PHYSICS

BOOKS - MODERN PUBLICATION PHYSICS (KANNADA ENGLISH)

GRAVITATION

Multiple Choice Questions Level I

1. If the earth shrinks in its radius by 6% mass remaining constant, the value of 'g' on its

surface will:

A. decrease

B. increase

C. remains the same

D. reduced to zero

Answer: B

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2. A man weighs 50 kg at earth's surface. At what height above the earth's surface his weight becomes half (Radius of earth = 6400 km) :

A. 2526 km

B. 6400 km

C. 2650 km

D. 3200 km.

Answer: C

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3. Intensity of gravitational field inside the hollow spherical shell is :

A. variable

B. zero

C. minimum

D. maximum.

Answer: B

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4. The weight of the body at earth's surface is W. At a depth half way to the centre of earth its weight will be (Density of earth is uniform) :

A. W

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

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

D. $\frac{W}{8}$

Answer: B

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5. A satellite is moving in a circular orbit around the earth. If gravitational pull suddenly disappears, then it:

A. continues to move with same speed along the same path

B. moves with same velocity tangential to original orbit

C. falls down with increasing velocity

D. none of these.

Answer: B

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6. A packet is released from a satellite by simply detaching it from the outer wall of the satellite. What will happen to the packet:

A. it will continue moving along with the satellite in the same orbit with same velocity.

B. it will fall to earth.

C. the packet goes to the space and is lost.

D. it continues moving along the satellite with half the velocity.

Answer: A

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7. If the gravitational force is assumed to vary as the nth power of the distance, then the time period of a planet round the sun will be proportional to :

A. R^n

B. R^{-n}

C. $R^{\frac{n+1}{2}}$

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

Answer: C

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8. Kepler's second law regarding constancy of areal velocity of a planet is a consequence of the law of conservation of:

A. energy

B. linear momentum

C. angular momentum

D. none of these.

Answer: C

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9. Two satellites of masses m_1 and $m_2(m_1 > m_2)$ are revolving around the earth in circular orbits of radius

r_1 and $r_2(r_1 > r_2)$ respectively, which of the following is true regarding their speeds V_1 and V_2 ?

A. $V_1 = V_2$

B. $V_1 < V_2$

C. $V_1 > V_2$

D. $\frac{V_1}{r_1} = \frac{V_2}{r_2}$

Answer: B

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10. The ratio of K.E. regd. to be given to satellite to escape earth's gravitational field to K.E. regd. to be given to satellite to move in a circular orbit just above earth's atmosphere is :

A. 1

B. 2

C. 0.5

D. infinity.

Answer: B

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11. If the earth suddenly stops rotating about its axis the value of g at the equator will:

A. remains same

B. decrease by ω^2 R factor

C. Increase by ω^2 R factor

D. Increase by ω R factor.

Answer: C

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12. The ratio of the radius of the earth to that of moon is 10. The ratio of acceleration due to gravity on earth and on moon is 6. The ratio of their escape velocity from earth to that from the moon is :

A. 10

B. 5

C. about 8

D. 1.66

Answer: C

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13. If radius of earth is reduced by 1%, the escape velocity will (If mass of earth remains same):

A. increase by 0.5%

B. decrease by 11%

C. no change

D. decrease by 5%

Answer: A

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14. The variation of gravitational field intensity (E) due to the earth is represented by curve in Fig. (R is radius of earth):

A. 

B. 

C. 

D. 

Answer: D

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15. The period of a satellite in a circular orbit of radius R is T.The period of another satellite in circular orbit of radius 4R is:

A. 4T

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

C. 8T

D. $\frac{T}{8}$

Answer: C

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16. The two planets have radius r_1 and r_2, densities d_1 and d_2. The ratio of acceleration due to gravity on them is :

A. $r_1 d_2 : r_2 d_1$

B. $r_1^2 d_1 : r_2^2 d_2$

C. $r_1 d_1^2 : r_2 d_2^2$

D. $r_1 d_1 : r_2 d_2$.

Answer: D

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17. Mass of mars is $\frac{1}{9}$ and radius $\frac{1}{2}$ that of earth. A body weighs 54 kg on surface of the earth. Its wt. on the surface of mars will be:

A. 50 kg

B. 24 kg

C. 30 kg

D. 0 kg.

Answer: B

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18. There are two bodies of mass 100 kg, 10000 kg separated by a distance of 1m. At what distance from the smaller body the intensity of gravitational field is zero:

A. $\frac{1}{9}m$

B. $\frac{1}{10}m$

C. $\frac{1}{11}m$

D. none of the above.

Answer: C

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19. A satellite is moving round the earth. In order to make it move to infinity, it velocity must be increased by:

A. $82.8\ \%$

B. $41.4\ \%$

C. 20.7%

D. It is not possible to do so.

Answer: B

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20. The minimum speed with which a body must be thrown to reach a height of $\frac{R}{4}$ above the surface of earth is :

A. $\sqrt{\frac{g(R)}{2}}$

B. $\sqrt{gR}$

C. $\sqrt{\frac{2}{5}gR}$

D. $\sqrt{\frac{g(R)}{5}}$.

Answer: C

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21. A satellite of mass m is revolving round the earth at a height R above surface of earth. If g is gravitational intensity at earth's surface and R is radius of the earth, the K.E. of satellite is :

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

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

C. $\mathrm{mg}R$

D. $2\mathrm{mg}R$

Answer: A

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22. Weightlessness experienced while orbitting the earth in spaceship is the result of :

A. acceleration

B. no gravity

C. inertia

D. centre of gravity

Answer: A

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23. Two satellites of masses in the ratio of $1:16$ are put in the same orbit round the sun. The ratio of their periods of revolution is :

A. $1:4$

B. $4:1$

C. $1:1$

D. $1:2$

Answer: C

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24. A satellite revolving close to earth has a K.E., E. What energy should be given to it so make it escape the gravitational pull of earth?

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

B. E

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

D. $2E$

Answer: B

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25. Infinite number of masses each of 2 kg are placed along x-axis at distance 1m, 2m, 4m, 8m ..... from the origin O, what is the magnitude

of gravitational potential at 'O'? (G = gravitational constant) :

A. $-G$

B. $-2G$

C. $-3G$

D. $-4G$.

Answer: D

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26. With what speed the earth should rotate about its own axis so that a person should weigh at the equator $\frac{3}{5}$th of his weight at persent? (Take R = 6400 km):

A. $7.83 \ \text{rad s}^{-1}$

B. $1.25 \times 10^{-4} \ \text{rad s}^{-1}$

C. $7.83 \times 10^{-4} \ \text{rad s}^{-1}$

D. none of the above.

Answer: C

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27. With what velocity should a body be thrown up so that it rises to a height equal to the radius of the earth ($g = 10ms^{-2}$ at the surface) ?

A. $8000ms^{-1}$

B. $6400ms^{-1}$

C. $1600ms^{-1}$

D. $1000ms^{-1}$

Answer: A

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28. The orbital velocity of a satellite in a circular orbit just above the earth's surface is v_0. The orbital velocity for a satellite orbiting in a circular orbit at an altitude of half of earth's radius is:

A. $\sqrt{\frac{3}{2}}v_0$

B. $\sqrt{\frac{2}{3}}v_0$

C. $\frac{3}{2}v_0$

D. $\left(\frac{2}{3}\right)v_0$

Answer: B

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29. A man falls 50 m distance in one minute near the earth's surface, how much distance would he cover in one minute near the moon's surface? $\left(g_m = \frac{g_e}{6}\right)$

A. $50 \times 6m$

B. $50m$

C. $\frac{50}{6}m$

D. 50×50m.

Answer: C

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30. The distances of two satellites P and Q from earth are in the ratio $3:1$. The ratio of their total energy will be:

A. $1:1$

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

C. $3:1$

D. $1:3$

Answer: D

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31. If R is the radius of the earth and g the acceleration due to gravity on the earth's surface, the mean density of the earth is:

A. $\frac{4\pi G}{3gR}$

B. $\frac{\pi Rg}{12G}$

C. $\frac{3g}{4\pi RG}$

D. $\frac{3\pi R}{4gG}$

Answer: C

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32. The time period of a satellite in a circular orbit of radius R is T. The radius of the orbit in which time period is 8T is:

A. 5R

B. 2R

C. 4R

D. 3R

Answer: C

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33. 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 $\frac{1}{2}\%$

D. decrease by 1%

Answer: A

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34. A planet has twice the density of earth but the acceleration due to gravity on the surface

is same as on the surface of earth. Its radius in terms of the radius R of earth is :

A. $\frac{R}{64}$

B. $\frac{R}{8}$

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

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

Answer: D

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35. Two satellites revolve around the earth at distances 3R and 6R from the centre of earth. Their periods of revolutions will be in the ratio:

A. $1:2^{0.67}$

B. $2:1$

C. $1:2^{1.5}$

D. $1:2$

Answer: C

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36. A satellite is revolving in a circular orbit of radius r around the earth. The angular momentum of the satellite is proportional to :

A. r

B. $\sqrt{r}$

C. $r^{\frac{3}{2}}$

D. $\frac{1}{\sqrt{r}}$

Answer: B

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37. The ratio of the acceleration due to gravity on two planets P_1 and P_2 is k_1. The ratio of their respective radii is k_2. The ratio of their respective escape velocities is:

A. $\sqrt{\frac{k_2}{k_1}}$

B. $\sqrt{2k_1k_2}$

C. $\sqrt{k_1k_2}$

D. $\sqrt{\frac{k_1}{k_2}}$

Answer: C

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38. If the mass of a planet is 10% less than that of the earth and the radius 20% greater than that of earth, the acceleration due to gravity on the planet will be:

A. $\frac{1}{2}$ times that on the surface of the earth

B. $\frac{3}{4}$ times that on the surface of the earth

C. $\frac{5}{8}$ times that on the surface of the earth

D. $\frac{9}{10}$ times that on the surface of the earth

Answer: C

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39. The time period of revolution of a satellite is T. The kinetic energy of the satellite is proportional to:

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

B. T^3

C. T^2

D. T

Answer: A

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40. The gravitational potential energy of a body of mass m at a distance r from the centre of the earth is U. What is the weight of the body at this distance?

A. $-U$

B. $-Ur$

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

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

Answer: C

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41. If both the mass and radius of earth decrease by 1% the value of acceleration due to gravity will decrease by nearly:

A. 1%

B. 2%

C. 1.5%

D. 2.5%

Answer: A

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42. If the satellite is stopped suddenly in its orbit and is allowed to fall freely into the

earth's surface with what speed it hits the surface of earth?

A. $7.92 km / s$

B. $11.2 \ \mathrm{km\ s^{-1}}$

C. $8.92 \ \mathrm{km\ s^{-1}}$

D. $5.6 \ \mathrm{km\ s^{-1}}$

Answer: A

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43. Two satellites A and B revolve round a planet in coplanar orbits in the same direction, rheir periods are 1 hour and 8 hours respectively. The orbital radius of A is 10^4 km the speed of B relative to A when they are closest is :

A. $10^4\pi km/h$

B. $2 \times 10^4\pi km/h$

C. $\frac{v_1}{r_1} = \frac{10^4\pi}{2} km/h$

D. $4 \times 10^4\pi km/h.$

Answer: A

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44. The mean radius of earth is R and its angular speed about its own axis is ω and acceleration due to gravity is 'g'. The cube of the radius of the orbit of geostationary satellite is :

A. $\frac{R^2 g}{\omega}$

B. $\frac{R^2 \omega^2}{g}$

C. $\frac{Rg}{\omega^2}$

D. $\frac{R^2 g}{\omega^2}$

Answer: D

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45. The gravitational potential at a height 'h' above earth's surface is $-5.12 \times 10^7 J/kg$ and acceleration due to gravity at this point is $6.4 ms^{-2}$. If R = 6400 km the value of h is : (Mass of object m=1 kg)

A. 1200 km

B. 1600 km

C. 1800 km

D. 2400 km

Answer: B

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46. Force on a 1 kg mass on earth of radius R is 10 N. Then the force on a satellite revolving

around the earth in the mean orbital radius $3R/2$ will be (mass of satellite is 100 kg):

A. $4.44 \times 10^2 N$

B. $500N$

C. $3.33 \times 10^2 N$

D. $6.66 \times 10^2 N$

Answer: A

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47. A body is projected vertically upwards from the surface of a planet of radius R with a velocity equal to half the escape velocity for that planet. The maximum height attained by the body is :

A. $R/2$

B. $R/3$

C. $R/4$

D. $R/5$

Answer: B

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

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

B. $22km/s$

C. $11km/s$

D. $\frac{11}{\sqrt{2}} km / s$

Answer: C

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

A. gX

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

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

D. $\frac{gR}{R-X}$

Answer: B

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50. If the gravitional force between two objects were proportional to 1/R (and not as $1R^2$) where R is separation between them , then a particle in circular orbit under such a

force would have its orbital speed v proportional to

A. R^1

B. $1/R$

C. R^0

D. $1/R^2$

Answer: C

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51. If the radius of earth's orbit is made $1/4$, the duration of an year will become :

A. 4 times

B. 8 times

C. $1/4$ times

D. $1/8$ times.

Answer: D

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52. If the potential energy of body on a planet is numerically U and the escape velocity for the same body is v_e for same planet then $\frac{U}{v_e}$ will be :

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

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

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

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

Answer: A

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53. The distance of geostationary satellite from centre of earth is nearest to :

A. 5 R

B. 10 R

C. 7 R

D. 18 R

Answer: C

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54. The time period of planet X around sun is 8 times that of Y. The distance of X from the sun is how many times greater than that of Y ?

A. 4 times

B. 3 times

C. $6\frac{1}{2}$ times

D. $5\frac{1}{2}$ times

Answer: A

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55. Feeling of weightlessness in a satellite or spaceship is due to

A. absence of inertia

B. absence of accelerating force

C. acceleration of satellite

D. free fall of spaceship.

Answer: C

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56. If the spinning speed of the earth is increased, then the weight of the body at equator:

A. does not change

B. decreases

C. doubles

D. increases.

Answer: B

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

A. $\frac{1}{4}$ mg R

B. $\frac{3}{4}$ mg R

C. $\frac{2}{3}$ mg R

D. $\frac{1}{2}$ mg R.

Answer: B

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58. The change in the value of g at a height h above the surface of earth is the same as at a depth X below its surface then

A. $X = h^2$

B. $X = h$

C. $X = 2h$

D. $X = 0.2h.$

Answer: C

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59. The duration of day is highest at :

A. earth

B. mercury

C. venus

D. mars.

Answer: C

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60. The velocity with which a projectile must be fired so that it escapes earth's gravitation, does not depend on :

A. mass of the earth

B. radius of the projectile orbit

C. mass of the projectile

D. gravitational constant.

Answer: C

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61. In an orbital motion, the angular momentum vector is:

A. along radius vector

B. perpendicular to orbital plane

C. parallel to linear momentum

D. in the orbital plane.

Answer: B

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62. There are two planets. The ratio of radius of the 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. $(Kg)^{2}$

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

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

Answer: A

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63. The radii of circular orbits of two satellites 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. 12V

B. $3V/2$

C. $3V/4$

D. 6V

Answer: D

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64. The height at which the weight of a body becomes $1/16^{th}$, its weight on the surface of earth (radius R), is:

A. 4 R

B. 5 R

C. 15 R

D. 3 R

Answer: D

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Multiple Choice Questions Level Ii

1. In order that a body of 15 kg weighs zero at the equator, then the angular speed of earth is :

$\left(g = 10ms^{-1}\right)$

A. $\frac{1}{80}\ \text{rad s}^{-1}$

B. $\frac{1}{400}\ \text{rad s}^{-1}$

C. $\frac{1}{800}\ \text{rad s}^{-1}$

D. $\frac{1}{1600}\ \text{rad s}^{-1}$

Answer: C

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2. Minimum work done to shift a body of mass m from a circular orbit of 2R to a higher orbit of radius 3R around the earth (R = Radius of earth):

A. $\frac{GMm}{12R}$

B. $\frac{GMm}{6R}$

C. $\frac{GMm}{4R}$

D. $\frac{GMm}{8R}$

Answer: B

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3. A body of mass m is raised through a distance equal to the radius of the earth from earth's surface. The change in P.E. will be:

A. mgR

B. 2 mgR

C. 3 mgR

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

Answer: A

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4. A satellite is orbiting round the earth in a circular orbit with speed v. If m is mass of satellite its total energy is:

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

B. mv^2

C. $-\frac{1}{2}mv^2$

D. $\frac{3}{4}mv^2$.

Answer: C

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5. A light planet is 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 two varies as $R^{-5/2}$, then T^2 is proportional to :

A. R^3

B. $R^{\frac{7}{2}}$

C. $R^{\frac{3}{2}}$

D. $R^{\frac{5}{2}}$

Answer: B

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6. The acceleration due to gravity at a distance x from the centre of earth is $8ms^{-2}$. The earth shrinks in radius by 5% but its mass remains constant. The acceleration due to gravity at a disatance 'x' from the centre of earth now is:

A. $7ms^{-2}$

B. $8ms^{-2}$

C. $9ms^{-2}$

D. $4ms^{-2}$.

Answer: B

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7. A satellite is moving in an orbit with half the speed required to escape the earth's field. What is the height of the satellite?

A. 64 km

B. 640 km

C. 6400 km

D. none of the above.

Answer: C

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8. Two masses m_1 and m_2 are initially at rest at infinite distance. They approach each other due to gravitational attraction. What is the speed of approach at a distance r between them?

A. $\frac{2G}{r(m_1+m_2)}$

B. $\left[\frac{2G(m_1+m_2)}{r}\right]^{\frac{1}{2}}$

C. $\left(\frac{2Gr}{m_1+m_2}\right)^{\frac{1}{2}}$

D. $\left(\frac{2Gr}{m_1+m_2}\right)$.

Answer: B

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9. A body is thrown up with a velocity $10\,\%$ more than the escape velocity v_e. When the body escapes the gravitational pull of the earth the velocity still left in the body is :

A. $0.1v_e$

B. $0.229v_e$

C. $0.458v_e$

D. $0.20v_e$.

Answer: C

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10. A satellite of mass m is circulating around the earth with constant angular velocity. If radius of the orbit is r and mass of the earth

M, the angular momentum about the centre of the earth is :

A. $m\sqrt{\frac{GM}{r}}$

B. $M\sqrt{Gmr}$

C. $M\sqrt{\frac{GM}{r}}$

D. $m\sqrt{GMr}$

Answer: D

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11. The earth moves around the sun in an elliptical orbit as shown in fig. The ratio of $\frac{OA}{OB} = K$. The ratio of the speed of the earth at B and at A is nearly:

A. $\sqrt{K}$

B. K

C. K^2

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

Answer: B

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12. A body is projected vertically upwards from the surface of a planet of radius R with a velocity equal to half the escape velocity for that planet. The maximum height attained by the body is :

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

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

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

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

Answer: A

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13. A mass m is raised from the surface of earth to a point which is at a height nR from the surface of earth. Change in potential energy is :

A. nmgR

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

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

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

Answer: C

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14. The eccentricity of earth's orbit is 0.017. The ratio of the maximum speed in its orbit to its minimum speed is :

A. 1.034

B. 1.051

C. 1.017

D. 1

Answer: A

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15. The energy required to shift a satellite from orbital radius r to orbital radius 2r is E. What

energy will be required to shift the satellite from orbital radius 2r to orbital radius 3r?

A. E

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

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

D. $\frac{E}{3}$.

Answer: D

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16. A man can jump vertically through a height 1.5 m on earth. The maximum radius of the planet of the same density as that of earth from whose gravitational field he can escape by jumping is $(R_e = 6400km)$:

A. 6 km

B. 7 km

C. 3.1 km

D. 5 km.

Answer: C

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17. A planet of mass m moves around the sun in an elliptical orbit. The maximum and minimum distance of the planet from the sun is r_1 and r_2. The time period is proportional to:

A. $r_1^{3/2}$

B. $r_2^{3/2}$

C. $(r_1 + r_2)^{3/2}$

D. $(r_1 - r_2)^{3/2}$

Answer: C

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18. A planet is revolving round the sun in elliptical orbit. Its closest distance is r and farthest distance is R. If the orbital velocity closest to the sun is v, then velocity v at farthest point is :

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

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

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

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

Answer: A

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19. A projectile is fired from earth vertically with a velocity Kv_e where $v_e =$ escape velocity and K is a constant less than unity.

What is the maximum height to which it rises as measured from centre of earth?

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

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

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

D. $\frac{K^2R}{R-1}$

Answer: B

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20. Two metal spheres of equal radius 'r' are so placed that their surfaces touch each other the gravitational force of attraction is proportional to:

A. r^2

B. $\frac{1}{r^2}$

C. r^4

D. r^6

Answer: C

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21. A reel of massless thread unrolls itself falling down under gravity. The acceleration of its fall is :

A. g

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

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

D. $\frac{4}{5}g.$

Answer: D

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22. Two bodies of masses 4 kg and 2 kg are moving with velocities $2ms^{-1}$ and $10ms^{-1}$ towards each other due to gravitational attraction, what is the velocity of their centre of mass?

A. $5ms^{-1}$

B. $6ms^{-1}$

C. $8ms^{-1}$

D. zero.

Answer: D

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23. The length of second pendulum is 1 m on earth. If mass and diameter of the planet is doubled than that of earth, then length becomes:

A. 1 m

B. 4 m

C. 0.5 m

D. 2 m.

Answer: C

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

A. $1/2$

B. $\sqrt{2}$

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

D. $1/3.$

Answer: C

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25. Statement I. Escape velocity of a body is independent of mass of a body.

Statement II. Escape velocity of an elephant

from the surface of planet is same as that of escape velocity of a mouse.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: A

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26. Statement I. An Astronaut feels weightlessness while inside the satellite.

Statement II. The value of acceleration due to gravity is zero inside the satellite.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: C

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27. Statement I. Gravitational potential at any point is equal to gravitational potential energy of a body of unit mass.

Statement II. The gravitational potential of a body of mass m is $U = -\frac{GMm}{r}$, where symbols have their usual meanings.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: A

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28. Statement I. Escape velocity of body is $\sqrt{2}$ times the orbital velocity of the body revolving very close toe surface of the earth.

Statement II. Moon would depart for ever if its velocity is increased by $42\ \%$.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct

explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: A

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29. Statement I. If ice at the poles melts then the duration of day will shorten.

Statement II. When ice flows from poles towards equator then moment of inertia

decreases. This increases the frequency of rotation of earth.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: D

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30. Statement I. The value of acceleration due to gravity does not depend upon the mass of the body on which it acts.

Statement II. Acceleration due to gravity (g) is a constant quantity.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation

for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: C

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31. Statement I. Time period of revolution of a satellite moving closer to earth is smaller than that revolving far away from earth.

Statement II. The square of time period (T) is directly proportional to cube of its orbital radius.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: A

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32. Read the paragraph and answer the following questions.

Paragraph : Two stars P and Q each having mass M constitute a binary system. The stars revolves in circular orbits about their centre of mass under the effect of mutual gravitational force of attraction. The radius of orbit of star P is R. The dimensions of stars are negligible as compared to the separation between the stars.

The orbital speed of star Q is :

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

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

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

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

Answer: D

Watch Video Solution

33. Read the paragraph and answer the following questions.

Paragraph : Two stars P and Q each having

mass M constitute a binary system. The stars revolves in circular orbits about their centre of mass under the effect of mutual gravitational force of attraction. The radius of orbit of star P is R. The dimensions of stars are negligible as compared to the separation between the stars.

The energy required to separate the two stars P and Q to infinite distance apart is

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

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

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

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

Answer: A

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34. Read the paragraph and answer the following questions.

Paragraph : Two uniform solid spheres of equal radii 'R', but mass 'M' and '4M' have a centre to centre separation 6r, as shown in fig. The spheres are held fixed. A projectile of mass

(m) is projected from surface of sphere of mass (M) directly towards the centre of second sphere.

The value of v_m is :

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

B. $\sqrt{\frac{3GM}{4R}}$

C. $\left(\frac{2GM}{5R}\right)^{1/2}$

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

Answer: A

View Text Solution

35. Read the paragraph and answer the following questions.

Paragraph : Orbital velocity is defined as the velocity required to put the satellite into satellite into its orbit around the earth. An artificial satellite is moving in circular orbit around the earth with speed equal to half the value of escape velocity from the earth.

The height of the satellite above the surface of earth is

A. R

B. 2R

C. 3R

D. 4R

Answer: A

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36. Read the paragraph and answer the following questions.

Paragraph : Orbital velocity is defined as the

velocity required to put the satellite into satellite into its orbit around the earth. An artificial satellite is moving in circular orbit around the earth with speed equal to half the value of escape velocity from the earth.

The linear momentum of the satellite at the height given in above question is

A. $m\sqrt{2GM}R$

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

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

D. $m\sqrt{\frac{GM}{4R}}$

Answer: A

Watch Video Solution

37. Read the paragraph and answer the following questions.

Paragraph : Orbital velocity is defined as the velocity required to put the satellite into satellite into its orbit around the earth. An artificial satellite is moving in circular orbit around the earth with speed equal to half the value of escape velocity from the earth.

If the satellite is stopped suddenly in its orbit and allowed to fall freely on the surface of earth then the speed with which it hits the surface of earth is

A. $\sqrt{\frac{gR}{g}}$

B. $\sqrt{gR}$

C. $\sqrt{2gR}$

D. $\sqrt{3gR}$

Answer: B

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38. The weight of a man in a lift moving upwards is 608 N while the weight of the same man in the lift moving downwards with the same acceleration is 368 N. His normal weight in newton is :

A. 488

B. 588

C. 480

D. 240

Answer: A

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39. Taking that earth revolves round Sun in a circular orbit of radius 15×10^{10}m, with a time period of 1 year, the time taken by another planet, which is at a distance of 540×10^{10}m, to revolve round the Sun in circular orbit once, will be:

A. 216 years

B. 144 years

C. 72 years

D. 36 years

Answer: A

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40. A particle of mass 10 g is kept on the surface of uniform sphere of mass 100 kg and radius 10 cm. Find the work done against the

gravitational force between them to take the particle far away from the sphere.

A. $13.44 \times 10^{-10} J$

B. $3.33 \times 10^{-10} J$

C. $6.67 \times 10^{-9} J$

D. $6.67 \times 10^{-10} J$

Answer: D

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41. The escape velocity of a body on an imaginary planet which is thrice the radius of the earth and double the mass of the earth is (v_e is the escape velocity of earth) :

A. $\sqrt{2/3}v_e$

B. $\sqrt{3/2}v_e$

C. $\sqrt{2}/3v_e$

D. $2/\sqrt{3}v_e$

Answer: A

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

A. 3F

B. $F/3$

C. F

D. $F/9$

Answer: C

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43. A satellite orbiting around earth of radius R is shifted to an orbit of radius 2R. How many times the time taken for one revolution increase?

A. $2 \cdot 5$ times

B. 2 times

C. $2 \cdot 8$ times

D. 8 times.

Answer: C

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44. Earth is revolving around the sun. If the distance of the earth from the sun is reduced to 1/4th of the present distance then the day length reduced to :

A. $1/4$

B. $1/8$

C. $1/2$

D. $1/6$

Answer: B

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45. The condition for the uniform sphere of mass m of radius r to be a black hole is (G = gravitational constant) :

A. $\left(\frac{2Gm}{r}\right)^{1/2} \geq C$

B. $\left(\frac{2Gm}{r}\right)^{1/2} \leq C$

C. $\left(\frac{2gm}{r}\right)^{1/2} = C$

D. $\left(\frac{gm}{r}\right)^{1/2} \geq C$

Answer: A

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46. The earth is assumed to be a sphere of radius R. A platform is arranged at a height R

from the surface of earth. The escape velocity of a body from this platform is fv, where v is its escape velocity from surface of the earth. The value of f is :

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

B. $\sqrt{2}$

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

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

Answer: C

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47. 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 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 same speed.

C. The kinetic energies of two satellites are equal.

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

Answer: B

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48. The figure shows eliptical orbit of a planet m about the Sun S. The shaded area SCD is twice the shaded area SAB. If t_1 is the time for the planet of move from C to D and t_2 is the

time to move from A to B then:

A. $t_1 = 4t_2$

B. $t_1 = 2t_2$

C. $t_1 = t_2$

D. $t_1 > t_2$.

Answer: B

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49. A body projected vertically from the earth reaches a height equal to earth's radius before returning ot the earth. The power exerted by the gravitational force is greatest:

A. at the highest position of the body.

B. at the instant just before the body hits the earth.

C. it remains constant all through.

D. at the instant just after the body is projected.

Answer: B

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50. A geostatationary satellite is orbiting the earth at a height of 5R above the surface of the earth, R being the radius of the earth. The time peiod of another satellite in hours at a height of 2R from the surface of the earth is :

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

B. 5

C. 10

D. $6\sqrt{2}$

Answer: D

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51. A spherical planet has a mass M_p and diameter D_p. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to :

A. $6GM_pm / D_p^2$

B. $4GM_p / D_p^2$

C. GM_pm / D_p^2

D. GM_p / D_p^2

Answer: B

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52. Geostationary satellite orbits around the earth in a circular orbit of radius 36000 km. Then the time period of a spy satellite orbiting

a few hundred kilometres above the earth's surface $(R_{\text{earth}} = 6400km)$ will be approximately be

A. $1/2$ hr

B. 1 hr

C. 2 hr

D. 4 hr.

Answer: C

View Text Solution

53. If W_1, W_2 and W_3 represent the work done in moving a particle from A to B along three different paths 1, 2 and 3 respectively (as shown) in a gravitational field of point mass m, then

A. $W_1 = W_2 = W_3$

B. $W_1 > W_2 > W_3$

C. $W_{11} < W_2 < W_3$

D. $W_1 < W_3 < W_2$

Answer: D

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54. Energy required to move a body of mass m from an orbital of radius 2R to 3R is (where M = mass or earth, R = radius of earth)

A. $\frac{GMm}{12R^2}$

B. $\frac{GMm}{8R}$

C. $\frac{GMm}{3R^2}$

D. $\frac{GMm}{6R}$

Answer: A

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55. The time period of a satellite of earth is 5 hours. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become

A. 10 hours

B. 80 hours

C. 40 hours

D. 20 hours

Answer: C

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56. Two spherical bodies of mass M and 5M and radii R and 2R respectively are released in free space with initial separation between their centres equal to 12 R. If they attract each other due to gravitational force only then the

distance covered by the smaller body just before collision is

A. 2.5 R

B. 4.5 R

C. 7.5 R

D. 1.5 R

Answer: C

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

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

B. $22km/s$

C. $11km/s$

D. $\frac{11}{\sqrt{2}}km/s$

Answer: C

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

A. gX

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

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

D. $\frac{gR}{R-X}$

Answer: B

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59. Average density of the earth

A. does not depend on g

B. is a complex function of g

C. is directly proportional to g

D. is inversly proportional to g

Answer: C

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60. The change in the value of g at a height 'h' above the surface of 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?

A. $d = \frac{h}{2}$

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

C. $d = 2h$

D. $d = h$

Answer: C

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61. A particle of mass 10 g is kept on the surface of uniform sphere of mass 100 kg and radius 10 cm. Find the work done against the

gravitational force between them to take the particle far away from the sphere.

A. $13.34 \times 10^{-10} J$

B. $3.33 \times 10^{-10} J$

C. $6.67 \times 10^{-9} J$

D. $6.67 \times 10^{-10} J$

Answer: D

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62. If g_E and 8_M are the accelerations due to gravity on the surfaces of the earth and the moon respectively and if Millikan oil drop experiment could be performed on the two surfaces, one will find the ratio $\frac{\text{electronic charge on moon}}{\text{electronic charge on earth}}$ to be:

A. 0

B. g_E / g_M

C. g_M / g_E

D. 1

Answer: D

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63. This question contain Statement-1 and Statement-2. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement-1:

For a mass M kept at centre of a cube of side 'a', the flux of gravitational field passing through its sides $4\pi GM$. and

Statement-2:

If the direction of a field due to a point source is radial and its dependence on the distance 'r' from the source is given as $\frac{1}{r^2}$, its flux through a closed surface depends only on the strength of the source enclosed by the surface and not on the size or shape of the surface.

A. Statement-1 is false, Statement-2 is true.

B. Statement-1 is true, Statement-2 is true, Statement-2 is correct explanation for Statement-1.

C. Statement-1 is true, Statement-2 is true, Statement-2 is not a correct explanation for Statement-1.

D. Statement-1 is true, Statement-2 is false.

Answer: B

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64. A planet in a distant solar system is 10 times more massive than the earth and its radius is 10 times smaller. Given that the

escape velocity from the earth is 11 km s^{-1}, the escape velocity from the surface of the planet would be :

A. $1.1 kms^{-1}$

B. $11 kms^{-1}$

C. $110 kms^{-1}$

D. $0.11 kms^{-1}$

Answer: C

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Multiple Choice Questions Level Iii Questions From Aieee Jee Examination

1. Two bodies of masses m and 4 m are placed at a distance r. The gravitational potential at a point on the line joining them where the gravitational field is zero is :

A. $-\frac{4Gm}{r}$

B. $-\frac{6Gm}{r}$

C. $-\frac{9Gm}{r}$

D. $zero$

Answer: C

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2. Two particles of equal mass 'm' go around a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle with respect to their centre of mass is :

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

B. $\sqrt{\frac{Gm}{3R}}$

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

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

Answer: A

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3. The mass of a spaceship is 1000 kg. It is to be launched from the earth's surface out into free space. The value of 'g' and 'R' (radius of earth) are 10 m/s^2 and 6400 km respectively. The required energy for this work will be :

A. 6.4×10^{10} joules

B. 6.4×10^{11} joules

C. 6.4×10^{8} joules

D. 6.4×10^{9} joules

Answer: A

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4. What is the minimum energy required to launch a satellite of mass m from the surface

of a planet of mass M and radius R in a circular orbit at an altitude of 2R?

A. $\frac{2GmM}{3R}$

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

C. $\frac{GmM}{3R}$

D. $\frac{5GmM}{6R}$

Answer: D

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5. 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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6. From a solid sphere of mass M and radius R, a spherical portion of radius $\frac{R}{2}$ is removed, as shown in the figure. Taking gravitational potential V = 0 at r = ∞, the potential at the centre of the cavity thus formed is :

(G = gravitational constant)

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

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

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

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

Answer: A

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Recent Competitive Questions

1. An astronaut on a strange planet finds that acceleration due to gravity is twice as that on

the surface of earth. Which of the following could explain thin ?

A. Both the mass and the radius of the planet are twice as that of Earth.

B. Mass of the planet is half as that of Earth, but radius is same as that of Earth.

C. Both the mass and the radius of the planet are half as that of Earth.

D. Radius of the planet is half as that of Earth, but the mass is the same as that of Earth.

Answer: C

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2. A planet moves around sun sweeps area A_1 in 2 days A_2 in 3 days and A_3 in 6 days. Then the relation between A_1, A_2 and A_3 is

A. $3A_1 = 2A_2 = A_3$

B. $2A_1 = 3A_2 = 6A_3$

C. $3A_1 = 2A_2 = 6A_3$

D. $6A_1 = 3A_2 = 2A_3$.

Answer: A

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3. A period of geostationary satellite is

A. 24 h

B. 12 h

C. 30 h

D. 48 h.

Answer: A

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4. Two satellites 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. $9:1$

B. $3:1$

C. $1:1$

D. $1:3$

Answer: C

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5. What is a period of revolution of earth satellite ? Ignore the height of satellite above the surface of earth.

Given :

The value of gravitational acceleration $g = 10ms^{-2}$

Radius of earta $R_E = 6400km$. Take $\pi = 3.14$.

A. 85 min

B. 156 min

C. 83.73 min

D. 90 min.

Answer: C

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6. If the mass of a body is M on the surface of the earth, the mass of the same body on the surface of the moon is

A. M

B. 0

C. $M/6$

D. 6M.

Answer: A

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7. A stone weighs 100N on the surface of the Earth. The ratio of its weight at a height of half the radius of the Earth to a depth of half the radius of the earth will be approximately

A. 3.6

B. 2.2

C. 1.8

D. 0.9

Answer: D

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8. The gravitational field strength at the surface of a certain planet is g. Which of the following is the gravitational field strength at the surface of a planet with twice the mass?

A. $g/2$

B. g

C. 2g

D. 4g.

Answer: A

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