PHYSICS

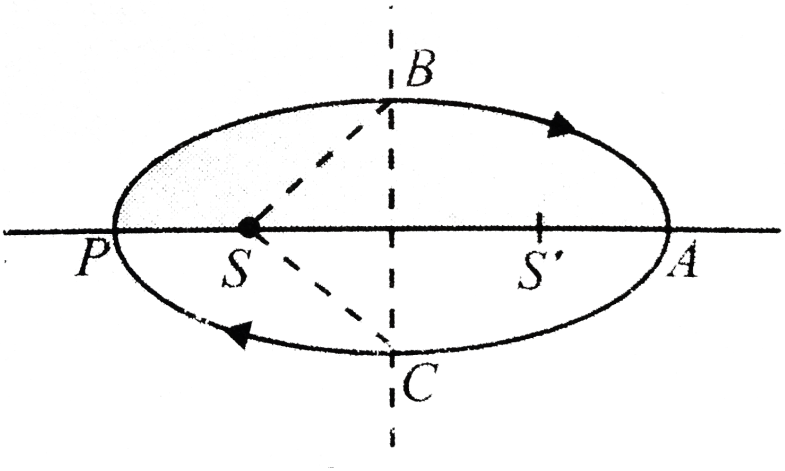
BOOKS - MTG GUIDE PHYSICS (HINGLISH)

GRAVITATION

Illustration

1. Let the speed of the planet at the perihelion P in figure be v_P and the Sun planet distance SP be r_P. Relater r_P, v_P to the corresponding quantities at the aphelion (r_A, v_A). Will the planet

take equal times to transverse BAC and CPB?



A. $\frac{r_p}{r_a} = \frac{v_p}{v_a}$

B. $\frac{r_p^2}{r_a^2} = \frac{v_a}{v_p}$

C. $\frac{v_p}{v_a} = \frac{r_a}{r_p}$

D. $\frac{v_p^2}{v_a^2} = \frac{r_a}{r_p}$

Answer: C

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2. The rotation period of an earth satellite close to the surface of the earth is 83 minutes. The time period of another earth satellite in an orbit at a distance of three earth radii from its surface will be

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3. A planet of mass m moves around the Sun of mass Min an elliptical orbit. The maximum and minimum distance of the planet from the Sun are r_1 and r_2, respectively. Find the relation between the time period of the planet in terms of r_1 and r_2.

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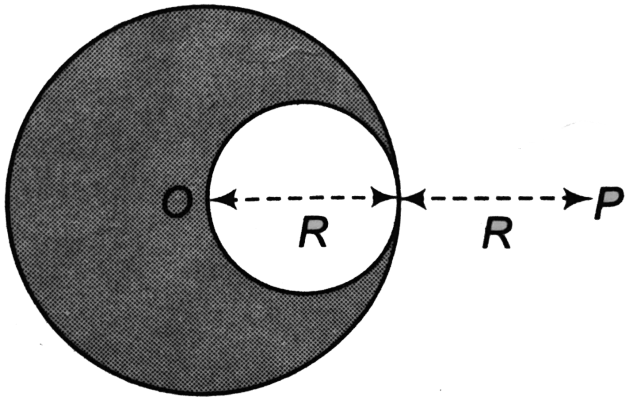
4. A solid sphere of uniform density and radius R applies a gravitational force of attraction equal to F_1 on a particle placed at P , distance $2R$ from the centre O of the sphere. A spherical cavity of radius $R/2$ is now made in the sphere as shown in figure. The

particle with cavity now applies a gravitational force F_2 on same particle placed at P. The radio F_2 / F_1 will be



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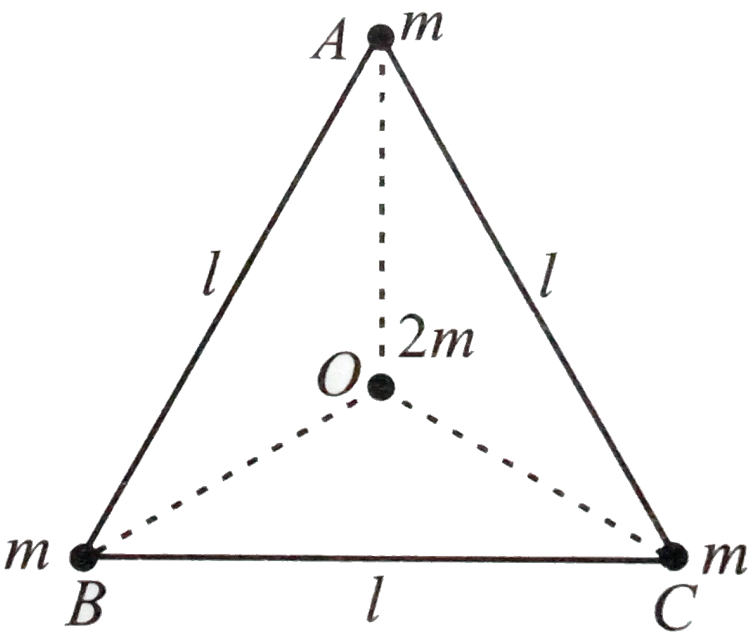
5. Three masses each of mass m are palced at the vertices of an equilateral triangles ABC of side l as shown in figure. The force acting

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



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6. A body of mass m is placed at a latitude of 45° on earth of radius R and angular speed ω . How does the weight of the body change if earth stops rotating about its axis?

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7. The change in the value of g at a height h above the surface of the earth is the same as at a depth d below the surface of earth. When both d and h are much smaller than the radius of earth, then which one of the following is correct?

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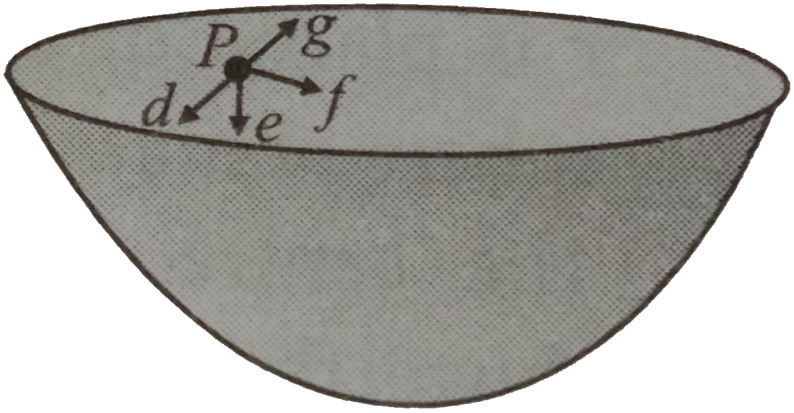
8. The direction of gravitational intensity at point P of a hemispherical shell of uniform mass desity is indicated by the arrow



A. a

B. b

C. c

D. 0

Answer: C

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9. How is gravitational potential on the surface of earth, at a given point, related with acceleration due to gravity g? Take radius of earth = R.

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10. A diametrical tunnel is dug across the earth. A ball dropped into the tunnel from one side. The velocity of the ball when it reaches the

centre of the earth is [Given: gravitational potential at the centre of earth $= -3/2(GM/R)$]

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11. If the acceleration due to gravity at the surface of the earth is g, the work done is slowly lifting a body of mass in from the earth's surface to a height R equal to the radius of the earth is

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12. Imagine a light planet revoling around a very massiv star in a circular orbit of radius R with a period of revolution T. if the gravitatinal force of attraction between the planet and the star is proportional to $R-(5/2)$

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13. The magnitude of gravitational potential energy of the moon earth system is U with zero potential energy at infinite separation. The kinetic energy of the moon with respect to the earth is K.

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14. Which quantity is conserved for a satellite revolving around the earth in a fixed orbit?

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15. The masses and radii of the earth an moon are M_1 and R_1 and M_2, R_2 respectively. Their centres are at a distacne r apart. Find the minimum speed with which the particle of mass m should be projected from a point mid-way between the two centres so as to escape to infinity.

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16. The escape velocity of a body from the earth is $11.2 km / s$. If a body is projected with a velocity twice its escape velocity, then the velocity of the body at infinity is (in km / s)

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17. A spaceship is launched into a circular orbit close to the earth's surface . What additional velocity has now to be imparted to the spaceship in the orbit to overcome the gravitational pull. Radius of earth $= 6400 km, g = 9.8 m / s^2$.

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Neet Cafe Topicwise Practice Questions Kepler S Laws Of Planetary Motion

1. Law of conservation of angular momentum

A. orbits

B. areas

C. periods

D. conservation of kinetic energy

Answer: B

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2. 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. $1.2 \times 10^9 km$

B. $1.3 \times 10^9 km$

C. $1.4 \times 10^9 km$

D. $1.5 \times 10^9 km$

Answer: C

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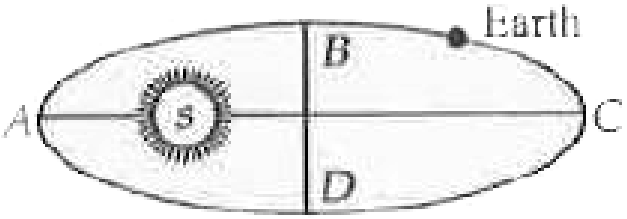
3. The earth rotates around the sun (see figure) in an elliptical orbit.

At which point will velocity be maximum?



A. At A

B. At B

C. At C

D. At D

Answer: A

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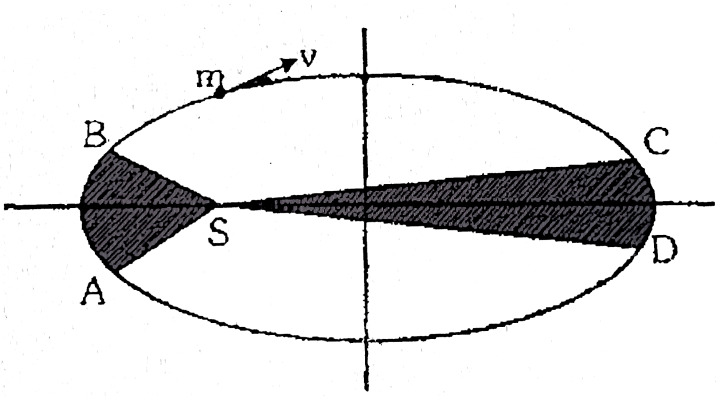
4.



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. $t_1 = 4t_2$

B. $t_2 = 2t_2$

C. $t_1 = t_2$

D. $t_1 > t_2$

Answer: B

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5. A binary star system consists of two stars. One star has twice the mass of the other. The star rotates about their common centre of mass. Which of the following statement is correct?

A. Star having the smaller mass has twice angular momentum compared to heavier star.

B. Both stars have same angular momentum about centre of mass.

C. Both stars have same linear speed.

D. Both the stars have same kinetic energy.

Answer: A

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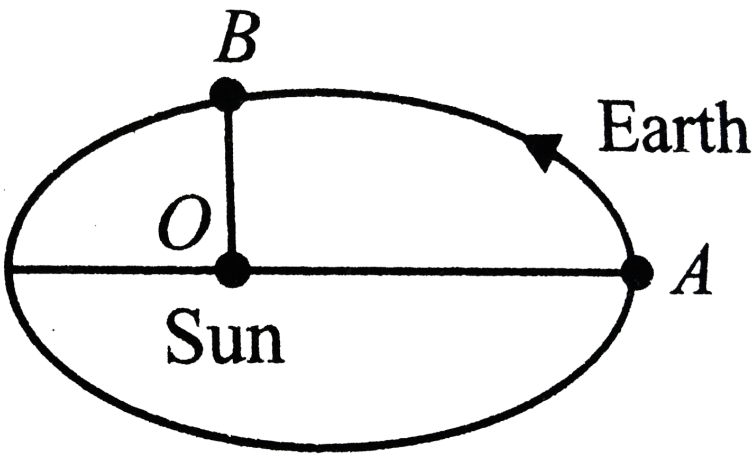
6. The earth moves around the Sun in an elliptical orbit as shown in Fig. The ratio $OA/OB = x$. The ratio of the speed of the earth at B to that at A is nearly



A. $\sqrt{3}$

B. x

C. x^2

D. $x\sqrt{x}$

Answer: B

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7. A system of binary stars of mass m_A and m_B are moving in circular orbits of radii r_A and r_B respectively. If T_A and T_B are at the time periods of masses m_A and m_B respectively then

A. $\frac{T_A}{T_B} = \left(\frac{R_A}{R_B}\right)^{1/2}$

B. $T_A > T_B(\quad \text{if} \quad R_A > R_B)$

C. $T_A > T_B(\quad \text{if} \quad M_A > M_B)$

D. $T_A = T_B$

Answer: D

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8. The mean distance of mars from sun is 1.5 times that of earth from sun. What is approximately the number of years required by mars to make one revolution about sun ?

A. 2.35 years

B. 1.84 years

C. 3.65 years

D. 2.75 years

Answer: B

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9. Let $'A'$ be the area swept by the line joining the earth and the sun during Feb 2012. The area swept by the same line during the first week of that month is

A. A

B. 2A

C. 4A

D. A/4

Answer: D

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Neet Cafe Topicwise Practice Questions Universal Law Of Gravitation

1. The universal law of gravitational is the force law known also as the

A. triangular law

B. square law

C. inverse square law

D. parallelogram law

Answer: C

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2. 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

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3. Three equal masses of 1 kg each are placed at the vertices of an equilateral triangle PQR and a mass of 2 kg is placed at the centroid O of the triangle which is at a distance of $\sqrt{2}m$ from each of the vertices of the triangle. The force, in newton, acting on the mass of 2 kg is :

A. 2

B. $\sqrt{2}$

C. 1

D. 0

Answer: D

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

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

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

Answer: C

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5. Mass M is split into two parts m and $(M-m)$, which are then separated by a certain distance. What is the ratio of (m/M) which maximises the gravitational force between the parts ?

A. $1:4$

B. $1:3$

C. $1:2$

D. $1:1$

Answer: C

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6. Three indentical bodes of mass M are locatd at the verticles of an equailateral triangle of side L they revolve undr the effect of mutual gravitational force in a circular orbit circumscibing the traingle while preserving the equilateral triangle their orbital velocity is

A. $\sqrt{\frac{GM}{L}}$

B. $\sqrt{\frac{3GM}{2L}}$

C. $\sqrt{\frac{3GM}{L}}$

D. $\sqrt{\frac{2GM}{3L}}$

Answer: A

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

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

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

Answer: D

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8. Two solid spherical planets of equal radii R having masses 4M and 9M their centre are separated by a distance 6R. A projectile of mass m is sent from theplanet of mass 4 M towards the heavier planet. What is the distance r of the point from the lighter planet where the gravitational force on the projectille is zero ?

A. 1.4R

B. 1.8R

C. 1.5R

D. 2.4R

Answer: D

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9. Four particles, each of mass M and equidistant from each other, move along a circle of radius R under the action of their mutual

gravitational attraction. The speed of each particle is:

A. $\frac{1}{2}\sqrt{\frac{GM}{R}(1+2\sqrt{2})}$

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

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

D. $\sqrt{\frac{GM}{R}(1+2\sqrt{2})}$

Answer: A

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10. If two particles each of mass m are placed at the two vertices of an equilateral triangle of side a, then the resultant gravitational force on mass m placed at the third vertex is

A. $\frac{\sqrt{3}Gm^2}{2r^2}$

B. $\frac{\sqrt{3}Gm^2}{r^2}$

C. $\frac{Gm^2}{r^2}$

D. $\frac{Gm^2}{2r^2}$

Answer: B

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11. 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. $-\frac{GMm}{R^2}$

C. 0

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

Answer: C

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12. The magnitudes of the gravitational field at distance r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are E_1 and E_2 respectively. Then:

A. $\frac{F_1}{F_2} = \frac{r_1}{r_2}$ if $r_1 < R$ and $R_2 < R$

B. $\frac{F_1}{F_2} = \frac{r_2}{r_1}$, if $r_1 < R$ and $r_2 < R$

C. $\frac{F_1}{F_2} = \frac{r_1^3}{r_2^3}$, if $r_1 > R$ and $r_2 > R$

D. $\frac{F_1}{F_2} = \frac{r_1^2}{r_2^2}$ if $r_2 > R$ and $r_2 > R$

Answer: A

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13. 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

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14. A planet of radius $R = \frac{1}{10} \times (radiusofEarth)$ has the same mass density as Earth. Scientists dig a well of depth $\frac{R}{5}$ on it and lower a wire of the same length and a linear mass density $10^{-3}kgm(\_1)$ into it. If the wire is not touching anywhere, the force applied at the top of the wire by a person holding it inplace is

(take the radius of Earth $= 6 \times 10^6 m$ and the acceleration due to gravity on Earth is $10 ms^{-2}$

A. 96N

B. 108N

C. 120N

D. 150N

Answer: B

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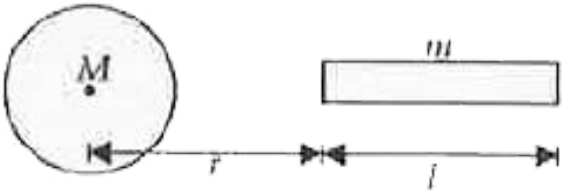
15. The gravitational force of attraction between a uniform sphere of mass M and a uniform rod of length l and mass in as shown in figure is



A. $\frac{GMm}{r(r+1)}$

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

C. Mm^2

D. $\left(r^2+1\right)mM$

Answer: A

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Neet Cafe Topicwise Practice Questions Acceleration Due To Gravity And Its Variation With Altitude And Depth

1. The acceleration due to gravity is g at a point distant r from the centre of earth of radius R. If $r < R$, then

A. $g \propto r$

B. $g \propto r^2$

C. $g \propto r^{-1}$

D. $g \propto r^{-2}$

Answer: A

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2. The height of the point vertically above the earth's surface, at which acceleration due to gravtiy becomes 1% of its value at the surface is (Radius of the earth =R)

A. 8R

B. 9R

C. 10R

D. 20R

Answer: B

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3. A uniform solid sphere of radius R produces a gravitational acceleration a_g on its surface. At what two distances from the centre of the sphere the acceleration due to gravity is $a_g/4$?

A. 4R, 0.50R

B. 2R, 0.25R

C. 3R, 0.33R

D. 2R, 0.50R

Answer: B

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4. At what height h above the earth's surface, the value of g becomes g/2 (where R is the radius of the earth)

A. $\left(\sqrt{2}-1\right)R$

B. $\sqrt{2R}$

C. $\left(\sqrt{2}+1\right)R$

D. $R\sqrt{2}$

Answer: A

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5. The depth d, at which the value of acceleration due to gravity becomes 1/n times the value at the surface is (R = radius of the earth)

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

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

C. $\frac{R(n-1)}{n}$

D. $\frac{Rn}{(n-1)}$

Answer: C

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6. The radii of two planets are respectively R_1 and R_2 and their densities are respectively ρ_1 and ρ_2.The ratio of the accelerations due to gravity at their surface is

A. $\frac{R_1\rho_2}{R_2\rho_1}$

B. $\frac{R_1\rho_1}{R_2\rho_2}$

C. $\frac{\rho_1 R_2^2}{\rho_2 R_1^2}$ s

D. $\frac{R_1 + R_2}{\rho_1\rho_2}$

Answer: B

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7. 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. 72N

B. 28N

C. 16N

D. 32N

Answer: D

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8. At what height the acceleration due to gravity decreases by 36% of its value on the surface of the earth ?

A. $\frac{R}{6}$

B. $\frac{R}{4}$

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

D. $\frac{2}{3}R$

Answer: B

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9. A body of mass 500g is town upwards with a velocity $20ms^{-1}$ and reaches back to the surface of a planet after 20s. Then the weight of the body on that planet is

A. 2N

B. 4N

C. 5N

D. 1N

Answer: D

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10. The earth is a solid sphere of radius 6400 km, the value of acceleration due to gravity at a height 800 km above the surface of the earth is

A. about 1.5%

B. about 5%

C. about 8%

D. about 3%

Answer: B

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11. If g_E and g_M are the acceleration due to gravity on the surfaces of the earth and the moon respectively and if Millikan's oil drop experiment could be performed on the two surfaces, one will find the ratio

electronic charge on the moon/electronic charge on the earth to be

A. $\frac{g_M}{g_L}$

B. 1

C. 0

D. $\frac{g_E}{g_M}$

Answer: B

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12. If g_e, g_h and g_d be the acceleration due to gravity at earth's surface, a height h and at depth d respectively . Then:

A. $g_0 < g_h$ and $g_0 > g_d$

B. $g_0 < g_h$ and $g_0 < g_d$

C. $g_0 > g_h$ and $g_0 > g_d$

D. $g_0 < g_h$ and $g_0 > g_d$

Answer: C

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13. 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. 1m

B. 0.8m

C. 0.5m

D. 1.25m

Answer: B

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14. The weight of an object in the coal mine, sea level and at the top of the mountain are W_1, W_2 and W_3 respectively, then

A. $W_1 < W_2 < W_3$

B. $W_1 = W_2 = W_3$

C. $W_1 < W_2 < W_3$

D. $W_1 > W_2 > W_3$

Answer: A

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15. Mass remaining constant, the radius of the earth shrinks by 1%. The acceleration due to gravity on the earth's surface would

A. increase by 2%

B. increase by 1%

C. decrease by 1%

D. decrease by $\frac{1}{2}$ %

Answer: A

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16. Compare the weight of a body 100 km above and 100 km below the surface of the earth . Radius of the earth = 6400 km .

A. 60m

B. 80m

C. 100m

D. 120m

Answer: C

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

A. $g' = 3g$

B. $g' = 9g$

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

D. $g' = 27g$

Answer: A

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18. 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. 880N

B. 889N

C. 890N

D. 892N

Answer: B

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19. If g is the acceleration due to gravity and R is the radius of earth, then the dimensional formula for g R is

A. a height $\frac{R}{2}$ from the earth's surface

B. the centre of the earth

C. the surface of the earth

D. a depth $\frac{R}{2}$ from earth's surface

Answer: C

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Neet Cafe Topicwise Practice Questions Gravitational Potential Energy And Gravitational Potential

1. The weight of a body of mass 3 kg at a height of 12.8×10^6 m from the surface of the Earth is _____.

A. $-3.23 \times 10^9 J$

B. $-3.19 \times 10^6 J$

C. $-2.5 \times 10^6 J$

D. $-4.0 \times 10^{11} J$

Answer: B

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2. Find the change in the gravitational potential energy when a body of mass m is raised to a height nR above the surface of the earth. (Here, R is the radius of the earth)

A. $mgR\dfrac{n}{(n-1)}$

B. mgR

C. $mgR\dfrac{n}{(n+1)}$

D. $mgR\dfrac{n^2}{(n^2+1)}$

Answer: C

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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. $-\frac{3Gm}{R}$

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

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

Answer: C

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4. A body of mass m rises to a height h=R/5 from the surface of earth. If g is the acceleration due to gravity at the surface of earth, the increase in potential energy is (R = radius of earth)

A. $\frac{4}{5}mgR$

B. $\frac{5}{6}mgR$

C. $\frac{6}{7}mgR$

D. mgR

Answer: B

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5. 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. 0

D. $-\frac{mgR}{2}$

Answer: B

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6. If g is the acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from the surface of the earth to a height equal to the radius R of the earth, is

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

B. $2mgR$

C. mgR

D. $\frac{1}{4}mgR$

Answer: A

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Neet Cafe Topicwise Practice Questions Escape Velocity

1. The escape velocity for a body projected vertically upwards from the surface of earth is 11km/s. If the body is projected at an angle of 45° with the vertical, the escape velocity will be

A. $11/\sqrt{2}km/\sec$

B. $11\sqrt{2}km/\sec$

C. $2km/\sec$

D. $11km/\sec$

Answer: D

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2. A ball is thrown vertically upwards with a velocity equal to half the escape velocity from the surface of the earth. The ball rises to a height h above the surface of the earth. If the radius of the earth is R, then the ratio $\frac{h}{R}$ is

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

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

C. 2

D. 3

Answer: B

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3. A body is projected up with a velocity equal to $3/4th$ of the escape velocity from the surface of the earth. The height it reaches is

(Radius of the earth is R)

A. $\frac{10R}{9}$

B. $\frac{9R}{7}$

C. $\frac{9R}{8}$

D. $\frac{10R}{3}$

Answer: B

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4. The escape velocity corresponding to a planet of mass M and radius R is $50kms^{-1}$. If the planet's mass and radius were $4M$ and R, respectively, then the corresponding escape velocity would be

A. 100 km/s

B. 50 km/s

C. 200 km/s

D. 25 km/s

Answer: A

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5. The moon has a mass of $\frac{1}{81}$ that of the earth and radius of $\frac{1}{4}$ that of the earth. The escape speed from the surface of the earth is 11.2 km / s. The escape speed from surface of the moon is-

A. $1.25 kms^{-1}$

B. $2.49 kms^{-1}$

C. $3.7 kms^{-1}$

D. $5.6 kms^{-1}$

Answer: B

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6. The escape velocity of an object from the earth depends upon the mass of the earth (M), its mean density (ρ), its radius (R) and the gravitational constant (G). Thus the formula for escape velocity is

A. $v_c = R\sqrt{\frac{8\pi}{3}G\rho}$

B. $v_e = M\left(\frac{8\pi}{3}GR\right)$

C. $v_e = \sqrt{2GMR}$

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

Answer: A

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7. A particles is fired vertically from the surface of the earth with a velocity Kv_e , where u_e is the escape velcocity ans $K < 1$.

Neglecting air resistance , calcualte the heightto which it will rise from the surface of the earth .(R= radius of the earth).

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

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

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

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

Answer: A

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8. The escape velocity form the earth is 11 kms^{-1} the esacpe velocity from a planet having twice the radius and the same mean denisty as the earth would be

A. $5.5kms^{-1}$

B. $11kms^{-1}$

C. $15.5kms^{-1}$

D. $22kms^{-1}$

Answer: D

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9. The escape velocity of a particle of mass m varies as

A. m^2

B. m

C. m^0

D. m^{-1}

Answer: C

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10. What is the escape velocity for body on the surface of planet on which the accelearation due to gravity is $(3.1)^2 ms^2$ and whose radius is 8100 km ?

A. $2700 kms^{-1}$

B. $27.9 kms^{-1}$

C. $\frac{27.9}{\sqrt{5}} kms^{-1}$

D. $27.9\sqrt{5} kms^{-1}$

Answer: C

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11. 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

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12. 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. $\sqrt{Gm\left(\frac{1}{R}-\frac{1}{r}\right)}$

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

C. $\sqrt{Gm\left(\frac{1}{R}+\frac{1}{r}\right)}$

D. $\sqrt{Gm\left(\frac{1}{2R}+\frac{1}{r}\right)}$

Answer: B

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13. A planet in a distant solar systyem is 10 times more massive than the earth and its radius is 10 times smaller. Given that the escape velocity from the earth is $11kms^{-1}$, the escape velocity from the surface of the planet would be

A. $0.11kms^{-1}$

B. $1.1kms^{-1}$

C. $11kms^{-1}$

D. $110kms^{-1}$

Answer: D

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14. Two balls A and B are thrown vertically upwards from the same location on the surface of the earth with velocities $2\sqrt{\frac{gR}{3}}$ and $\sqrt{\frac{2gR}{3}}$ respectively, where R is the radius of the earth and g is the acceleration due to gravity on the surface of the earth. The ratio of the maximum height attained by A to that attained by B is

A. 2

B. 4

C. 8

D. $4\sqrt{2}$

Answer: B

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15. The radius in kilometers, to which the present radius of the earth (R = 6400 km) is to be compressed so that the escape velocity velocity is increased ten times is

A. 6.4

B. 64

C. 640

D. 4800

Answer: B

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16. Escape velocity of a body from the surface of earth is 11.2km/sec. from the earth surface. If the mass of earth becomes double of its

present mass and radius becomes half of its present radius then escape velocity will become

A. 5.6 km/s

B. 11.2 km/s

C. 44.8 km/s

D. 22.4 km/s

Answer: D

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17. A particle of mass 'm' is kept at rest at a height 3R from the surface of earth, where 'R' is radius of earth and 'M' is mass of earth. The minimum speed with which it should be projected, so that it does not return back, is (g is acceleration due to gravity on the surface of earth)

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

B. $\left(\frac{gR}{4}\right)^{1/2}$

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

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

Answer: A

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18. A body is released from a point of distance R' from the centre of earth. Its velocity at the time of striking the earth will be $(R' > R_e)$

A. $\sqrt{gR}$

B. $\sqrt{2gR}$

C. $\sqrt{\frac{2gRr}{r-R}}$

D. $\sqrt{\frac{2gR(r-R)}{r}}$

Answer: D

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19. Two spherical planets P and Q have the same uniform density ρ, masses M_p and M_Q and surface areas A and 4A respectively. A spherical planet R also has uniform density ρ and its mass is $\left(M_P + M_Q\right)$. The escape velocities from the plantes P,Q and R are $V_P V_Q$ and V_R respectively. Then

A. $v_Q > v_R > v_P$

B. $v_R > v_Q > v_P$

C. $R_R > R_Q > R_P$

D. $\frac{v_P}{v_Q} = \frac{1}{2}$

Answer: A

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20. If the escape velocity of a planet is 3 times that of the earth and its radius is 4 times that of the earth, then the mass of the planet is (Mass of the earth = $6 \times 10^{24} kg$)

A. $1.62 \times 10^{22} kg$

B. $0.72 \times 10^{22} kg$

C. $2.16 \times 10^{26} kg$

D. $1.22 \times 10^{22} kg$

Answer: C

Watch Video Solution

21. The escape velocity of a body from the surface of earth is

A. $\sqrt{gR_E}$

B. $\sqrt{\frac{gR_E}{2}}$

C. gR_E

D. $\sqrt{2gR_E}$

Answer: D

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22. Two satellites M and N go around the earth in circular orbits at heights of R_M and R_N respectively from the surrface of the earth. Assuming the earth to be a uniform sphere of radius R_E, the ratio of velocities of the satellites $\frac{V_M}{V_N}$ is

A. $\sqrt{\frac{R_B}{R_A}}$

B. $\frac{R_B + R_e}{R_A + R_e}$

C. $\sqrt{\frac{R_B + R_e}{R_A + R_e}}$

D. $\left(\frac{R_A}{R_B}\right)$

Answer: C

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23. Assuming density d of a planet to be uniform, we can say that the time period of its artificial satellite is proportional to

A. d

B. $\sqrt{d}$

C. $\frac{1}{\sqrt{d}}$

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

Answer: C

Watch Video Solution

24. Two satellite of mass m and $9m$ are orbiting a planet in orbits of radius R. Their periods of revolution will be in the ratio of

A. $1:9$

B. $1:3$

C. $1:1$

D. $3:1$

Answer: C

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25. An artificial satellite moving in circular orbit around the earth has total (kinetic + potential) energy E_0. Its potential energy and kinetic energy respectively are :

A. E_0

B. $1.5E_0$

C. $2E_0$

D. E_0

Answer: C

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26. The time period of an earth satellite in circular orbit is independent of

A. the mass of the satellite

B. radius of its orbit

C. both the mass of satellite and radius of the orbit

D. neither the mass of satellite nor the radius of its orbit

Answer: A

Watch Video Solution

27. A satellite is launched into a circular orbit of radius 'R' around earth while a second satellite is launched into an orbit or radius 1.02 R. The percentage difference in the time periods of the two satellites is

A. 0.007

B. 0.01

C. 0.015

D. 0.03

Answer: D

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28. The ratio of the energy required to raise a satellite upto a height h above the surface of earth to that the kinetic energy of the satellite into the orbit there is (R=radius of earth)

A. $R:h$

B. $h:R$

C. $R:2h$

D. $2h:R$

Answer: D

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29. In a satellite if the time of revolution is T, then kinetic energy is proportional to

A. T^{-1}

B. $T^{-2/3}$

C. T^{-2}

D. $T^{-1/3}$

Answer: B

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30. Two identical satellites A and B revolve round the earth in circular orbits at distance R and 3R from the surface of the earth. The ratio of the linear momenta of A and B is (R = radius of the earth)

A. $1:1$

B. $1:\sqrt{2}$

C. $\sqrt{2}:1$

D. $2:1$

Answer: C

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31. An earth satellite is moving round the earth in a circular orbit . For such a satellite which of the following statement is wrong ?

A. Velocity

B. Linear momentum

C. Angular momentum

D. None of these

Answer: C

Watch Video Solution

32. An asteroid of mass $2 \times 10^{-4} M_e$, where M_e is the mass of the earth, revolves in a circular orbit around the sun at a distance that is twice earth's distance from the sun. Find the ratio of the kinetic energy of the asteroid to that of earth

A. 0.9×10^{-4}

B. 1.6×10^{-5}

C. 3.6×10^{-5}

D. 1.0×10^{-4}

Answer: D

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33. Two satellites are revolving around the earth in circular orbits of same radii. Mass of one satellite is 100 times that of the other. Then their periods of revolutions are in the ratio

A. $1:1$

B. $10:1$

C. $100:1$

D. $1:100$

Answer: A

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34. 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. (i) only

B. (i) and (ii)

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

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

Answer: D

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35. The distance of two satellites from the surface of the earth R and $7R$. There time periods of rotation are in the ratio

A. $1:7$

B. $1:8$

C. $1:49$

D. $1:7^{3/2}$

Answer: B

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36. The escape velocity for a planet is v_e. A particle is projected from its surface with a speed v. For this particle to move as a satellite around the planet.

A. $\frac{v_e}{2} < v < v_e$

B. $\frac{v_e}{\sqrt{2}} < v < v_e$

C. $v_e < v < \sqrt{2}v_e$

D. $\frac{v_e}{\sqrt{2}} < v < \frac{v_e}{2}$

Answer: B

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37. At what height from the surface of the earth, the total energy of satellite is equal to its potential energy at a height $2R$ from the surface of the earth (R=radius of earth)

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

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

C. 2R

D. 4R

Answer: B

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38. A satellite is in a circular orbit very close to the surface of a planet. At some point it is given an impulse along its direction of motion, causing its velocity to increase n times . It now goes into an elliptical orbit. The maximum possible value of n for this to occur is

A. 2

B. $\sqrt{2}$

C. $\sqrt{2}+1$

D. $\frac{1}{\sqrt{2}-1}$

Answer: B

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39. An artificial satellite is orbiting at a height of 1800 km from the earth's surface. The earth's radius is 6300 km and $g = 10\frac{m}{s^2}$ on its surface. What is the radial acceleration of the satellite?

A. $6ms^{-2}$

B. $7ms^{-2}$

C. $8ms^{-2}$

D. $9ms^{-2}$

Answer: A

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40. How long will a satellite, placed in a circular orbit of radius that is $\left(\frac{1}{4}\right)^{th}$ the radius of a geostationary satellite, take to complete one revolution around the earth?

A. 12 hours

B. 6 hours

C. 3 hours

D. 4 days

Answer: C

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41. A satellite of mass m revolves around the earth of radius R at a hight x from its surface. If g is the acceleration due to gravity on the surface of the earth, the orbital speed of the satellite is

A. gx

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

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

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

Answer: D

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42. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of escape velocity from the earth. The height of the satellite above the surface of the earth is x R. Find the value of x.

A. 2R

B. R/2

C. R

D. R/4

Answer: C

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43. 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. 10 hour

B. $\left(6/\sqrt{2}\right)$ hour

C. 6 hour

D. $6\sqrt{2}$ hour

Answer: D

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44. The kinetic energy of a satellite is 2 MJ. What is the total energy of the satellite?

A. $-2MJ$

B. $-1MJ$

C. $-\frac{1}{2}MJ$

D. $-4MJ$

Answer: A

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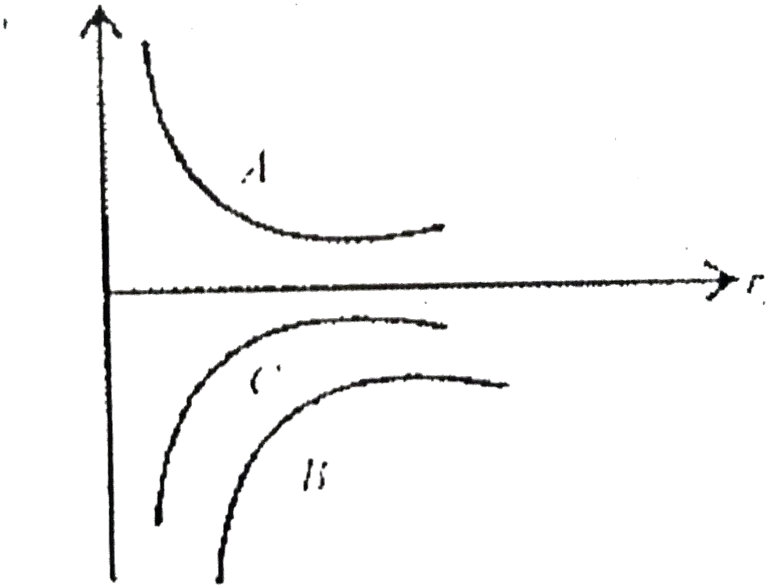
45. Figure shows the variation of energy with the orbit radius r of a satellite in a circular motion. Mark the correct statement.



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

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

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

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

Answer: B

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46. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius 4R. The ratio of their respective periods is

A. $4:1$

B. $1:8$

C. $8:1$

D. $1:4$

Answer: B

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47. The total energy of a circularly orbiting satellite is

A. twice the kinetic energy of the satellite

B. half the kinetic energy of the satellite

C. twice the potential energy of the satellite

D. half the potential energy of the satellite

Answer: D

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48. Energy required in moving a body of mass m from a distance 2R to 3R from centre of earth of mass M is

A. mgR

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

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

D. $\frac{mgR}{12}$

Answer: D

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49. If r is the distance between the Earth and the Sun. Then, angular momentum of the Earth around the sun is proportional to

A. $r^{3/2}$

B. r

C. $\sqrt{r}$

D. r^2

Answer: C

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

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

Answer: A

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51. Height of geostationary satellite is

A. 1000 km

B. 32000km

C. 36000km

D. 850km

Answer: C

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Check Your Neet Vitals

1. The acceleration due to gravity on the surface of the earth is g. If a body of mass m is raised from the surface of the earth to a height equal to the radius R of the earth, then the gain in its potential energy is given by

A. MgR_E

B. $\frac{1}{2}mgR_E$

C. $\frac{3}{2}mgR_E$

D. $\frac{2}{3}mgR_E$

Answer: B

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2. A satellite is to be placed in equatorial geostationary orbit around 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 at least one satellites is visible from any point on the equator.

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

A. $3.59 \times 10^5 m$

B. $3.59 \times 10^6 m$

C. $3.59 \times 10^7 m$

D. $3.59 \times 10^8 m$

Answer: C

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3. 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. $-2\frac{Gm}{l}$

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

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

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

Answer: D

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

A. $\sqrt{2gR}$

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

C. $\sqrt{\frac{8\pi G\rho R^2}{3}}$

D. $\sqrt{\frac{4\pi G\rho R^3}{3}}$

Answer: D

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5. A body weighs 63 N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the earth ?

A. 24N

B. 28N

C. 32N

D. 36N

Answer: B

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

A. Angular momentum

B. Mass of an object

C. Total mechanical energy

D. Linear momentum

Answer: D

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7. 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

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8. A rocket is fired from the earth towards the sun. At what distance from the earth's centre is the gravitational force on the rocket zero? Mass of the sun $= 2 \times 10^{30} kg$, mass of the earth $= 6 \times 10^{24} kg$. Neglect the effect of other planets etc. (orbital radius=$1.5 \times 10^{11} m$).

A. $2.6 \times 10^{4} kg$

B. $2.6 \times 10^{6} kg$

C. $2.6 \times 10^{8} kg$

D. $2.6 \times 10^{10} kg$

Answer: C

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9. 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

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10. A satellite is in an elliptical orbit around the earth with aphelion of $6R_E$ and perihelion of $3R_E$, where R_E is the radius of the earth. The eccentricity of the orbit is

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

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

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

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

Answer: B

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11. In the question number 10, 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

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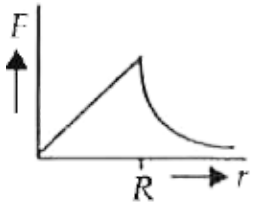
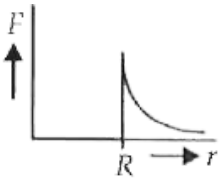
12. The gravitational force between a hollow spherical shell (of radius R and uniform density) and a point mass is F. Show the nature of F versus r graph where r is the distance of the point from the centre of the hollow spherical shell of uniform density

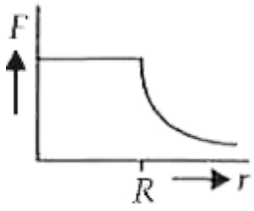
A.

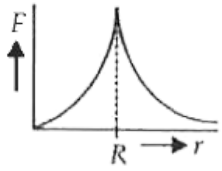


B.



C.



D. 

Answer: A

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

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

B. the gravitational force is large at that location in space.

C. the astronaut experiences no gravity.

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

Answer: C

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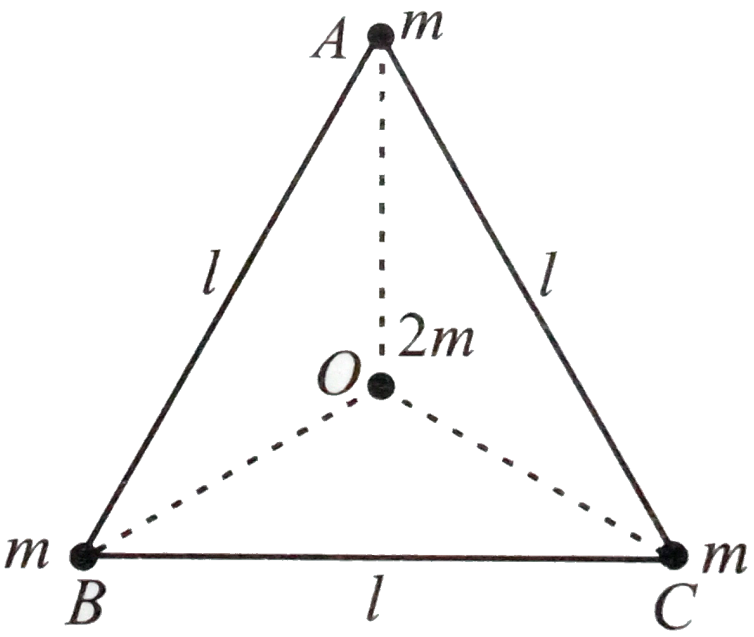
14. Three masses each of mass m are palced at the vertices of an equilateral triangles ABC of side l as shown in figure. The force acting on a mass 2m placed at the centroid O of the triangle is



A. 0

B. $\frac{6Gm^2}{a^2}\hat{j}$

C. $-\frac{6Gm^2}{a^2}\hat{j}$

D. $-\frac{Gm^2}{a^2}$ hatj `

Answer: A

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15. A satellite of a mass m orbits the earth at a hight 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

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16. Two starts each of one solar mass $\left(= 2 \times 10^{30} kg \right)$ are approaching each other for a head on collision. When they are a distance 10^9km. their speeds are negligible. What is the speed with which they collide? The radius of each star is 10^4km. Assume the stars to remain undistorted until they collide. (Use the known value of G).

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

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

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

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

Answer: B

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17. 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 torque 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

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18. A comet is revolving around the sun in an elliptical orbit. Which of the following will remain constant throughout its orbit?

A. Linear speed

B. Angular speed

C. Angular momentum

D. Kinetic energy

Answer: C

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19. 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. Kinetic energy $= -\frac{GM_Em}{2r}$

B. Potential energy $= \frac{GM_Em}{2r}$

C. Total energy $= -\frac{GM_Em}{r}$

D. Orbital velocity $= \sqrt{\frac{GM_E}{r}}$

Answer: B

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

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

B. The gravitational force is a conservative force.

C. The gravitational force is a central force.

D. The gravitational force obeys the inverse square law.

Answer: A

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21. The angle between the equatorial plane and the orbital plane of a polar satellite is

A. 0°

B. 45°

C. 90°

D. 180°

Answer: C

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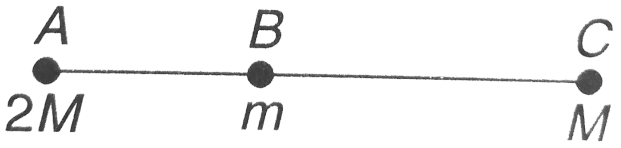
22. particles of masses 2M m and M are resectively at points A , B and C with $AB = \frac{1}{2}(BC)$ m is much - much smaller than M and at time $t = 0$ they are all at rest as given in figure . As subsequent times before any collision takes palce .



A. m will remain at rest.

B. m will move towards M.

C. m will move towards 2M.

D. m will have oscillatory motion

Answer: C

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23. The escape speed of a body from the earth depends upon

A. the mass of the body

B. the location from where it is projected

C. the height of the location from where the body is launched

D. Both (b) and (c)

Answer: D

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24. 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. $11.2\sqrt{3} kms^{-1}$

B. $11.2 kms^{-1}$

C. $11.2\sqrt{2} kms^{-1}$

D. $\frac{11.2}{\sqrt{2}} kms^{-1}$

Answer: A

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25. 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 does not obey 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

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Aipmt Neet Mcqs

1. The radii of circular orbits of two satellite A and B of the earth are $4R$ and R, respectively. If the speed of satellite A is $3v$, then the

speed of satellite B will be

A. $\frac{3V}{4}$

B. $6V$

C. $12V$

D. $\frac{3V}{2}$

Answer: B

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2. A particle of mass M is situated at the centre of a spherical shell of same mass and radius 'a'. The gravitational potential at a point situated at $\frac{a}{2}$ distance from the centre, will be

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

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

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

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

Answer: A

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3. A man of $50kg$ mass is standing in a gravity free space at a height of $10m$ above the floor. He throws a stone of $0.5kg$ mass downwards with a speed $2m/s$. When the stone reaches the floor, the distance of the man above the floor will be

A. 9.9 m

B. 10.1 m

C. 10 m

D. 20 m

Answer: B

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4. 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

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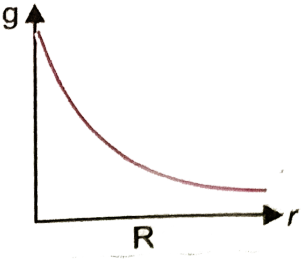
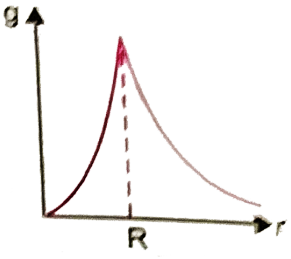
5. The dependence of acceleration due to gravity g on the distance r from the centre of the earth, assumed to be a sphere of radius R of uniform density is as shown in Fig. below:

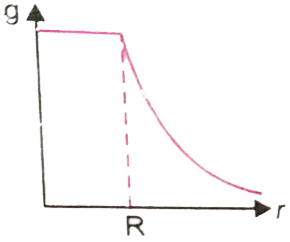
(1)



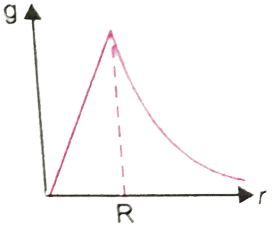
(2)



(3)



(4)



The correct figure is

A. 4

B. 1

C. 2

D. 3

Answer: A

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6. (1) Centre of gravity (C.G.) of a body is the point at which the weight of the body acts,

(2) Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius,

(3) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be cosidered to be concentrated at its C.G..,

(4) The radius of gyration of any body rotating about ab axis is the length of the perpendicular dropped from thr C.G. the body to the axis. which one of the following paries of statements is correct ?

A. (4) and (1)

B. (1) and (2)

C. (2) and (3)

D. (3) and (4)

Answer: A

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7. A plenet moving along an elliptical orbit is closest to the sun at a distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are the linear velocities at these points respectively, then the ratio $\frac{v_1}{v_2}$ is

A. $(r_1/r_2)^2$

B. r_2/r_1

C. $(r_2/r_1)^2$

D. r_1/r_2

Answer: B

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8. A particle of mass m is thrown upwards from the surface of the earth, with a velocity u. The mass and the radius of the earth are, respectively, M and R. G is gravitational constant g is acceleration due to gravity on the surface of earth. The minimum value of u so that the particle does not return back to earth is

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

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

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

D. $\sqrt{2gR^2}$

Answer: B

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9. 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. $\frac{GM}{a}$

B. $\frac{2GM}{a}$

C. $\frac{3GM}{a}$

D. $\frac{4GM}{a}$

Answer: C

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10. The height a which the weight of a body becomes $1/16th$ its weight on the surface of earth (radius R) is

A. 5R

B. 15R

C. 3R

D. 4R

Answer: C

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11. A spherical planet far out in space has a mass M_0 and diameter D_0. A particle of mass m falling freely near the surface of this planet will experience an accelertion due to gravity which is equal to

A. $\frac{4GM_P}{D_P^2}$

B. $\frac{GM_Pm}{D_P^2}$

C. $\frac{4GM_Pm}{D_P^2}$

D. none of these

Answer: A

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12. A geostationary satellite is orbiting the earth at a height of $5R$ above the surface of the earth, $2R$ being the radius of the earth. The time period of another satellite in hours at a height of $2R$ form the surface of the earth is

A. 5

B. 10

C. $6\sqrt{2}$

D. $\frac{6}{\sqrt{2}}$

Answer: C

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13. 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. $v_0 = \sqrt{2v_e}$

B. $v_0 = v_e$

C. $v_e = \sqrt{2v_0}$

D. $v_e = \sqrt{2}v_0$

Answer: D

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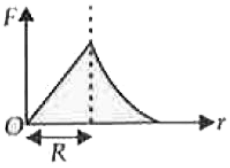
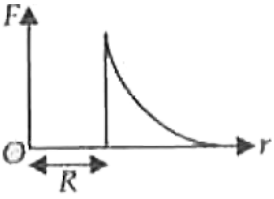
14. Which one of the following plots represents the variation of the gravitational field on a particle with distance r due to a thin spherical shell of raduis R? (r is measured from the centre of the spherical shell).

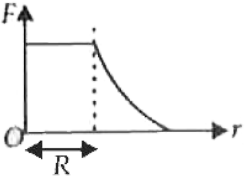
A.



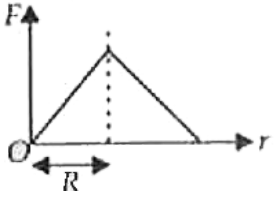
B.



C.



D.



Answer: B

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15. Infinite number of bodies, each of mass $2kg$, are situated on x-axis at distance $1m$, $2m$, $4m$, $8m$..... respectively, from the origin.

The resulting gravitational potential the to this system at the origing will be

A. $-\frac{4}{3}G$

B. $-4G$

C. $-G$

D. $-\frac{8}{3}G$

Answer: B

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16. A body of mass m taken form the earth's surface to the height is equal to twice the radius (R) of the earth. The change in potential energy of body will be

A. 3mgR

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

C. mg2R

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

Answer: D

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17. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass $= 5.98 \times 10^{24} kg$) have to be compresed to be a black hole?

A. $10^{-9}m$

B. $10^{-6}m$

C. $10^{-2}m$

D. $100m$

Answer: C

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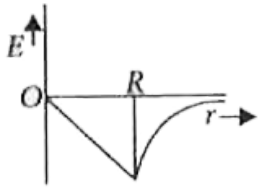
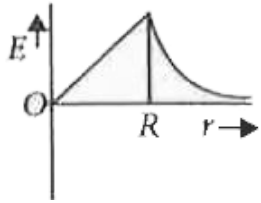
18. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by

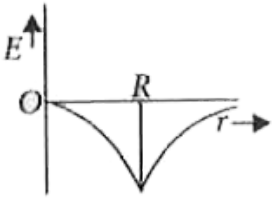
A.

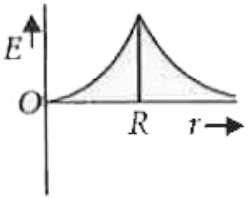


B.



C.



D. 

Answer: A

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19. Kepler's third law states that square of period revolution (T) of a planet around the sun is proportional to third power of average distance i between sun and planet i.e. $T^2 = Kr^3$

here K is constant

if the mass of sun and planet are M and m respectively then as per Newton's law of gravitational the force of alteaction between them is $F = \frac{GMm}{r^2}$, here G is gravitational constant. The relation between G and K is described as

A. K = G

B. $K = \frac{1}{G}$

C. $GK = 4\pi^2$

D. $GMK = 4\pi^2$

Answer: D

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20. Two spherical bodies of mass M and 5M & radii R & 2R respectively are released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by the smallar body just before collision is

A. 7.5R

B. 1.5R

C. 2.5R

D. 4.5R

Answer: A

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21. A remote-sensing satellite of earth revolves in a circular orbit at a hight of $0.25 \times 10^6 m$ above the surface of earth. If earth's radius is $6.38 \times 10^6 m$ and $g = 9.8 ms^{-2}$, then the orbital speed of the satellite is

A. $9.13 kms^{-1}$

B. $6.67 kms^{-1}$

C. $7.76 kms^{-1}$

D. $8.56 kms^{-1}$

Answer: C

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22. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth.

A. the linear momentum of S remains constant in magnitude.

B. the acceleration of S is always directed towards the centre of the earth.

C. the angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant.

D. the total mechanical energy of S varies periodically with time.

Answer: B

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23. At what height from the surface of earth the gravitation potential and the value of g are $-5.4 \times 10^7 Jkg^{-2}$ and $6.0ms^{-2}$ respectively ? Take the radius of earth as $6400km$:

A. 1400 km

B. 2000 km

C. 2600 km

D. 1600 km

Answer: C

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24. The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_y) whose radius and density are twice

A. $1:4$

B. $1:\sqrt{2}$

C. $1:2$

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

Answer: D

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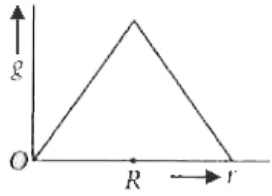
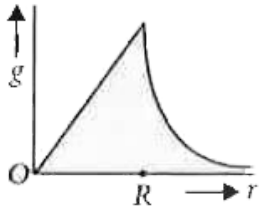
25. Starting from the centre of the earth having radius R, the variation of g (acceleration due to gravity) is shown by

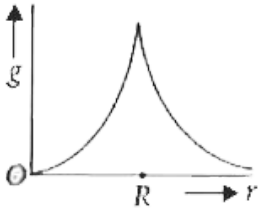
A.



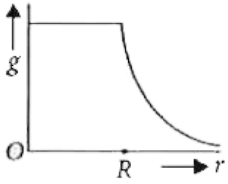
B.



C.



D.



Answer: B

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26. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of g_0, the value of acceleration due to gravity at the earth's surface,

A. $\frac{mg_0R^2}{2(R+h)}$

B. $-\frac{mg_0R^2}{2(R+h)}$

C. $\frac{2mg_0R^2}{R+h}$

D. $-\frac{2mg_0R^2}{R+h}$

Answer: B

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27. The acceleration due to gravity at a height $1km$ above the earth is the same as at a depth d below the surface of earth. Then :

A. d = 1 km

B. $d = \frac{3}{2}km$

C. $d = 2km$

D. $d = \frac{1}{2}km$

Answer: C

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28. Two astronauts are floating in gravitational free space after having lost contanct with their spaceship. The two will:

A. move towards each other.

B. move away from each other

C. will become stationary.

D. keep floating at the same distance between them.

Answer: A

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29. If the mass of the sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is not correct ?

A. Raindrops will fall faster.

B. Walking on the ground would become more difficult.

C. Time period of a simple pendulum on the Earth would decrease.

D. g on the Earth will not change.

Answer: D

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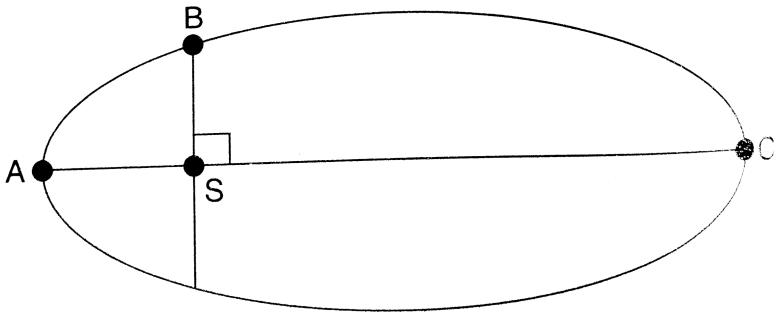
30. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B and K_C respectively. AC is the major axis and SB is perpendicular to AC at the position of the sun as shown in the figure. Then



A. $K_A < K_B < K_C$

B. $K_A > K_B > K_C$

C. $K_B < K_A < K_C$

D. $K_B > K_A > K_C$

Answer: B

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31. The work done to raise a mass m from the surface of the earth to a height h, which is equal to the radius of the earth, is :

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

B. mgR

C. $2mgR$

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

Answer: D

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32. A body weighs 200N on the surface of the earth. How much will it weigh half way down to the center of the earth ?

A. 100 N

B. 150 N

C. 200 N

D. 250 N

Answer: A

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