PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

GRAVITATION

Physics

1. 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. $2/3$

B. $3/4$

C. $1/2$

D. $1/3$

Answer:

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2. What would be the angular speed of earth, so that bodies lying on equator may experience weightlessness ?

(g = $10m/s^2$ and radius of earth = 6400 km)

A. $1.25 \times 10^{-3} \text{rad/sec}$

B. $1.25 \times 10^{-2} \text{rad/sec}$

C. $1.25 \times 10^{-4} \text{rad/sec}$

D. $1.25 \times 10^{-1} \text{rad/sec}$

Answer:

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3. Determine the speed with which the earth would have to rotate on its axis , so that a person on the equator would weigh $\frac{3}{5}$ th as much as the person. Take $R = 6400km$.

A. $3.28 \times 10^{-4} \text{rad/sec}$

B. $7.826 \times 10^{-4} \text{rad/sec}$

C. $3.28 \times 10^{-3} \text{rad/sec}$

D. $7.28 \times 10^{-3} \text{rad/sec}$

Answer:

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4. A planet whose size is the same and mass 4 times as that of Earth, find the amount of energy needed to lift a $2kg$ mass vertically upwards through $2m$ distance on the planet. The value of g on the surface of Earth is $10ms^{-2}$.

A. 16J

B. 32J

C. 160 J

D. 320J

Answer:

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5. Two bodies of mass 10^2 kg and 10^3 kg are lying 1 m apart .

The gravitational potential at the mid-point of the line joining them is

A. 0

B. $-1.47\text{Joule}/\text{kg}$

C. $1.47\text{Joule}/\text{kg}$

D. $-1.47\times10^{-7}\text{Joule}/\text{kg}$

Answer:

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6. A particle of mass 'm' is raised to a height $h=R$ from the surface of earth. Find increase in potential energy. $R=$ radius of

earth. $g =$ acceleration due to gravity on the surface of earth.

A. mgR

B. 2mgR

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

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

Answer:

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7. 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. $\sqrt{\frac{Gm}{r}(2\sqrt{2}+1)}$

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

C. $\sqrt{\frac{Gm}{r}\left(\frac{2\sqrt{2}+1}{4}\right)}$

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

Answer:

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8. Three particles, each of mass m, are situated at the vertices of equilateral triangle of side length a. The only forces. It is desired that each particle moves in a circle while maintaining the original mutual speration a. Find the intial velocity that should be given to each particle and also the time period of the circular motion.

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

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

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

D. $\sqrt{\frac{GM}{3l}}$

Answer:

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9. What will be acceleration due to gravity on the surface of the moon if its radius were $(1/4)^{th}$ the radius of earth and its mass

$(1/80)^{th}$ the mass of earth? What will be the escape velocity on the surface of moon if it is $11.2km/s$ on the surface of the earth? (given that $g = 9.8m/s^2$)

A. g/6

B. g/5

C. g/7

D. g/8

Answer:

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10. 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. $x = h$

B. $x = 2h$

C. $x = \frac{h}{2}$

D. $x = h^2$

Answer:

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11. At what height above the earth's surface the acceleration due to gravity will be 1/9 th of its value at the earth's surface? Radius of earth is 6400 km.

A. 12800 km

B. 1280 km

C. 128000 km

D. 128 km

Answer:

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12. If the radius of the earth were to shrink by one percent its mass remaining the same, the acceleration due to greavity on the earth's surface would

A. decrease

B. remain unchanged

C. increase

D. None of these

Answer:

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13. At what height above the earth's surface does the force of gravity decrease by 10% ? Assume radius of earth to be 6370 km.

A. 350 km

B. 250 km

C. 150 km

D. 300 km

Answer:

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14. A particle hanging from a spring stretches it by 1 cm at earth's surface. How much will the same particle stretch the spring at a place 800

km above the earth's surface/ Radius of the earth=6400 km.

A. 0.79 cm

B. 0.1 cm

C. $\pi / 6 \mathrm{rad} / \mathrm{hr}.$

D. $2\pi / 7 \mathrm{rad} / \mathrm{hr}.$

Answer:

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15. The percentage change in the acceleration of the earth towards the Sun from a total eclipse of the Sun to the point where the Moon is on a side of earth directly opposite to the Sun is

A. $6.73 \times 10^{-2} m/s^2$

B. $6.73 \times 10^{-3} m/s^2$

C. $6.73 \times 10^{-4} m/s^2$

D. $6.73 \times 10^{-5} m/s^2$

Answer:

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16. The radius and mass of Earth are R and M. The acceleration due to gravity at its surface is g. Calculate the work required in raising a body of mass m to a height h from the surface of earth.

A. $\frac{mgh}{\left(1-\frac{h}{R_e}\right)}$

B. $\frac{mgh}{\left(1+\frac{h}{R_e}\right)^2}$

C. $\frac{mgh}{\left(1+\frac{h}{R_e}\right)}$

D. $\frac{mg}{\left(1+\frac{h}{R_e}\right)}$

Answer:

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17. The masses and radii of the Earth and the Moon are M_1, R_1 and M_2, R_2 respectively. Their centres are at a distance d apart. The minimum speed with which a particel of mass m should be projected from a point midway

between the two centres so as to escape to infinity is .....

A. $2\sqrt{\frac{G}{d}(M_1+M_2)}$

B. $\sqrt{\frac{G}{d}(M_1+M_2)}$

C. $\sqrt{\frac{G}{2d}(M_1+M_2)}$

D. $2\sqrt{\frac{G}{d}\frac{M_1}{M_2}}$

Answer:

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18. With what velocity must a body be thrown upward form the surface of the earth so that it reaches a height of 10 R_e ?

earth's mass $M_e = 6 \times 10^{24}$ kg , radius $R_e = 6.4 \times 10^6$m and $G = 6.67 \times 10^{-11} N - m^2 / kg^2$.

A. $10.7 \times 10^4 m / s$

B. $10.7 \times 10^3 m / s$

C. $10.7 \times 10^5 m / s$

D. $1.07 \times 10^4 m / s$

Answer:

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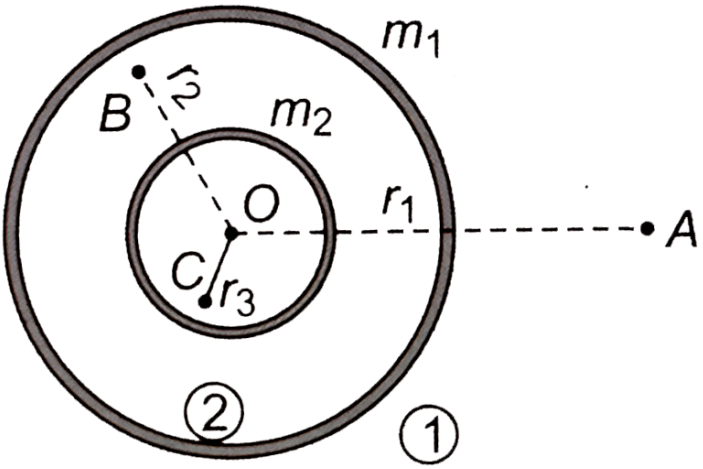
19. Two concentric shells of mass m_1 and m_2 are situated as shown. Find the force on a particle of mass m when the particles is located at $(a) r = r_1, (b) r = r_2, (c) r = r_3$. The distance r is measured from the centre of

the shell.



A. $\frac{GM_1m}{b^2}$

B. $\frac{GM_2m}{b^2}$

C. $G\frac{(M_1+M_2)m}{b^2}$

D. $G\frac{(M_1-M_2)m}{b^2}$

Answer:

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20. What is the mass of the planet that has a satellite whose time period is T and orbital radius is r?

A. $\frac{4\pi^2 r^3}{GT^2}$

B. $\frac{3\pi^2 r^3}{GT^2}$

C. $\frac{4\pi^2 r^3}{GT^3}$

D. $\frac{4\pi^2 T}{GT^2}$

Answer:

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21. The gravitational force between two point masses m_1 and m_2 at separation r is given by $F = k\frac{m_1 m_2}{r^2}$

The constant k doesn't

A. 1 , 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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22. Which of the following statements about the gravitional constant are false ?

A. 1 , 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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23. Spot the correct statements :

The acceleration due to gravity 'g' decreases if

A. 1 , 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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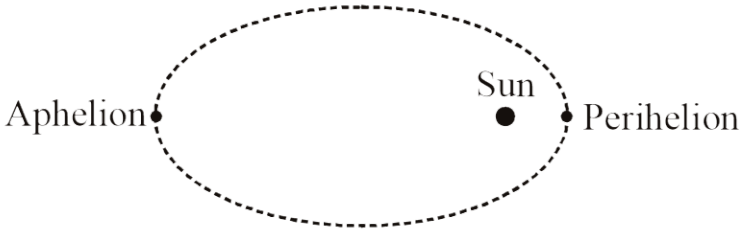
24. The orbit of Pluto is much more eccentric than the orbits of the other planets. That is, instead of being nearly circular, the orbit is noticeably elliptical. The point in the orbit nearest to the sun is called the perihelion and the point farthest from the sun is called the aphelion.



At perihelion, the gravitational potential energy of Pluto in its orbit has

A. its maximum value

B. its minimum value

C. the same value as at every other point in the orbit

D. value which depends on sense of rotation

Answer:

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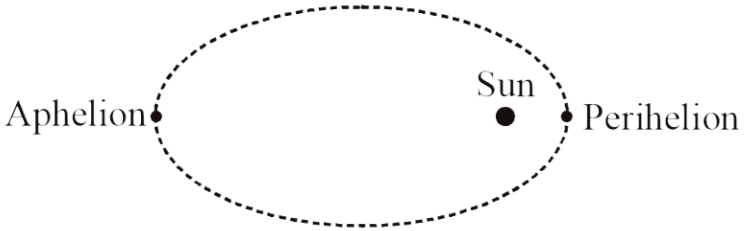
25. The orbit of Pluto is much more eccentric than the orbits of the other planets. That is, instead of being nearly circular, the orbit is noticeably elliptical. The point in the orbit nearest to the sun is called the perihelion and the point farthest from the sun is called the aphelion.



At perihelion, the mechanical energy of Pluto's orbit has

A. its maximum value

B. its minimum value

C. the same value as at every other point in the orbit

D. value which depends on sense of rotation

Answer:

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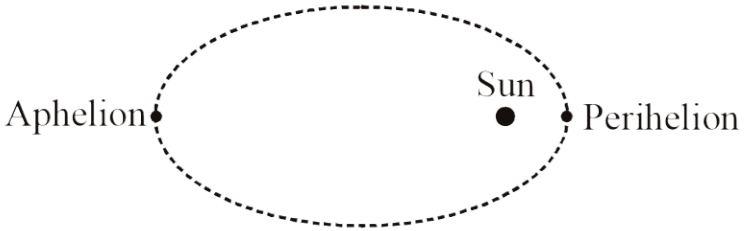
26. The orbit of Pluto is much more eccentric than the orbits of the other planets. That is, instead of being nearly circular, the orbit is noticeably elliptical. The point in the orbit nearest to the sun is called the perihelion and the point farthest from the sun is called the aphelion.



As Pluto moves from the perihelion to the aphelion, the work done by gravitational pull of Sun on Pluto is

A. is zero

B. is positive

C. is negative

D. depends on sense of rotation

Answer:

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27. Statement -1: Gravitational force between two particles is negligibly small compared to the electrical force.

Statement-2 :The electrical force is experienced by charged particles only.

A. Statement -1 is true , Statement -2 is True , Statement -2 is a correct explanation for Statement-1.

B. Statement-1 is True , Statement -2 is True , Statement-2 is NOT a correct explanation for statement-1.

C. Statement-1 is False, Statement - 2 is True.

D. Statement - 1 is True , Statement -2 is False.

Answer:

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28. Statement-1 :The universal gravitational constant is same as acceleration due to gravity.

Statement-2 :Gravitional constant and acceleration due to gravity have different dimensional formula

A. Statement -1 is true , Statement -2 is True , Statement -2 is a correct explanation for Statement-1.

B. Statement-1 is True , Statement -2 is True , Statement-2 is NOT a correct explanation for statement-1.

C. Statement-1 is False, Statement - 2 is True.

D. Statement - 1 is True , Statement -2 is False.

Answer:

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29. Assertion: There is no effect of rotation of a earth on acceleration due to gravity at poles.

Reason : Rotation of earth is about polar axis.

A. Statement -1 is true , Statement -2 is True , Statement -2 is a correct explanation for Statement-1.

B. Statement-1 is True , Statement -2 is True , Statement-2 is NOT a correct explanation for statement-1.

C. Statement-1 is False, Statement - 2 is True.

D. Statement - 1 is True , Statement -2 is False.

Answer:

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30. A body of mass $100kg$ falls on the earth from infinity. Its kinetic energy on reaching the earth is $6.27 \times 10^n J$. What is the value of n?

Given, radius of earth is $6400km$ and $g = 9.8m/s^2$. Air friction is neglected.

A. $6.27 \times 10^9 J$

B. $6.27 \times 10^{10} J$

C. $6.27 \times 10^{10} J$

D. $6.27 \times 10^7 J$

Answer:

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31. An artificial satellite of the earth is to be established in the equatorial plane of the earth and to an observer at the equator it is required that the satellite will move eastward, completing one round trip per day. The distance of the satellite from the centre of the earth will be - (The mass of the earth is 6.00×10^{24} kg and its angular velocity = $7.30 \times 10^{-5} \mathrm{rad/sec.}$)

A. $2.66 \times 10^{3} m$

B. $2.66 \times 10^{5} m$

C. $2.66 \times 10^6 m$

D. $2.66 \times 10^7 m$

Answer:

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32. Two satellites S_1 and S_2 revolve round a planet in the same direction in circular orbits. Their periods of revolutions are 1 hour and 8 hour respectively. The radius of S_1 is 104 km. The velocity of S_2 with respect to S_1 will be -

A. $\pi \times 10^4 \text{km}/\text{hr}$

B. $\pi/3 \times 10^4 \text{km}/\text{hr}$

C. $2\pi \times 10^4 \text{km}/\text{hr}$

D. $\pi/2 \times 10^4 \text{km}/\text{hr}$

Answer:

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

A. $\pi / 3 \mathrm{rad} / \mathrm{hr}$

B. $\pi / 3 \mathrm{rad} / \mathrm{sec}$

C. $\pi / 6 \mathrm{rad} / \mathrm{hr}$

D. $2\pi / 7 \mathrm{rad} / \mathrm{hr}$

Answer:

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34. The moon revolves round the earth 13 times in one year. If the ratio of sun-earth

distance to earth-moon distance is 392, then the ratio of masses of sun and earth will be

A. 365

B. 356

C. 3.56×10^5

D. 1

Answer:

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35. Two planets of radii in the ratio $2:3$ are made from the materials of density in the ratio $3:2$. Then the ratio of acceleration due to gravity g_1 / g_2 at the surface of two planets will be

A. 1

B. 2.25

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

D. 0.12

Answer:

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36. A satellite of mass m is revolving in a circular orbit of radius r. The relation between the angular momentum J of satellite and mass m of earth will be -

A. $J = \sqrt{G.Mm^2r}$

B. $J = \sqrt{GMm}$

C. $J = \sqrt{GMmr}$

D. $J = \sqrt{\frac{mr}{M}}$

Answer:

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

A. 3.285 km/sec

B. 32.85 m/sec

C. 11.32 km/sec

D. 7.32 m/sec

Answer:

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38. The ratio of the radius of the earth to that of moon is 10. The ratio of acceleration due to gravity on the earth and on the moon is 6. What is the ratio (in intergral value) of the

escape velocity from the earth's surface to that from the moon?

A. 10

B. 8

C. 4

D. 2

Answer:

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39. Acceleration due to gravity on a planet is 10 times the value on the earth. Escape velocity for the planet and the earth are V_p and V_e respectively. Assuming that the radii of the planet and the earth are the same, then -

A. $V_P = 10V_e$

B. $V_P = \sqrt{10}V_e$

C. $V_P = \dfrac{V_e}{\sqrt{10}}$

D. $V_P = \dfrac{V_e}{10}$

Answer:

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40. The Jupiter's period of revolution round the Sun is 12 times that of the Earth. Assuming the planetary orbits are circular, how many times the distance between the Jupiter and Sun exceeds that between the Earth and the sun.

A. 5.242

B. 4.242

C. 3.242

D. 2.242

Answer:

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41. The mean distance of Mars from the sun in 1.524 times that of the Earth from the sun. Find the number of years requires for Mars make one revolution about the Sun.

A. 2.88 earth year

B. 1.88 earth year

C. 3.88 earth year

D. 4. 88 earth year

Answer:

42. The semi-major axes of the orbits of mercury and mars are respectively 0.387 and 1.524 in astronomical unit. If the period of

Mercury is 0.241 year, what is the period of Mars.

A. 1.2 years

B. 3.2 years

C. 3.9 years

D. 1.9 years

Answer:

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

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

B. $\frac{GM}{4\pi^2}$

C. $4\pi GM$

D. 0

Answer:

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44. The masses and radii of the Earth and the Moon are M_1, R_1 and M_2, R_2 respectively. Their centres are at a distance d apart. The minimum speed with which a particel of mass m should be projected from a point midway between the two centres so as to escape to infinity is .....

A. $\sqrt{\frac{G(M_1+M_2)}{d}}$

B. $\sqrt{\frac{2G(M_1+M_2)}{d}}$

C. $\sqrt{\frac{4G(M_1+M_2)}{d}}$

D. $\sqrt{\frac{GM_1M_2}{d}}$

Answer:

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45. A satellite has to revolve round the earth in a circular orbit of radius 8×10^3 km. The velocity of projection of the satellite in this orbit will be -

A. 16 km/sec

B. 8 km/sec

C. 3 km/sec

D. 7.08 km/sec

Answer:

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46. If the satellite is stopped suddenly in its orbit which is at a distnace = radius of earth from earth's surface and allowed to fall freely

into the earth, the speed with which it hits the surface of earth will be -

A. 7.919 m/sec

B. 7.919 km/sec

C. 11.2 km/sec

D. 11.2 km/sec

Answer:

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

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

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

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

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

Answer:

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48. A satellite is revolving in an orbit close to the earth's surface. Taking the radius of the earth as $6.4x \times 10^6$ metre, the value of the orbital speed and the period of revolution of the satellite will respectively be (g = $9.8 \text{meter} / \text{sec}^2$)

A. 7.2 km /sec , 84.6 minutes

B. 2.72 km/sec , 84.6 minutes

C. .72 km/sec ., 8.6 minutes

D. 7.2 km/sec ., 8.6 minutes

Answer:

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49. If the period of revolution of an artificial satellite just above the earth be T second and the density of earth be ρ, kg/m^3 then (G =$6.67 \times 10^{-11} m^3/kg.\,\text{second}^2$)

A. ρT^2 is a universal constant

B. ρT^2 varies with time

C. $\rho T^2 = \frac{3\pi}{G}$

D. Both (a) and (c)

Answer:

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50. Two satellites A and B of equal mass move in the equatorial plane of the earth, close to earth's surface. Satellite A moves in the same

direction as the of the rotation of the earth while satellite B moves in the opposite direction. Calclate the ratio of the kinetic energy of B of that of A in the reference frame fixed to the earth $\left(g = 9.8ms^{-2}\right.$ and radius of the earth $\left. = 6.37 \times 10^{6}km\right)$

A. $\left(\frac{8363}{7437}\right)^{2}$

B. $\left(\frac{7437}{8363}\right)^{2}$

C. $\left(\frac{8363}{7437}\right)$

D. $\left(\frac{7437}{8363}\right)$

Answer:

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51. Gas escapes from the surface of a planet because it acquires an escape velocity. The escape velocity will depend on which of the following factors:

(1) Mass of the planet

(2) Radius of the planet

(3) Mass of the particle escaping

(4) Temperature of the planet

A. 1 , 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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52. $v_e \text{and} v_p$ denotes the escape velocity from the earth and another planet having twice the radius and the same mean density as the

earth. Then which of the following is (are) wrong ?

A. 1 , 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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53. Select the wrong statements from the following

(1) The orbital velocity of a statellite increases with the radius of the orbit

(2) Escape velocity of a particle from the surface of the earth depends on the speed with which it is fired

(3) The time period of a satellight does not depend on the radius of the orbit

(4) The orbital velocity is inversely proportional to the square root of the radius of the orbit

A. 1 , 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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54. Assertion: The speed of revolution of an artificial satellite revoving very near the earth is $8kms^{-1}$.

Reason: Orbital velocity of a satellite, becomes independent of height near earth.

A. Statement -1 is true , Statement -2 is True , Statement -2 is a correct explanation for Statement-1.

B. Statement-1 is True , Statement -2 is True , Statement-2 is NOT a correct explanation for statement-1.

C. Statement-1 is False, Statement - 2 is True.

D. Statement - 1 is True , Statement -2 is False.

Answer:

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55. Assertion: if an earth satellite moves to a lower orbit, there is some dissipation of energy but the satellite speed increases.

Reason: The speed of satellite is a constant quantity.

A. Statement -1 is true , Statement -2 is True , Statement -2 is a correct explanation for Statement-1.

B. Statement-1 is True , Statement -2 is True , Statement-2 is NOT a correct explanation for statement-1.

C. Statement-1 is False, Statement - 2 is True.

D. Statement - 1 is True , Statement -2 is False.

Answer: