PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

GRAVITATION

Example

1. Two particles of masses 1 kg and 2 kg are placed at a separation of 50 cm find out

gravitational force between them

A. $5.3x10^{-10}N$

B. $4.9 \times 10^{-9}N$

C. $6.5 \times 10^{-8}N$

D. $6.9 \times x10^{-7}N$

Answer:

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

A. remain same

B. decrease by 50%

C. decrease by 100%

D. increase by 100%

Answer:

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3. At what height from the surface of earth will the value of g be reduced by $36\,\%$ from the value on the surface? Take radius of earth $R = 6400km.$

A. 1800 km

B. 1600 km

C. 2000 km

D. 2200 km

Answer:

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4. What would be the accelearation due to gravity at a depth of 200 km from ythe earth surface assuming that earth has uniform denisty [Take ,R =6400 km]

A. 4.37 ms^{-2}

B. 6.737 ms^{-2}

C. 5.709 ms^{-2}

D. 4.751 ms^{-2}

Answer:

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5. Find wight of the body of mass 200 kg on the earth at equator and at the latitude of 30° [Take R= 6400 km]

A. 1953 and 1955 N

B. 1960 and 1965 N

C. 1860 and 1800 N

D. None of these

Answer:

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6. At what distance (in metre) from the centre of the Moon,the intensity of gravitational field will be zero? (Take, mass of Earth and Moon as 5.98×10^{24} kg and 7.35×10^{23} kg respectively and the distance between Moon and Earth is 3.85×10^{8}m)

A. zero

B. 3.90×10^7

C. 8×10^8

D. 3.46×10^8

Answer:

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7. The radius of the earth is 6.37×10^6 m its mass 5.98×10^{24} kg determine the gravitational potential on the surface of the

earth

Given $G = 6.67 \times 10^{-11} N - m^2 / khg^2$

A. $6.2616 \times 10^7 jkg^{-1}$

B. $-62.616 \times 10^{-7} jkg^{-1}$

C. $-6.2616 \times 10^7 jkg^{-1}$

D. $62.619 \times 10^7 jkg^{-1}$

Answer:

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8. A planet is revolving around the Sun in an elliptical orbit. Its closest distance from the Sun is r and farthest distance is R. If the orbital velocity of the planet closest to the Sun is v, then what is the velocity at the farthest point?

A. 20 kms^{-1}

B. 15 kms^{-1}

C. 10 kms^{-1}

D. 16 kms^{-1}

Answer:

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9. If the distacne between the earth and the sun gets doubled then what would be the duration of the year

A. 2.828 years

B. 3.285 years

C. 1.234 years

D. 5.234 years

Answer:

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10. Assuming the radius of the earth to be 6.4×10^6 m calculate the time period T of a satellite for equatorial orbit at 1.4×10^3 km above the surface of the earth and the speed of the satellite in this orbit ?

A. 6831 and 7200 ms^{-1}

B. 6850 s and 7151 ms^{-1}

C. 68321 s and 7190 ms^{-1}

D. 6850 and 7400 ms^{-1}

Answer:

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11. Binding energy of satellite is $4 \times 10^8 J$. Its potential energy is

A. $-4 \times x10^8 j$

B. $8 \times 10^8 j$

C. $8 \times 10^8 j$

D. $4 \times 10^8 J$

Answer:

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12. A 400 kg satellite is in a circular orbite of radius 2R around the earth how much energy is required to transfer it to circular orbit of radius 4R

A. $3.13 \times 10^9 J$

B. $3.59 \times 10^9 j$

C. $4.1 \times 10^9 j$

D. $5.2 \times 10^9 j$

Answer:

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13. A person sitting in a chair in a satellite feels weightless because

A. the earth does not attract the objects inside a satellite

B. the normal force by the chair on the person balances the earth attraction

C. the normal force is zero

D. the person in satellite is not accelerated

Answer:

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14. The escape velocity on the surface of the earth is 11.2 kms^{-1}. If mass and radius of a planet is 4 and 2 tims respectively than that of the earth, what is the escape velocity from the planet?

A. 15.5 kms^{-1}

B. 55.5 kms^{-1}

C. 11.2 kms^{-1}

D. 22.4 kms^{-1}

Answer:

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Exercise 1

1. Two speres of radii r and 2r touching each other the force of attraction betweeen them is proportional

A. r^6

B. r^4

C. r^2

D. r^{-2}

Answer: D

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

now applies gravitional force F_2 on same particle placed at P the ratio F_2 / F_1 will be

A. $1/2$

B. $7/9$

C. 3`

D. 7

Answer: B

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

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

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

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

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

Answer: B

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4. 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_2/r_1)

B. $(r_2/r_1)^2$

C. $(r_1/r_2)^2$

D. $(r_1/r_2)^2$

Answer: A

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5. A acceleration of moon with respect to earth is 0.0027 ms^{-2} and the acceleration of an apple falling on earth's surface is about $10ms^{-2}$. Assume that the radius of the moon is one fourth of the earth's radius. If the moon is stopped for an instant and then released, it will fall towards the earth. The initial

acceleration of the moon toward the earth will be

A. 0.0027 ms^{-2}

B. 5.0 ms^{-2}

C. 6.4 ms^{-2}

D. 10 ms^{-2}

Answer: C

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6. The accelearation due to gravity on a planet is 1.96 ms^{-2} if tit is safe to jump from a height of 3 m on the earth the corresponding height on the planet will be

A. 3 m

B. 6m

C. 9m

D. 15m

Answer: D

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

A. moon is the satelite of the earth

B. the radius of the earth is $8/6$ of the moon radius

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

D. the radius of the moon is $6/8$ of the earth radius

Answer: C

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8. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. if the gravitational force of attraction between the planet and the star is proportational to

$R^{-5/2}$, then

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

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

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

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

A. R^3

B. $R^{5/2}$

C. $R^{3/2}$

D. $R^{7/2}$

Answer: B

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9. If a planet of given density were made larger, its force of attraction for an object on its surface would increase because of the greater distance from the object to the centre of the planet. Which effect predominates?

A. increase in mass

B. increase in radius

C. both effect the attraction equally

D. none of the above

Answer: A

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10. If radius of earth is R then the height ' h ' at which value of ' g ' becomes one-fourth is

A. 2 R

B. 3R

C. R

D. 4R

Answer: C

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11. 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. $R\frac{n-1}{n}$

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

D. $R\frac{n}{n+1}$

Answer: B

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12. Two point masses each equal to 1 kg attract one another with a force of 9.8×10^{-9} kg-wt. the distance between the two point masses is approximately $\left(G = 6.6 \times 10^{-11} \text{MKS units}\right)$

A. 8.2 cm

B. 0.8 cm

C. 82 cm

D. 0.08 cm

Answer: A

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13. A body has a weight 72 N. When it is taken to a height $h = R$= radius of earth, it would weight

A. 72 N

B. 36 N

C. 18N

D. zero

Answer: C

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14. 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. $1:2$

C. $4:1$

D. $2:1$

Answer: B

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

A. 2.52 days

B. 1.41 days

C. 0.70 day

D. 0.41 day

Answer: B

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16. If there particles, each of mass M, are placed at the three corners of an equilateral triangle of side, a the force exerted by this system on another particle of mass M placed (i) at the midpoint of side and (ii) at the centre of the triangle are, respectively.

A. (0,0)

B. $\frac{4GM^2}{3a^2, 0}$

C. $0, \frac{4GM^2}{3a^2}$

D. $\frac{3GM(2)}{a^2}, \frac{GM^2}{a^2}$

Answer: B

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17. If the diameter of mars is 6760 km and mass one tenth that of the earth the diameter of earth is 12742 km if acceleration due to gravity

on earth is $9.8mx^{-2}$ the acceleartion due to gravity on eath is $9.8m, s^{-2}$ the acceleartion due to gravity on mars is

A. $34.8ms^{-2}$

B. $2.48ms^{-2}$

C. $3.48ms^{-2}$

D. $28.4ms^{-2}$

Answer: C

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18. A body weighs W newton at the surface of the earth. Its weight at a height equal to half the radius of the earth, will be

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

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

C. $\frac{4W}{9}$

D. $\frac{8W}{27}$

Answer: C

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19. Two objects of massses m and 4 m are at rest at infinite separtion they move twoards each other under mutula gravitonal attraction then at a separation r which of the following is true ?

A. the total energy of the system is not zero

B. the force between them is not zero

C. the centre of mass of the system is at rest

D. all the above are true

Answer: D

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

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

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

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

Answer: D

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21. Two particles each of mass M and equidistant from each other move along a circle of radius R under the action of their

mutual gravitional attraction the speed of each particle is

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

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

C. $\frac{1}{2}\sqrt{G\frac{M}{R}}$

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

Answer: C

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22. 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. 20 N

B. 45 N

C. 40 N

D. 90 N

Answer: A

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23. 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?

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

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

C. $d = 2h$

D. $d = h$

Answer: C

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24. The magnitude of gravitational field intensities at distance r_1 and r_2 from the centre of a uniform solid sphere of radius R and mass M are I_1 and I_2 respectively. Find the ratio of I_1 / I_2 if (a) $r_1 > R$ and $r_2 > R$ and

(b) $r_1 < R$ and $r_2 < R$ (c) $r_1 > R$ and $r_2 < R$.

A. $\frac{R^2}{r_1 r_2}$

B. $\frac{R^3}{r_1 r_2^2}$

C. $\frac{R^3}{r_1^2 r_2}$

D. $\frac{R^4}{r_1^2 r_2 r^2}$

Answer: C

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25. If two planets of radii R_1 and R_2 have densities d_1 and d_2, then the ratio of their respective acceleration due to gravity is

A. $r_1 d_1 : r_2 d_2$

B. $r_1 d_2 : r_2 d_1$

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

D. $r_1 : r_2$

Answer: A

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26. The time period of the moon is T= 27.3 days and radius of orbit is $R_m = 3.84 \times 10^8 m$ The value of centripetal acceleartion due to earht 's gravity is

A. much smaller than the value of acceleration due to gravity g on the surface of the earth

B. is eual to the value of acceleration due to gravity g on the surface of the earth

C. much larger than the value of acceeration due to gravity g on the surface of the earth

D. either a or b

Answer: A

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27. If one assume that the gravitational force due to the earth decreases in proportion to the iverse squre of the distance from the

centre of the earth then which fo the followng relation between $a_m r_m$ g and R_E

A. $\frac{g}{a_m} = \frac{R_m}{R_E}$

B. $\frac{g}{a_m} = \left(\frac{R_m}{R_E}\right)^2$

C. $\frac{g}{a_m} = \left(\frac{R_E}{R_m}\right)^{-2}$

D. both b and c

Answer: D

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28. The force of attraction due to a hollow speheical shell of mass M radius R and and unifor density on a point mass m situdated inside it is

A. $\frac{GmN}{r^2}$

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

C. zero

D. data insufficient

Answer: C

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29. The magnitude of force of attraction on a point mass m due to hollow sperical shell of mass M and radius R as funciton of its distance r form the centre is given is

A. $A \to \frac{GMm}{r^2}, B \to zero$

B. $A \to zero, B \to \frac{GMm}{r^2}$

C. $A \to \frac{GMm}{R^2}, B \to \frac{GMm}{r^2}$

D. none of the abvoe

Answer: C

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

A. 8 times

B. 4 times

C. $1/8$ times

D. $1/4$ times

Answer: B

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31. The period of revolution of planet A round from the sun is 8 times that of B. The distance of A from the sun is how many times greater then tht of B from the sun ?

A. 2

B. 4

C. 3

D. 5

Answer: C

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32. Which of the following graphs between the square of the time period and cube of the distance of the planet from the sun is correct ?

A. 

B. 

C. 

D. 

Answer: D

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33. A comet of mass m moves in a highly elliptical orbit around the sun of mass M the maximum and minium distacne of the comet

from the centre of the sun are r_1 and r_2 respectively the magnitude of angular momentum of the comet with respect to the centre of sun is

A. $\left[\frac{GM_1}{r_1+r_2}\right]^{1/2}$

B. $\left[\frac{GMmr_1}{r_1+r_2}\right]^{1/2}$

C. $\left[\frac{rGM^2r_1r_2}{r_1+r_2}\right]^{1/2}$

D. $\left[\frac{2GMm^2r_1r_2}{r_1+r_2}\right]^{1/2}$

Answer: D

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34. 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. $GK = 4\pi^2$

B. $GMK = 4\pi^2$

C. $K = G$

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

Answer: C

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35. A staellite in a circular orbit of raidus R has a period of 4h another satellite with orbital radius 3R around the same planet will have a period (in h)

A. 16

B. 4

C. $4\sqrt{27}$

D. $4\sqrt{8}$

Answer: c

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

A. 10 h

B. 80 h

C. 40 h

D. 20 h

Answer: C

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37. The ratio of mean distances of three planets from the sun are $0.5:1:1.5$, then the square of time periods are in the ratio of

A. $1:4:9$

B. $1:9:4$

C. $1:8:27$

D. $2:1:3$

Answer: A

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38. All planets move in elliptical orbits with the sun situtated at one of the forci of the ellipse the point at wihich the planet is closest to the sun is

A. perihelion

B. aphelion

C. helion

D. none of above

Answer: B

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39. Law of areas is valid for any

A. force

B. cental force

C. attractive force

D. radial force

Answer: A

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40. For motiion of planets in ellipticla orbits around the sun the central force is

A. the force on the plantet along the vector joining the sun and the planet

B. the force on the sun along the vector joining the sun and the other focus of

the ellipse

C. the force on the planet along the line joining focus of the ellipse

D. none of the above

Answer: A

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41. The law of areas can be interpreted as

A. $\frac{\triangle A}{\triangle t} = \text{constant}$

B. $\frac{\triangle A}{\triangle t} = \frac{L}{2}$

C. $\frac{\triangle A}{\triangle t} = \frac{1}{2}(r \times p)$

D. none of these

Answer: A

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42. Kepler 's law of periods as applied to motion of satellite around the earth is givne by

$T^2 = K(R_E + h)^3$

Th value of constant is $10^{-13}s^2m^3$ and the Moon is at a distance of 3.84×10^5 km from the earth with reference to hte above reletion and data mathc the items in column I with terms in column II and choose the correct option from the code gives below

A. $\begin{matrix} A & B & C \\ 1 & 2 & 3 \end{matrix}$

B. $\begin{matrix} A & B & C \\ 2 & 3 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C \\ 3 & 2 & 1 \end{matrix}$

D. $\begin{matrix} A & B & C \\ 1 & 3 & 2 \end{matrix}$

Answer: B

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43. Which of the following statement is correct about satellites?

A. a satellite cannot move in a stable orbit in a plane passing throught the earth centre

B. Geostationary satellites are launched in the quatorial plane

C. we can use juset oine geostationary satellite for global communication around the globe

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

Answer: A

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

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

C. the total mechanical energy of s varies periodically with time

D. the linear momentum of s remains constant in magnitude

Answer: B

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45. A satellite is placed in a circular orbit around the earth at such a height that it always remains sationary with respect to the earth surface in such case it s heights form the earth surface is

A. 32000 km

B. 36000 km

C. 6400 km

D. 4800 km

Answer: D

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46. The earth (mass $= 6 \times 10^{24} kg$) revolves round the sun with an angular velocity of $2 \times 10^{-7} \mathrm{rad/s}$ in a circular orbit of radius

$1.5 \times 10^8 km$. The gravitational force exerted by the sun on the earth, in newtons, is

A. zero

B. 18×10^{25}

C. 27×10^{39}

D. 36×10^{21}

Answer: C

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47. The orbital velocity of an artifical satellite in a cirular orbit above the earth's surface at a distance equal to radiu of earth is v. For a satellite orbiting at an altitude half of earth's radius, orbital velocity is

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

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

C. $\sqrt{\frac{2}{3}}V$

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

Answer: A

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48. If total enrgy of satellite is E what is its potential enrgy

A. 2 E

B. $-2E$

C. E

D. $-E$

Answer: C

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49. A relay satellite transmits the television programme from one part of the world to another part continuously because its period

A. period of revolution is greater than the period of ratation of the earth about its axis

B. period of revolution is less than the period of ratation of the earth about its

axis

C. period of revolution is equal to the period of ratation of the earth about its axis

D. mass is less than the mass of earth

Answer: C

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50. By what percent the energy of the satellite has to be increased to shift it from an orbit of radius r to $\frac{3r}{2}$.

A. 0.15

B. 0.203

C. 0.667

D. 0.3333

Answer: D

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51. A satellite moves around the earth in a circular orbit with speed v. If m is the mass of the satellite, its total energy is

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

B. $\frac{1}{4}mv^2$

C. $-\frac{1}{4}mv^2$

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

Answer: D

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52. The field which artifical satellite are useful stelites are useful for practical purpose is

A. telecommunication

B. geophysics

C. meterology

D. all of these

Answer: D

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53. A lauching vehicle carrying an artificial satellite of mass m is set for launch on the surface of the earth of mass M and radius R. If the satellite intended to move in a circular orbit of radius $7R$, the minimum energy required to be spent by the launching vehicle on the satellite is

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

B. $-\frac{13GMm}{14R}$

C. $\frac{GMm}{7R}$

D. $\frac{GMm}{14R}$

Answer: B

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54. A body is orbiting around earth at a mean radius which is two times as greater as the parking orbit of a satellite, the period of body is

A. 4days

B. 16 days

C. $2\sqrt{2}$days

D. 64 days

Answer: C

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

A. the mass of the satellite

B. radius of the orbit

C. none of these

D. both of these

Answer: A

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56. The radius of the orbit of a satellite is r and its kinetic energy is k if the radius of the orbit is doubled then the new kinetic energy k is

A. 2k

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

C. 4 k

D. data insufficient

Answer: B

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57. The pitentil energy of a satellite is given as

$PE = \lambda(KE)$

where PE = potential energy of the satellite

KE = kinetic energy of the satellite

The vlaue of constant λ is

A. -2

B. 2

C. $-1/2$

D. $+1/2$

Answer: A

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58. A 400 kg satellite is in a circular orbit of radius 2 R_E about the earth where R_E= radius of the earth with reference to the

above situation match the term in column I with items in column II and choose the correct option from the codes given below

A. $\begin{matrix} A & B & C \\ 2 & 3 & 1 \end{matrix}$

B. $\begin{matrix} A & B & C \\ 1 & 2 & 3 \end{matrix}$

C. $\begin{matrix} A & B & C \\ 3 & 2 & 1 \end{matrix}$

D. $\begin{matrix} A & B & C \\ 2 & 1 & 3 \end{matrix}$

Answer: A

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59. The time period of a geostationary satellite at a height 36000 km is 24 h a spy satellite orbits vergy close to earth surface (R=6400 km) what will be its time period ?

A. 4h

B. 1h

C. 2h

D. 1.5 h

Answer: D

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60. A simple pendulum has a time period T_1 on the earth 's surface and T_2 when taken to height 2R above the earth 's surface when R is 2R above earth 'ssurface where R is the radius of earht The value of (T_1 / T_2)

A. $1/9$

B. $1/3$

C. $\sqrt{3}$

D. 9

Answer: B

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61. The mass of a planet is six times that of the earth. The radius of the planet is twice that of the earth. It's the escape velocity from the earth is v, then the escape velocity from the planet is:

A. $\sqrt{3}v_e$

B. $\sqrt{2}v_e$

C. v_e

D. $\sqrt{5}v_e$

Answer: A

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62. For a body to escape from earth, angle from horizontal at which it should be fired is

A. 45°

B. $> 45^\circ$

C. $< 45^\circ$

D. any angle

Answer: D

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63. 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. 5.5 kms^{-1}

B. $11kms(-1)$

C. $15.5kms^{-1}$

D. $22kms^{-1}$

Answer: D

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64. The ratio of the radii of the planets P_1 and P_2 is a the ratio of their acceleraton due to

gravity is b the ratio of the escape velocity form them will be

A. ab

B. $\sqrt{ab}$

C. $\sqrt{a/b}$

D. $\sqrt{b/a}$

Answer: B

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65. The mass of the moon is $7/81$ th of earth 's mass and its radius is $1/4$ th that of the earth if the escape velocity from the earth surface is 11.2 kms^{-1} its value for the moon will be

A. $0.15kms^{-1}$

B. $5kms^{-1}$

C. $2.5kms^{-1}$

D. $0.5kms^{-1}$

Answer: C

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66. The escape velocity of a body from the earth is V_e if the radius of earth contracts to $1/4$ th of its value keeping the mass of the earth constant the escape velocity will be

A. doubled

B. halved

C. tripled

D. unaltered

Answer: A

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67. 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. $2790 kms^{-1}$

B. $27.9 kms^{-1}$

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

D. $2.79\sqrt{5}kms^{-1}$

Answer: C

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

Given,

(i) the value of gravitational acceleration, $g = 10ms^{-2}$

(ii) radius of the earth, $R_g = 6400$ km (take, $\pi = 3.14$)

A. 85 min

B. 156 min

C. 83.73 min

D. 90 min

Answer: C

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69. 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. $V_R > V_R > V_P$

C. $V_R / V_P = 3$

D. $V_P / V_Q = \frac{1}{2}$

Answer: B

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Exercise 2

1. If the radius of the Earth shrinks by 2%, mass remaing same, then how would the have of acceleration due to gravity change?

A. decrease by 2%

B. increased by 2%

C. incresed by 4%

D. decrease by 4%

Answer: C

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

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

B. $\sqrt{5}R - R$

C. $\frac{\sqrt{5}R - r}{2}$

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

Answer: C

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3. If the radius of the earth were to shrink by 1% its mass remaining the same, the

acceleration due to gravity on the earth's surface would

A. decrease by 2%

B. remain by 2%

C. increase by 2%

D. become zero

Answer: C

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4. Tow spherical planet A and B have same mass but of acceleartion due to gravity at the surface of A to its value at surface of B is

A. $1:4$

B. $1:2$

C. $4:1$

D. $8:1$

Answer: C

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5. 320 Km above the surface of earth the value of acceleartion due to gravity is nearly 90% of ts value on the sruface fo the earth its value will be 95 % of the value on the eath surface

A. nearly 160 km below the earth surface

B. nearly 80 km below the earth 's surface

C. nearly 640 km below the eath 's surface

D. nearly 320 km below the earth 's surface

Answer: D

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6. The acceleration due to gravity at a height $(1/20)^{th}$ the radius of the earth above earth s surface is $9m/s^2$ Find out its approximate value at a point at an equal distance below the surface of the earth .

A. 8.5

B. 9.5

C. 9.8

D. 11.5

Answer: B

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7. A solid sphere of mass M and radius R has a spherical cavity of radius R/2 such that the centre of cavity is at a distance R/2 from the centre of the sphere. A point mass m is placed inside the cavity at a distance R/4 from the centre of sphere. The gravitational force on mass m is

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

B. $\frac{14GMm}{R^2}$

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

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

Answer: B

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

B. $\sqrt{3GM}/(2L)$

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

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

Answer: A

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9. From a solid spere of mass M and radius R a sperhical poriton of radius $\frac{R}{2}$ is removed as show in the taking gravitational potential V=0 at $r = \infty$ the potential at the centre of the cavity thus formed (G= gravitonal constant)

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

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

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

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

Answer: B

View Text Solution

10. 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 1.5 m on the earth with the same effort the maximum height he can jump on that planet is

A. 1m

B. 0.75 m

C. 0.5 m

D. 1.25 m

Answer: B

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11. The height at which the acceleration due to gravity becomes $g/9$ in terms of R the radius of the earth is

A. 2R

B. $\frac{R}{\sqrt{r}}(3)$

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

D. $\sqrt{2}R$

Answer: A

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12. The effect of rotation of the eath on the value of acceleration deu to gravity g is

A. maximum at the equator and minimum at the poles

B. minimum at the equator and maximum at the poles

C. maximum at both poles

D. minimum at both poles

Answer: A

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13. A rocket is launched vertical from the surface of the earth of radius R with an initial speed v. If atmospheric resistance is neglected, then maximum height attained by the rocket is

A. $h = \dfrac{R}{\frac{2gR}{V^2} - 1}$

B. $h = \dfrac{R}{\frac{2gR}{V^2} + 1}$

C. $h = \dfrac{(R)^2}{\frac{2gR}{V^2} - 1}$

D. $h = \dfrac{(R)^2}{\frac{2gR}{V^2} + 1}$

Answer: A

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14. Suppose the gravitational force varies inversely as then n th power of distance then the time period of a planet in circular orbit of radius r around the sun will be propotinal to

A. $r^{\frac{1}{2}(n+1)}$

B. $r^{\frac{1}{2}(n-1)}$

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

D. R

Answer: A

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15. A body is projected vertically upwards from the surface of the earth with a velocity equal to half of escape velocity of the earth. If R is radius of the earth, maximum height attained by the body from the surface of the earth is

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

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

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

D. R

Answer: B

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16. Pertaining to two planets, the ratio of escape velocities from respective surfaces is $1:2$, the ratio of the time period of the same simple pendulum at their respective surfaces

is $2:1$ (in same order). Then the ratio of their average densities is

A. $1:1$

B. $1:2$

C. $1:4$

D. $8:1$

Answer: C

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17. Four equal masses (each of mass M) are placed at the corners of a squares side a the escape velocity of a body from the centre O of the square is

A. $4\frac{\sqrt{2GM}}{a}$

B. $\frac{\sqrt{8\sqrt{2GM}}}{a}$

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

D. $\frac{\sqrt{4\sqrt{2}GM}}{a}$

Answer: B

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18. A point $P\left(R\sqrt{3}, 0, 0\right)$ lies on the axis of ring of mass M and radius R the ring is located in YZ plane with its centre at origin O A small particle of mass m starts from P and reaches O under gravitatinal attracton only its speed at O will be

A. $\sqrt{G\frac{M}{R}}$

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

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

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

Answer: A

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19. The ratio of energy required to raise a satellite to a height h above the earth surface to that required to put it into the orbit is

A. $h:2R$

B. $2h:R$

C. $R : h$

D. $h : R$

Answer: B

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20. A small body of superdense material, whose mass is twice the mass of the earth but whose size is very small compared to the size of the earth, starts form rest at a height $H < < R$ above the earth's surface, and

reaches the earth's surface in time t. then t is equal to

A. $t = \frac{\sqrt{h}}{g}$

B. $t = \frac{\sqrt{2h}}{g}$

C. $t = \frac{\sqrt{2h}}{3g}$

D. $t = \frac{\sqrt{4h}}{3g}$

Answer: C

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21. The magnitude 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 F_1 and F_2 respectively. Then:

A. $\frac{f_1}{f_2} = \frac{r_1}{r_2}$ if $r_1 < R$ and $r_2 < R$

B. $\frac{f_1}{f_2} = \frac{r_1^2}{r_2^2}$ if $r_1 > R$ and $r_2 > R$

C. $\frac{f_1}{f_2} = \frac{r_1}{r_2^2}$ if $r_1 < R$ and $r_2 < R$

D. $\frac{F_1}{F_2} = \frac{r_2}{r_1}$ if $\_(1) < R$ and $r_2 < R$

Answer: A

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Watch video solution

22. A satellite is revolving round the earth with orbital speed v_0 if it is imagined to stop suddenly the speed with which it will strike the surface of the earth would be (v_e - escape speed of a body from earth s surface)

A. $\frac{V_e}{v_0}$

B. $2V_0$

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

D. $\sqrt{v_e^2 - 2v_0^2}$

Answer: D

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23. Four particles each of mass M move along a circle of radius R under the action of their mutula gravitational attraction the speed of each paritcles is

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

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

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

D. $\frac{\sqrt{GM}}{R}\frac{2\sqrt{2}+1}{4}$

Answer: D

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24. Suppose a verticle tunnel is alng the diametrer of earth assumed to be a sphere of uniform mass density p if a body of mass m is thrown in this tunnel its acceleration at a distance y from the centre is given by

A. $\frac{\pi}{3}Gpym$

B. $\frac{3}{4}\pi py$

C. $\frac{4}{3}\pi py$

D. $\frac{4}{3}\pi gpy$

Answer: D

View Text Solution

25. F is the gravitational force between two point masses m_1 and m_2 , separated by a

distance d. A point mass $2m_1$ is then brought near m_1. What is the total force on m_2 ?

A. 2F

B. 3F

C. F

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

Answer: B

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26. 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.

A. $(r_1 + r_2)$

B. $(r_1 + r_2)^{1/2}$

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

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

Answer: D

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27. An artifical satellite of mass 'm' is moving in a circular orbit aroundthe earth. The height of the satellite above the surface of the earth is R. Suppose that it stops suddenly in its orbit and falls freely under gravity. With what speed it will strike the surface of the earth?

A. $\sqrt{gR}$

B. $2\sqrt{gR}$

C. $3\sqrt{gR}$

D. $5\sqrt{gR}$

Answer: A

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28. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of esacpe velocity from the

earth the height of the satellite satellite above the earth surface will be

A. 6000 km

B. 5800 km

C. 7500 km

D. 6400 km

Answer: D

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29. The period of a planet around sun is 27 times that of earth the ratio of radius of planet orbit to the radius of eath ' orbit is

A. 4

B. 9

C. 64

D. 27

Answer: B

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

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

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

C. $\sqrt{2Emr^2}$

D. $\sqrt{2Emr}$

Answer: C

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31. Which of the following most closely depicts the correct variation of the gravitational potential V(r) due to a large planet of radius R and unifrom mass denisty ?

A. 

B. 

C. 

D. 

Answer: C

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32. There are two particles of masses m_1 and m_2 separted by a distance 'r'

with reference to the above situtation match the item in column II with terms in column II and choose the options from the codes given below

A. $(A, B, C), (1, 23)$

B.
A	B	C
2	3	1

C.
A	B	C
2	1	3

D.
A	B	C
3	1	2

Answer: B

View Text Solution

33. If the big sphere and the small are of masses M,m respectively and d is the separation between their centres then the

grvitational force is F if the mass of the big shpere is doubled the restoring torque at equilibrium is

A. doubled

B. halved

C. quadrupled

D. none of the above

Answer: A

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34. If the distance between the sun and the earth is increased by three times, then attraction between two will

A. remain by 63%

B. decrease by 63%

C. increase by 63%

D. decrease by 89%

Answer: D

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35. 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: B

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36. 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. mg 2R

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

C. 3mgR

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

Answer: B

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Mht Cet Corner

1. The value of gravitational accelerationg at a height h above the earth's surface is One forth the value of gravitational acceleration at surface ,then (R = radius of earth)

A. $h = R$

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

C. $h = \frac{R}{3}$

D. $h = \frac{R}{4}$

Answer: A

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2. Two particles of masses 'm' and '9m' are separated by a distance 'r'. At a point on the line joining them the gravitational field is zero. The gravitational potential at that point is (G = Universal constant of gravitation)

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

B. $-\frac{8Gm}{r}$

C. $-\frac{16Gm}{r}$

D. $\frac{32Gm}{r}$

Answer: C

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3. Let g_h and g_d the acceleration due to gravity at height h above the earth s surface and at depth d below the earth surface respecitively

if $g_n = g_d$ then the releation between h and d is

A. d=h

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

C. $d = \frac{h}{4}$

D. $d = 2h$

Answer: D

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4. A body of mass m is raised to a height 10 R from the surface of the earth, where R is the radius of the earth. Find the increase in potential energy. (G = universal constant of gravitational, M = mass of the earth and g= acceleration due to gravity)

A. $\frac{Gmm}{11R}$

B. $\frac{GMm}{10R}$

C. $\frac{mgR}{11G}$

D. $\frac{10GMm}{11R}$

Answer: D

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5. Calculate angular velocity of the earth so that acceleration due to gravity at 60° latitude becomes zero (radius of the earth = 6400 km, gravitational acceleration at poles = $10m/s^2, \cos 60^\circ = 0.5$)

A. $7.8 \times 120^{-2} rads^{-1}$

B. $0.5 \times 10^{-3} rads^{-1}$

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

D. $2.5 \times 10^{-3} rads^{-1}$

Answer: D

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6. The masses of two planets are in the ratio $1:2$. Their radii are in the ratio $1:2$. The acceleration due to gravity on the planets are in the ratio

A. $1:2$

B. $2:1$

C. $3:5$

D. $5:3$

Answer: B

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7. The mass of the earth is 81 times that of the moon and the radius of the earth is 3.5 times that of the moon. The ratio of the escape

velocity on the surface of earth to that on the surface of moon will be

A. 0.2

B. 2.57

C. 4.81

D. 0.39

Answer: C

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8. Which of the following is the evidence to show that there must be force acting on earth nd directed towards Sun?

A. deviation of the falling bodies toward east

B. revolution of the earth around the sun

C. phenomenon of day and night

D. apparent motion of sun round the earth

Answer: B

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9. If the density of a small planet is the same as that of earth while the radius of the planet is 0.2 times that of the earth the gravitational on the surface of that planet is :

A. 0.2 g

B. 0.4 g

C. 0.2 g

D. 4 g

Answer: A

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

A. $9.8ms^{-2}$

B. $19.6ms^{-2}$

C. $4.9ms^{-2}$

D. $39.2ms^{-2}$

Answer: B

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

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

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

C. $\frac{1}{T^3}$

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

Answer: D

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12. 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 surface of the earth to a height equal to radius R of the earth is - [M = mass of earth]

A. 2mgR

B. mgR

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

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

Answer: C

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13. The acceleration due to gravity on the planet A is 9 times the acceleration due to gravity on planet B. A man jumps to a height of $2m$ on the surface of A. What is the height of jump by the same person on the planet B?

A. 6 m

B. $2/3$ m

C. $2/9$ m

D. 18 m

Answer: D

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14. Kepler second law sates that the straight line joining the planet to the sun sweeps out

equal areas in equal times this statement is equivalent to saying that

A. total acceleration is zero

B. tangential acceration is zero

C. longitudinal acceraleration is zero

D. radial acceleration is zero

Answer: B

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15. A body is projected upwards with a velocity of $4 \times 11.2 \mathrm{km\ s^{-1}}$ from the surface of earth.What will be the velocity of the body when it escapes from the gravitational pull of earth ?

A. $11.2 kms^{-1}$

B. $2 \times 11.2 kms^{-1}$

C. $3 \times 11.2 kms^{-1}$

D. $\sqrt{15} \times 11.2 kms^{-1}$

Answer: D

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16. The ratio of acceleration due to gravity at a height 3R above earth 's surface to the acceleration due to gravity on the surface of the earth is (where R=radius of earth)

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

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

C. $\frac{1}{16}$

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

Answer: C

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17. Find the binding energy of a satellite of mass m in orbit of radius r, (R = radius of earth, g = acceleration due to gravity)

A. $\frac{mgR^2}{r}$

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

C. $-\frac{mgR^2}{r}$

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

Answer: B

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18. A planet has twice the radius but the mean density is $\frac{1}{4}$ th as compared to earth. What is the ratio of escape velocity from earth to that from the planet

A. $3:1$

B. $1:2$

C. $1:1$

D. $2:1$

Answer: C

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19. If the Earth losses its gravity, then for a body

A. weight becomes zero but not the mass

B. mass becomes zero but not weight

C. neither mass nor weight is zero

D. both mass and weight are zero

Answer: A

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20. The distance between centre of the earth and moon is 384000 km . If the mass of the earth is $6 \times 10^{24} kg$ and $G = 6.66 \times 10^{-11} Nm^2 / kg^2$. The speed of the moon is nearly

A. $1 kms^{-1}$

B. $4kms^{-1}$

C. $8kms^{-1}$

D. $11.2kms^{-1}$

Answer: A

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