional to $R^{7/2}$

(c) T^2 is proportional to $R^{3/3}$

(d) T^2 is proportional to $R^{3.75}$.

A. $R^{3/2}$

B. $R^{3/5}$

C. $R^{7/2}$

D. $R^{7/2}$

Answer: D

Watch Video Solution

The Gravitational Constant

1. Which of the following statement is correct regarding the universal gravitational constant G ?

A. G has same value in all system of units.

B. The value of G is same everywhere in the universe.

C. The value of G was first experimentally determined by Johannes Kepler

D. G is a vector quantity.

Answer: B

Watch Video Solution

2. Mass of the earth has been determined through

A. use of Kepler's $\frac{T^2}{R^3}$ constancy law

B. sampling the density of earth's crust and using earth's radius

C. Cavandish's determination of G and using earth's radius and g at its surface

D. use of periods of satellite at different heights above earth's surface.

Answer: C

Watch Video Solution

3. Radius of earth is 6400 km and that of mars is 3200 km. Mass of mars is 0.1 that of earth's mass. Then the acceleration due to gravity on mars is nearly

A. $1m/s^2$

B. $2.5m/s^2$

C. $4m/s^2$

D. $5m/s^2$

Answer: C

Watch Video Solution

4. The ratio of radii of earth to another planet is $2/3$ and the ratio of their mean densities is $4/5$. If an astronaut can jump to a maximum height of $1.5m$ on the earth, with the same effort, the maximum height he can jump on the planet is

A. 1 m

B. 0.8 m

C. 0.5 m

D. 1.25 m

Answer: B

Watch Video Solution

5. If the mass of sun were ten times smaller and gravitational consitant G were ten times larger in magnitudes

A. Walking on ground would become more difficult.

B. The acceleration due to gravity on earth will not change.

C. Raindrops will fall much faster.

D. Airplanes will have to travel much faster.

Answer: B

Watch Video Solution

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

A. $\frac{R_E^2}{M_E}$

B. $\frac{M_E}{R_E^2}$

C. $M_E R_E^2$

D. $\frac{M_E}{R_E}$

Answer: B

Watch Video Solution

Watch Video Solution

7. The acceleration due to gravity g and density of the earth ρ are related by which of the following relations? (where G is the gravitational constant and R_E is the radius of the earth)

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

B. $\rho = \frac{3g}{4\pi G R_E}$

C. $\rho = \frac{3G}{4\pi g R_E}$

D. $\rho = \frac{4\pi g R_E}{3G}$

Answer: B

Watch Video Solution

8. The mass of the moon is $\frac{1}{8}$ of the earth but the gravitational pull is $\frac{1}{6}$ earth It is due to the fact that .

A. moon is the satellite of the earth

B. the radius of the earth is (8/6) of the moon

C. the radius of the earth is $\left(\sqrt{8/6}\right)$ of the moon

D. the radius of the moon is (6/8) of the earth

Answer: C

Watch Video Solution

Acceleration Due To Gravity Below And Above The Surface Of Earth

1. Value of g is

A. maximum at poles

B. maximum at equator

C. same everywhere

D. minimum at poles

Answer: A

Watch Video Solution

2. Earth is flattened at the poles and budges at the eqator. This is due to the fact that

A. the earth revolves around the sun in an elliptical orbit

B. the angular velocity of spinning about its axis is more at the equator

C. the centrifugal force is more at the equator than at poles.

D. none of these.

Answer: C

Watch Video Solution

3. The acceleration due to gravity at the pols and the equator is g_p and g_e respectively. If the earth is a sphere of radius R_E and rotating about its axis with angular speed ω and $g_p - g_e$ given by

A. $\frac{\omega^2}{R_E}$

B. $\frac{\omega^2}{R_E^2}$

C. $\omega^2 R_E^2$

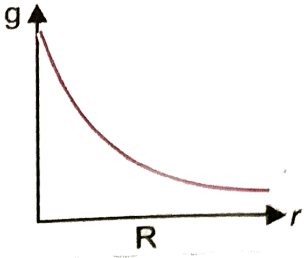
D. $\omega^2 R_E$

Answer: D

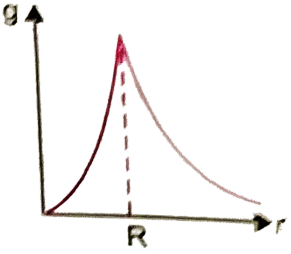
Watch Video Solution

4. The dependence of acceleration due to gravity g on the distance r from the centre of the earth, assumed to be a sphere of radius R of uniform density is as shown in Fig. below:

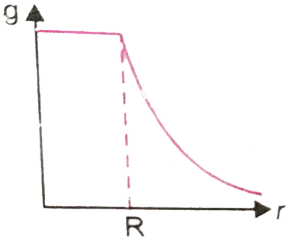
(1)



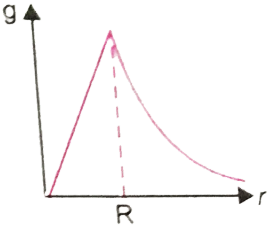
(2)



(3)



(4)



The correct figure is

A. (i)

B. (ii)

C. (iii)

D. (iv)

Answer: D

Watch Video Solution

5. Which of the following statement is correct ?

A. Acceleration due to gravity increase with increasing altitude.

B. Acceleration due to gravity increase with increasing depth.

C. Acceleration due to gravity increase with increasing latitude.

D. Acceleration due to gravity is independent of the mass of the earth.

Answer: C

Watch Video Solution

6. A body hanging from a spring strethces it by 1cm at the earth's surface. How much will the same body stretch the spring at a place 1600km above the earth's surface? (Radius of the earth 6400km)

A. 1.28 cm

B. 0.64 cm

C. 3.6 cm

D. 0.12 cm

Answer: B

Watch Video Solution

7. A body weighs 250N on the surface of the earth. How much will it weighs half way down to the centre of the earth?

A. 125 N

B. 150 N

C. 175 N

D. 250 N

Answer: A

Watch Video Solution

8. A body weighs 72 N on the surface of the earth. What is the gravitational force on it due to earth at a height equal to half the radius of the earth from the surface

A. 16 N

B. 28 N

C. 32 N

D. 72 N

Answer: C

Watch Video Solution

Gravitational Potential Energy

1. Two spheres each of mass M and radius R are separated by a distance of r. The gravitational potential at the midpoint of the line joining the centres of the spheres is

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

B. $-\frac{2GM}{r}$

C. $-\frac{GM}{2r}$

D. $-\frac{4GM}{r}$

Answer: D

Watch Video Solution

2. A particle of mass M is placed at the centre of a spherical shell of same mass and radius a. What will be the magnitude of the gravitational potential at a point situated at a/2 distance from the centre ?

A. $-\frac{3GM}{R}$

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

C. $-\frac{GM}{R}$

D. $-\frac{4GM}{R}$

Answer: A

Watch Video Solution

3. A particle of mass m is placed at the centre of a unifrom spherical shell of mass 3 m and radius R The gravitational potential on the surface of the shell is .

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

B. $-\frac{GM}{R}$

C. $-\frac{4GM}{R}$

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

Answer: C

Watch Video Solution

4. Four particles each of mass m are placed at the vertices of a square of side l. the potential at the centre of square is

A. $-\frac{\sqrt{2}Gm^2}{l}\left(2-\frac{1}{\sqrt{2}}\right)$

B. $-\frac{2Gm^2}{l}\left(2+\frac{1}{\sqrt{2}}\right)$

C. $-\frac{\sqrt{2}Gm^2}{l}\left(\sqrt{2}-\frac{1}{\sqrt{2}}\right)$

D. $-\frac{2Gm^2}{l}\left(\sqrt{2}-\frac{1}{\sqrt{2}}\right)$

Answer: B

Watch Video Solution

5. In the question number 51 , the potential at the centre is

A. $-2\frac{Gm}{l}$

B. $3\sqrt{2}\frac{Gm}{l}$

C. $-2\sqrt{2}\frac{Gm}{l}$

D. $-4\sqrt{2}\frac{Gm}{l}$

Answer: D

Watch Video Solution

6. 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. $mgR_E\frac{n}{(n-1)}$

B. mgR_E

C. $mgR_E\frac{n}{(n+1)}$

D. $\frac{mgR_E}{n}$

Answer:

Watch Video Solution

7. The mass of the earth is $6 \times 10^{24} kg$ and that of the moon is $7.4 \times 10^{22} kg$. The potential energy of the system is $-7.79 \times 10^{28} J$. The mean distance between the earth and moon is $\left(G = 6.67 \times 10^{-11} Nm^2 kg^{-2}\right)$

A. $3.8 \times 10^8 m$

B. 3.37×10^6 m

C. 7.60×10^4 m

D. 1.9×10^2 m

Answer: A

Watch Video Solution

Escape Speed

1. The escape velocity of a body form the earth depends on

(i) the mass of the body.

(ii) the location from where it is projected.

(iii) the direction of projection.

(iv) the height of the location form where the body is launched.

A. (i) and (ii)

B. (ii) and (iv)

C. (i) and (iii)

D. (iii) and (iv)

Answer: B

Watch Video Solution

2. The escape velocity from the surface of the earth is (where R_E is the radius of the earth)

A. $\sqrt{2gR_E}$

B. $\sqrt{gR_E}$

C. $2\sqrt{gR_E}$

D. $\sqrt{3gR_E}$

Answer: A

Watch Video Solution

3. If v_e is escape velocity and v_0, is orbital velocity of satellite for orbit close to the earth's surface. Then are related by

A. $v_o = \sqrt{2}v_e$

B. $v_o = v_e$

C. $v_e = \frac{v_o}{2}$

D. $v_e = \sqrt{2}v_o$

Answer: D

Watch Video Solution

4. 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. $\frac{R_E}{1-k^2}$

B. $\frac{R_E}{k^2}$

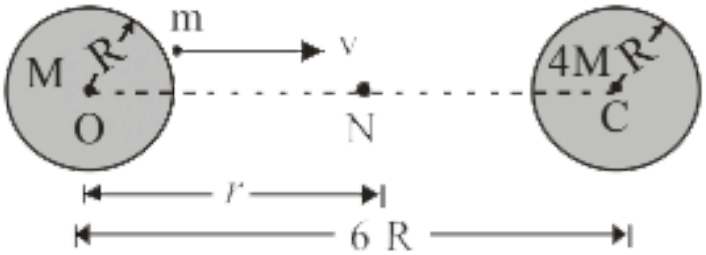
C. $\frac{1-k^2}{R_E}$

D. $\frac{k^2}{R_E}$

Answer: A

Watch Video Solution

5. Two uniform solid spheres of equal radii R, but mass M and 4 M have a centre to centre separation 6 R, as shown in figure. The two spheres are held fixed. A projectile of mass m is projected from the surface of the sphere of mass M directly towards the centre of the second sphere. Obtain an expression for the minimum speed v of the projectile so that it reaches the surface of the second sphere.



A. $\sqrt{\frac{4}{5}\frac{GM}{R}}$

B. $\sqrt{\frac{5}{4}\frac{GM}{R}}$

C. $\sqrt{\frac{3}{5}\frac{GM}{R}}$

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

Answer: C

Watch Video Solution

6. The escape speed of a body on the earth's surface is $11.2 kms^{-1}$. A body is projected with thrice of this speed. The speed of the body when it escape the gravitational pull of earth is

A. $11.2 kms^{-1}$

B. $22.4\sqrt{2} kms^{-1}$

C. $\frac{22.4}{\sqrt{2}} kms^{-1}$

D. $22.4\sqrt{3} kms^{-1}$

Answer: B

Watch Video Solution

7. The escape velocity of 10g body from the earth is 11.2 kms^{-1}. Ignoring air resistance, the escape velocity of 10 kg of the iron ball from the earth will be

A. $0.0112kms^{-1}$

B. $0.112kms^{-1}$

C. $11.2kms^{-1}$

D. $0.56kms^{-1}$

Answer: C

Watch Video Solution

Earth Satellite

1. Which of the following statement is correct but satellites ?

A. A satellite cannot move in a stable orbit in a plane passing through the earth's centre.

B. Geostationary satellites are launched in the equatorial plane.

C. We can use just one geostationary satellite for global communication around the globe.

D. The speed of satellite increase with an increase in the radius of its orbit.

Answer: B

Watch Video Solution

2. The time period of an artificial satellite in a circular orbit of radius R is 2 days and its orbital velocity is v_0. If time period of another satellite in a circular orbit is 16 days then

A. its radius of orbit is 4R and orbital velocity is v_0

B. its radius of orbit is 4R and orbital velocity is $\frac{v_0}{2}$

C. its radius of orbit is 2R and orbital velocity is v_0

D. its radius of orbit is 2R and orbital velocity is $\frac{v_0}{2}$

Answer: B

Watch Video Solution

3. The time period T of the moon of planet mars (mass M_m) is related to its orbital radius R as (G=gravitational constant)

A. $T^2 = \frac{4\pi^2 R^3}{GM_m}$

B. $T^2 = \frac{4\pi^2 GR^3}{M_m}$

C. $T^2 = \frac{4\pi R^3 G}{M_m}$

D. $T^2 = 4\pi M_m G R^3$

Answer: A

Watch Video Solution

Watch Video Solution

4. A synchronous satellite goes around the earth one in every 24 h. What is the radius of orbit of the synchronous satellite in terms of the earth's radius ? (Given: Mass of the earth , $M_E = 5.98 \times 10^{24} kg$, radius of the earth, $R_E = 6.37 \times 10^6 m$, universal constant of gravitational , $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$)

A. $2.4R_E$

B. $3.6R_E$

C. $4.8R_E$

D. $6.6R_E$

Answer: D

Watch Video Solution

Energy Of An Orbiting Satellite

1. Match the Column I with Column II

For a satellite in circular orbit

Column I		Column II	
(A)	Kinetic energy	(p)	$-\frac{GM_Em}{2r}$
(B)	Potential energy	(q)	$\sqrt{\frac{GM_E}{r}}$
(C)	Total energy	(r)	$-\frac{GM_Em}{r}$
(D)	Orbital velocity	(s)	$\frac{GM_Em}{2r}$

(where M_E is the mass of the earth , m is the mass of the satellite and r is the radius of the orbit)

A. A-r, B-s,C-q,D-p

B. A-q,B-p,C-r,D-s

C. A-p,B-q,C-s,D-r

D. A-s,B-r,C-p,D-q

Answer: D

Watch Video Solution

2. A satellite is orbiting the earth in a circular orbit of radius r. Its

A. 1. Kinetic energy varies as r

B. 2. angular momentum varies as $\frac{1}{\sqrt{r}}$

C. 3. linear momentum varies as $\frac{1}{r}$

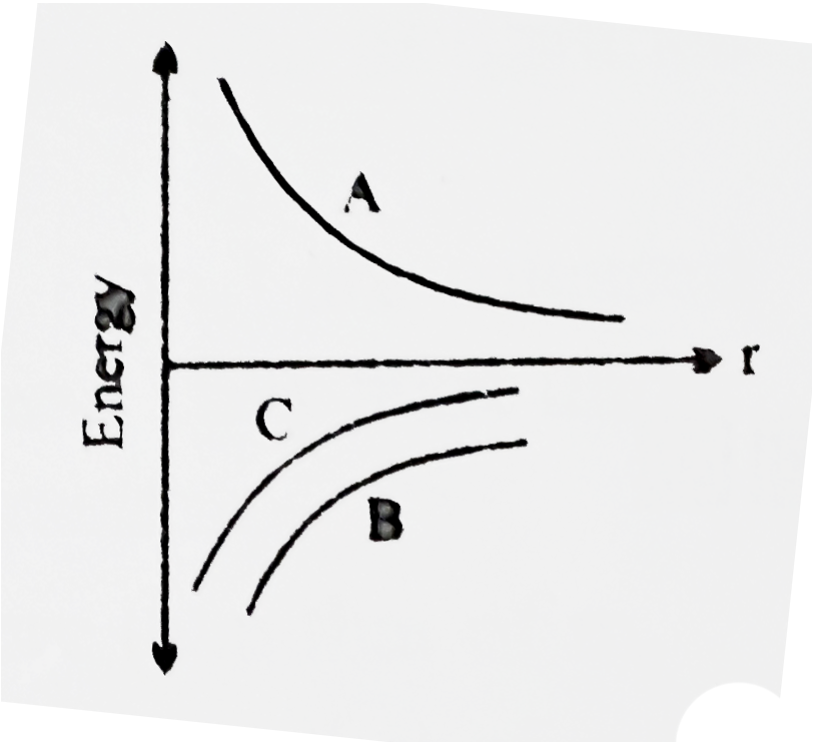
D. 4. frequency of revolution varies as $\frac{1}{r^{3/2}}$

Answer: D

Watch Video Solution

3. The figure shows the variation of energy with the orbit radius of a body in circular planetary motion. Find the correct statements about

the curves A, B and C



A. A shows the kinetic energy, B shows the total energy and C the potential energy of the satellite

B. A and b are kinetic energy and potential energy respectively and C the total energy of the satellite.

C. A and B are the potentital energy and kinetic energy respectively and C the total energy of the satellite .

D. C and A are the kinetic and potential energies and B the total energy of the satellite .

Answer: B

Watch Video Solution

4. 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 statements is true?

A. The potential energies of 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 S_2.

Answer: B

Watch Video Solution

5. In motion of an object under the gravitational influence of another object. Which of the following quantities is not conserved ?

A. 1. Angular momentum

B. 2. Mass of an object

C. 3. Total mechanical energy

D. 4. Linear momentum

Answer: D

Watch Video Solution

6. A comet orbits the Sun in a highly elliptical orbit. Does the comet have a constant (a) linear speed (b) angular speed (c) angular momentum (d) kinetic energy (e) potential energy (f) total energy

throughout its orbit? Neglect any mass loss of the comet when it comes very close to the Sun.

A. (i),(ii),(iii)

B. (iii),(iv),(v)

C. (iii) and (vi)

D. (ii),(iii) and (vi)

Answer: C

Watch Video Solution

7. A satellite of mass m is in a circular orbit of radius $2R_E$ about the earth. The energy required to transfer it to a circular orbit of radius $4R_E$ is (where M_E and R_E is the mass and radius of the earth respectively)

A. 1. $\frac{GM_Em}{2R_E}$

B. 2. $\frac{GM_Em}{4R_E}$

C. 3. $\frac{GM_Em}{8R_E}$

D. 4. $\frac{GM_Em}{16R_E}$

Answer: C

Watch Video Solution

8. in the previous question, the change in potential energy.

A. 1. $\frac{GM_Em}{2R_E}$

B. 2. $\frac{GM_Em}{4R_E}$

C. 3. $\frac{GM_Em}{8R_E}$

D. 4. $\frac{GM_Em}{16R_E}$

Answer: B

Watch Video Solution

9. The additional kinetic energy to be provided to a satellite of mass m revolving around a planet of mass M, to transfer it forms a circular orbit of radius R_1 to another of radius $R_2(R_2 > R_1)$ is

A. $GmM\left(\frac{1}{R_1^2} - \frac{1}{R_2^2}\right)$

B. $GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

C. $2GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

D. $\frac{1}{2}GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

Answer: D

Watch Video Solution

10. A satellite of a mass m orbits the earth at a height h above the surface of the earth. How much energy must be expended to rocket the satellite out of earth's gravitational influence? (where M_E and R_E be mass and radius of the earth respectively)

A. $\frac{GM_Em}{4(R_E+h)}$

B. $\frac{GM_Em}{2(R_E+h)}$

C. $\frac{GM_Em}{(R_E+h)}$

D. $\frac{2GM_Em}{(R_E+h)}$

Answer: B

Watch Video Solution

11. For a satellite moving in a circular orbit around the earth, the ratio of its potential energy to kinetic energy is

A. 1

B. -1

C. 2

D. -2

Answer: D

Watch Video Solution

12. An artificial satellite moving in a circular orbit around the earth has a total energy E_0. Its potential energy is

A. 1. $-E_0$

B. 2. E_0

C. 3. $2E_0$

D. 4. $-2E_0$

Answer: C

Watch Video Solution

13. A rocket is launched vertically from the surface of earth with an initial velocity v. How far above the surface of earth it will go? Neglect the air resistance.

A. $\frac{R_E v^2}{gR_E - v^2}$

B. $\frac{R_E v^2}{gR_E + v^2}$

C. $\frac{R_E v^2}{2gR_E - v^2}$

D. $\frac{R_E v^2}{2gR_E + v^2}$

Answer: C

Watch Video Solution

14. An asteroid of mass m is approaching earth, initially at a distance $10R_E$ with speed v_i. It hits earth with a speed v_f (R_E and M_E are radius and mass of earth),. Then

A. $v_f^2 = v_i^2 + \frac{2Gm}{R_E}\left(1 + \frac{1}{10}\right)$

B. $v_f^2 = v_i^2 + \frac{2GM_E}{R_E}\left(1 + \frac{1}{10}\right)$

C. $v_f^2 = v_i^2 + \frac{2GM_E}{R_E}\left(1 - \frac{1}{10}\right)$

D. $v_f^2 = v_i^2 + \frac{2Gm}{R_E}\left(1 - \frac{1}{10}\right)$

Answer: C

Watch Video Solution

15. Two stars each of mass M and radius R are approaching each other for a head-on collision. They start approaching each other when their separation is $r > > R$. If their speed at this separation are negligible, the speed v with which they collide would be

A. 1. $v = \sqrt{GM\left(\frac{1}{R} - \frac{1}{r}\right)}$

B. 2. $v = \sqrt{GM\left(\frac{1}{2R} - \frac{1}{r}\right)}$

C. 3. $v = \sqrt{GM\left(\frac{1}{R} + \frac{1}{r}\right)}$

D. 4. $v = \sqrt{GM\left(\frac{1}{2R} + \frac{1}{r}\right)}$

Answer: B

Watch Video Solution

Geostationary And Polar Satellites

1. Which of the following statement is correct regarding a geostationary satellite?

A. A geostationary satellite goes around the earth in east-west direction.

B. A geostationary satellite goes around the earth in west-east direction.

C. The time -period of a geostationary satellite is 48 hours.

D. The angle between the equatorial plane and the orbital plane of geostationary satellite is 90°

Answer: B

Watch Video Solution

2. Which one of the following statement is correct ?

A. 1. The energy required to rocket an orbiting satellite out of earth's gravitational influence is more than the energy required to project a stationary object at the same height (as the statellite) out of earth's influence.

B. 2. If the zero of potential energy is at infinity, the total energy of an orbiting satellite is negative of potential energy.

C. 3. The first artificial satellite Sputnik I was launched in the year 1950.

D. 4. The orbital speeed of the SYNCOMS (Synchronous communications satellite) is $3.07 \times 10^2 ms^{-1}$.

Answer: D

Watch Video Solution

3. Which of the following statement is incorrect regarding the polar satellite ?

A. 1. A polar satellite goes around the earth's pole in north-south direction.

B. 2. Polar satellite are used to study topography of Moon, Venus and Mars.

C. 3. A polar satellite is a high altitude satellite.

D. 4. The time period of polar satellite is about 100 minutes.

Answer: C

Watch Video Solution

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

A. 1. (i) only

B. 2. (i) and (ii)

C. 3. (i),(ii) and (iii)

D. 4. (ii),(iii) and (iv)

Answer: D

Watch Video Solution

5. LANDSAT series of satellite move in near polar orbits at an altitude of _____

A. 1. 3600 km

B. 2. 3000 km

C. 3. 918 km

D. 4. 512 km

Answer: C

Watch Video Solution

6. Height of geostationary satellite is

A. 1000 km

B. 32000 km

C. 36000 km

D. 850 km

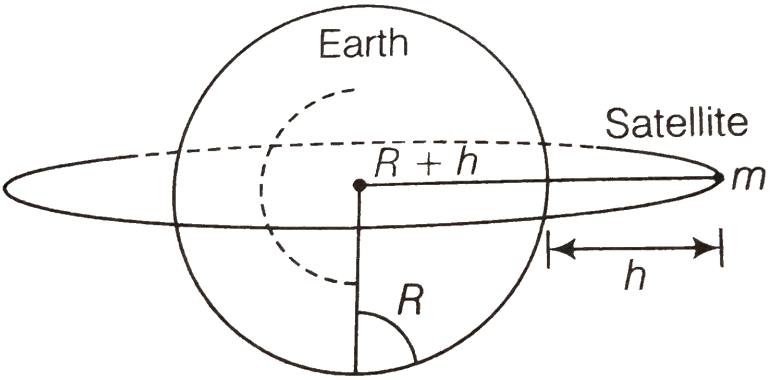
Answer: C

Watch Video Solution

7. A satellite is to be placed in equatorial geostationary orbit around the earth for communication.

(a) Calculate height of such a satellite

(b) Find out the minimum number of satellites that are needed to cover entire earth, so that atleast one satellite is visible from any point on the equator.



$\left[M = 6 \times 10^{24} kg, R = 6400 km, T = 24h, G = 6.67 \times 10^{-11} \text{ SI unit } \right]$

A. $3.57 \times 10^{5} m$

B. $3.57 \times 10^{6} m$

C. $3.57 \times 10^{7} m$

D. $3.57 \times 10^8 m$

Answer: C

Watch Video Solution

Weightlessness

1. An astronaut experiences weightlessness in a space satellite It is because .

A. 1. the gravitational force is small at that location in space

B. 2. the gravitational force is larger at that location in space

C. 3. the astronaut experience no gravity.

D. 4. the gravity force is infinitely large at that location in space.

Answer: C

Watch Video Solution

2. Feeling of weightlessness in a satellite is due to

A. zero gravitational acceleration

B. zero acceleration

C. zero mass

D. none of these.

Answer: A

Watch Video Solution

Miscellaneous Question

1. Two identical spheres of radius R made of the same material are kept at a distance d apart. Then the gravitational attraction between them is proportional to

A. d^{-2}

B. d^2

C. d^4

D. d

Answer: A

Watch Video Solution

2. The time interval between two successive noon when sun passes through zenith point (meridian) is known as

A. 1. sidereal day

B. 2. mean solar day

C. 3. solar year

D. 4. lunar month

Answer: B

Watch Video Solution

3. Which of the following planets has two moons phobos and deimos ?

A. 1. Jupiter

B. 2. Saturn

C. 3. Mars

D. 4. Earth

Answer: C

Watch Video Solution

4. Black Hole is

A. super surface of atmosphere

B. ozone layer

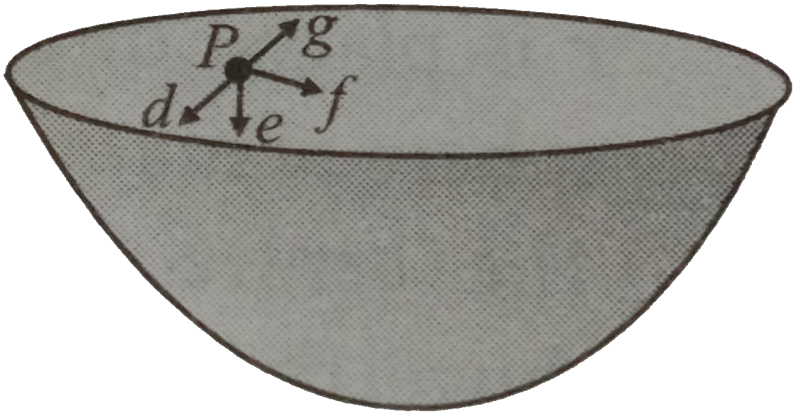
C. super dense planetary material none of these .

D.

Answer: C

Watch Video Solution

5. The direction of gravitational intensity at point P of a hemispherical shell of uniform mass desity is indicated by the arrow



A. d

B. e

C. f

D. g

Answer: B

Watch Video Solution

6. The angular speed of rotation of the earth is

A. $7.3 \times 10^{-5} rads^{-1}$

B. $7.3 \times 10^{-4} rads^{-1}$

C. $7.3 \times 10^{-6} rads^{-1}$

D. $7.3 \times 10^{-3} rads^{-1}$

Answer: A

Watch Video Solution

7. A non-homogeneous sphere of radius R has the following density variation :

$$\rho \begin{cases} \rho_0 & r \leq R/3 \\ \rho_0/2 & (R/3) < r \leq (3R/4) \\ \rho_0/8 & (3R/4) < r \leq R \end{cases}$$

The gravitational field at a distance 2R from the centre of the sphere is

A. $0.1\pi GR\rho_0$

B. $0.2\pi GR\rho_0$

C. $0.3\pi GR\rho_0$

D. $0.4\pi GR\rho_0$

Answer: A

Watch Video Solution

8. The gravitational field intensity at a point $10,\ 000km$ from the centre of the earth is $4.8Nkg^{-1}$. The gravitational potential at that point is

A. $-4.8 \times 10^7 Jkg^{-1}$

B. $-2.4 \times 10^7 Jkg^{-1}$

C. $4.8 \times 10^6 Jkg^{-1}$

D. $3.6 \times 10^6 Jkg^{-1}$

Answer: A

Watch Video Solution

9. A satellite is revolving in a circular orbit at a height 'h' from the earth's surface (radius of earth R). The minimum increase in its orbital velocity required, So that the satellite could escape from the earth's gravitational field, is close to :(Neglect the effect of atomsphere.)

A. $\sqrt{2gR}$

B. $\sqrt{gR}$

C. $\sqrt{gR/2}$

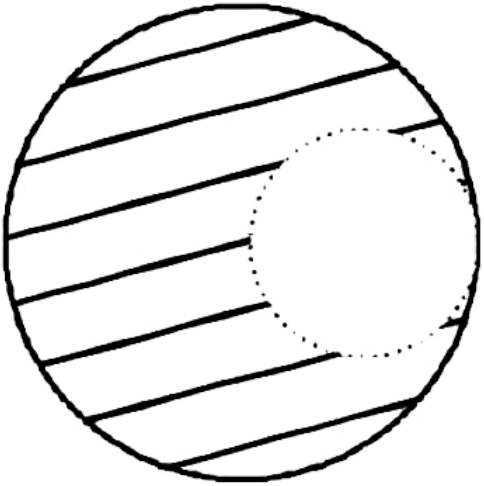
D. $\sqrt{gR}(\sqrt{2}-1)$

Answer: D

Watch Video Solution

10. From a solid sphere of mass M and radius R, a spherical portion of radius R/2 is removed, as shown in the figure Taking gravitational potential $V = 0 at r = \infty$, the potential at (G = gravitational

constatn)



A. $\frac{-2GM}{3R}$

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

C. $\frac{-GM}{2R}$

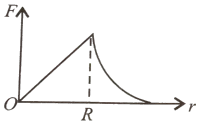
D. $\frac{-GM}{R}$

Answer: D

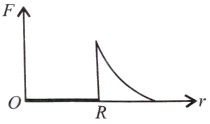
Watch Video Solution

11. Which one of the following plots represents the variation of the gravitational field on a particle with distance r due to a thin spherical shell of raduis R? (r is measured from the centre of the spherical shell).

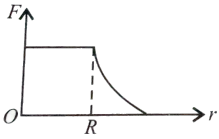
A. (a)



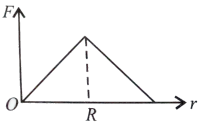
B. (b)



C. (c)



D. (d)



Answer: B

Watch Video Solution

Hots

1. A bullet is fired vertically upwards with a velocity v from the surface of a spherical planet when it reaches its maximum height, its acceleration due to the planet's gravity is $\frac{1}{4}th$ of its value at the surface of the planet. If the escape velocity from the planet is $V_{\text{escape}} = v\sqrt{N}$, then the value of N is : (ignore energy loss due to atmosphere).

A. 2

B. 3

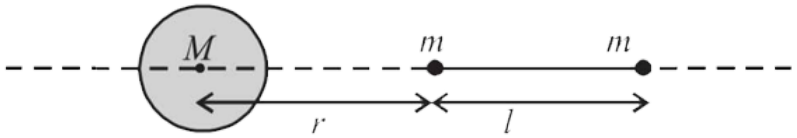
C. 4

D. 5

Answer: A

Watch Video Solution

2. A larger spherical mass M is fixed at one position and two identical point masses m are kept on a line passing through the centre of M. The point masses are connected by rigid massless rod of length l and this assembly is free to move along the line connecting them. All three masses interact only throght their mutual gravitational interaction. When the point mass nearer to M is at a distance r =3l form M, the tensin in the rod is zero for $m = k\left(\frac{M}{288}\right)$. The value of k is



A. 5

B. 6

C. 7

D. 8

Answer: C

Watch Video Solution

3. Two satellites S_1 and S_2 revolve around a planet in coplanar circular orbits in the same sense their periods of revolution are 1 hour and 8hours respectively the radius of the orbit of S_1 is 10^4 km when S_1 is closest to S_2 the angular speed of S_2 as observed by an astronaut in S_1 is :

A. $\pi \times 10^4$

B. $-\pi \times 10^4$

C. $\pi \times 10^5$

D. $\pi \times 10^5$

Answer: B

Watch Video Solution

4. In the above example the angular velocity of S_2 as actually observed by an astronaut in S_1 is -

A. 3×10^{-4}

B. 3×10^{23}

C. 3×10^{-6}

D. 3×10^{-7}

Answer: A

View Text Solution

5. The ratio of the earth's orbital angular momentum (about the Sun) to its mass is $4.4 \times 10^{15} m^2 s^{-1}$. The area enclosed by the earth's orbit is approximately-_____m^(2).

A. 6.94×10^{22}

B. 6.94×10^{23}

C. 7.94×10^{22}

D. 7.94×10^{23}

Answer: A

Watch Video Solution

6. A particle of mass m is subjected to an attractive central force of magnitude k/r^2, k being a constant. If at the instant when the particle is at an extreme position in its closed orbit, at a distance a from the centre of force, its speed is $\sqrt{k/2ma}$, if the distance of other extreme position is b. Find a/b.

A. 2

B. 3

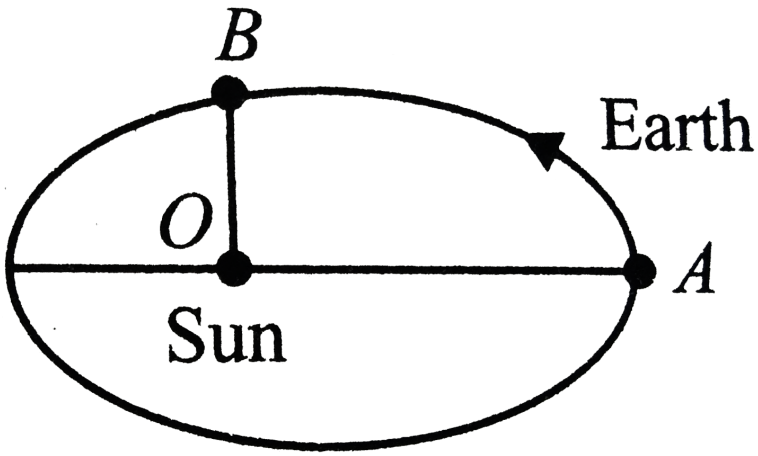
C. 4

D. 5

Answer: B

Watch Video Solution

7. The earth moves around the Sun in an elliptical orbit as shown in Fig. The ratio $OA/OB = x$. The ratio of the speed of the earth at B to that at A is nearly



A. $\sqrt{x}$

B. x

C. $x\sqrt{x}$

D. x^2

Answer: B

Watch Video Solution

8. A uniform ring of mass m and radius a is placed directly above a uniform sphere of mass M and of equal radius. The centre of the ring is at distance $\sqrt{3}a$ from the centre of the sphere. Find the gravitational force exerted by the sphere on the ring.

A. $\frac{GMm}{8r^2}$

B. $\frac{GMm}{4r^2}$

C. $\sqrt{3}\frac{GMm}{8r^2}$

D. $\frac{GMm}{8r^3\sqrt{3}}$

Answer: C

Watch Video Solution

9. Three particles are projected vertically upward from a point on the surface of earth with velocities

$v_1 = \sqrt{\frac{2gR}{3}}, v_2\sqrt{gR}, v_3\sqrt{\frac{4gR}{3}}$

respectively, where g is acceleation due to gravity on the surface of earth. If the maximum height attained are $h_1, h_2 \text{ and } h_3$ respectively, then $h_1 : h_2 : h_3$ is

A. $1:2:3$

B. $2:3:4$

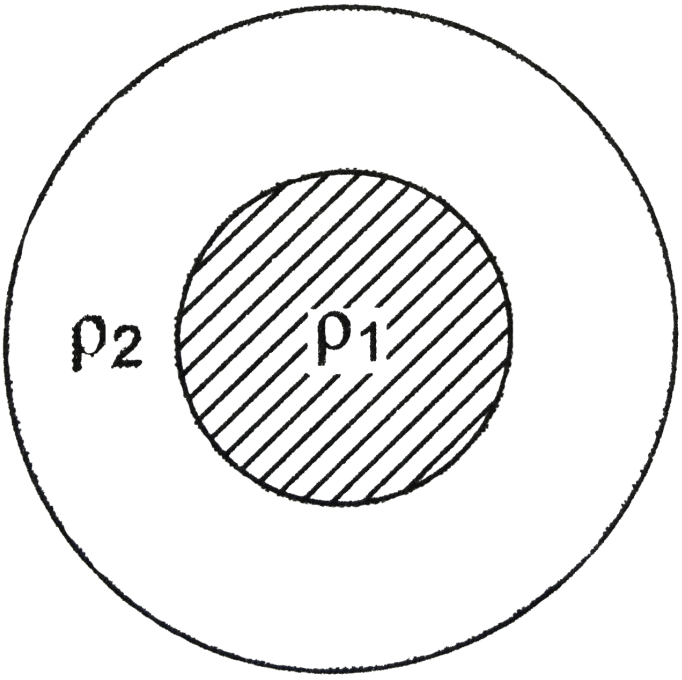
C. $1:2:4$

D. $1:3:5$

Answer: C

Watch Video Solution

10. The density of the core a planet is ρ_1 and that of the outer shell is ρ_2. The radii of the core and that of the planet are R and $2R$ respectively. The acceleration due to gravity at the surface of the planet is same as at a depth R. Find the ratio of $\frac{\rho_1}{\rho_2}$



A. 2.3

B. 4.5

C. 3.2

D. 5.4

Answer: A

Watch Video Solution

Ncert Exemplear Problems

1. The earth is an approximate sphere. If the interior contained matter which is not of the same density every where, then on the surface of the earth, the acceleration due to gravity

A. willl be directed towards the centre but not the same everywhere.

B. will have the same value everywhere but not directed towards the centres.

C. will be same everywhere in magnitude directed towards the centres.

D. cannot be zero at any point.

Answer: D

Watch Video Solution

2. As observed from the earth, the sun appears to move an approx. circular orbit. For the motion of another planet like mercury as observed from the earth, this would

A. be similarly true

B. not be true because the force between earth and mercury is note inverse square law

C. not be true because the major gravitational force on mercury is due to sun

D. not be true because mercury is influenced by forces other than gravitational forces.

Answer: C

Watch Video Solution

3. Different points in the earth are at slightly different distance from the sun and hence experience different force due to gravitation. For a rigid body, we know that if various forces act at various points in it, the resultant motion is as if a net force acts on the CM (centre of mass) causing translation and a net torque at the CM causing rotation around an axis through the CM. for the earth-sun system (approximating the earth as a uniform density sphere).

A. the torques is zero

B. the torque causes the earth to spin.

C. the rigid body result is not applicable since the earth is not even approximately a rigid body.

D. the torque causes the earth to move around the sun.

Answer: A

Watch Video Solution

4. Satellites orbiting the earth have finite life and sometimes debris of satellites fall to the earth. This is because,

A. the solar cells and batteries in satellites run out.

B. the laws of gravitation predict a trajectory spiralling inwards .

C. of viscous forces causing the speed of satellite and hence height to gradually decrease.

D. of collisions with other satellites.

Answer: C

Watch Video Solution

5. Both earth and moon are subjected to the gravitational force of the sun. as observed from the sun, the orbit of the moon

A. will be elliptical.

B. will not be strictly elliptical because the total gravitational force on it is not central .

C. is not elliptical but will necessarily be a closed curve.

D. deviates considerably from being elliptical due to influence of planets other than earth .

Answer: B

Watch Video Solution

6. In our solar system, the inter-planetery region has chunks of matter (much smaller in size compared to planets) called asteriods. They

A. will not move around the sun since they have very small masses compared to sun.

B. will move in an irregular way because of their small masses and will drift away into outer space.

C. will move around the sun in closed orbits but not obey Kepler's laws.

D. will move in orbits like planets and obey Kepler's laws.

Answer: D

Watch Video Solution

7. Choose the wrong option.

A. Inertial mass is a measure of difficulty of accelerating a body by an external force whereas the gravitational mass is relevant in determining the gravitational force on it by an external mass. .

B. That the gravitational mass and inertial mass are equal is an experimental result.

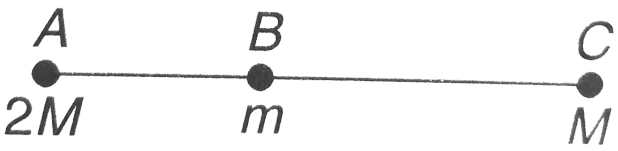
C. That the acceleration due to the gravity on Earth is the same for all bodies and is due to the quality of gravitational mass and inertial mass.

D. Gravitational mass of a particle like proton can depend on the presence of neighbouring heavy objects but the inertial mass cannot .

Answer: D

Watch Video Solution

8. particles of masses 2M m and M are resectively at points A , B and C with $AB = \frac{1}{2}(BC)$ m is much - much smaller than M and at time $t = 0$ they are all at rest as given in figure . As subsequent times before any collision takes palce .



Watch Video Solution

Assertion Reason Corner

1. Assertion: The planet move slower when they are farther from the Sun than when they are nearer.

Reason : Angular velocity of a planet is a constant quantity.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

2. Assertion : A central force is such that the force on the planet is along the vector joining the sun and the planet.

Reason : Conservation of angular momentum is valid for any central force.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

3. Assertion: The motion of a particle under the central force is always confined to a plane.

Reason: Angular momentum is always conserved in the motion under a central force.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

4. Assertion: The time period of revolution of a satellite close to surface of earth is smaller then that revolving away from surface of earth.

Reason: The square of time period of revolution of a satellite is directely proportioanl to cube of its orbital radius.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

5. Assertion: When distance between bodies is doubled and also mass of each body is also doubled, gravitational force between them remains the same.

Reason: According to Neweton's law gravitational, force is directely proportional to mass of bodies and inversely proportional to square of distance between them.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

6. Assertion : The principle of superposition is not valid for gravitational force.

Reason : Gravitational force is a conservative force.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer:

Watch Video Solution

7. Assertion: The gravitational force on a particle inside a spherical shell is zero.

Reason: The shell shields other bodies outside it form exerting gravitational forces on a particle inside.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

8. Assertion : Gravitational force between two masses in air is F. If they are immersed in water, force will remain F

Reason : Gravitational force does not depend on the medium between the masses.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

9. Assertion: A man in a dosed cabin falling freely does not experience gravity.

Reason: Inertial and gravitational mass have equivalence.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

10. Assertion : For a free falling object, the next external force is just the weight of the object .

Reason : In this case the downward acceleration of the object is equal to the acceleration due to gravity.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

11. Assertion: The total energy of a satellite is negative.

Reason: Gravitational potential energy of an object is negative.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

12. Assertion : Moon has no atmosphere.

Reason : The escape velocity for moon is less than that for earth.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

13. Assertion : The gravitational attraction of moon is much less than that of earth.

Reason : Moon is the neutral satellite of the earth.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

14. Assertion: A person sitting in an artificial satellite revolving around the earth feels weightless.

Reason: There is no gravitational force on the satellite.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

15. Assertion : Geostationary satellites appear fixed from any point on earth.

Reason : The time period of geostationary satellite is 24 hours.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

Kepler Laws

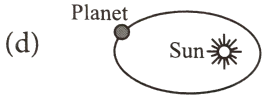
1. Which of the following orbits is a possible orbit for a planet?

A.

B.

C.

D.



Answer: D

Watch Video Solution

2. Kepler's second law is a consequenc of

A. conservation of energy

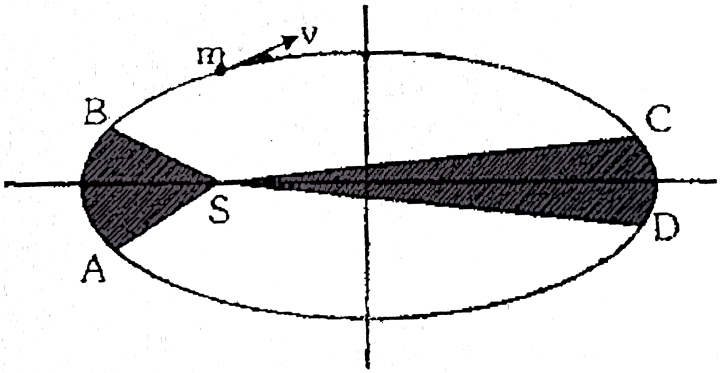
B. conservation of linear momentum

C. conservation of angular momentum

D. conservation of mass

Answer: C

Watch Video Solution



3.

The figure shows elliptical orbit of a planet m about the sun S. the shaded area SCD is twice the shaded area SAB. If t_1 be the time for the planet to move from C to D and t_2 is the time to move from A to B, then:

A. $t_1 = t_2$

B. $t_1 = 2t_2$

C. $t_1 = 4t_2$

D. $t_1 > t_2$

Answer: B

Watch Video Solution

4. The aeral velocity and the angular moementum of the planet are related by which of the following relationos? (where m_p is the same mass of the planet)

A. $\frac{\Delta \vec{t}}{\Delta t} = \frac{\vec{L}}{2m_p}$

B. $\frac{\Delta \vec{t}}{\Delta t} = \frac{\vec{L}}{m_p}$

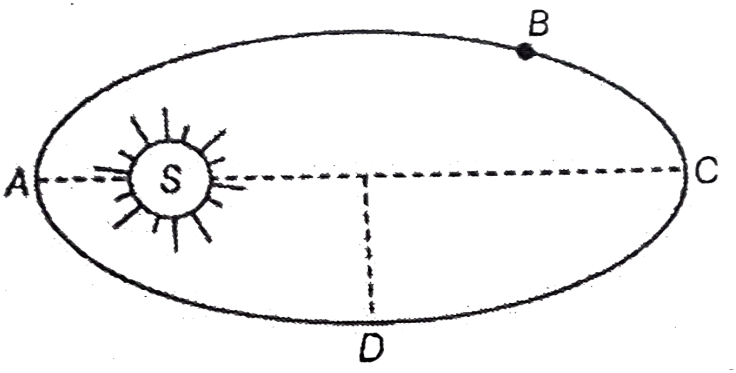
C. $\frac{\Delta \vec{t}}{\Delta t} = \frac{2\vec{L}}{m_p}$

D. $\frac{\Delta \vec{t}}{\Delta t} = \frac{\vec{L}}{\sqrt{2}m_p}$

Answer: A

Watch Video Solution

5. 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

6. Which of the following Kepler's laws is also known as harmonic law?

A. First law

B. Second law

C. Third law

D. None of these

Answer: C

Watch Video Solution

7. If a graph is plotted between T^2 and r^3 for a planet, then its slope will be be (where M_S is the mass of the sun)

A. $\frac{4\pi^2}{GM_S}$

B. $\frac{GM_S}{4\pi}$

C. $4\pi GM_S$

D. GM_S

Answer: A

Watch Video Solution

Watch Video Solution

8. A geostationary satellite is orbiting the earth at a height of 6R above the surface of the earth, where R is the radius of the earth. The time period of another satellite at a height of 2.5 R from the surface of the earth is ..... hours.

A. $3\sqrt{2}h$

B. $1.5\sqrt{2}h$

C. $6\sqrt{2}h$

D. $12\sqrt{2}h$

Answer: C

Watch Video Solution

9. Assuming that earth and mars move in circular orbits around the sun, with the martian orbit being 1.52 times the orbital radius of the

earth. The length of the martian year is days is

A. $(1.52)^{2/3} \times 365$

B. $(1.52)^{3/2} \times 365$

C. $(1.52)^{2} \times 365$

D. $(1.52)^{3} \times 365$

Answer: B

Watch Video Solution

10. A saturn year is 29.5 times the earth year. How far is the saturn from the sun if the earth is 1.5×10^8 away from the sun?

A. 1.4×10^6 km

B. 1.4×10^7 km

C. 1.4×10^8 km

D. 1.4×10^9 km

Answer: D

Watch Video Solution

11. The period of moon's rotation around the earth is approx. 29 days. IF moon's mass were 2 fold its present value and all other things remain unchanged, the period of Moon's rotation would be nearly

A. $29\sqrt{2}$ days

B. $\frac{29}{\sqrt{2}}$ days

C. 29×2 days

D. 29 days

Answer: D

Watch Video Solution

12. 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

Watch Video Solution

13. A planet revolves around the sun in elliptical orbit of eccentricity 'e'. If 'T' is the time period of the planet then the time spent by the planet between the ends of the minor axis and major axis close to the sun is

A. $\frac{T\pi}{2e}$

B. $T\left(\frac{2e}{\pi}-1\right)$

C. $\frac{Te}{2\pi}$

D. $T\left(\frac{1}{4}-\frac{e}{2\pi}\right)$

Answer: D

Watch Video Solution

14. A planet revolves around the sun in an elliptical orbit. If v_p and v_a are the velocities of the planet at the perigee and apogee respectively, then the eccentricity of the elliptical orbit is given by :

A. $\frac{v_p}{v_a}$

B. $\frac{v_a-v_p}{v_a+v_p}$

C. $\frac{v_p+v_a}{v_p-v_a}$

D. $\frac{v_p-v_a}{v_p+v_a}$

Answer: D

Watch Video Solution

15. An artificial satellite is in an elliptical orbit around the earth with aphelion of $6R$ and perihelion of $2R$ where R is radius of the earth $= 6400km$. Calculate the eccentricity of the elliptical orbit.

A. $\frac{1}{2}$

B. $\frac{1}{3}$

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

D. $\frac{1}{6}$

Answer: A

Watch Video Solution

16. In the question number 15, the ratio of the velocity of the satellite at apogee and perigee is

A. $\frac{1}{2}$

B. $\frac{1}{3}$

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

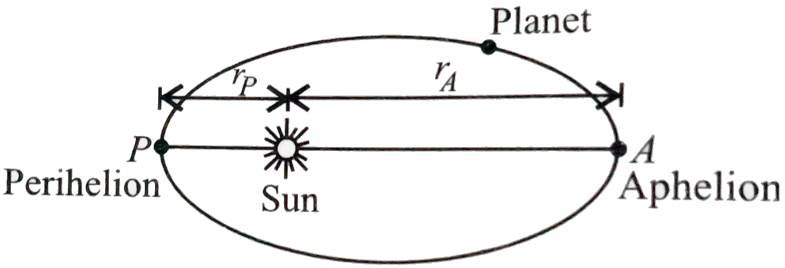
D. $\frac{1}{6}$

Answer: B

Watch Video Solution

17. A planet orbits the sun in an elliptical path as shown in the figure. Let v_p and v_A be spped of the planet when at perohelion and

aphelion respectively. Which of the following relations is correct ?



A. $\frac{r_p}{r_A} = \frac{v_A}{v_p}$

B. $\frac{r_p}{r_A} = \frac{v_p}{v_A}$

C. $\frac{r_p}{r_A} = \sqrt{\frac{v_p}{v_A}}$

D. $\frac{r_p}{r_A} = \sqrt{\frac{v_A}{v_p}}$

Answer: A

Watch Video Solution

Acceleration Due To Gravity

1. Radius of earth is 6400 km and that of mars is 3200 km. Mass of mars is 0.1 that of earth's mass. Then the acceleration due to gravity on mars is nearly

A. $1m/s^2$

B. $2.5m/s^2$

C. $4m/s^2$

D. $5m/s^2$

Answer: C

Watch Video Solution

2. The ratio of radii of earth to another planet is $2/3$ and the ratio of their mean densities is $4/5$. If an astronaut can jump to a maximum height of $1.5m$ on the earth, with the same effort, the maximum height he can jump on the planet is

A. 1 m

B. 0.8 m

C. 0.5 m

D. 1.25 m

Answer: B

Watch Video Solution

3. If the mass of sun were ten times smaller and gravitational consitant G were ten times larger in magnitudes

A. Walking on ground would become more difficult.

B. The acceleration due to gravity on earth will not change.

C. Raindrops will fall much faster.

D. Airplanes will have to travel much faster.

Answer: B

Watch Video Solution

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

A. $\frac{R_E^2}{M_E}$

B. $\frac{M_E}{R_E^2}$

C. $M_E R_E^2$

D. $\frac{M_E}{R_E}$

Answer: B

Watch Video Solution

5. The acceleration due to gravity g and density of the earth ρ are related by which of the following relations? (where G is the gravitational constant and R_E is the radius of the earth)

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

B. $\rho = \frac{3g}{4\pi G R_E}$

C. $\rho = \frac{3G}{4\pi g R_E}$

D. $\rho = \frac{4\pi g R_E}{3G}$

Answer: B

Watch Video Solution

6. The mass of the moon is $\frac{1}{8}$ of the earth but the gravitational pull is $\frac{1}{6}$ earth It is due to the fact that .

A. moon is the satellite of the earth

B. the radius of the earth is (8/6) of the moon

C. the radius of the earth is $\left(\sqrt{8/6}\right)$ of the moon

D. the radius of the moon is (6/8) of the earth

Answer: C

Watch Video Solution

Higher Order Thinking Skills

1. A bullet is fired vertically upwards with a velocity v from the surface of a spherical planet when it reaches its maximum height, its acceleration due to the planet's gravity is $\frac{1}{4}th$ of its value at the surface of the planet. If the escape velocity from the planet is $V_{\text{escape}} = v\sqrt{N}$, then the value of N is : (ignore energy loss due to atmosphere).

A. 2

B. 3

C. 4

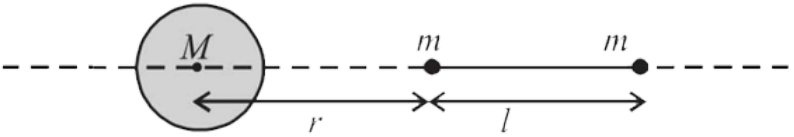
D. 5

Answer: A

Watch Video Solution

2. A larger spherical mass M is fixed at one position and two identical point masses m are kept on a line passing through the centre of M. The point masses are connected by rigid massless rod of length l and this assembly is free to move along the line connecting them. All three masses interact only throght their mutual gravitational interaction. When the point mass nearer to M is at a distance r =3l form M, the

tensin in the rod is zero for $m = k\left(\frac{M}{288}\right)$. The value of k is



A. 5

B. 6

C. 7

D. 8

Answer: C

Watch Video Solution

3. Two satellites S_1 and S_2 revolve around a planet in coplanar circular orbits in the same sense their periods of revolution are 1 hour and 8hours respectively the radius of the orbit of S_1 is 10^4 km when S_1 is closest to S_2 the angular speed of S_2 as observed by an astronaut in S_1 is :

A. $\pi \times 10^4$

B. $-\pi \times 10^4$

C. $\pi \times 10^5$

D. $\pi \times 10^5$

Answer: B

Watch Video Solution

4. In the above example the angular velocity of S_2 as actually observed by an astronaut in S_1 is -

A. 3×10^{-4}

B. 3×10^{23}

C. 3×10^{-6}

D. 3×10^{-7}

Answer: A

View Text Solution

5. The ratio of the earth's orbital angular momentum (about the Sun) to its mass is $4.4 \times 10^{15} m^2 s^{-1}$. The area enclosed by the earth's orbit is approximately-_____m^(2).

A. 6.94×10^{22}

B. 6.94×10^{23}

C. 7.94×10^{22}

D. 7.94×10^{23}

Answer: A

Watch Video Solution

6. A particle of mass m is subjected to an attractive central force of magnitude k/r^2, k being a constant. If at the instant when the particle is at an extreme position in its closed orbit, at a distance a from the centre of force, its speed is $\sqrt{k/2ma}$, if the distance of other extreme position is b. Find a/b.

A. 2

B. 3

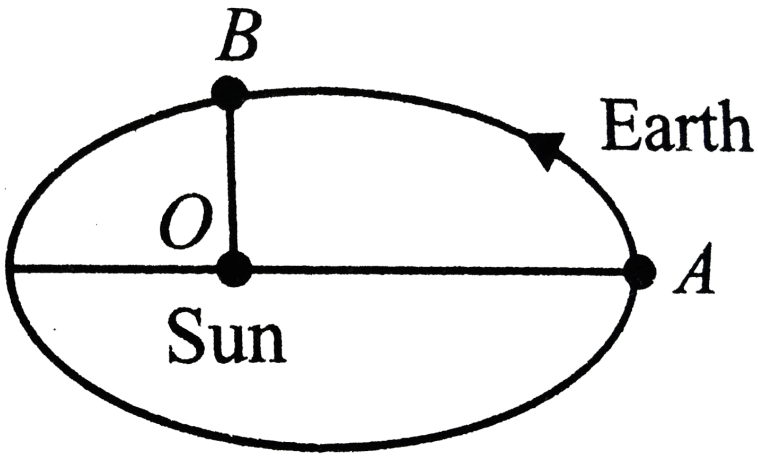
C. 4

D. 5

Answer: B

Watch Video Solution

7. The earth moves around the Sun in an elliptical orbit as shown in Fig. The ratio $OA/OB = x$. The ratio of the speed of the earth at B to that at A is nearly



A. $\sqrt{x}$

B. x

C. $x\sqrt{x}$

D. x^2

Answer: B

Watch Video Solution

8. A uniform ring of mass m and radius a is placed directly above a uniform sphere of mass M and of equal radius. The centre of the ring is at distance $\sqrt{3}a$ from the centre of the sphere. Find the gravitational force exerted by the sphere on the ring.

A. $\frac{GMm}{8r^2}$

B. $\frac{GMm}{4r^2}$

C. $\sqrt{3}\frac{GMm}{8r^2}$

D. $\frac{GMm}{8r^3\sqrt{3}}$

Answer: C

Watch Video Solution

9. Three particles are projected vertically upward from a point on the surface of earth with velocities

$v_1 = \sqrt{\frac{2gR}{3}}, v_2\sqrt{gR}, v_3\sqrt{\frac{4gR}{3}}$

respectively, where g is acceleation due to gravity on the surface of earth. If the maximum height attained are h_1, h_2 and h_3 respectively, then $h_1 : h_2 : h_3$ is

A. $1:2:3$

B. $2:3:4$

C. $1:2:4$

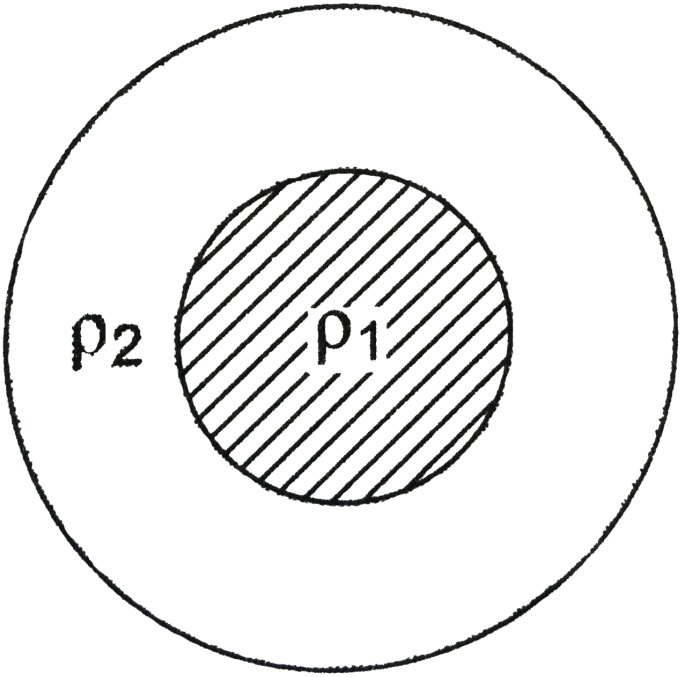
D. $1:3:5$

Answer: C

Watch Video Solution

10. The density of the core a planet is ρ_1 and that of the outer shell is ρ_2. The radii of the core and that of the planet are R and $2R$ respectively. The acceleration due to gravity at the surface of the

planet is same as at a depth R. Find the ratio of $\frac{\rho_1}{\rho_2}$



A. 2.3

B. 4.5

C. 3.2

D. 5.4

Answer: A

Watch Video Solution

Ncert Exemplar

1. The earth is an approximate sphere. If the interior contained matter which is not of the same density every where, then on the surface of the earth, the acceleration due to gravity

A. willl be directed towards the centre but not the same everywhere.

B. will have the same value everywhere but not directed towards the centres.

C. will be same everywhere in magnitude directed towards the centres.

D. cannot be zero at any point.

Answer: D

Watch Video Solution

2. As observed from the earth, the sun appears to move an approx. circular orbit. For the motion of another planet like mercury as observed from the earth, this would

A. be similarly true

B. not be true because the force between earth and mercury is note inverse square law

C. not be true because the major gravitational force on mercury is due to sun

D. not be true because mercury is influenced by forces other than gravitational forces.

Answer: C

Watch Video Solution

3. Different points in the earth are at slightly different distance from the sun and hence experience different force due to gravitation. For a rigid body, we know that if various forces act at various points in it, the resultant motion is as if a net force acts on the CM (centre of mass) causing translation and a net torque at the CM causing rotation around an axis through the CM. for the earth-sun system (approximating the earth as a uniform density sphere).

A. the torques is zero

B. the torque causes the earth to spin.

C. the rigid body result is not applicable since the earth is not even approximately a rigid body.

D. the torque causes the earth to move around the sun.

Answer: A

Watch Video Solution

4. Satellites orbiting the earth have finite life and sometimes debris of satellites fall to the earth. This is because,

A. the solar cells and batteries in satellites run out.

B. the laws of gravitation predict a trajectory spiralling inwards .

C. of viscous forces causing the speed of satellite and hence height to gradually decrease.

D. of collisions with other satellites.

Answer: C

Watch Video Solution

5. Both earth and moon are subjected to the gravitational force of the sun. as observed from the sun, the orbit of the moon

A. will be elliptical.

B. will not be strictly elliptical because the total gravitational force on it is not central .

C. is not elliptical but will necessarily be a closed curve.

D. deviates considerably from being elliptical due to influence of planets other than earth .

Answer: B

Watch Video Solution

6. In our solar system, the inter-planetery region has chunks of matter (much smaller in size compared to planets) called asteriods. They

A. will not move around the sun since they have very small masses compared to sun.

B. will move in an irregular way because of their small masses and will drift away into outer space.

C. will move around the sun in closed orbits but not obey Kepler's laws.

D. will move in orbits like planets and obey Kepler's laws.

Answer: D

Watch Video Solution

7. Choose the wrong option.

A. Inertial mass is a measure of difficulty of accelerating a body by an external force whereas the gravitational mass is relevant in determining the gravitational force on it by an external mass. .

B. That the gravitational mass and inertial mass are equal is an experimental result.

C. That the acceleration due to the gravity on Earth is the same for all bodies and is due to the quality of gravitational mass and

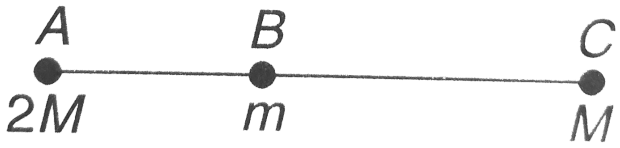
inertial mass.

D. Gravitational mass of a particle like proton can depend on the presence of neighbouring heavy objects but the inertial mass cannot .

Answer: D

Watch Video Solution

8. particles of masses 2M m and M are resectively at points A , B and C with $AB = \frac{1}{2}(BC)$ m is much - much smaller than M and at time $t = 0$ they are all at rest as given in figure . As subsequent times before any collision takes palce .



Watch Video Solution

Assertion And Reason

1. Assertion: The planet move slower when they are farther from the Sun than when they are nearer.

Reason : Angular velocity of a planet is a constant quantity.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

2. Assertion : A central force is such that the force on the planet is along the vector joining the sun and the planet.

Reason : Conservation of angular momentum is valid for any central force.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

3. Assertion: The motion of a particle under the central force is always confined to a plane.

Reason: Angular momentum is always conserved in the motion under a central force.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

4. Assertion: The time period of revolution of a satellite close to surface of earth is smaller then that revolving away from surface of earth.

Reason: The square of time period of revolution of a satellite is directely proportioanl to cube of its orbital radius.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

5. Assertion: When distance between bodies is doubled and also mass of each body is also doubled, gravitational force between them remains the same.

Reason: According to Neweton's law gravitational, force is directely proportional to mass of bodies and inversely proportional to square of distance between them.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

6. Assertion : The principle of superposition is not valid for gravitational force.

Reason : Gravitational force is a conservative force.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer:

Watch Video Solution

7. Assertion: The gravitational force on a particle inside a spherical shell is zero.

Reason: The shell shields other bodies outside it form exerting gravitational forces on a particle inside.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

8. Assertion : Gravitational force between two masses in air is F. If they are immersed in water, force will remain F

Reason : Gravitational force does not depend on the medium between the masses.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

9. Assertion: A man in a dosed cabin falling freely does not experience gravity.

Reason: Inertial and gravitational mass have equivalence.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

10. Assertion : For a free falling object, the next external force is just the weight of the object .

Reason : In this case the downward acceleration of the object is equal to the acceleration due to gravity.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

11. Assertion: The total energy of a satellite is negative.

Reason: Gravitational potential energy of an object is negative.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

12. Assertion : Moon has no atmosphere.

Reason : The escape velocity for moon is less than that for earth.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

Watch Video Solution

13. Assertion : The gravitational attraction of moon is much less than that of earth.

Reason : Moon is the neutral satellite of the earth.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

14. Assertion: A person sitting in an artificial satellite revolving around the earth feels weightless.

Reason: There is no gravitational force on the satellite.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

15. Assertion : Geostationary satellites appear fixed from any point on earth.

Reason : The time period of geostationary satellite is 24 hours.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are truebut reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution