PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

GRAVITATION

Example

1. A sphere of mass 40 kg is being attracted by another sphere of mass 80 kg with aforce equal to $1/4$ of a milligram weight their centres are 30 cm apart. Calculate the value of G.

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2. A sphere of mass $40kg$ is attracted by a second sphere of mass $60kg$ with a force equal to $4mg$. If $G = 6 \times 10^{-11} Nm^2 kg^{-2}$, calculate the distance between them. Acceleration due to gravity $= 10ms^{-2}$.

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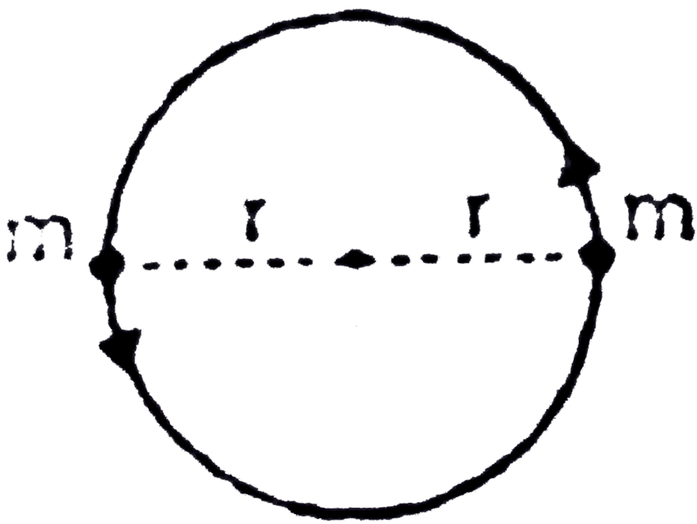
3.



Two particles of equal mass (m) each move in a circle of radius

(r) under the action of their mutual gravitational attraction find the speed of each particle.

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4. The mass of planet Jupiter is $1.9 \times 10^7 kg$ and that of the Sun is $1.9x10^{30} kg$. The mean distance of Jupiter from the Sun is 7.8×10^{11}m. Calculate te gravitational force which Sun exerts on Jupiter. Assuming that Jupiter moves in circular orbit around the Sun, also calculate the speed of Jupiter $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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5. The moon takes about 27.3 days to revolve round the earth in a nearly circular orbit of radius 3.84×10^5 k. Calculate the mass of the earth from this data.

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6. Calculate the mass of sun if the mean radius of the earth's orbit is $1.5 \times 10^8 km$ and $G = 6.67 \times 10^{-11} N \times m^2 / kg^2$

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7. A rocket is fired the Earth towards the Moon. At what distance from the Moon is the gravitational force on the rocket is zero. Mass of Earth is $6 \times 10^{24} kg$, mass of Moon is $3.8 \times 10^8 m$. Neglect the effect of the sun and other planes.

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8. A mass M is broken into two parts of masses m_1 and m_2. How are m_1 and m_2 related so that force of gravitational attraction between the two parts is maximum?

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9. find the gravitational force of attraction between a uniform sphere of mass M and a uniform rod of length L and mass m, placed such that r is the distance between the centre of the sphere and the near end of the road.

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10. A uniform spheres has a radius of 2 cm. Find the percentage increase in its weight when a second sphere of radius 20 cm and density $12 \times 10^3 \text{kg} m^{-3}$ is brought underneath it and nearly touching it. Take $g = 9.8 m s^{-2}$ and G=6.67×10^{-11} SI units.

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11. In an experiment using the Cavendish balance, the smaller spheres have a mass of 5.0×10^{-3}kg each, the larger spheres have a mass 12.0 kg each, the length of the rod is 100.0 cm, the torsion constant of the fibre is 3.56×10^{-8} Nm per rad, the angle of twist is 4.86×10^{-3}rad, and the distance between the centres of each pair of heavy and light spheres is 15.0 cm. Compute the value of the gravitational constant G from this data.

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12. Calculate the mass and mean density of the earth from the following data :

Gravitational constant	(G)	$= 6.6 \times 10^{-11} Nm^2 kg^{-2}$
Radius of the earth	(R)	$= 6.37 \times 10^6 m$
Acceleration due to gravity	(g)	$= 9.8 ms^{-2}$

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13. Find the acceleration due to gravity of the moon at a point 1000 km above the moon's surface. The mass of the moon is 7.4×10^2 kg and its radius is 1740 km.

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14. A star 2.5 times the mass of the sun is reduced to a size of $12 km$ and rotates with a speed of $1.5 rps$. Will an object placed on its equator remain stuck to its surface due to gravity? (Mass of the sun $= 2 \times 10^{30} kg$)

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15. If the Earth were made of lead of relative density 11.4, then find the value of acceleration due to gravity on the surface of Earth ? Radius of the Earth is $6400 km$ and $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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16. A spherical mass of $20 kg$ lying on the surface of the Earth is attracted by another spherical mass of $150 kg$ with a force equal to $0.23 mgf$. The centres of the two masses are $30 cm$

apart. Calculate the mass of the Earth. Radius of the Earth is $6 \times 10^6 m$.

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17. Two lead spheres of $20cm$ and $2cm$ diametre respectively are planet with centres $100cm$ apart. Calculate the attraction between them, given the radius of the Earth as $6.37 \times 10^8 cm$ and its mean density as $5.53 \times 10^3 kgm^{-3}$. Speciffic gravity of lead $= 11.5$. If the lead spheres are replaced by bress sphere of the same radii, would the force of attraction be the same?

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18. Compares the gravitational acceleration of the eartrh due to attraction of the sun with that due to attraction of the moon. Given that mass of sun, $M_s = 1.99 \times 10^{30}$ kg, mass of moon, $M_m = 7.35 \times 10^{22}$ kg , distance of sun from earth , $r_{es} = 1.49 \times 10^{11}$ m and the distance moon from earth $r_{em} = 3.84 \times 10^8$ m.

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19. A body weighs $54 kgf$ on the surface of Earth. How much will it weigh on the surface of mers whose mass is $1/9$ and the redius is $1/2$ of that of earth?

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

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21. If the radius of the earth were incresed by a factor of 3, by what factor would its density to be changed to keep 'g' the same ?

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22. A man can jump $1.5m$ on the Earth. Calculate the approximate height he might be able to jump on a planet whose density is one-quarter that of the Earth and whose radius is one-third that of the Earth.

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

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24. 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 $R = 6400 km$.

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25. The Mount Everst is 8848 m above sea level. Estimate the accelleration due to gravity at this height, given that mean g on the surface of the earth is $9.8ms^{-2}$ and mean radius of the earth is 6.37×10^6m

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26. At what height above the earth surface, the value of g is half of its value on earth's surface ? Given its radius is 6400 km

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27. Find the percentage decrease in the weight of the body when taken to a depth of $32km$ below the surface of earth. Radius of the earth is $6400km$.

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28. A body of mass m is raised to aheight h from the surface of the earth where the acceleration due to gravity is g. Prove that the loss in eight due to variation in g is approximately 2 mgh / R, where R is the radius of the earth.

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29. A mass of 0.5 kg is wheighd on abalance at the top of a tower 20 m high. The mass is then suspended from the pan of the balance by afine wire 20 m long and is reweighd. Find the change in weight. Assume that the radius of the earth is 6400 km

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30. A body hanging frm a spring stretches it by 1 cm at the earth's surface. How much will the same body stretch the spring at aplace 1600 km above the earth surface ? Radius of the earth=6400 km.

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31. Assuming the earth to be a sphere of uniform mass density, how much would a body weigh half way down to the centre of the earth if it weighd 250 N on the surface ?

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32. Find the percentage decrease in the weight of a body when taken 16 km below the surface of the earth. Take radius of the earth is 6400 km.

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33. How much below the surface of the earth does the acceleration due to gravity become 1% of its value at the earth's surface ? Radius of the earth=6400 km.

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34. At what height above the earth's surface, the value of g is same as in mine 80 km deep?

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35. Compare the weights of the body when it is (i) 1km above the surface of the earth and (ii) 1 km below the surface of the earth . Radius of the earth is 6300 km.

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36. Imagine a tunnel dug along a diameter of the earth. Show that a particle dropped from one end of the tunnel executes simple harmonic motion. What is the time period of this motion? Assume the earth to be a sphere of uniform mass density (equal to its known average density=5520 kg m^{-3}.)G= $6.67 \times 10^{-11} Nm^2 kg^{-2}$.Neglect all damping forces.

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37. Calculate that imaginary angular velocity of the Earth for which effective acceleration due to gravity at the equator becomes zero. In this condition, find the length (in hours) of a day? Radius of Earth $= 6400km. g = 10ms^{-2}$.

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38. Determine the speed with which the earth would have to rotate on its axis so that a person on the equator would weigh $3/5$ the as much as at present. Take the equatorial radius as 6400 km.

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39. If the Earth were a perfect sphere of radius $6.37 \times 10^6 m$, rotating about its polar exis with a period of 1 day $(= 8.64 \times 10^4 s)$ how much would the acceleration due to gravity differ from the poles to equator?

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40. If the earth, supposed to be a unifrom sphere contracts slightly so that its radius becomes less by $(1/n)$ than before, show that the length of the day shortens by $(48/n)$ hours.

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41. A remote sensing satellite of the earth revolves in a circular orbit at a height of 250 km above the earth's surface.

What is the (i) orbital speed and (ii) period of revolution of the satellite ? Radius of the earth, $R = 6.38 \times 10^6$ m, and acceleration due to gravity on the surface of the earth, $g = 9.8ms^{-2}$.

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42. An artificial satellite is going round the earth, close to its surface. What is the time taken by it to complete one round? Given radius of the earth=6400 km.

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43. A satellite revolves in an orbit close to the surface of a planet of mean density $5.51 \times 10^3 kgm^{-3}$. Calculate the time period of satellite.

Given $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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44. An earth's satellite makes a circle around the earth in 90 minutes. Calculate the height of the satellite above the earth's surface. Given radius of the earth is 6400 km and g=980 cms^{-2}

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45. An artificial satellite revolves round the earth at a height of $1000 km$. The radius of the earth is $6.38 \times 10^3 km$. Mass of the earth $6 \times 10^{24} kg$, $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$. Find the orbital speed and period of revolution of the satellite.

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46. If the period of revolution of an artificial satellite above the earth's surface be T and the density of earth be p, then prove that p T^2 is a universal constant. Also calculate the value of this constant. Given G=$6.67 \times 10^{-11} m^3 kg^{-1} s^{-2}$

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47. Find the velocity of escape at the earth given that its radius is $6.4 \times^6$ m and the value of g at its surface is $9.8 ms^{-2}$

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48. Determine the escape speed of Moon. Given, the radius of Moon is $1.74 \times 10^6 m$, its mass is $7.36 \times 10^{22} kg$. Does your answer throw light on why the moon has no atmosphere? $G = 6.67 \times 10^{-11} nm^2 kg^{-2}$.

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49. Jupiter has a mass 318 times that of the earth, and its radius is 11.2 times the earth's radius. Estimate the escape velocity of a body from Jupiter's surface, given that the escape velocity from the earth's surface is 11.2 Km S^{-1}.

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

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51. Show that the moon would depart for ever if its speed were increased by 42% .

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52. Calculate the escape velocity for an atmospheric particle 1600 km above the earth's surface, given that the radius of the earth is 6400 km and acceleration due to gravity on the surface of earth is 9.8 ms^{-2}.

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53. The radius of a planet is double that of the earth but then average densities are the same. If the escape velocities at the planet and at the earth are v_P and v_E respectively, then prove that $v_P = 2v_E$.

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54. Calculate the period of revolution of Neptune around the sun, given that diameter of its orbit is 30 times the diameter of earth's orbit around the sun, both orbits being assumed to be circular.

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

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56. Compare the period of rotation of planet Mars about the sun with that of the earth. The mean distance of the Mars from the sun is 1.52 AU.

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57. In an imaginary planetary system, the central star has the same mass as our sun, but is brighter so that only a planet twice the distance between the earth and the sun can support life. Assuming biological evolution (inculuding aging process etc.) on that planet similar to ours, what would be the average life span of a 'human' on that planet in terms of its natural year ? The average life span of a human on the earth may be taken ot be 70 years.

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58. The distances of two planets from the sun are 10^{13} m and 10^{12}m respectively. Find the ratio of time periods and speeds of the two planets.

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59. Find the intensity of gravitational field when a force of 100 N acts on a body of mass 10 kg in the gravitational field.

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60. Two masses, 800 kg and 600 kg, are at a distance 0.25 m apart. Compute the magnitude of the intensity of the gravitational field at a point distant 0.20 m from the 800 kg mass and 0.15 m from the 600 kg mass.

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61. Calculate the gravitational field strength and the gravitational potential at the surface of the moon. The mass of the moon is $7.34 \times 10^{22} kg$ and its radius is $1.74 \times 10^{6} m$. $(G = 6.67 \times 10^{-11} Nm^{2} kg^{-2})$.

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62. At a point above the surface of the earth, the gravitational potential is $-5.12 \times 10^{7} JKg^{-1}$ and the acceleration due to gravity is $6.4 ms^{-2}$. Assuming the mean radius of the earth to be 6400 km, calculate the heights of this point above the earth's surface.

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63. Two bodies of masses 10 kg and 1000 kg are at a distance 1 m apart. At which point on the line joining them will the gravitational field-intensity be zero ?

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64. The radius of the earth is $6.37 \times 10^6 m$, its mean density is $5.5 \times 10^3 Kgm^{-3}$ and G=$6.66 \times 10^{-11} Nm^2 Kg^{-2}$. Determine the gravitational potential on the surface of the earth.

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65. A geostationary satellite orbits the earth at a height of nearly 36,000 km from the surface of the earth. What is the potential due to earth's gravity at the site of the satellite ? Mass of the earth= 6×10^{24}kg and radius =6400 km.

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66. Two heavy spheres each of mass 100 kg and radius 0.1 m are placed 1.0 m apart on a horizontal table. What is the gravitational field and potential at the mid point of the line joiningthe centres of the spheres ? Take G= $6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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67. Three mass points each of mass m are placed at the vertices of an equilateral tringale of side l. What is the gravitational field and potential due to three masses at the centroid of the triangle ?

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68. Find the work done to bring 4 particles each of mass 100 gram from large distances to the vertices of square of side 20 cm.

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69. A satellite orbits the earth at a height of 500 km from its surface. Compute its (i) Kinetic energy, (ii) potential energy, and (iii) total energy. Mass of the satellite=300 kg, Mass of the earth=6.0×10^{24}kg, radius of the earth=6.4×10^{6}m, G=$6.67 \times 10^{-11} Nm^2 Kg^{-2}$. Will your answer alter if the earth were to shrink suddenly to half its size?

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70. A satellite orbits the earth at a height of 400 km, above the surface. How much energy must be expended to rocket the satellite out of the earth's gravitational influence ? Mass of the satellite=200 kg, mass of the earth=6.0×10^{24}kg, radius of the earth=$6.4 \times 10(6)$m, G=$6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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71. A spaceship is stationed on Mars. How much energy must be expended on the spacesship to rocket it out of the solar system ? Mass of the spaceship 1000 kg, mass of the sun= 2×10^{30}kg, mass of Mars=6.4×10^{23}kg, radius of Mars 3395 km, radius of the orbit of Mars =2.28×10^{8}Km, G= $6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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72. A rocket is fired vertically with a speed of 5 kms^{-1} from the earth's surface. How far from the earth does the rocket go before returning to the earth ? Mass of earth=6.0×10^{24}kg, mean radius of the earth =6.4×10^{6}m, G= $6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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73. A rocket is fired fired vertically from the surface of Mars with a speed of 2 Kms^{-1}. If 20% of its initial energy is lost due to martain atmospheric resistance, how far will the rocket go from the surface of Mars before returning to it ? Mass of Mars=6.4×10^{23}Kg, radius of Mars=3395 Km, G= $6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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

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75. A rocket in launched vertically from the sruface of earth with an initial velocity u. Find the height up to which the rocket can go from the surface velocity u. Find t eh height up to which the rocket can go from the surface of earth before back or earth

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

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77. Distinguish between gravitational and gravity.

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78. (a) What do you mean by the term free fall ?

(b) uring a free fall, will heavier objects accelerate more than lighter ones?

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79. What do you mean by acceleration due to gravity?

Watch Video Solution

80. Explain what is meant by momentum of a body. Is it a scalar or a vector? What are its units?

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81. Universal Law of Gravitation

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82. Define G (universal gravitational constant).

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83. What is the experimental evidence in support of the diea that electronic energies in an atom are quantized?

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84. State and explain universal law of gravitation. What is its importance ?

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85. State any one characteristic of gravitational force.

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86. PRINCIPLE OF SUPERPOSITION OF GRAVITATION

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87. State Newton's shell theorein for the gravitational force.

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88. Is gravitational shielding possible ?

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89. Calculate the gravitational force of attraction between two spherical bodies, each of mass 1kg placed at 10m apart $\left(G = 6.67 \times 10^{-11} Nm^2 / kg^2\right)$.

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90. The mass of planet Jupiter is $1.9 \times 10^7 kg$ and that of the Sun is $1.9x10^{30} kg$. The mean distance of Jupiter from the Sun is 7.8×10^{11}m. Calculate te gravitational force which Sun exerts on Jupiter. Assuming that Jupiter moves in circular orbit around the Sun, also calculate the speed of Jupiter $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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91. Two particles of equal mass go around a circle of radius R under the action of their mutual gravitational attraction. Find the speed of each particle.

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92. The mean orbital radius of the Earth around the Sun is $1.5 \times 10^8 km$. Estimate the mass of the Sun.

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93. A mass M is broken into two parts of masses m_1 and m_2. How are m_1 and m_2 related so that force of gravitational attraction between the two parts is maximum?

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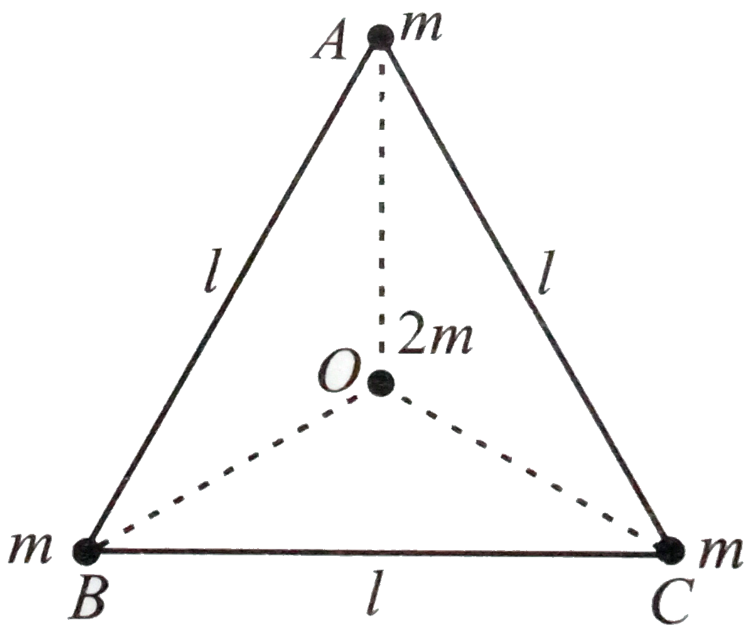
94. Three masses each of mass m are palced at the vertices of an equilateral triangles ABC of side l as shown in figure. The force acting on a mass 2m placed at the centroid O of the triangle is



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95. Where is 'g' maximum, on the surface of earth, above the surfce or below the surface of Earth ?

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96. The acceleration due to gravity'g' for objects on or near the surface of earth is related to the universal gravitational constant 'G' as ('M' is the mass of the earth and 'R' is its radius):

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97. Explain how the mass of the Earth can be estimated from the knowledge of G?

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98. You are given the following data : $g = 9.81 ms^{-2}$, radius of earth $= 6.37 \times 10^6 m$ the distance the Moon from the earth $= 3.84 \times 10^8 m$ and the time period of the Moon's revolution $= 27.3 days$. Obtain the mass of the earth in two different ways. $G = 6.67 \times 10^{-11} Nm^2 kg^2$.

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99. If the Earth were made of lead of relative density 11.4, then find the value of acceleration due to gravity on the surface of Earth ? Radius of the Earth is $6400 km$ and $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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100. The acceleration due to gravity at the moon's surface is $1.67 ms^{-2}$. If the radius of the moon is $1.74 \times 10^6 m$, calculate the mass of the moon.

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101. Two lead spheres of $20cm$ and $2cm$ diametre respectively are planet with centres $100cm$ apart. Calculate the attraction between them, given the radius of the Earth as $6.37 \times 10^8 cm$ and its mean density as $5.53 \times 10^3 kgm^{-3}$. Speciffic gravity of lead $= 11.5$. If the lead spheres are replaced by bress sphere of the same radii, would the force of attraction be the same?

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106. Why does value of 'g' vary from place to place on earth ?

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107. Discuss the variation of g with altitude.

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108. 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 $R = 6400km$.

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109. At what height above the earth surface, the value of g is half of its value on earth's surface ? Given its radius is 6400 km

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110. Find the percentage decrease in the wight of the body when taken to a heigh of $16km$ above the surface of Earth. Radius of the earth is $6400km$.

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112. A body hanging frm a spring stretches it by 1 cm at the earth's surface. How much will the same body stretch the spring at aplace 1600 km above the earth surface ? Radius of the earth=6400 km.

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113. Discuss the variation of g with height and depth.

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114. The weight of a body at the centre of the earth is

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115. If g is same at a height h and at a depth d, then

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120. When a body is taken from the equator to the poles, its weight

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121. Define latitude at a place.

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122. Explain how is the acceleration due to gravity affected at a latitude due to the rotational motion of the earth.

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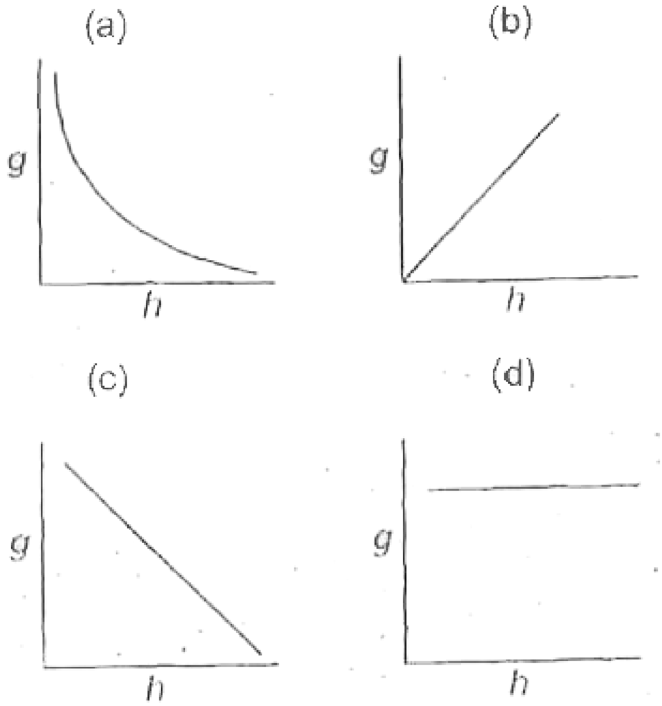
123. Which of the following graphs shows the variation of acceleration due to gravity g with depth h from the surface of the earth ?



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124. Calculate that imaginary angular velocity of the Earth for which effective acceleration due to gravity at the equator becomes zero. In this condition, find the length (in hours) of a day? Radius of Earth $= 6400 km. \ g = 10 m s^{-2}$.

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125. Determine the speed with which the earth would have to rotate on its axis so that a person on the equator would weigh $3/5$ the as much as at present. Take the equatorial radius as 6400 km.

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127. Give the concept of gravitational field.

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128. Define intensity of gravitational field at any point. Is it a scalar or vector ?

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129. Show that the electric field intensity at a point can be given as negative of potential gradient.

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130. Show that the gravitational field intensity of the earth at any point is equal to the acceleration produced in the freely falling body at that point.

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131. Give the units and dimensions of gravitational field intensity.

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132. What is meant by gravitational potential energy of a body ? What is the zero level of potential energy ?

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133. The gravitational potential energy of a body at a distance r from the center of the earth is U. The force at that point is :

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134. State the dimensions of gravitational potential.

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135. EXPRESSION FOR GRAVITATIONAL POTENTIAL AT A POINT

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136. Find the intensity of gravitational field when a force of 100 N acts on a body of mass 10 kg in the gravitational field.

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137. Two bodies of masses 10 kg and 1000 kg are at a distance 1 m apart. At which point on the line joining them will the gravitational field-intensity be zero ?

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139. At a point above the surface of the earth, the gravitational potential is $-5.12 \times 10^{7} JKg^{-1}$ and the acceleration due to gravity is $6.4ms^{-2}$. Assuming the mean radius of the earth to be 6400 km, calculate the heights of this point above the earth's surface.

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140. The radius of the earth is 6.37×10^{6} m and its mean density is $5.5 \times 10^{3} \text{kg m}^{-3}$ and $G = 6.67 \times 10^{-11} \text{N-m}^{2} kg^{-2}$ Find the gravitational potential on the surface of the earth.

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141. Three mass points each of mass m are placed at the vertices of an equilateral tringale of side l. What is the gravitational field and potential due to three masses at the centroid of the triangle ?

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142. Find the potential energy of a system of four particles each of mass 2m kept at the vertices of a square of side x. Also find the potential at the centr of the square.

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143. Two bodies of masses m_1 and m_2 ar placed at a distance r apart. Shows that the position where the gravitational field due to them is zer, the potential is given by

$$V = -\frac{G}{r}[m_1 + m_2 + 2\sqrt{m_1 m_2}$$

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

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145. Find the velocity of escape at the earth given that its radius is $6.4 \times^6$ m and the value of g at its surface is $9.8 ms^{-2}$

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146. Determine the escape velocity of a body from the moon. Take the moon to be a uniform sphere of radius $1.76 \times 10^6 m$, and mass $7.36 \times 10^{22} kg$. Given $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$

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147. A block hole is a body from whose surface nothing may even escape. What is the condition for a uniform spherical body of mass M to be a block hole? What should be the radius of such a black hole if its mass is nine times the mass of the earth?

Mass of earth $= 6 \times 10^{24} kg$,

$G = 6.61 \times 10^{-11} Nm^2 kg^{-2}$.

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148. Jupiter has a mass 318 times that of the earth, and its radius is 11.2 times the earth's radius. Estimate the escape velocity of a body from Jupiter's surface, given that the escape velocity from the earth's surface is 11.2 Km S^{-1}.

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149. Show that the moon would depart for ever if its speed were increased by 42% .

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150. Calculate the escape velocity for an atmospheric particle 1600 km above the earth's surface, given that the radius of the earth is 6400 km and acceleration due to gravity on the surface of earth is 9.8 ms^{-2}.

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151. The radius of a planet is double that of the earth but then average densities are the same. If the escape velocities at the planet and at the earth are v_P and v_E respectively, then prove that $v_P = 2v_E$.

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152. What is a satellite?

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153. What are natural and artificial satellites ? Give examples.

Watch Video Solution

154. Define an artificial satellite.

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155. Explain the use of multistage rockets in launching a satellite.

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156. Define orbital velocity of a satellite. Derive expressions for the orbital velocity of a satellite. Show that the escape velocity of a body from the earth's surface is $\sqrt{2}$ times its velocity in a circular orbit just above the earth's surface.

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157. A satellite of time period 24 h is orbiting the earth at a height 6R above the surface of earth, where R is radius of earth. What will be the time period of another satellite at a height 2.5 R from the surface of earth ?

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158. A satellite revolves around the earth at a height of 1000 km. The radius of the earth is 6.38×10^3km. Mass of the earth is $6 \times 10^{24} kg$ and $G = 6.67 \times 10^{-14}\text{N-m}^2 kg^{-2}$. Determine its orbital velocity and period of revolution.

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159. A remote sensing satellite of the earth revolves in a circular orbit at a height of 250 km above the earth's surface. What is the (i) orbital speed and (ii) period of revolution of the satellite ? Radius of the earth, $R = 6.38 \times 10^6$ m, and acceleration due to gravity on the surface of the earth, $g = 9.8ms^{-2}$.

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160. A remote sensing satellite of the earth revolves in a circular orbit at a height of 250 km above the earth's surface. What is the (i) orbital speed and (ii) period of revolution of the satellite ? Radius of the earth, $R = 6.38 \times 10^6$ m, and

acceleration due to gravity on the surface of the earth, $g = 9.8 ms^{-2}$.

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161. An artificial satellite is going round the earth, close to its surface. What is the time taken by it to complete one round? Given radius of the earth=6400 km.

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162. A satellite revolves in an orbit close to the surface of a planet of mean density $5.51 \times 10^3 kgm^{-3}$. Calculate the time period of satellite.

Given $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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163. An earth's satellite makes a circle around the earth in 90 minutes. Calculate the height of the satellite above the earth's surface. Given radius of the earth is 6400 km and g=980 cms^{-2}

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164. If the period of revolution of an artificial satellite above the earth's surface be T and the density of earth be p, then prove that p T^2 is a universal constant. Also calculate the value of this constant. Given G=$6.67 \times 10^{-11} m^3 kg^{-1} s^{-2}$

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165. In a two stage launch of a satllite, the first stage bringe the satlilte to a height of $500 km$ and the second stage given it the necessary critical speed to put it in circular orbit around the Earth. Which stage requires more expenditude of fuel?

(Neglect damping due to air resistance, especially in the first stage).

Mass of the Earth $= 6.0 \times 10^{24} kg$,radius of Earth $= 6400 km, G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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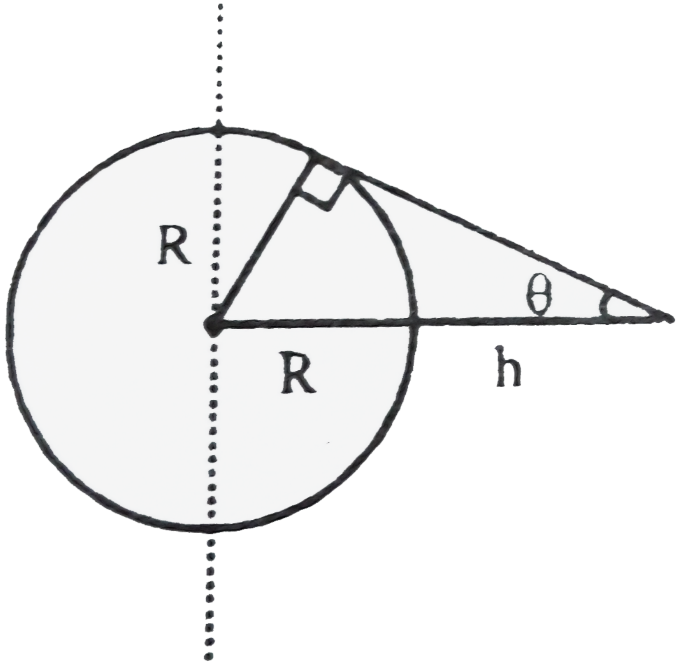
166. A geostationary satellite is at a height h above the surface of earth. If earth radius is R-



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167. A geostationary satellite

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168. A geostationary satellite

Watch Video Solution

169. A geostationary satellite

Watch Video Solution

170. What do you understand by geostationary and polar satellite ? Discuss their important uses.

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171. Derive an expression for the total energy of a satellite orbiting the earth. What is the significance of negative total energy ?

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172. What is binding energy of a satellite?

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173. A $400kg$ satellite is in a circular orbit of radius $2R_E$ around the Earth. How much energy is required to transfer it to a circular orbit of radius $4R_E$? What are the changes in the kinetic and potential energies?

Given $g = 9.81m^{-2}$, $R_E = 6.37 \times 10^6 m$.

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174. A satellite orbits the earth at a height of 500 km from its surface. Compute its (i) Kinetic energy, (ii) potential energy, and (iii) total energy. Mass of the satellite=300 kg, Mass of the earth=6.0×10^{24}kg, radius of the earth=6.4×10^{6}m, G= $6.67 \times 10^{-11} Nm^{2} Kg^{-2}$. Will your answer alter if the earth were to shrink suddenly to half its size?

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175. State keper's laws of planetary motion.

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176. State Kepler's laws of planetary motion.

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177. Kepler's Law

Watch Video Solution

178. State Kepler's 1st law of planetary motion.

Watch Video Solution

179. State Kepler's 2nd law of planetary motion.

Watch Video Solution

180. State Kepler's 3rd law of planetary motion.

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181. Newton's law of gravitation

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182. Calculate the period of revolution of Neptune around the sun, given that diameter of its orbit is 30 times the diameter of earth's orbit around the sun, both orbits being assumed to be circular.

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183. Given that $T^2 = kR^3$, express the constant k of the above relation in days and kilometres. Given,

$k = 10^{-13} s^2 m^{-3}$. The Moon is at a distance of $3.84 \times 10^5 km$ from the earth. Obtain its time period of revolution in days.

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184. In an imaginary planetary system, the central star has the same mass as our sun, but is brighter so that only a planet twice the distance between the earth and the sun can support life. Assuming biological evolution (inculuding aging process etc.) on that planet similar to ours, what would be the average life span of a 'human' on that planet in terms of its natural year ? The average life span of a human on the earth may be taken ot be 70 years.

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185. The planet Mars has two moons. Phobos and Delmos (i) phobos has period 7 hours, 39 minutes and an orbital radius of $9.4 \times 10^3 km$. Calculate the mass of Mars. (ii) Assume that Earth and mars move in a circular orbit around the sun, with the martian orbit being 1.52 times the orbital radius of the Earth. What is the length of the martian year in days? $(G = 6.67 \times 10^{-11} Nm^2 kg^{-2})$

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186. Assuming that earth and mars move in circular orbits around the sun, with the martian orbit being 1.52 times the orbital radius of the earth. The length of the martian year is days is

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187. The distances of two planets from the sun are 10^{13} m and 10^{12}m respectively. Find the ratio of time periods and speeds of the two planets.

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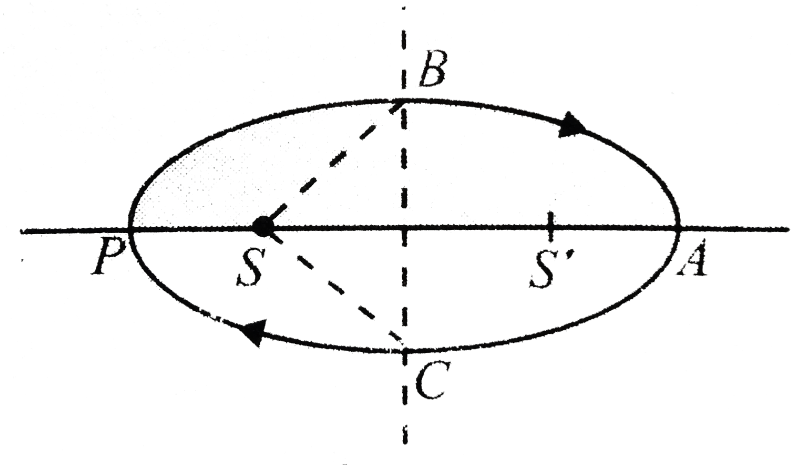
188. Let the speed of the planet at the perihelion P in figure be v_P and the Sun planet distance SP be r_P. Relater r_P, v_P to the corresponding quantities at the aphelion (r_A, v_A). Will the planet take equal times to transverse BAC and CPB?



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189. Feeling of weightlessness in a satellite is due to

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190. What is inertial mass of a body ? Give its important properties.

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191. COMPARISION OF INERTIAL MASS AND GRAVITATIONAL MASS

Watch Video Solution

192. EQUIVALENCE OF INERTIAL AND GRAVITATIONAL MASSES

Watch Video Solution

193. Why is Newton's law of gravitational called a universal law?

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194. Define G (universal gravitational constant).

Watch Video Solution

195. The force of attraction between two charged bodies depend on

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196. Spheres of the same material and same radius r are touching each other. Show that gravitational force between them is directly proportional to r^4.

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197. If the density of the planet is double that of the earth and the radius 1.5 times that of the earth, the acceleration due to gravity on the planet is

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198. Is it possible to shield a body from gravitational effects?

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199. Gravitational force acts on all objects in properties to their masses. Why then, a heavy object does not fall faster than a light object?

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200. The mass of the moon is about 1.2% of the mass of the earth. Compared to the gravitational force the earth exerts on the moon, the gravitational force the moon exerts on earth

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201. The earth is continuously pulling the Moon towards its centre. Why the moon does not fall on to the earth?

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202. We cannot move finger without disturbing all stars. Why?

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203. According to Newton's law of gravitation, the apple and the earth experience equal and opposite forces due to gravitation. But it is the apple that falls towards the earth and not vice-versa. Why ?

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204. According to Newton's law of gravitational, every particle of matter attracts every other particle. But bodies on the surface of Earth never move towards each other on account of this force of attraction. Why ?

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205. Does the graviatational force of attraction of the Earth on a body become zero at some height above the earth? Explain.

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206. Which is more fundamental the mass of a body or its weight ? Why ?

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207. If diameter of earth becomes half of its present value and its mass becomes four times its present value, how would the weight of any object on the surface of earth be affected ?

Watch Video Solution

208. If diameter of earth becomes half of its present value and its mass becomes four times its present value, how would the weight of any object on the surface of earth be affected ?

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209. The mass and diameter of a planet are twice those of earth. What will be the period of oscillation of a pendulum on this plenet. If it is a 2 second's pendulum on earth?

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210. 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

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211. The distance between two bodies A and B is r. Taking the gravitational force according to the law of inverses square of r, the acceleration of the body A is a. If the gravitational force follows an inverse fourth power law, then what would be the acceleration of the body A?

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212. For any given body, the centre of the mass of a body always coincides with its centre of gravity.

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213. Why the value of acceleration due to gravity is more at the poles than at the equator?

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214. A body weighs more at poles than at the equator of earth. Why ?

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215. Where does a body weigh more – at the surface of the earth or in a mine?

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216. Where will a body weigh more, $2km$ above the surface of earth or $2km$ below the surface of earth ?

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217. Does the concentration of the earth's mass near its centre change the variation of g (acceleration due to gravity) with height from its surface?

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218. The weight of a body is less inside the earth than on the surface. Why?

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219. Why do you feel giddy while moving on a merry-go-round ?

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220. At which place on earth's surface, the value of g is largest and why?

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221. A body weighs more at poles than at the equator of earth. Why ?

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222. When a clock controlled by a pendulum is taken from plains to mountain, it becomes slow but a wrist watch controlled by a spring remains unaffected. Why ?

Watch Video Solution

223. A pendulum clock thast keeps correct time on the earth is taken to the moon. It will run

Watch Video Solution

224. Why does a tunnis ball bounce heigher on a hill than on plains?

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225. A man can jump six times as high on the moon as that on the earth. Justify.

Watch Video Solution

226. With a specific initial velocity, we can jump higher on the moon than on the earth.

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227. Moon travellers tie heavy weight at their back before landing on the Moon. Why ?

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

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229. 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.

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230. What are the two factors which determine why some bodies in solar system have atmosphere and others do not?

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231. If the Earth stops rotating about its polar axis, what will be the effect on the value of acceleration due to gravity 'g' ? Will this effect be same at all places?

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232. The earth rotates about its own axis, then the value of acceleration due to gravity is

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233. Explain why tidal waves (high tide and low tide) are formed on seas.

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234. Why are we not thrown off the surface of the earth by the centrifugal force ?

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235. A satellite moves in a circle around the earth. The radius of this circle is equal to one half of the radius of the moon's orbit. The satellite completes one revolution is :

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236. PRINCIPLE OF LAUNCHING A SATELLITE

Watch Video Solution

237. Why do different planets have different escape speeds?

Watch Video Solution

238. Why do we need appendicular skeleton ?

Watch Video Solution

239. Does a rocket really need the escape speed of $11.2 km / s$ initially to escape from the Earth?

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240. Why does Moon have no atmosphere?

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241. The D-layer and E-layer disappear at night in earth's atmosphere? Why?

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242. Lighter gases like H_2, He, etc. are rare in the atmosphere of the earth. Why?

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243. The gravitational force exerted by the Sun on the Moon is about twice as great as the gravitational force exerted by the earth on the Moon, but still Moon is not escaping from the gravitational influence of the earth. Mark the option which correctly explains the above system.

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244. For a satellite, escape speed is $11 kms^{-1}$. If the satellite is launched at an angle of 60° with the vertical, what will be the escape speed?

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245. An artificial satellite is revolving in a circular orbit at height of $1200 km$ above the surface of the earth. If the radius of the earth is $6400 km$ and mass is $6 \times 10^{24} kg$, the orbital velocity is

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246. An artifical satellite revolves in the orbit around the Earth without using any fuel. But an aeroplane requires fuel to fly at a centain height. Why ?

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247. Why rockets are launched from west to east in the equatorial plane?

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248. A satellite of small mass burns during its descent and not during ascent. Why ?

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249. Is it possible to place an artificial satellite in an orbit such that it is always visible over kota ? Write down the reason.

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250. The astronauts in a satellite orbiting the Earth feel weightlessness. Does the weightlessness depend upon the distance of the satellite from the Earth ? If so how ? Explain your answer.

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251. Can we determine the gravitational mass of a body inside an artificial satellite?

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252. When a satellite is moving around the earth with velocity v, then to make the satellite escape, the minimum percentage increase in its velocity should be

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253. Assertion : An astronaut in an orbiting space station above the earth experience weightlessness.

Reason : An object moving around the earth under the infuence of earth's gravitational force is in a state of 'free fall'

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254. An astronaut in a satellite feels weightlessness because

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255. Two indentical geostationary satellite each of mass m are moving with equal speed v in the same orbit but their sense of rotation brings them on a collision course. What will happen to the debris?

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256. The linear speed of a planet around the sun is not constant in its orbit. Comment.

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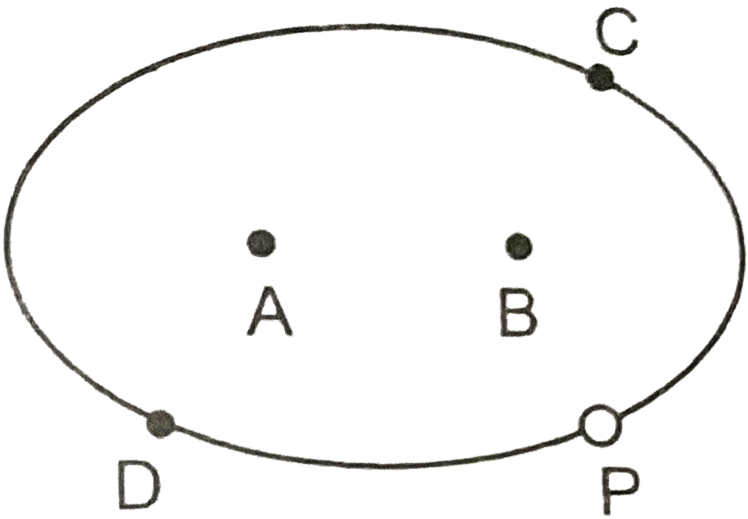
257. Identify the portion of sun in the Fig. if the linear speed of the planet is greater at C compared to that at D.



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258. The largest and the shortest distance of the earth from the sun are r_1 and r_2, its distance from the sun when it is at the perpendicular to the major axis of the orbit drawn from the sun

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259. The weight of a body will be zero

Watch Video Solution

260. How does the weight ofa bodyvarywhile moving from the earth to the moon ?

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261. Assertion: The artifical satellite does not have any fuel but even then it remains orbiting around the earth.

Reason: The necessary centripetal force required to move the satellite in an ·orbit around the earth is provided by the gravitational force of attraction between the satellite and the earth.

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262. What is the maximum height attained by a body projected with a velocity equal to one- third of the escape velocity from the surface of the earth? (Radius of the earth=R)

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263. Which one among the following is the correct value of the gravitational force of the Earth acting on a body of mass 1 kg?

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264. Do the forces of friction and other contact fores aries due to gravitational attraction ? If not, what is the origin of these force?

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265. Choose the correct alternative :

(a) If the gravitational potential energy of two mass points infinite distance away is taken to be zero, the gravitational potential energy of a galaxy is (positive /negative/zero).

(b) The universe on the large is shaped by (gravitational/electromagentic) forces, on the atomic scale by (gravitational/electromagnetic) forces, on the nuclear scale by (gravitational/electromagnetic/strongnuclear) forces.

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266. Choose the correct alternative :

(a) If the gravitational potential energy of two mass points infinite distance away is taken to be zero, the gravitational potential energy of a galaxy is (positive /negative/zero).

(b) The universe on the large is shaped by (gravitational/electromagentic) forces, on the atomic scale by (gravitational/electromagnetic) forces, on the nuclear scale by (gravitational/electromagnetic/strongnuclear) forces.

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267. What is the difference between inertial mass and gravitational mass of a body?

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268. A body is taken from the centre of the Earth to the Moon. What will be the changes in the weight of the body?

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269. Mention the conditions under which the weight of a person can become zero.

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270. How will the value of g be affected if he rotation of the earth stops.

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271. How will the value of g be affected if the rotational speed of the earth is doubled.

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272. How will the value of g be affected if the rotational speed of the earth is increased to seventeen times its present value ?

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273. What would happen if the force of gravity were to disappear suddenly ?

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274. The radii of two planets are R and 2R respectively and their densities p and $\rho/2$ respectively, What is the ratio of acceleration due to gravity at their surfaces ?

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275. The time period of the satellite of the earth is 5 hours. If the separation between the earth and the satellite is increased to 4 times the previous value,then what will be the new time period of the satellite ?

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276. Prove that acceleration due to gravity on the surface of the earth is given by $g = \frac{4}{3}npGR$ where G is gravitational constant, p is mean density and R is the radius of the earth.

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277. Why is the weight of a body at the poles more than the weight at the equator ? Explain.

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278. Why does the earth impart the same acceleration to all bodies ?

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279. If suddenly the gravitational force of attraction between the earth and a satellite revolving around it becomes zero, what will happen to the satellite ?

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280. Draw graphs showing the variation of acceleration due to gravity with (i) height above the earth's surface.

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281. Draw graphs showing the variation of acceleration due to gravity with depth below the earth's surface.

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282. A person in an artificial satellite of Earth feels weightlessness. But a person on the Moon has weight though the Moon is also a satellite of the Earth. Why?

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283. 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

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284. A simple pendulum has a time period T when m the earth's surface,and T2 when taken to a height R above the earth's surface, where R is the radius of the earth. What is the value of T_2 / T_1 ?

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285. A geo-stationary stellite orbits around the earth in a circular orbit of radius 36,000km. Then, the time period of a spy stellite orbitting a few hundred km above the earth's surface $(R_{earth} = 6400km)$ will approximately be

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286. Find the period of oscillation of a simple pendulum of length L suspended from the roof of a vehicle which moves without friction down an inclined plane of inclination a.

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287. Answer the following : An astronaut inside a small space ship orbiting around the earth cannot detect gravity. If the space station orbiting around the Earth has a large size, can he hope to detect gravity ?

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288. Choose the correct alternative : Acceleration due to gravity increases!decreases with increasing altitude.

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289. Choose the correct alternative : Acceleration due to gravity increases/decreases with increasing depth (assume the Earth to be a sphere of uniform density).

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290. Choose the correct alternative :The effect of rotation on the effective value of acceleration due to gravity is greatest at the equator/poles.

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291. Choose the correct alternative : Acceleration due to gravity is independent of mass of the Earth/mass of the body.

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292. Suppose there existed a planet that went around the sun twice as fast as the earth. What would be its orbital size as compared to that of the earth ?

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293. One of the satellite of jupiter, has an orbital period of 1.769 days and the radius of the orbit is $4.22 \times 10^8 m$. Show that mass of jupiter is about one thousandth times that of the mass of the sun. (Take 1 year $= 365.15$ mean solar day).

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294. Let us consider that our galaxy consists of 2.5×10^{11} stars each of one solar mass. How long will this star at a distance of $50, 000$ light year from the galastic entre take to complete one revolution? Take the diameter of the Milky way to be $10^5 ly. G = 6.67 \times 10^{-11} Nm^2 Kg^{-2}. (1ly = 9.46 \times 10^{15} m)$

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295. Choose the correct alternatives : If the zero of potential energy is at infinity, the total energy of an orbiting satellite is negative of its kinetic/potential energy.

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296. Does the escape speed of a body from the Earth depend on (the mass of the body. Explain your answer.

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297. Does the escape speed of a body from the Earth depend on , the location from where it is projected. Explain your answer.

Watch Video Solution

298. Does the escape speed of a body from the Earth depend on , the direction of projection.Explain your answer.

Watch Video Solution

299. Does the escape speed of a body from the Earth depend on , the height of the location from where the body is launched ? Explain your answer.

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300. A comet orbits the Sun in a highly elliptical orbit. Does the comet have a constant (a) linear speed (b) angular speed (c) angular momentum (d) kinetic energy (e) potential energy (f) total energy throughout its orbit? Neglect any mass loss of the comet when it comes very close to the Sun.

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301. Which of the following symptoms is likely to afflict an astronaut in space (a) swollen feet, (b) swollen face, (c) headache, (d) orientational problem.

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302. The gravitation intensity at the centre C of the drumhead defined by a hemispherical shell has the direction indicated by the arrow [see Fig. 8.46]

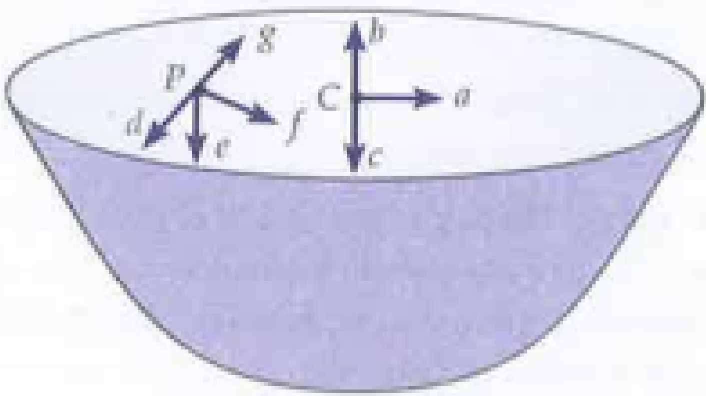

Fig. 8.46

A. a

B. b

C. c

D. zero

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303. For the above problem, the direction of the gravitational intensity at an arbitrary point P is indicated by the arrow (i) d, (ii), e, (iii) f (iv) g.

A. d

B. e

C. f

D. g

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

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305. How will you weight the sun. that is estimate its mass? The mean orbital radius of the earth around the sun is

$1.5 \times 10^6 km.$

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

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

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308. Assuming the earth to be a sphere of uniform mass density, how much would a body weigh half way down to the centre of the earth if it weighd 250 N on the surface ?

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309. A rocket is fired vertically with a speed of 5 kms^{-1} from the earth's surface. How far from the earth does the rocket go before returning to the earth ? Mass of earth=6.0×10^{24}kg, mean radius of the earth =6.4×10^{6}m, G= $6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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310. The escape speed of a projectile on the earth's surface is 11.2 km s^{-1}. A body is projected out with thrice this speed. What is the speed of the body far away from the earth? Ignore the presence of the sun and other planets.

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311. A satellite orbits the earth at a height of 400 km, above the surface. How much energy must be expended to rocket the satellite out of the earth's gravitational influence ? Mass of the satellite=200 kg, mass of the earth=6.0×10^{24}kg, radius of the earth=$6.4 \times 10(6)$m, G=$6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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312. Two starts each of one solar mass $\left(=2\times10^{30}kg\right)$ are approaching each other for a head on collision. When they are a distance 10^9km. their speeds are negligible. What is the speed with which they collide? The radius of each star is 10^4 km. Assume the stars to remain undistorted until they collide. (Use the known value of G).

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313. Two heavy spheres each of mass 100 kg and radius 0.1 m are placed 1.0 m apart on a horizontal table. What is the gravitational field and potential at the mid point of the line joiningthe centres of the spheres ? Take G= $6.67\times10^{-11}Nm^2Kg^{-2}$.

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314. A geostationary satellite orbits the earth at a height of nearly 36,000 km from the surface of the earth. What is the potential due to earth's gravity at the site of the satellite ? Mass of the earth= 6×10^{24}kg and radius =6400 km.

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315. A star 2.5 times the mass of the sun is reduced to a size of $12km$ and rotates with a speed of $1.5rps$. Will an object placed on its equator remain stuck to its surface due to gravity? (Mass of the sun $= 2 \times 10^{30} kg$)

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316. A spaceship is stationed on Mars. How much energy must be expended on the spacesship to rocket it out of the solar system ? Mass of the spaceship 1000 kg, mass of the sun= 2×10^{30}kg, mass of Mars=6.4×10^{23}kg, radius of Mars 3395 km, radius of the orbit of Mars =2.28×10^{8}Km, G= $6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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317. A rocket is fired vertically from the surface of Mars with a speed of $2 kms^{-1}$. If $20\,\%$ of its initial energy is lost due to Martian atmospheric resistance, how far will the rocket go from the surface of Mars before returning to it? Mass of Mars $= 6.4 \times 10^{23} kg$, radius of Mars $= 3395 km$,

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Problem From Competitive Examinations

1. Two bodies of mass m_1 and m_2 are initially at rest placed infinite distance apart. They are then allowed to move towards each other under mutual gravitational attaction. Show that their relative velocity of approach at separation r betweeen them is

$$v = \frac{\sqrt{2G(m_1 + m_2)}}{r}$$

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2. Suppose the gravitational force varies inverseley as the nth power of the distance. Show that the time period of a planet in circular orbit of raidus r arount the sun will be proportional to $r^{n+1}/^{2}$.

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3. Imagine a light planet revolving around a massive star in a circular orbit of raidus r with a a period of revolution T. If the gravitational force of attraction between planet and the star is proportioanl to $r^{-5}/^{2}$, then find the relation between T and r.

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4. A spherical cavity is made inside a sphere of density ρ. If its centre lies at a distacne l from the centre of the sphere, show that the gravitational field strength of the field inside the cavatiy is

$$E = \frac{4\pi}{3} Gl\rho$$

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5. Three parties, each of mass m, are situated at the vertices of an equilateral triangle of side length a . The only forces acting on the pariclaes are th eir mutual gravitational forces. It is desired that each particles moves ina a circle while maintaining the original mutual separation a. Find the initial velocity that should be given to each particle and also the time period of teh circular motion.

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6. Two satellite S_1 and S_2 revolve round a planet in coplanar circular orbits in the same sense. Their periods of revolution are 1hr and 8hours respectively. The radius of the orbit of $S_1 is 10^4 km$. When S_2 is closet to S_1 (i) the speed S_2 relative to S_1 as actually observed by an astronaut in S_1.

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7. The distance between the centres of two stars is 10α. The masses of these stars are M and 16M and their radii α and 2α. A body of mass m is fired straight from the surface of the larger star towards the smaller star. What should be its minimum initial speed to reach the surface of teh smaller star? Obtain the expression interms of G, M and α.

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8. The artifical satellite is moving in a circular around the earth with a speed equal to half the magnitude of escape velocity from the earth. (i) Determine the height of the satellite above the earth's surface, (ii) If the satellite is stopped suddenly in its orbit and allowed to fall freely on to the earth , find the speed with which it hits surface of the earth. Take$g = 9.8ms^{-2}$, radius of the earth =6400km.

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9. A mass is raised from the surface of the earth to a point which is at a height pR from the centre of the earth, where r is the radius of the earth. Calculation the chagne P.E. If the lifted mass is to be made an artificial satellite of the earth at that distacnce, what is the total work done? Acceleration due to gravity at the suraface of the earth is g.

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10. The mass M of a planet earth is uniformly distributed over a spherical volume of radius R. Calciulate the energy needed to de assemble the planet against the gravitational pull amongst its constitutent particles. Given $MR = 2.5 \times 10^{31} kg$ and $g = 10 ms^{-2}$.

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11. Two equal masses of 6.40kg are separated by a distance iof 0.16m.. A small body is released from a point P, equivalent from the two masses and at a distance of 0.06m from the line joining them as shown in Fig.913 (i) Calculate the velocity when it passes through Q. (ii) Calculate the accleration of this body at P and Q if its mass is 0.1kg.

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12. Two bodies of masses m_1 and m_2 ar placed at a distance r apart. Shows that the position where the gravitational field due to them is zer, the potential is given by

$$V = -\frac{G}{r}[m_1 + m_2 + 2\sqrt{m_1 m_2}]$$

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13. A particle is projected upward from the surface of the earth (radius) with KE equal to half the minimum a value needed for it to escape. To which height does it rise above the surface of theeearth?

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14. A chord of length 64m is used to connect a 100 kg astronaut to a spaceship whose mass is much larger than the that of the astronaut. Estimate the value of tension in the cord. Assume that the spacehip is orbiting near the earth surface. Also assume that the spaceship and hte astronaut fall on strainght line from the earth's centre. The radius of he earth 6400km.

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Exercise

1. A sphere of mass 20 kg is attached by another sphere of mass 10 kg when their centres are 20 cm apart , with a force of 3.3×10^{-7}N . Calculate the constant of gravitation .

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2. The centre of two identical spheres are 1.0 m apart . If the gravitational force between the spheres be 1.0 N , then what is the mass of each sphere ?

$(G = 6.67 \times 10^{-11} m^3 kg^{-1} s^{-2})$.

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3. The bodies of masses 40 kg and 80 kg are at a distance of 0.15 m from each other . Two force of gravitation between the bodies is 1.0 mg wt. calculate the constant of gravitation . Take g = $10ms^{-2}$.

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4. Calculate the force of gravitation between the bodies , each of mass 100 kg and 1 m apart on the surface of the earth . Will the force of attraction be different if the same bodies are taken on the moon , their separation remaining constant ?

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5. An apple of mass 0.25 kg falls from a tree . What is the acceleration of the apple towards the earth ? Also calculate the acceleration of the earth towards the apple . Mass of the earth = 5.983×10^{24} kg , Radius of the earth = 6.378×10^{6} m and G = $6.67 \times 10^{-11} Nm^2 kg^{-2}$

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6. If the mass of the sun is 2×10^{30} kg , the distance of the earth from the sun is 1.5×10^{11} m and period of revolution of the earth around the sun is one year ($= 365.3$ days) , calculate the value of gravitational constant .

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7. How far from earth must a body be along a line towards the sun so that the sun's gravitational pull on it balances that of the earth . Distance between sun and earth's centre is

1.5×10^{10} km . Mass of the sun is 3.24×10^{5} times mass of the earth .

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8. In an experiment using the Cavendish balance , the smaller spheres have a mass of 20 kg each , the larger spheres have a mass 5 kg each , the length of the rod is 50.0 cm the torsion constant of the fibre is 4.8×10^{-8} Nm per radian , the angle of twist is 7×10^{-3} rad , and the distance between the centres of each pair of heavy and light spheres is 100 cm . Compute the value of the gravitational constant G from this data .

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9. A sphere of mass 40 kg is being attracted by another sphere of mass 80 kg with aforce equal to $1/4$ of a milligram weight their centres are 30 cm apart. Calculate the value of G.

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10. The centre of two identical spheres are 1.0 m apart . If the gravitational force between the spheres be 1.0 N , then what is the mass of each sphere ?

$\left(G = 6.67 \times 10^{-11} m^3 kg^{-1} s^{-2}\right)$.

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15. A spherical mass of $20kg$ lying on the surface of the Earth is attracted by another spherical mass of $150kg$ with a force equal to $0.23mgf$. The centres of the two masses are $30cm$

apart. Calculate the mass of the Earth. Radius of the Earth is $6 \times 10^6 m$.

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16. The period of moon around the earth is 27.3 days and radius of the orbit is $3.9 \times 10^5 km$. $G = 6.67 \times 10^{-11} Nm^{-2} kg^{-2}$, find the mass of the earth.

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17. Assuming the earth to be a uniform sphere of radius 6400 km and density $5.5 gcm^{-3}$, find the value of g on its surface . Given G = $6.66 \times 10^{-11} Nm^2 kg^{-2}$

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18. The mass of Jupiter is 314 times that of earth and the diameter of Jupiter is 11.35 times that of earth . If 'g' has a value of $9.8ms^{-2}$ on the earth , what is its value on Jupiter ?

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19. The value of 'g' on the surface of the earth is $9.81ms^{-2}$. Find its value on the surface of the moon . Given mass of earth 6.4×10^{24} kg , radius of earth = 6.4×10^{6} m , mass of the moon = 7.4×10^{22} kg , radius of moon = 1.76×10^{6} m .

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20. An astronaut on the moon measures the acceleration due to gravity to be $1.7ms^{-2}$. He known that the radius of the

moon is about 0.27 times that of the earth . Find the ratio of the mass of the earth to that of the moon , if the value of g on the earth's surface is $9.8ms^{-2}$.

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21. The acceleration due to gravity on the surface of the earth is $10ms^{-2}$. The mass of the planet . Mars as compared to earth is 1/10 and radius is 1/2 . Determine the gravitational acceleration of a body on the surface on Mars .

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22. A body weights 100 kg on earth . Find its weight on mars . The mass and radius of mars are 1/10 and 1/2 of the mass and radius of earth .

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23. The weight of a person on the Earth is $80kgwt$. What will be his weight on the Moon ? Mass of the Moon $= 7.34 \times 10^{22} kg$, radius $= 1.75 \times 10^{6} m$ and gravitational constant $= 6.67 \times 10^{-11} Nm^{2} kg^{-2}$. What will be the mass of the person at the Moon and acceleration due to gravity there ? If this person can jump $2m$ high on the Earth, how much high can he jump at the Moon ?

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24. 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 $10ms^{-2}$.

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25. The radius of the earth is 6000 km . What will be the weight of a 120 kg body if it is taken to a height of 2000 km above the surface of the earth?

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26. A body of mass m is raised to aheight h from the surface of the earth where the acceleration due to gravity is g. Prove that the loss in eight due to variation in g is approximately 2 mgh / R, where R is the radius of the earth.

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27. The Mount Everst is 8848 m above sea level. Estimate the accelleration due to gravity at this height, given that mean g on the surface of the earth is $9.8ms^{-2}$ and mean radius of the earth is 6.37×10^{6}m

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28. At what height above the surface of the earth will the acceleration due to gravity be 25% of its value on the surface of the earth ? Assume that the radius of the earth is 6400 km .

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29. Find the value of g at a height of 400 km above the surface of the earth . Given radius of the earth , R = 6400 km and value of g at the surface of the earth = $9.8ms^{-2}$.

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30. How far away from the surface of earth does the acceleration due to gravity become 4% of its value on the surface of earth ? $[R_e = 6400km]$

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31. Find the value of g at a height of 400 km above the surface of the earth . Given radius of the earth , R = 6400 km and value of g at the surface of the earth = $9.8ms^{-2}$.

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32. Calculate the depth below the surface of the earth where acceleration due to gravity becomes half of its value at the surface of the earth . Radius of the earth = 6400 km.

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33. How much below the surface of the earth does the acceleration due to gravity become 70% of its value at the surface of the earth ? Radius of the earth is 6400 km

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34. How much below the surface of the earth does the acceleration due to gravity (i) reduced to 36% (ii) reduces by 36% , of its value on the surface of the earth ? Radius of the earth = 6400 km .

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35. How much above the surface of the earth does the acceleration due to gravity reduce by 36% of its value on the surface of the earth.

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

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

.

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38. Calculate the value of acceleration due to gravity at a place of latitude 45° . Radius of the earth = 6.38×10^3 km .

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39. If the earth stops rotating about its axis , then what will be the change in the value of g at a place in the equitorial plane ? Radius of the earth = 6400 km.

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40. Assuming that the whole variation of the weight of a body with its position on the surface of the earth is due to its rotation , find the difference in the weight of 5 kg as measured at the equator and at the poles . Radius of the earth = 6.4×10^6 m.

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41. How many times faster than its present speed the earth should rotate so that the apparent weight of an object at equator becomes zero ? Given radius of the earth = 6.37×10^6 m . What would be the duration of the day in that case ?

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

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43. The distance between the earth and the moon is 3.85×10^8 metre. At what point in between the two will the gravitational field intensity be zero ? Mass of the earth is $= 6.0 \times 10^{24}$ kg, mass of the moon $= 7.26 \times 10^{22}$ kg

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44. Two bodies of masses $100kg$ and $1000kg$ are at a distance $1.00m$ apart.Calculate the gravitational field intensity and the potential at the middle point of the line joining them

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45. A satellite revolves in an orbit close to the surface of a planet of mean density $5.51 \times 10^3 kgm^{-3}$. Calculate the time period of satellite.

Given $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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46. The mass of the earth is $6 \times 10^{24} kg$. The distance between the earth and the sun is 1.5×10^{11} m. If the gravitational force between the two is 3.5×10^{22} N, what is the mass of the Sun ? Use $G = 6.7 \times 10^{-11} N. m^2 kg^{-2}$ gt

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47. 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.

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48. Find the work done to bring 4 particles each of mass 100 gram from large distances to the vertices of square of side 20 cm.

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49. Find the velocity of escape at the moon. Given that its radius is 1.7×10^{6} m and the value of 'g' is $1.63 ms^{-2}$.

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50. The mass of Jupiter is 1.91×10^{36} kg and its diameter is 13.1×10^{7} m. Calculate the escape velocity on the surface of

Jupiter.

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51. If Earth has mass nine times and radius twice that of the planet Mars, calculate the velocity required by a rocket to pull out of the gravitational force of Mars. Take escape speed on surface of Earth to be $11.2 km / s$

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52. The escape speed of a projectile on the earth's surface is 11.2 km s^{-1}. A body is projected out with thrice this speed. What is the speed of the body far away from the earth? Ignore the presence of the sun and other planets.

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53. Find the velocity of escape from the sun, if its mass is 1.89×10^{30} kg and its distance from the earth is 1.59×10^{8} km. Take G $= 6.67 \times 10^{-11} Nm^2 kg^{-2}$

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54. 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 $G = 6.67 \times 10^{-11} N - m^2 / kg^2$.

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55. A body of mass $50kg$ falls on the earth from infinity. What will be its velocity on reaching the earth? What will be its KE ? Take radius of the earth $= 6.4 \times 10^6 m, g = 10ms^{-2}$. Air friction is neglected.

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56. A satellite of mass m is orbiting around the earth at a height equal to twice the radius of the earth (R). Its potential energy is given by

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57. The orbit of a geostationary satellite is concentric and coplanar with the equator of Earth and rotates along the direction of rotation of Earth. Calculate the height and speed. Take mass of Earth $= 6 \times 10^{-11} Nm^2 kg^{-2}$. Given $\pi^2 = 10$.

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58. A satellite revolves round a planet in an orbit just above the surface of planet. Taking $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$ and the mean density of the planet $= 8.0 \times 10^3 kgm^{-3}$, find the period of satellite.

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59. An artifical satellitee of mass $100 kg$ is in a circular orbit at $500 km$ above the Earth's surface. Take redius of Earth as $6.5 \times 10^6 m$.(a) Find the acceleration due to gravity at any point along the satellite path (b) What is the centripetal acceleration o fthe satellite?

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60. An artifical satellitee of mass $100kg$ is in a circular orbit at $500km$ above the Earth's surface. Take redius of Earth as $6.5 \times 10^6 m$.(a) Find the acceleration due to gravity at any point along the satellite path (b) What is the centripetal acceleration o fthe satellite?

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

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62. A rocket is launched vetically from the surface of the earth with an initial velocity of 10 kms^{-1}. How for above the surface of the earth would it go ? Radius of the earth =6400 km and $g = 9.8 ms^{-2}$.

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63. A satellite orbits the earth at a height of 400 km, above the surface. How much energy must be expended to rocket the satellite out of the earth's gravitational influence ? Mass of the satellite=200 kg, mass of the earth=6.0×10^{24}kg, radius of the earth=$6.4 \times 10(6)$m, G=$6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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64. A body is to be projected vertically upwards from earth's surface to reach a height of $9R$, where R is the radius of earth. What is the velocity required to do so? Given $g = 10 ms^{-2}$ and radius of earth $= 6.4 \times 10^6 m$.

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65. The energy required to move an earth satellites of mass m from a circular orbit of radius 2 R to a radius 3 R is (R is radius of the earth)

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66. If the distance of venus from sun is 0.73 AU, find out the orbital period of the venus in days.

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67. If the earth be one half its present distance from the sun, how many day will the present one year on the surface of earth will change?

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68. The distance of planet Jupiter from the Sun is 5.2 times that of the earth. Find the period of revolution of Jupiter around the Sun.

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69. The planet neptune travels around the sun with a period of 165 yr. What is the radius of the orbit approximately, if the orbitt is considered as circular ?

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

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71. The mean radius of the earth's orbit around the sun is $1.5 \times 10^{11} m$ and that of the orbit of mercury is $6 \times 10^{10} m$. The mercury will revolve around the sun is nearly

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

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

A. $1:1$

B. $1:10$

C. $1:100$

D. $2:1$

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74. Two balls, each of radius R, equal mass and density are placed in contact, then the force of gravitation between them is proportional to

A. Fprop $\frac{1}{R^2}$

B. $F \propto R$

C. $F \propto R^4$

D. $F \propto \frac{1}{R}$

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75. There are two bodies of masses 1kg and 100 kg separated by a distance 1 m. At what distance from the smaller body, the intensity of gravitational field will be zero?

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

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

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

D. $\frac{10}{11}m$

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76. 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. $11GMm/R^2$

B. $14GMm/R^2$

C. $GMm/2R^2$

D. GMm/R^2

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77. Three particles each of mass m are kept at vertices of an equilateral triangle of side L. The gravitational field at centre due to these particle is

A. zero

B. $3G\frac{M}{L^2}$

C. $9G\frac{M}{L^2}$

D. $12G\frac{M}{S}qrt3L^2$

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

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

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

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

D. $\dfrac{m_1 + m_2}{(r_1 + r_2)^2}$

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79. A point mass m is placed inside a spherical shell of radius R and mass M at a distance $\dfrac{R}{2}$ form the centre of the shell.

The gravitational force exerted by the shell on the point mass is

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

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

C. zero

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

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80. Acceleration due to gravity ' g ' for a body of mass ' m ' on earth's surface is proportional to (Radius of earth= R , mass of earth= M

A. M / R^2

B. m

C. mM

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

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

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

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

C. MR^2

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

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82. If the mass of the earth is 80 times of that of moon and its diameter is double that of moon and g on earth is $98m/\sec^2$,then the value of g on moon is

A. $0.98m/s^2$

B. $0.49m/s^2$

C. $98m/s^2$

D. $4.9m/s^2$

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83. If R is the radius of a planet and g is the acceleration due to gravity, then the mean density of the planet is given by

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

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

C. $\frac{4\pi GR}{3G}$

D. $3\frac{g}{4}\pi GR$

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

A. $20m / s^2$

B. $10 m//s^2$

C. $5 m//s^2$

D. $2.5 m//s^2$

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85. 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. increases by 1%

B. decreases by 1%

C. increases by 2%

D. decreases by 2%

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

A. 3R

B. $\sqrt{2}R$

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

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

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87. A man standing on an international space station, which is orbiting earth at an altitude $520km$ with a constant speed $7.6km/s$. If the man's weight is $50kg$, there acceleration due to gravity is (radius of earth is $6400km$ and value of g on earth is $9.8m/s^2$).

A. $7.6km/s^2$

B. $7.6km/s^2$

C. $8.4m/s^2$

D. $10m/s^2$

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

A. 880N

B. 889N

C. 885N

D. 892 N

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89. If g denotes the value of acceleration due to gravity at a point distance r from the centre of earth of radius R. If

$r < R$, then

A. gprop$\frac{1}{r^2}$

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

C. gprop r

D. g prop r^2

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90. Find ratio of acceleration due to gravity g at depth d and at height h where $d = 2h$

A. 1

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

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

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

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91. Assuming earth to be a sphere of a uniform density, what is the value of gravitational acceleration in mine 100km below the earth's surface (Given $R = 6400km$)

A. $9.66ms^{-2}$

B. $5.06ms^{-2}$

C. $7.64ms^{-2}$

D. $3.10ms^{-2}$

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92. When a body is taken from the equator to the poles, its weight

A. increases

B. decreases

C. remain the same

D. increases at south pole and decreases at north pole

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93. Acceleration due to gravity

A. decreases from equator to poles

B. decreases from poles to equator

C. is maximum at the centre of the earth

D. is maximum at the equator

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94. If the earth stops rotating, the value of ' g ' at the equator will

A. increases

B. decreases

C. no effect

D. none of the above

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95. If earth is supposed to be sphere of radius R, if g_{20} is value of acceleration due to gravity at latitude of 30° and g at the equator, then value of $g - g_{30^{\circ}}$ is

A. $\frac{1}{4}\omega^2 R$

B. $\frac{3}{4}\omega^2$ R

C. ω^2 R

D. $\frac{1}{2}m\omega$ R

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96. 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. $3.85 \times 10^{7} m$

C. $8 \times 10^{8} m$

D. $3.46 \times 10^{8} m$

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97. If V is the gravitational potential on the surface of the earth, then what is its value at the centre of the earth ?

A. 2V

B. 3V

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

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

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

B. 2mgr

C. mgR

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

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99. A particle falls towards the earth from inifinity. The velocity with which it reaches the earth is surface is

A. infinity

B. $\sqrt{2}gR$

C. $2\sqrt{g}R$

D. Zero

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100. A thin rod of mass m and length l is hinged at the lower end to a level floor and stands vertically. Then its upper end will strike the floor with a velocity given by:

A. $\sqrt{2}gl$

B. $\sqrt{5}gl$

C. $\sqrt{3}gl$

D. $\sqrt{m}gl$

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101. The velocity with which a projectile must be fired so that it escape earth's gravitational does not depend on

A. mass of the earth

B. mass of the projectile

C. radius of orbit

D. universal gravitational constant G

Watch Video Solution

102. The escape velocity of a projectile from the earth is approximately

A. $7km/\sec$

B. $11.2km/\sec$

C. $112km/\sec$

D. $1.2km/\sec$

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

A. $22km^{-1}$

B. $11kms^{-1}$

C. `11sqrt2kms^-1

D. $\frac{11}{\sqrt{2}}kms^{-1}$

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

A. $0.0112kms^{-1}$

B. $0.112kms^{-1}$

C. $11.2kms^{-1}$

D. $0.56kms^{-1}$

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105. Escape velocity from a planet is underset (e)(v). If its mass is increased to 8 times and its radius is increased to 2 times , then the new escape velocity would be

A. v_e

B. $\sqrt{2}v_e$

C. $2v_e$

D. $2\sqrt{v}_e$

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106. The escape velocity from the earth is $11.2k\frac{m}{s}$. another planet is having mass 1000times and radius 10 times that of earth, then escape velocity at that planet will be

A. $11.2km/s$

B. $112km/s$

C. $1.12km/s$

D. $1120 km / s$

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107. Mass of moon is $1/81$time that of earth and its radius is $1/4$ the earth's radius. If escape velocity at surface of earth is $11.2k\frac{m}{s}$, then its value at surface of moon is

A. $0.14 km / s$

B. $2.5 km / s$

C. $0.5 km / s$

D. $5 km / s$

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108. the escape velocity on a planet is v. if the radius of the planet contracts to $\frac{1}{4}$ of the present value without any change in its mass, the escape velocity will be

A. halved

B. doubled

C. quadrupled

D. one-fourth

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109. The escape velocity from earth is v_{es}. A body is projected with velocity $2v_{es}$ with what constant velocity will it move in the inter planetary space

A. $v_e s$

B. $3v_e s$

C. $\sqrt{3}v_e s$

D. $\sqrt{5}v_e s$

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110. To required kinetic energy of an object of mass m, so that it may escape, will be

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

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

C. mgR

D. 2mgR

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111. A satellite revolves very near to the earth surface. Its speed should be around

A. $5km / s$

B. $8km / s$

C. $2km / s$

D. $11km / s$

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112. The value of escape velocity on a certain planet is 2 km/s. Then the value of orbital speed for a satellite orbiting close to its surface is

A. $12km/s$

B. $1km/s$

C. $\sqrt{2}km/s$

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

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113. A ball is dropped from a spacecraft revolving around the earth at a height of $1200km$. What will happen to the ball ? .

A. it will go very far in the space

B. it will move with the same speed tangentially to the spacecraft

C. it will fall down to the earth gradually

D. it will continue to move with the same speed along the original orbit of spacecraft

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114. Two satellites P and Q are in the same circular orbit round the earth. The mass of Pis greater than that Q. It follows that

A. the speed of P is equal to that of Q

B. the speed of P is greater than that of Q

C. the speed of P is less than that of Q

D. the kinetic energy of P is equal to that of Q

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115. Two satellites of masses m_1 and $m_2(m_1 > m_2)$ are revolving around earth in circular orbits of radii r_1 and $r_2(r_1 > r_2)$ respectively. Which of the following statements is true regarding their velocities V_1 and V_2

A. $v_j > v_2$

B. $v_1 < v_2$

C. $v_x = v_2$

D. $v_1 l r_1 > v_2 l r_2$

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116. A body is projected from earth's surface to become its satellite, its time period of revolution will not depend upon

A. mass of earth

B. its own mass

C. gravitational constant

D. radius of earth

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117. The time period of a satellite is related to the density of earth (p) as

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

B. ρ

C. $\rho^{-\left(\frac{3}{2}\right)}$

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

Watch Video Solution

118. A satellite is in a circular orbit round the earth at an altitude R above the earth's surface, where R is the radius of the earth. If g is the acceleration due to gravity on the surface of the earth, the speed of the satellite is

A. $\sqrt{2}Rg$

B. $\sqrt{Rg}$

C. $\sqrt{Rg/2}$

D. $\sqrt{Rg/4}$

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119. A satellite of mass m is placed at a distance r from the centre of earth (mass M). The mechanical energy of the satellite is

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

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

C. $\frac{GMm}{2r}$

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

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120. The total energy of a satellite is E. What is its P.E. ?

A. 2E

B. $-2E$

C. E

D. $-E$

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121. Two satellite A and B , ratio of masses $3:1$ are in circular orbits of radii r and 4 r . Then ratio of total mechanical energy of A to B is

A. $1:3$

B. $3:1$

C. $3:4$

D. $12:1$

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122. Potential energy of a satellite having mass m and rotating at a height of $6.4 \times 10^6 m$ from the earth surface is

A. $-mgR_e$

B. $-0.5mgR_e$

C. $-0.67mgR_e$

D. $-0.33mgR_e$

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123. The minimum energy required to launch a m kg satellite from earth's surface in a circular orbit at an altitude of 5R, R is the radius of earth, will be

A. $3mgR$

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

C. $2mgR$

D. $\frac{5}{12}mgR$

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124. Kepler discovered

A. laws of motion

B. laws of rotational motion

C. laws of planetary motion

D. laws of curvilinear motion

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125. According to Kepler's laws, which of the following is correct ?

A. $T \propto R^{\frac{3}{2}}$

B. $T \propto R^3$

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

D. $T \propto R^2$

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126. Which of the following quantities does not depend upon the orbital radius of the satellite

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

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

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

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

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127. A satellite is orbiting around the earth with orbital radius R and time period T. The quantity which remains constant is

A. T/R

B. T^2/R

C. T^2/R^2

D. T^2/R^3

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128. What is not conserved in the case of celestial bodies revolving around sun?

A. kinetic energy

B. mass

C. angular momentum

D. linear momentum

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129. If Gravitational constant is decreasing in time, what will remain unchanged in case of a satellite orbiting around earth

A. time period

B. orbiting radius

C. areal velocity

D. angular velocity

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130. A satellite is moving on a circular path of radius r around earth has a time period T. if its radius slightly increases by Δr, determine the change in its time period.

A. $\frac{3}{2}\left(\frac{T}{r}\right)\Delta r$

B. $\left(\frac{T}{r}\right)\Delta r$

C. $\frac{3}{2}\left(\frac{T^2}{r^2}\right)\Delta r$

D. none of these

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

A. 8 times

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

C. 4 times

D. $\frac{1}{8}\times$

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132. Satellite is revolving around earth. If its height is increased to four times the height of geostationary satellite, what will become its time period ?

A. 8 days

B. 4 days

C. 2 days

D. 16 days

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133. 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. 4 days

B. $2\sqrt{2}days$

C. 16 days

D. 64 days

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134. 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. 4sqrt8`

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135. If a new planet is discovered rotating around Sun with the orbital radius double that of earth, then what will be its time period (in earth's days)

A. 1032

B. 1023

C. 1024

D. 1043

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136. The period of a planet around Sun is 27 times that of Earth. The ratio of radius if planet's orbit to the radius of Earth's orbit is:

A. 4

B. 9

C. 64

D. 27

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137. A planet moves around the Sun. It is closest to Sun at a distant d_1 and has velocity v_1 and farthest with distance d_2, its speed at this point will be:

A. $d_1^2 \frac{v_1}{d_2^2}$

B. $d_2 \frac{v_1}{d_1}$

C. $d_1 \frac{v_1}{d_2}$

D. $d_2^2 \frac{v_1}{d_1^2}$

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138. A satellite moves in elliptical orbit about a planet. The maximum and minimum velocities of satellites are$3 \times 10^4 \frac{m}{s}$ and $1 \times 10^3 \frac{m}{s}$ respectively What is the minimum distance of satellite from planet if maximum distance is $4 \times 10^4 km$?

A. $4 \times 10^3 km$

B. $3 \times 10^3 km$

C. $\frac{4}{3} \times 10^3 km$

D. $1 \times 10^3 km$

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139. The maximum and minimum distance of a comet form the sun are $8 \times 10^{12} m$ and $1.6 \times 10^{12} m$. If its velocity when nearest to the sun is $60 m/s$, what will be its velocity in m/s when it is farthest

A. 12

B. 6

C. 112

D. 60

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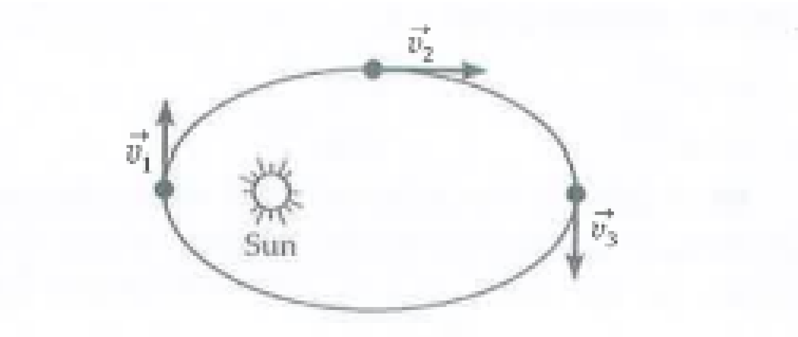
140. Figure shows the velocity of a planet revolving around the sun at three times of a year. Let v be the speed of the planet when its velocity is $\vec{v}$ Which of the following alternatives is correct?



A. $v_2 = 2v_1$ and $v_3 = 3v_1$

B. $v_3 > v_2 > v_1$

C. $v_2 = v_1 + v_3 / 2$

D. $v_1 > v_2 > v_3$

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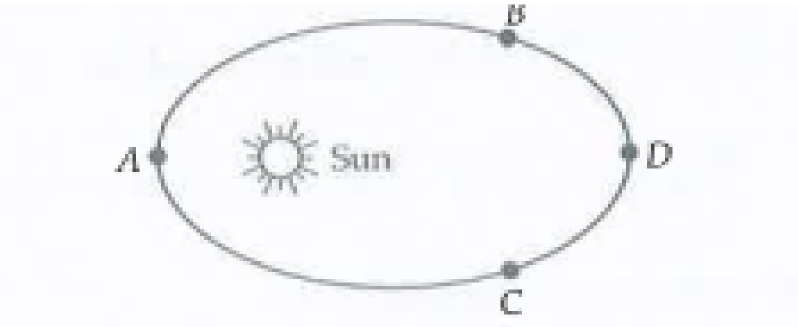
141. The maximum rotational kinetic energy of a planet moving around the sun is at position



A. A

B. B

C. D

D. C

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142. If radius of the earth is reduced, then

A. time duration is reduced

B. earth rotates slower

C. time period of earth decreases

D. duration of day increases

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

A. $2 \cdot 4r_e$

B. $3 \cdot 6r_e$

C. $4 \cdot 8r_e$

D. $6 \cdot 6r_e$

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144. Choose the correct statement from the following :

Weightlessness of an astronaut moving in a satellite is a situation of

A. zero

B. no gravity

C. zero mass

D. free fall

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145. Geostationary satellite :-

A. falls with g towards the earth

B. has period of 24h

C. has equatorial orbit

D. all the above

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

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

B. $6v$

C. $12v$

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

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147. 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

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148. Statement-1: A black hole is an example of a perfectly black body.

Statement-2: A perfectly black body absorbs every kind of radiation incident on it.

A. super surface of atmosphere

B. ozone layer

C. super dense planetary material

D. none of the above

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149. The law of gravitation is strictly true for....

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150. The gravitational force between two bodies is ....the presence of other bodies.

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151. A : The gravitational force does not depend on the intervening medium .

R : The value of G has same value anywhere in the space

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152. The gravitational force is a force and has .... symmetry.

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153. Does Coulomb's law of electric force obey Newton's third law of motion ?

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154. The value of G does not depend on the .... and ....of the masses.

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155. The force of attraction between two balls each of mass 1 kg when their centres are 10 cm apart is ....

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156. The value of G was first determined experimentally by English scientist ....

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157. The acceleration due to gravity _____ with an increases in height and depth.

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158. The acceleration due to gravity is _____ at the surface of the earth and ____ at the centre of the earth.

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159. The acceleration due to gravity at a height h above the surface of the earth has the same value as that at depth d= ____below the earth surface.

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160. At what height above the earth's surface, the value of g is same as in mine 80 km deep?

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161. Acceleration due to gravity at the centre of the earth is :-

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162. The acceleration due to gravity ____ with an increases in height and depth.

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163. The effect of rotation of the earth on the value of g is ____ at the equator and ____ at the poles.

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164. If the mass of the earth remains constant but the diameter of the earth becomes two times its present value, then the weight of a person weighing 80 kg - wt, would be

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165. If the diameter of the earth becomes half its present value but its average density remains unchanged, then the weight of the object on the surface of the earth will be _____

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

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167. 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 .

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168. The gravitational potential energy of mass m at a distance r in the gravitational field of mass M is_____.

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169. The intensity of gravitational field is___quantity and its SI unit is.

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170. The time period of a simple pendulum at the centre of the earth is

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171. Gravitational intensity at a point is equal to the negative of____at that point.

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172. When a body is brought closer to the earth, its gravitational potential energy_____.

Watch Video Solution

173. ______at a point is the amount of work done in bringing a body of unit mass from infinity to that point.

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174. Gravitational potential is a___ quantity and its SI unit is___.

Watch Video Solution

175. Gravitational P.E. =_____ $\times$ mass.

Watch Video Solution

176. Compare the minimum velocity with which a particle must be projected vertically upwards from the surfaces of the earth in order that it may never return to the earth with that which is needed to make it escape from the earth ' s gravitational field .

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177. The escape velocity of an object projected from the surface of a given planet is independent of

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178. The escape velocity of a body does not depend on the mass of the body.

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179. If the escape velocity on the earth is $11.2km - s^{-1}$, its value for a planet having double the radius and 8 times the mass of earth is

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180. Orbital velocity of a satellite around a planet is independent of the mass of the ____ but depends on the mass of the .

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181. Orbital velocity of an artificial satellite does not depend upon

Watch Video Solution

182. If v_0 be the orbital velocity of a satellite in a circular orbit close to the earth's surface and v_e is the escape velocity from the earth , then relation between the two is

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183. The orbital period of revolution of an artificial satellite revolving in a geostationary orbit is ____.

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

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185. The height of a geo-stationary satellite above the centre of the earth is (in KM)

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186. The distance of two planets from the sun are $10^{12}m$ and $10^{10}m$ respectively. Then the ratio of their time periods is

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187. 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

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188. According to Kepler's second law, the radius vector to a planet from the Sun sweeps out equal areas in equal intervals of time. This law is a consequence of the conservation of ____________.

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189. Gravitational force between two bodies exist

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190. Spheres of the same material and same radius r are touching each other. Show that gravitational force between them is directly proportional to r^4.

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191. Is it possible to shield a body from gravitational effects?

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192. Assertion : We can not move even a finger without disturbing all the stars.

Reason : Every body in this universe attracts every other body with a force which is unversely proportional to the square of distance between them.

Watch Video Solution

193. Escape velocity from the moon surface is less than that on the earth surface, because

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194. 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.

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195. Why do different planets have different escape speeds?

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196. Does a rocket really need the escape speed of $11.2km/s$ initially to escape from the Earth?

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197. Lighter gases H_2, He, etc., are rare in the atmosphere of the earth.

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198. The linear speed of a planet around the sun is not constant in its orbit. Comment.

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

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200. Two satellites of masses 3 m and m orbit the earth in circular orbits of radii r and 3 r respectively. The ratio of the their speeds is

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

Reason: There is no gravitational force on the satellite.

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202. A person in an artificial satellite of Earth feels weightlessness. But a person on the Moon has weight though the Moon is also a satellite of the Earth. Why?

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203. Let g be the acceleration due to gravity on the earth's surface.

(a)	At the centre of the earth	(p)	4g
(b)	At a height R above the earth's surface	(q)	0
		(r)	g / 4

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204.

(a)	Gravitational field intensity	(p)	$-\frac{GMm}{r}$
(b)	Gravitational potential energy	(q)	$-\frac{GM}{r}$
(c)	Gravitational potential	(r)	$\frac{GM}{r^2}$

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205. For a satellite of mass m revolving around the earth of mass M in an orbit of radius r.

(a)	Potential energy	(p)	$-\frac{GMm}{2r}$
(b)	Kinetic energy	(q)	$-\frac{GMm}{r}$
(c)	Total energy	(r)	$\frac{1}{2}\frac{GMm}{r}$

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206. MATCH THE QUESTIONS:

(a)	Geocentric model of planetary motion	(p)	Copernicus
(b)	Heliocentric model of planetary motion	(q)	Keplar
(c)	Laws of planetary motion	(r)	Ptolemy

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207. Distinguish between gravitational and gravity.

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208. What do you mean by free fall?

Watch Video Solution

209. State and explain Newton's law of gravitation.

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210. How does the force of attraction between the two bodies depend upon their masses and distance between them ? A student thought that two bricks tied together would fall faster than a single one under the action of gravity. Do you agree with his hypothesis or not ? comment.

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211. On Earth value of $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

What is its value on Moon, where g is nearly one-sixth than that of Earth?

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212. What is the dimensional formula of gravitational constant ?

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213. STATEMENT -1 : In absence of air friction, it is claimed that all object fall with the same acceleration although, a heavier object is pulled towards the earth with more force than a lighter object.

because

STATEMENT-2 : Net external force is always equal to rate of change of linear momentum.

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214. What is the value of 'g' at the centre of Earth ?

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215. Distinguish between g and G.

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216. Which is scalar and which is vector amongst g and G ?

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217. Name the scientist who first determined the value of G experimentally.

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218. Name the apparatus used for the experimental determination of G.

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219. The action and reaction forces referred to Newton's third law of motion

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220. The gravitational force between two bodies is 1 N. If the distance between them is doubled, what will be the force ?

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221. Does the acceleration with which a body falls towards the centre of the earth depend on mass of the body ?

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222. Calculate the force of attraction between two balls each of mass 10kg when their centres are 10 cm apart. The value of gravitational constant $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$

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223. The distance of Pluto from the sun is 40 times the distance of earth. If the masses of earth and Pluto be equal, what will be ratio of gravitational forces of sun on these planets ?

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224. Derive an expression for the acceleration due to gravity at a depth d below the Earth's surface.

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225. Write an equation for the mean density of the earth.

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226. The gravitational force acting on a rocket at a height h from the earth's surface is $\frac{1}{3}$ rd of the force acting on a body at sea level. What is relation between h and R_e (radius of the earth) ?

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227. The mass and diameter of a planet have twice the value of the corresponding parameters of earth. Acceleration due to gravity on the surface of the planet is

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228. What is the mass of a body that weighs 1 N at a place where $g = 9.80 ms^{-2}$. what is its mass?

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229. How much is the torque due to gravity on a body about its centre of mass ?

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230. Which is greater - the attraction of earth for 1 kg of iron or attraction of 1 kg of iron for the earth ? Give reason.

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231. Why do different planets have different escape speeds?

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232. (a) What are the SI units of G? (b) on what factors does the value of G depend ?

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233. What is the effect of altitude on acceleration due to gravity ?

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234. There is no effect of rotational motion of earth on the value of g at

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235. If accelerations due to gravity at a height h and at a depth d below the surface of the earth are equal, how are h and d related ?

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236. The value of g on the Moon is $1/6$th of that of Earth. If a body is taken from the Earth to the Moon, then what will be the change in its (i) weight, (ii) intertial mass and (iii) gravitational mass?

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237. The time period of a simple pendulum at the centre of the earth is

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238. Why does a body lose weight at the centre of the earth?

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239. A body of mass 5 kg is taken to the centre of the earth. What will be its mass there ?

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240. If a man goes from the surface of Earth to a height equal to the radius of the Earth, then what will be his weight relative to that on the Earth? What if he goes equally below the surface of Earth?

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241. The Earth is acted upon by the gravitational force of attraction due to the sun. They why does the Earth not fall towards sun?

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242. If the Earth stops rotating about its polar axis, what will be the effect on the value of acceleration due to gravity 'g' ? Will this effect be same at all places?

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243. If the earth were to spin faster, acceleration due to gravity at the poles :

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244. What is the moment of the gravitational force of the sun on earth about the axis of its rotation about the sun ?

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245. What is the gravitational potential energy of a body of mass m at a height h ?

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246. What is the work done in bringing a body of mass m from infinity to the surface of Earth of radius R and mass m?

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247. What is the unit of intensity of the gravitational field ?

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248. What is the value of gravitational potential energy at infinity ?

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249. What is the value of gravitational intensity at the surface of Earth and at the Earth's centre?

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250. What is the relation between gravitational intensity and gravitational potential at a point?

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251. Why is gravitational potential energy negative?

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252. The gravitational potential energy at 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 ?

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253. From where does a satellite revolving around a planet get the required centripetal force?

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254. The escape velocity of a rocket launched from the surface of the earth

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255. What do you underestand by orbital velocity ? Derive an expression for the orbital velocity of a satellite.

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256. How does the orbital velocity of a satellite depend on the mass of the satellite ?

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257. A small satellite is revolving near earth's surface. Its orbital velocity will be nearly

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258. What are the values of the escape velocities for the moon and the sun respectively ?

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259. Which has greater value of escape velocity-Mercury or Jupiter ?

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260. The escape velocity of a body depeds upon mass as

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261. Why does hydrogen escape from the earth's atmosphere more readily than oxygen ?

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262. does speed of satellite remain constant in an orbit ? Explain.

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263. A satellite revolving around the earth loses height. What happens to its time period?

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264. If the kinetic energy of a satellite orbiting around the earth is doubled then

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265. If the escape velocity on the earth is $11.2 km / s$, its value for a planet having double the radius and 8 times the mass of the earth is ...... (in Km / s)

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266. A geosynchronous satellite is

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267. What is a parking orbit ?

Watch Video Solution

268. What is period of revolution ?

Watch Video Solution

269. A geostationary satellite

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270. The centripetal force on a satellite revolving around the Earth is F. What is the gravitational force due to Earth on it ? Net force?

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271. What do you observe on seeing the slides showing reproduction in amoeba? What is the name given to this method of reproduction in Amoeba?

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272. What is the angular velocity of a geostationary satellite in radian per hour ?

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

Watch Video Solution

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

Watch Video Solution

275. A body lying on the surface of planet Venus has gravitational potential energy equal to $-7.5 \times 10^{6} J$. How much energy will be required for the body to escape from the planet ?

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276. Two artificial satellites one close to the surface and the other away, are revolving around the earth. Which one has larger speed?

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277. Write two conditions for the existence of atmosphere on a planet.

Watch Video Solution

278. What do you understand by geostationary and polar satellite ? Discuss their important uses.

Watch Video Solution

279. What would happen to an artificial satellite, if its orbital velocity is slightly decreased due to some defects in it?

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280. Time period of a simple pendulum in a freely falling lift will be

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281. State Kepler's 2nd law of planetary motion.

Watch Video Solution

282. Newton's law of gravitation

Watch Video Solution

283. A simple pendulum is inside a space craft. What should be its time period of vibration ?

Watch Video Solution

284. Why is gravitational potential energy negative?

Watch Video Solution

285. What do you understand by geostationary and polar satellite ? Discuss their important uses.

Watch Video Solution

286. What is full form of geostationary satellite APPLE ?

Watch Video Solution

287. The kinetic energy needed to project a body of mass m from the earth surface (radius R) to infinity is

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288. What is gravitational force ?

Watch Video Solution

289. Define universal gravitational constant.

Watch Video Solution

290. The weight of a body at the centre of the earth is

Watch Video Solution

291. Where does a body weigh more – at the surface of the earth or in a mine?

Watch Video Solution

292. If 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 it (both h and d are much smaller than the radius of the earth), then

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293. 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

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294. The distance of two plenets from the sun are $10^{11}m$ and $10^{10}m$ respectively. What is the ratio of time period of these two planets ?

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295. Name India's first cosmonaut.

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296. An astronaut inside a satellite is in a state of weightlessness because of the effect of

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297. A geostationary satellite

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298. State Newton's law of gravitation. Hence define universal gravitational constant. Give the value and dimensions of G.

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299. What is the relation between gravitational intensity and gravitational potential at a point?

Watch Video Solution

300. Define gravitational potential energy.

Watch Video Solution

301. Define gravitational potential.

Watch Video Solution

302. What is the relation between gravitational intensity and gravitational potential at a point?

Watch Video Solution

303. The escape velocity of a rocket launched from the surface of the earth

Watch Video Solution

304. What happens to a body when it is projected vertically upwards from the surface of the earth with a speed of $11200\frac{m}{s}$, ? Compare escape speeds for two planets of masses M and 4M and radii 2R and R respectively.

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305. A satellite revolving around the earth is

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306. What is binding energy of a satellite?

Watch Video Solution

307. State Joule's law of heating and give its mathematical form. An electric iron takes a current of 5A and develops $1.5 \times 10^4 J$ of heat energy in 30 s. Calculate the resistance of the electric iron.

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308. According to Kepler's second law, the radius vector to a planet from the Sun sweeps out equal areas in equal intervals of time. This law is a consequence of the conservation of ____________.

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309. KEPLERS THIRD LAW

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310. Two bodies of masses M and m are allowed to fall from the same height . If air resistance for each body be same , will the two bodies reach the ground simultaneously ?

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311. State the universal law of gravitation. Establish the relationship $M_e = gR_e^2/G$, where M_e and R_e are the mass and radius of the earth respectively

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312. Define acceleration due to gravity. Derive expression of 'g' from the surface of the earth.

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313. At which depth from earth surface acceleration due to gravity is decreased by 1%

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314. What is the effect of latitude of 'g'?

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315. What do you understand by 'g'. Discuss the variation of g with rotation of earth after establishing a relation for the same.

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316. Define the term gravitational field.

Watch Video Solution

317. What is meant by gravitational field strength ?

Watch Video Solution

318. Which of the planets of the solar-system has the greatest gravitational field strength ?

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319. What is the gravitational field strength of a planet where the weight of a 60kg astronaut is 300N?

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320. Define escape velocity.

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321. The escape velocity from the surface of the earth is V_e. The escape velcotiy from the surface of a planet whose mass and radius are three times those of the earth, will be

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

(i) the mass of the body.

(ii) the location from where it is projected.

(iii) the direction of projection.

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

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323. The escape velocity of a rocket launched from the surface of the earth

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324. A block hole is a body from whose surface nothing may even escape. What is the condition for a uniform spherical body of mass M to be a block hole? What should be the radius of such a black hole if its mass is nine times the mass of the earth?

Mass of earth $= 6 \times 10^{24} kg$,

$G = 6.61 \times 10^{-11} Nm^2 kg^{-2}$.

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325. Define orbital velocity. Derive an expression for the orbital velocity of a satellite revolving around a planet

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326. The height (in km) of the orbit above the surface of the earth in which a satellite, if placed, will appear stationary is

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327. State Newton's third law of motion and principle of conservation of momentum.

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328. Two satellites are at different heights from the surface of earth. Which would have greater velocity?

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329. Express escape velocity in terms of g and R.

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330. State Kepler's laws of planetary motion.

Watch Video Solution

331. Suppose there existed a planet that went around the sun twice as fast as the earth. What would by its orbital size?

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332. An astronaut inside a satellite is in a state of weightlessness because of the effect of

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333. COMPARISION OF INERTIAL MASS AND GRAVITATIONAL MASS

Watch Video Solution

334. State and explain Newton's law of gravitation.

Watch Video Solution

335. What do you understand by 'g'. Discuss the variation of g with rotation of earth after establishing a relation for the same.

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336. Obtain an expression for the acceleration due to gravity on the surface of the earth in terms of mass of the earth and its radius. Discuss the variation of acceleration due to gravity with altitude and depth. If a body is taken to a height R / 4 from the surface of the earth, find percentage decrease in the weight of the body ? Here R is the radius of the earth.

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337. Derive an expression for the acceleration due to gravity at a depth d below the Earth's surface.

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338. At what height above the earth's surface, the value of g is same as in mine 80 km deep?

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339. Using the law of conservation of energy, obtain the expression for the escape velocity.

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340. Define escape velocity.

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

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342. Statement I : Escape velocity of a tennis ball from the surface of earth is the same as the escape velocity of a cricket ball from the surface of earth. Statement II : Escape velocity of a body is independent of the mass of the body

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343. What do you underestand by orbital velocity ? Derive an expression for the orbital velocity of a satellite.

Watch Video Solution

344. Deduce the law of gravitation from Kepler's laws of planetary motion

Watch Video Solution

345. 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. (would decrease

B. (would remain unchanged

C. (would increase

D. (cannot be predicted

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346. A simple pendulum has a time period T_1 when on the earth's surface and T_2 when taken to a height R above the earth's surface, where R is the radius of the earth. The value of $\frac{T_2}{T_1}$ is

A. (1

B. (#

C. 4

D. 2

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347. If the distance between the earth and the sun were half its present value, the number of days in a year would have been

A. 64.5

B. 129

C. 182.5

D. 730

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348. A geo-stationary stellite orbits around the earth in a circular orbit of radius 36,000km. Then, the time period of a spy stellite orbitting a few hundred km above the earth's surface $(R_{earth} = 6400 km)$ will approximately be

A. $0.2 / h$

B. 1h

C. 2h

D. 4h

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349. A binary star system consists of two stars A and B which have time period T_A and $T_B, radius R_B a$ and mass M_a and M_B. Then

A. (if $TA > Tb$, then RA gt Rg

B. (if TA gtTb, then MA gt MB

C. $\left(\left(\frac{T}{(T)^2} = \left(\left(\frac{R}{(R_{\square})^V}\right.\right.\right.\right.$

D. (TA=TB

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

A. (6A/2 hours

B. (6 hours

C. (6\/3 hours

D. (J 0 hours

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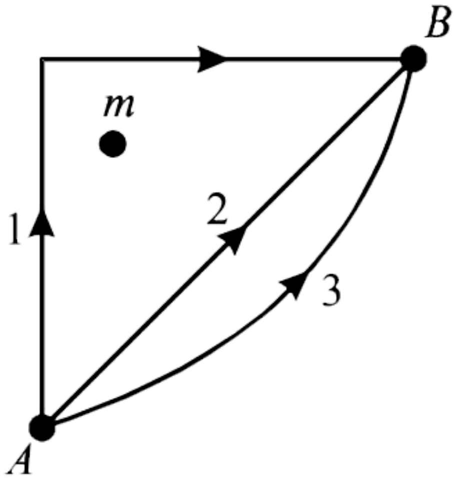
351. If $W_1 W_2$ and W_3 represent the work done in moving a particle from A to B along three different paths 1.2 and3 respectively (asshown) in the gravitational fieled of a point mass m, find the correct relation between W_(1) W_(2) and

W_(3)`



A. a) w, gt w2 gt

B. (Wj - W2 = IV3

C. (W1 ltW2ltW3

D. (W2 gt W, gtW_3

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

A. (1/2mgR

B. (2mgR

C. (mgR

D. (1/4mgR

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

A. E_0

B. $1.5E_0$

C. $2E_0$

D. `frac(1)(4)mgR

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354. A spherically symmetric gravitational system of particles has a mass density $\rho = \begin{cases} \rho_0 & f \text{ or } \quad r \quad < \quad R \\ 0 & f \text{ or } \quad r \quad > \quad R \end{cases}$ where ρ_0 is a constant. A test mass can undergo circular motion under the influence of the gravitational field of particles. Its speed v as a function of distahce $r(0 < r < OO)$ form the centre of the system is represented by

A.

B.

C.

D.

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355. A planet of radius $R = \frac{1}{10} \times (radius of Earth)$ has the same mass density as Earth. Scientists dig a well of depth $\frac{R}{5}$ on it and lower a wire of the same length and a linear mass density $10^{-3} kgm(\_1)$ into it. If the wire is not touching anywhere, the force applied at the top of the wire by a person holding it inplace is (take the radius of Earth $= 6 \times 10^{6} m$ and the acceleration due to gravity on Earth is $10 ms^{-2}$

A. 96N

B. 108N

C. 120N

D. 150N

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356. A satellite is moving with a constant speed 'V' in a circular orbit about the earth. An object of mass 'm' is ejected from the satellite such that it just escapes form the gravitational pull of the earth. At the tme of its ejection, the kinetic energy of the object is

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

B. mV^2

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

D. $2mV^2$

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357. A rocket is launched normal to the surface of the earth, away from the sun, along the line joining the sun and the earth. The sun is 3×10^5 times heavier than the earth and is at a distance 2.5×10^4 times larger than the radius of the earth. the escape velocity from earth's gravitational field is $u_e = 11.2kms^{-1}$. The minmum initial velocity $(u_e) = 11.2kms^{-1}$. the minimum initial velocity (u_s) required for the rocket to be able to leave the sun-earth system is closest to (Ignore the rotation of the earth and the presence of any other planet

A. $V_s = 72kms^{-1}$

B. $V_s = 22kms^{-1}$

C. $v_s = 42kms^{-1}$

D. $v_s = 62kms^{-A}$

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

A. T^2 is proportional to R^3

B. T^2 is proportional to $\frac{R^7}{2}$

C. T^2 is proportional to $\frac{R^3}{2}$

D. T2 is proportional to R//3

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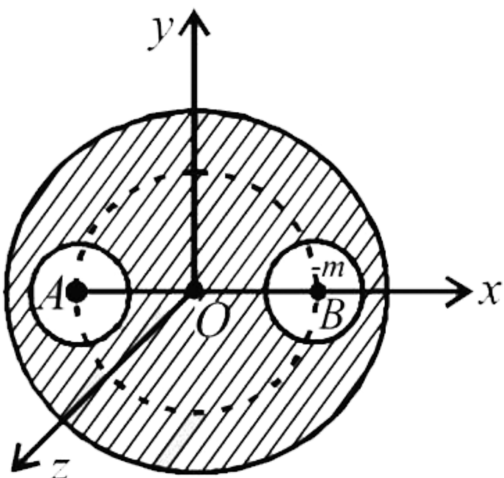
359. A solid sphere of uniform density and radius 4 units is located with its centre at the origin O of coordinates. Two sphere of equal radii 1 unit, with their centres at A(-2,0 ,0) and B(2,0,0) respectively, are taken out of the solid leaving behind spherical cavities as shown if fig Then:



A. the gravitational force due to this object at the origin is zero

B. the gravitational force at the point B(2,0,0)is zero

C. the gravitational potential is the same at all points of circle$y^2 + z^2 = 36$

D. the gravitational potential is the same at all points of circle $y^2 + z^2 = 4$

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

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

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

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361. 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 Sabout the centre of the earth changes in direction, but its magnitude remains constant

C. (the total mechanical energy of Svaries periodically with time

D. the linear momentum of S remains constant in magnitude

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362. Two bodies, each of mass M, are kept fixed with a separation 2L. A particle of mass m is projected from the midpoint of the line joining their cehntres, perpendicualr to the line. The gravitational constant is G. The correct statement (s) is (are)

A. The minimum initial velocity of the mass in to escape the gravitational field of the two bodies is $4\sqrt{G\frac{M}{L}}$

B. The minimum initial velocity of the mass m to escape the gravitational field of the two bodies is $2\sqrt{G\frac{M}{L}}$

C. The minimum initial velocity of the mass in to escape the gravitational field of the two bodies is $\sqrt{\frac{2GM}{L}}$

D. The energy of the mass m remains constant.

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363. 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 $(M_P + M_Q)$. The escape velocities from the plantes P,Q and R are $V_P V_Q$ and V_R respectively. Then

A. $V_Q > V_R > V_P$

B. $v_R > v_Q > V_p$

C. $V_R / V_p = 3$

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

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364. A spherical body of radius R consists of a fluid of constant density and is in equilibrium under its own gravity. If P(r) is the pressure at r(rltR), then the correct option(s) is (are)

A. P(r=0)=0

B. $\frac{P}{r = 3R/4}\left(P(r = 2R/3) = \frac{63}{80}\right.$

C. $\frac{P}{r = 3R/5}\left(P(r = 2R/5) = \frac{16}{21}\right.$

D. $\frac{P}{r = R/2}\left(P(r = 2R/3) = \frac{20}{27}\right.$

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365. If suddenly the gravitational force of attraction between earth and satellite revolving around it becomes zero, then the satellite will

A. continue to move in its orbit with same velocity

B. move tangentially to the original orbit with the same velocity

C. become stationary in its orbit

D. move towards the earth.

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366. 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 inversely proportional to g

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

A. 4.5 R

B. 7.5 R

C. 1.5 R

D. 2.5 R

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

B. $\sqrt{2\sqrt{\frac{G}{M}}R}$

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

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

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369. 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

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370. The height at which the acceleration due to gravity becomes $\frac{g}{9}$ (where g =the acceleration due to gravity on the surface of the earth) in terms of R, the radius of the earth, is :

A. 2R

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

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

D. $\sqrt{R}$

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371. 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. zero

B. $-\frac{4Gm}{\text{®}}$

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

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

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

A. `frac(1)(4)

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

C. 2mgR

D. 3gR

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373. Energy required to move a body of mass m from an orbit of radius 2R to 3R is

A. $GMm/12R^2$

B. $GMm/3R^2$

C. GMm/8R

D. GMm/6R

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374. A particle of mass 10g is kept on the surface of a uniform sphere of mass 100 kg and radius 10 cm. Find the work to be done against the gravitational force between them, to take the particle far away from the sphere (you may take $G = 6.67 \times 10^{-11} Nm^2 / kg^2$)

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

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

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

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

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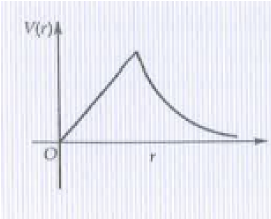
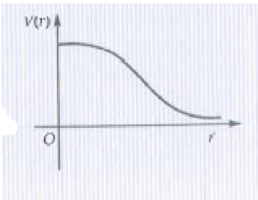
375. The correct variation of gravitational potential V with radius r measured from the centre of earth of radius R is given by

A.



B.



C.

D.

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376. The kinetic energy needed to project a body of mass m from the earth surface (radius R) to infinity is

A. $mgR/2$

B. 2 mgR

C. mgR

D. $mgR/4$

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377. The escape velocity of a body depeds upon mass as

A. m^0

B. m

C. m^2

D. m^3

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

A. $11 / \sqrt{2} kms^{-1}$

B. $11 kms^{-1}$

C. $11\sqrt{2} km^{-1}$

D. 22 km s^{-1}

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

A. 0.11 km s^{-1}

B. 1.1 km s^{-1}

C. 11 km s^{-1}

D. 110 km s^{-1}

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

A. gx

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

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

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

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

A. the mass of the satellite

B. radius of it's orbit

C. both the mass and radius of the orbit

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

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382. The time period of a satellite of earth is 5 hours . If the separation between 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

Watch Video Solution

383. Suppose the gravitational force varies inversely as the nth power of distance. Then the time period of a planet in circular orbit of radius 'R' around the sun will be proportional to

A. R ^ $(n+1)/2$

B. $R^{n-1}/2$

C. R ˆ n

D. R ˆ $(n-2)/2$

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

A. 6.4 $\times$ 10^{11} joules

B. 6.4 $\times$ 10^{8} joules

C. 6.4 $\times$ 10^{9} joules

D. 6.4 $\times$ 10^10` joules

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385. 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(5GmM)(6R)

B. frac(2GmM)(3R)

C. frac(GmM)(2R)

D. frac(GmM)(3R)

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386. A very long (length L) cylindrical galaxy is made of uniformly distributed mass and has radius R $(R < < L)$ A star outside the galaxy is orbiting the galaxy in a plane perpendicular to the galaxy and passing through its centre. If the time period of star is T and its distance from the galaxy's axis is r, then-

A. $T \propto R$

B. $T \propto \sqrt{r}$

C. $T \propto r^2$

D. $T^2 - \propto r^3$

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

A. $\sqrt{gR}$

B. $\sqrt{gR/2}$

C. $\sqrt{g}R$ ($\sqrt{2}$-1

D. $\sqrt{2}gR$

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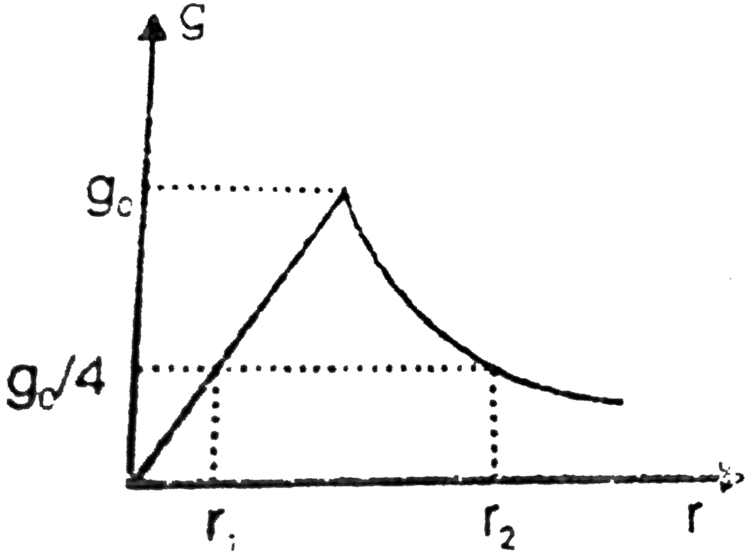
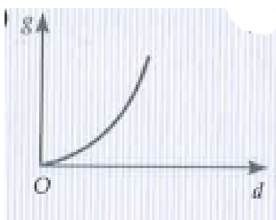
388. Figure shows variation of acceleration due to gravity with distance from centre of a uniform spherical planet, Radius of planet is R. What is $r_2 - r_1$



A. `



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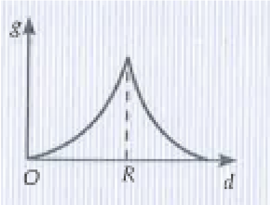

C.

D.

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389.

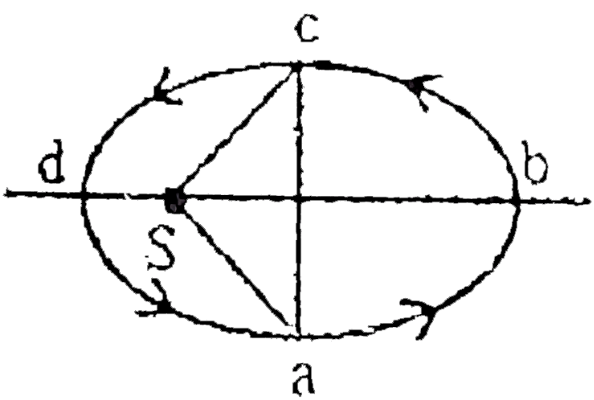

Figure elliptical path abcd of a planet around the sun S such that the area of Delta csa is $\frac{1}{4}$ the area of the ellipse, (see figure) with db as the semimajor axis, and ca as the semiminor axis if t_1 is the time taken for planet to go over path abc and t_2 for path taken over cda then:

A. $t_1 = 3t_2$

B. $t_1 = t_2$

C. $t_1 = 2t_2$

D. $t_1 = 4t_2$

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390. A particle is moving with a uniform speed in a circular orbit of radius R in a central force inversely proportional to the n^{th} power of R. If the period of rotation of the particle is T, then :

A. T $\propto R^3/2$, For any n

B. T $\propto R^{\frac{n}{2}}+1$

C. T $\propto R^{n+1}/2$

D. T $\propto R^n/2$

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391. The force of gravitation is

A. repulsion

B. electrostatic

C. non-conservative

D. conservative

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392. 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 towards east

B. revolution of the earth round the sun

C. phenomenon of day and night

D. apparent motion of sun round the earth

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393. Apes use while walking

A. to keep constant velocity

B. to ease the tension

C. to increase the velocity

D. to balance the effect of earth's gravity

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

A. $M/6$

B. ZERO

C. M

D. none of these

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395. Two spheres of same size, one of mass $2kg$ and another of mass $4kg$, are dropped simultaneously from the top of Quata Minar $(height = 72m)$. When they are $1m$ above the ground, the two spheres have the same.

A. momentum

B. kinetic energy

C. potential energy

D. acceleration

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396. Two planets of radii r_1 and r_2 are made from the same material. The ratio of the acceleration of gravity g_1 / g_2 at the surfaces of the planets is

A. r_1 / r_2

B. r_2 / r_1

C. $(r_1 / r_2)^2$

D. r_2 / r_1^2

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397. 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. increase

C. remain constant

D. either decrease and remain constant

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398. At what depth below the surface of the earth, is the value of g same as that of a height of 5 km ?

A. 10 km

B. 7.5 km

C. 5 km

D. 2.5 km

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399. Assuming the earth to be a sphere of uniform mass density, how much would a body weigh half way down to the centre of the earth if it weighd 250 N on the surface ?

A. 240 N

B. 210 N

C. 195 N

D. 125 N

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400. If the mass of moon is $\frac{M}{81}$, where M is the mass of earth, find the distance of the point where gravitational field due to earth and moon cancel each other, from the centre of moon. Given the distance between centres of earth and moon is 60 R where R is the radius of earth

A. 2 R

B. 4 R

C. 6 R

D. 8 R

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401. If the Earth stops rotating about its polar axis, what will be the effect on the value of acceleration due to gravity 'g' ? Will this effect be same at all places?

A. Remain same

B. Increase

C. Decrease but not zero

D. Decrease to zero

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402. The value of ' g ' at a particular point is $9.8m/s^2$. Suppose the earth suddenly shrinks uniformly to half its present size without losing any mass. The value of ' g ' at the same point (assuming that the distance of the point from the centre of earth does not shrink) will now be

A. 9.8 ms^{-2}

B. 4.9 ms^{-2}

C. 19.6 ms^{-2}

D. 39.2 ms^-2`

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403. The maximum vertical distance through which a full dressed astronaut can jump on the earth is 0.5m. Estimate the maximum vertical distance through which he can jump on the motion, which has a mean density 2/3 rd that of the earth and radius one-quarter that of the earth.

A. 1.5 m

B. 3 m

C. 6 m

D. 7.5 m

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404. The reading of a spring balance corresponds to 100 N while situated at the North pole and a body is kept on it. The weight recorded on the same scale if it is shifted to the equator (take, $g = 10 m / s^2$ and radius of the Earth $R = 6.4 \times 10^6 m$) is:

A. 99.66 N

B. 110 N

C. 97.66 N

D. 106 N

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405. The velocity with which a projectile must be fired so that it escape earth's gravitational does not depend on

A. mass of the earth

B. mass of the projectile

C. radius of the projectile's orbit

D. radius of the projectile's orbit

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406. The angular velocity of rotation of a planet of mass M and radius R, at which the matter start to escape from its equator is

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

B. $\sqrt{2GM}$ / R^3

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

D. $\sqrt{2GR}$/M

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407. The escape velocity of a body depeds upon mass as

A. m^2

B. m

C. m^0

D. m^{-1}

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408. For a satellite escape velocity is 11 km/s . If the satellite is launched at an angle of 60° with the vertical , then escape velocity will be

A. 11.2 kms^{-1}

B. 11.6 km s^{-1}

C. 12.8 km s^{-1}

D. 16.2 km s^{-1}

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409. Given mass of the moon is 1/81 of the mass of the earth and corresponding radius is 1/4 of the earth. If escape velocity on the earth surface is 11.2 km / s , the value of same on the surface of the moon is

A. 0.14 km s^{-1}

B. 0.76 km s^{-1}

C. 2.45 km s^{-1}

D. 5.28 km s^{-1}

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410. The escape Velocity from the earth is $11.2 Km / s$. The escape Velocity from a planet having twice the radius and the same mean density as the earth, is :

A. 22.4 km s^{-1}

B. 11.2 km s^{-1}

C. 5.5 km s^{-1}

D. 15.5 km s^{-1}

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411. There is no atomosphere on moon because

A. it is closer to the earth and also it has the inactive inert gases in it.

B. it is too far from the sun and has very low pressure in its outer surface.

C. escape velocity of gas molecules is greater than their root mean square velocity.

D. escape velocity of gas molecules is less than their root mean square velocity

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412. A missile is launched with a velocity less than the escape velocity. The sum of its kinetic and potential energy is

A. zero

B. negative

C. positive

D. first (then (

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413. A satellite of the earth is revolving in a circular orbit with a uniform speed v. If the gravitational force suddenly disappears, the satellite will

A. continue to move with velocity v along the original orbit

B. move with a velocity v tangentially to the original orbit

C. fall down with increasing velocity

D. ultimately come to rest, somewhere on the original orbit

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414. Two satellites of masses m_1 and $m_2(m_1 > m_2)$ are revolving around earth in circular orbits of radii r_1 and $r_2(r_1 > r_2)$ respectively. Which of the following statements is true regarding their velocities V_1 and V_2

A. $v_1 = v_2$

B. $v_1 // r_1 = v_2 // r_2$

C. v_1 gt v_2

D. v_1 lt v_2

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415. If v_0 be the orbital velocity of a satellite in a circular orbit close to the earth's surface and v_e is the escape velocity from the earth , then relation between the two is

A. v_e = v

B. v_e= $\sqrt{2}v$

C. v = $\sqrt{3}v_e$

D. v_e = 2v

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416. A satellite is in an orbit around the earth. If its kinetic energy is doubled, then it will:

A. it will maintain its path

B. it will fall on the earth

C. it will rotate with a great speed

D. it will escape out of earth's gravitational field

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417. According to Kepler , planets move in

A. straight path

B. circular path

C. elliptical path

D. hyperbolic path

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418. Kepler's second law is based on

A. Newton's first law

B. Newton's second law

C. Special theory of relativity

D. conservation of angular momentum

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419. The radius vector drawn from the sun to a planet sweeps out___areas in equal time

A. Kepler's first law

B. Kepler's second law

C. Kepler's third law

D. Newton's third law

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420. The orbital speed of Jupiter is

A. greater than the orbital speed of earth

B. less than the orbital speed of earth

C. equal to the orbital speed of earth

D. proportional to distance from the earth

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421. A planet of mass m is moving around the sun in an elliptical orbit of semi-major axis a :

A. the torque acting on the planet about the sun is non-zero

B. the angular momentum of the planet about the sun is constan

C. the planet moves with a constant speed around the sun

D. the areal velocity is $\pi ab/ T$

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422. The change in the gravitational potential energy when a body of a mass m is raised to a height nR above the surface of the earth is (here R is the radius of the earth)

A. $\left(\frac{n}{n+1}\right)$ mgR

B. $\left(\frac{n}{n-1}\right)$ mgR

C. nmgR

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

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423. A satellite is moving with a constant speed 'V' in a circular orbit about the earth. An object of mass 'm' is ejected from the satellite such that it just escapes form the gravitational pull of the earth. At the tme of its ejection, the kinetic energy of the object is

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

B. mv^2

C. $\frac{1}{3}mv^2$

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

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

A. $GmM\left(\frac{1}{r_1^2} - \frac{1}{r\ 2}^2\right)$

B. $GmM\left(\frac{1}{r_1} - \frac{1}{r\ 2}\right.$

C. $2GmM\left(\frac{1}{r_1} - \frac{1}{r\ 2}\right.$

D. $1/2GmM\left(\frac{1}{r_1} - \frac{1}{r\ 2}\right.$

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425. A satellite is revolving round the earth. Its kinetic energy is E_k. How much energy is required by the satellite such that it escapes out of the gravitational field of earth

A. 2E

B. $\sqrt{E}$

C. $E/2$

D. E

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426. Average distance of the earth from the sun is L_1. If one year of the earth =D days, one year of another planet whose average distance from the sun is L_2 will be

A. $D\left(\frac{L_2}{L_1}\right)^{\frac{1}{2}}$ days

B. $D\left(\frac{L_2}{L_1}\right)^{\frac{3}{2}}$ days

C. $D\left(\frac{L_2}{L_1}\right)^{\frac{2}{3}}$ days

D. $D\left(\frac{L_2}{L_1}\right)$ days

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

A. 3F

B. F

C. F/3

D. F/9

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428. The earth (mass $= 6 \times 10^{24} kg$) revolves round the sun with an angular velocity of $2 \times 10^{-7} \text{rad/s}$ 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. 36 $\times$ 10^{21}

B. 27 $\times$ 10^{39}

C. zero

D. 18 $\times$ 10^{25}

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429. 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. $1/2\sqrt{\frac{Gm}{R}}$

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

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

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

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430. The gravitational force between two objects is proportional to $1/R$ (and not as $1/R^2$) 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

B. R^0

C. $1/R^2$

D. 1/R

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431. Gravitational force is required for:

A. stirring of liquid

B. convection

C. conduction

D. radiation

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432. What will be the formula of mass of the earth in terms of g , R and G ?

A. $G\frac{R}{g}$

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

C. $\frac{g^2R}{G}$

D. $G\frac{g}{R}$

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

A. $p = \frac{3g}{4\pi GR}$

B. $p = \frac{3g}{4\pi GR^3}$

C. $p = \frac{4\pi gR^2}{3G}$

D. $p = \frac{4\pi gR^3}{3G}$

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434. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth is R, the radius of the planet would be

A. 2R

B. 4R

C. 1/4 R

D. 1/2 R

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435. imagine a new planet having the same density as that of earth but it is 3 times bigger than the earth is size. If the acceleration due to gravity on the surface of earth is g and that on the surface of the new planet is g', then find the relation between g and g'.

A. g'=g/9

B. g'=27g

C. g'=9g

D. g'=3g

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436. 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. $4GM_p / D_p^2$

B. GM_pm / D_p^2

C. GM_p / D_p^2

D. $GM_p m / D_p^2$

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437. 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. (2/9) m

B. 18 m

C. 6 m

D. (2/3) m

438. A body of weight 72 N moves from the surface of earth at a height half of the radius of earth , then geavitational force exerted on it will be

A. 36 N

B. 32 N

C. 144 N

D. 50 N

439. The radius of earth is about 6400 km and that of Mars is 3200 km . The mass of the earth is about 10 times the mass of Mars . An object weighs 200 N on te surface of Earth . Its weight on the surface of mars will be .

A. 20 N

B. 8 N

C. 80 N

D. 40 N

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

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

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

C. $\frac{3}{4}mgR$

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

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441. 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. mg2R

B. 2/3 mgR

C. 3 mgR

D. 1/3 mgR

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

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

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

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

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

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443. Infinite number of bodies, each of mass 2kg are situated on X-axis at distance $1m, 2m, 4m, 8m,$ respectively from the origin, What is the resulting gravitational potential due to this system at the origin ?

A. $-G$

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

C. `-4/3G

D. $-4G$

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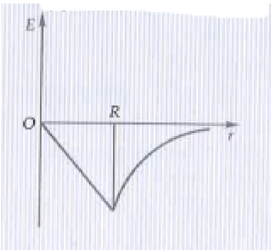
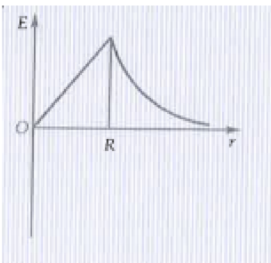
444. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by

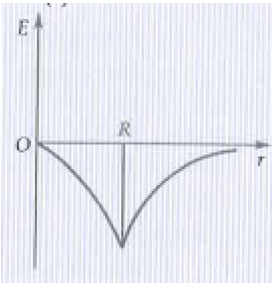
A.



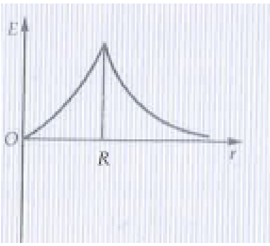
B.



C.



D.



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445. Which one of the following plots represents the variation of the gravitational field on a particle with distance

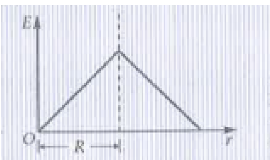
r due to a thin spherical shell of raduis R? (r is measured from the centre of the spherical shell).

A.

B.

C.

D.



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446. The escape velocity of a sphere of mass m is given by (G= univesal gravitational constant, $M_e =$ mass of the earth and $R_e =$ radius of the earth)

A. $\sqrt{\frac{2GM_e m}{R_e}}$

B. $\sqrt{\frac{2GM_e}{R_e}}$

C. $\sqrt{\frac{GM_e}{R_e}}$

D. $\sqrt{\frac{2GM_e - R_e}{R_e}}$

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447. For a satellite escape velocity is 11 km/s . If the satellite is launched at an angle of 60° with the vertical , then escape velocity will be

A. $11km / s$

B. $11\sqrt{3}km / s$

C. $11/\sqrt{3}$ km// s

D. $33km / s$

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448. The escape velocity for a body projected vertically upwards from the surface of the earth is $11.2kms^{-1}$. If the body is projected in a direction making an angle 45° with the vertical, the escape velocity will be

A. 11.2 $\times$ 2 km//s

B. $11.2km/s$

C. $11.2/\sqrt{2}km/s$

D. $11.2\sqrt{2}$ km//h`

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449. Escape velocity of a body from the surface of earth is 11.2km/sec. from the earth surface. If the mass of earth becomes double of its present mass and radius becomes half of its present radius then escape velocity will become

A. $22.4km/s$

B. $44.8km/s$

C. $5.6km/s$

D. $1.2km/s$

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450. A planet has mass equal to mass of the earth but radius one fourth of radius of the earth . Then escape velocity at the surface of this planet will be

A. $11.2km/s$

B. $22.4km/s$

C. $5.6km/s$

D. $44.8km/s$

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451. With what velocity should a particle be projected so that its height becomes equal to radius of earth ?

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

B. $\left(\frac{8GM}{R}\right)^{\frac{1}{2}}$

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

D. $\left(\frac{4GM}{R}\right)^{\frac{1}{2}}$

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452. The earth is assumed to be a sphere of raduis R. A plateform is arranged at a height R from the surface of the

fv_e, where v_e is its escape velocity form the surface of the earth. The value of f is

A. $1/2$

B. $\sqrt{2}$

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

D. $1/3$

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

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

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

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

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

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

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

B. $v_0 = v_e$

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

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

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

A. 10^{-9} m

B. 10^{-6} m

C. 10^{-2} m

D. 100 m

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

A. 6.67 km s^{-1}

B. 7.76 km s^{-1}

C. 8.56 km s^{-1}

D. 9.13 km s^{-1}

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

A. 3 V/4

B. 6V

C. 12 V

D. 3V /2

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458. A satellite A of mass m is at a distance of r from the centre of the earth. Another satellite B of mass 2m is at distance of 2r from the earth's centre. Their time periode are in the ratio of

A. $1:2$

B. $1:16$

C. $1:32$

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

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459. The mean radius of earth is R, its angular speed on its own axis is w and the acceleration due to gravity at earth's surface is g. What will be the radius of the orbit of a geostationary satellite

A. $(R^2 g / \omega^2)^1 / 3$

B. $(Rg / \omega^2)^1 / 3$

C. $(R^2 \omega^2 / g)^1 / 3$

D. $(R^g / \omega)^1 / 3$

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460. For a satellite moving in an orbit around the earth, the ratio of kinetic energy of potential

A. $1/2$

B. `1//sqrt2

C. 2

D. $\sqrt{2}$

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461. 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. $(3/4)mv^2$

B. $(1/2)\,mv^2$

C. mv^2

D. $-(1/2)\,mv^2$

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462. A ball is dropped from a spacecraft revolving around the earth at a height of $1200km$. What will happen to the ball ? .

A. it will fall down to the earth gradually

B. it will go very far in the space

C.

D. it will move with the same speed, tangentially to the spacecraft.

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463. The largest and the shortest distance of the earth from the sun are r_1 and r_2, its distance from the sun when it is at the perpendicular to the major axis of the orbit drawn from the sun

A. $\dfrac{r_1 + r_2}{4}$

B. $\dfrac{r_1 + r_2}{r_1 - r_2}$

C. $\dfrac{2r_1r_2}{r_1 + r_2}$

D. $\dfrac{2r_1 + r_2}{3}$

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464. 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. 4

B. 5

C. 2

D. 3

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465. The distance of two planets from the sun are 10^{13} and 10^{12} m respectively. The ratio of the periods of the planet is

A. $\sqrt{10}$

B. $10\sqrt{10}$

C. 10

D. $1//\sqrt{10}$

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

A. 5

B. 10

C. $6\sqrt{2}$

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

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467. 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

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468. Two satellites of earth S_1 and S_2 are moving in the same orbit. The mass of S_1 is four times the mass of S_2. Which one of the following statements is true?

A. The potential energies of earth and satellite in the two cases are equal

B. $S_1$and $S_2$are moving with the same speed

C. The kinetic energies of the two satellites areequal

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

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469. A planet is moving in an elliptic orbit. If T, V, E and L stand, respectively, for its kinetic energy, gravitational potential energy, total energy and angular momentum about the centre of force, then

A. T is conserved

B. V is always positive

C. E is always negative

D. L is conserved but direction of vector t. changes continuously

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470. A satellite in force-free sweeps stationary interplanetary dust at a rate of $d\frac{M}{dt} = \alpha v$, where M is mass and v is the speed of satellite and α is a constant. The tangential acceleration of satellite is

A. $\frac{-\alpha v^2}{2M}$

B. $\frac{-\alpha v^2}{}$

C. $\frac{-2\alpha v^2}{M}$

D. $\frac{-\alpha v^2}{M}$

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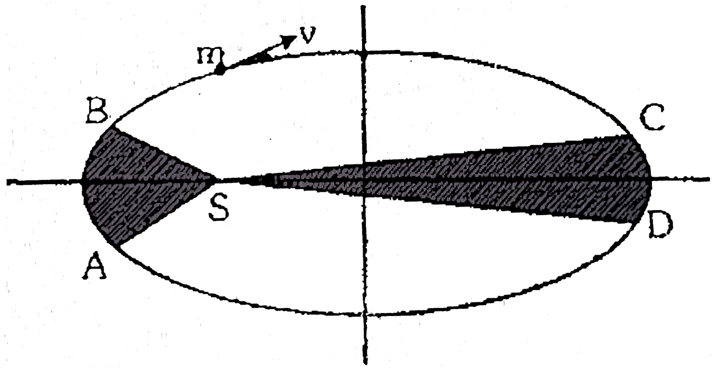
471. 

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

A. $t_1 = 4t_2$

B. $t_1 = 2t_2$

C. $t_1 = t_2$

D. $t_1 gt t_2$

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472. 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. GMk=4π^2

B. K=G

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

D. GK=4π^2

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

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

B. d=1km

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

D. d=2km

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

A. keep floating at the same distance between them

B. move towards each other

C. move away from each other

D. will become stationary

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

A. $1:2$

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

C. $1:4$

D. $1:\sqrt{2}$

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

A. 2600 km

B. 1600 km

C. 1400 km

D. 2000 km

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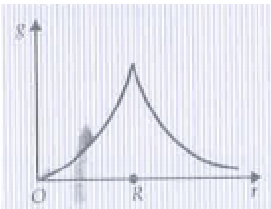
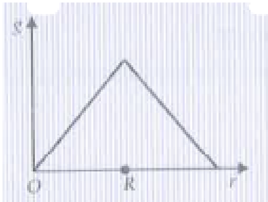
477. Starting from the centre of the earth having radius R, the variation of g (acceleration due to gravity) is shown by

A.

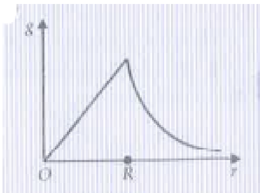


B.

C.



D.



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

A. $\dfrac{2mg_0R^2}{R+h}$

B. $\dfrac{2mg_0R^2}{R+h}$

C. $\dfrac{mg_0R^2}{2(R+h)}$

D. $\dfrac{mg_0R^2}{2(R+h)}$

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

A. Raindrops will fall faster

B. g on the Earth will not change

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

D. Walking on the ground would become more difficult

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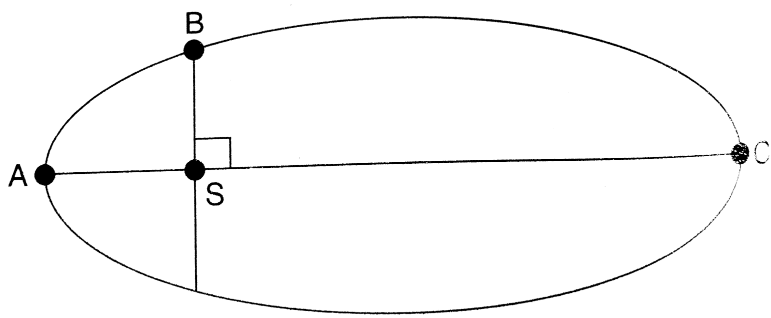
480. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B and K_C respectively. AC is the major axis and SB is perpendicular to AC at the position of the sun as shown in the figure. Then



A. $K_A$ltK_BltK_C

B. $K_B$gtK_AgtK_C

C. $K_B$ltK_A $<$ K_C`

D. $K_A$gtK_BgtK_C

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Based on Acceleration due to gravity

1. The radius of the moon is 1.7×10^6 m and its mass is 7.35×10^{22} kg . What is the acceleration due to gravity on the surface of the moon ? Given G = $6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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2. Assuming the earth to be a uniform sphere of radius 6400 km and density $5.5gcm^{-3}$, find the value of g on its surface . Given G = $6.66 \times 10^{-11} Nm^2 kg^{-2}$

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3. The mass of Jupiter is 314 times that of earth and the diameter of Jupiter is 11.35 times that of earth . If 'g' has a value of $9.8ms^{-2}$ on the earth , what is its value on Jupiter ?

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4. The value of 'g' on the surface of the earth is $9.81ms^{-2}$. Find its value on the surface of the moon . Given mass of earth 6.4×10^{24} kg , radius of earth = 6.4×10^{6} m , mass of the moon = 7.4×10^{22} kg , radius of moon = 1.76×10^{6} m .

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5. Given that the mass of the earth is 81.5 times the mass of the moon and the diameter of the moon is 0.27 times that of the earth . Calculate the value of acceleration due to gravity at the surface of the moon . Given 'g' on the earth = $9.8ms^{-2}$

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6. An astronaut on the moon measures the acceleration due to gravity to be $1.7ms^{-2}$. He known that the radius of the moon is about 0.27 times that of the earth . Find the ratio of the mass of the earth to that of the moon , if the value of g on the earth's surface is $9.8ms^{-2}$.

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7. The acceleration due to gravity on the surface of the earth is $10ms^{-2}$. The mass of the planet . Mars as compared to earth is 1/10 and radius is 1/2 . Determine the gravitational acceleration of a body on the surface on Mars .

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8. A body weights 100 kg on earth . Find its weight on mars . The mass and radius of mars are 1/10 and 1/2 of the mass and radius of earth .

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9. The weight of a person on the Earth is $80 kgwt$. What will be his weight on the Moon ? Mass of the Moon $= 7.34 \times 10^{22} kg$, radius $= 1.75 \times 10^{6} m$ and gravitational constant $= 6.67 \times 10^{-11} Nm^{2} kg^{-2}$. What will be the mass of the person at the Moon and acceleration due to gravity there ? If this person can jump $2m$ high on the Earth, how much high can he jump at the Moon ?

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10. The radius and density of two artificial satellites are R_1, R_2 an,d ,ρ_1, ρ_2 respectively. The ratio of acceleration due to gravitation them will be

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11. 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 $10ms^{-2}$.

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Based on Variation of g with Altitude

1. The radius of the earth is 6000 km . What will be the weight of a 120 kg body if it is taken to a height of 2000 km above the surface of the earth?

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2. At what height above the surface of the earth will the acceleration due to gravity be 25% of its value on the surface of the earth ? Assume that the radius of the earth is 6400 km .

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3. Find the value of g at a height of 400 km above the surface of the earth . Given radius of the earth , R = 6400 km and value of g at the surface of the earth = $9.8ms^{-2}$.

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4. At what height from the surface of earth will the value of g becomes 40% from the value at the surface of earth. Take radius of the earth $= 6.4 \times 10^6 m.$

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5. At what height above the surface of earth , acceleration due to gravity will be (i) 4% , (ii) 50% of its value on the surface of the earth ? Given , radius of the earth = 6400 km .

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Based on Variation of g with Depth

1. Find the value of acceleration due to gravity in a mine at a depth of 80 km from the surface of the earth . Radius of the earth = 6400 km .

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2. Calculate the depth below the surface of the earth where acceleration due to gravity becomes half of its value at the surface of the earth . Radius of the earth = 6400 km.

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3. How much below the surface of the earth does the acceleration due to gravity become 70% of its value at the surface of the earth ? Radius of the earth is 6400 km

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4. How much below the surface of the earth does the acceleration due to gravity (i) reduced to 36% (ii) reduces by 36% , of its value on the surface of the earth ? Radius of the earth = 6400 km .

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

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Based on Variation of g with Rotation of the earth

1. Calculate the value of acceleration due to gravity at a place of latitude 45° . Radius of the earth = 6.38×10^3 km .

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2. If the earth stops rotating about its axis , then what will be the change in the value of g at a place in the equitorial plane ? Radius of the earth = 6400 km.

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3. Assuming that the whole variation of the weight of a body with its position on the surface of the earth is due to its rotation , find the difference in the weight of 5 kg as measured at the equator and at the poles . Radius of the earth = 6.4×10^6 m.

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4. How many times faster than its present speed the earth should rotate so that the apparent weight of an object at equator becomes zero ? Given radius of the earth = 6.37×10^6 m . What would be the duration of the day in that case ?

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G :Based on Orbital Velocity of Satellites

1. An artificial satellite circled around the earth at a distance of 3400 km. Calculate its orbital velocity and period of revolution. Radius of earth =6400 km and $g = 9.8ms^{-2}$.

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2. The orbit of a geostationary satellite is concentric and coplanar with the equator of Earth and rotates along the direction of rotation of Earth. Calculate the height and speed. Take mass of Earth $= 6 \times 10^{-11} Nm^2 kg^{-2}$. Given $\pi^2 = 10$.

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3. A satellite revolves round a planet in an orbit just above the surface of planet. Taking $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$ and the mean density of the planet $= 8.0 \times 10^3 kgm^{-3}$, find the period of satellite.

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4. An artifical satellitee of mass $100kg$ is in a circular orbit at $500km$ above the Earth's surface. Take redius of Earth as $6.5 \times 10^6 m$.(a) Find the acceleration due to gravity at any point along the satellite path (b) What is the centripetal acceleration o fthe satellite?

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H: Based on Escape Velocity

1. Find the velocity of escape at the moon. Given that its radius is 1.7×10^6 m and the value of 'g' is $1.63 ms^{-2}$.

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2. The mass of Jupiter is 1.91×10^{36} kg and its diameter is 13.1×10^7 m. Calculate the escape velocity on the surface of Jupiter.

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3. Calculate the minimum speed required by a rocket to pull out of the gravitational force of Mars. Given that the earth has a mass 9 times and radius twice of the planet Mars. Escape speed on the surface of earth is $11.2 kms^{-1}$.

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

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5. Find the velocity of escape from the sun, if its mass is 1.89×10^{30} kg and its distance from the earth is 1.59×10^{8} km. Take G $= 6.67 \times 10^{-11} Nm^{2} kg^{-2}$

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6. A body is at a heighyt equal to the radius of the earth from the surface of the earth. With what velocity be it thrown so that it goes out of the gravitational field of the earth? Given $M_e = 6.0 \times 10^{24}$kg, $R_e = 6.4 \times 10^6$m and $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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7. A body of mass 100 kg falls on the earth from infinity. What will be its velocity on reaching the earth? What will be its K.E.. ? Radius of the earth is 6400 km and $g = 9.8 ms^{-2}$. Air friction is negligible.

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8. 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 $= 6400km, g = 9.8m/s^2$.

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I: Based on Kepler s Law of Periods

1. If the earth be one half its present distance from the sun, how many day will the present one year on the surface of earth will change?

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2. The distance of planet Jupiter from the Sun is 5.2 times that of the earth. Find the period of revolution of Jupiter around the Sun.

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3. The time period of Jupiter is 11.6 years. How far is Jupiter from the Sun? Distance of the Earth from the sun is $1.5 \times 10^{11} m$

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

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5. The radius of earth's orbit is 1.5×10^8 km and that of Mars is $2.5 \times 10^{11} m$. In how many years, does the Mars complete its one revolution ?

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

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J: Based on Gravitational Intensity, Potential and Potential Energy

1. Two masses $90kg$ and $160kg$ are at a distance $5m$ apart. Compute the magnitude of intensity of the gravitational field at a point distance $3m$ from the $90kg$ and $4m$ from the $160kg$ mass. $G = 6.67 \times 10^{-11} kg^{-2}$

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

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3. The distance between the earth and the moon is 3.85×10^8 metre. At what point in between the two will the gravitational field intensity be zero ? Mass of the earth is $= 6.0 \times 10^{24}$ kg, mass of the moon $= 7.26 \times 10^{22}$ kg

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4. Two bodies of masses $100kg$ and $1000kg$ are at a distance $1.00m$ apart.Calculate the gravitational field intensity and the potential at the middle point of the line joining them

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5. The mass of the earth is 6.0×10^{24} kg. Calculate (i) the potential energy of a body of mass 33.5 kg and (ii) the gravitational potential, at a distance of 3.35×10^{10} m from the centre of the earth. Take $G = 6.67 \times 10^{-1} Nm^2 kg^{-2}$

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6. The mass of the earth is $6.0 \times 10^{24} kg$ and its radius is $6.4 \times 10^6 m$. How much work will be done in taking a $10 kg$ body from the surface of the Earth to infinity ? What will be the gravitational potential energy of the body on the Earth's surafce ?

$G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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7. A rocket is launched vetically from the surface of the earth with an initial velocity of 10 kms^{-1}. How for above the surface of the earth would it go ? Radius of the earth =6400 km and $g = 9.8ms^{-2}$.

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8. A satellite orbits the earth at a height of 400 km, above the surface. How much energy must be expended to rocket the satellite out of the earth's gravitational influence ? Mass of the satellite=200 kg, mass of the earth=6.0×10^{24}kg, radius of the earth=$6.4 \times 10(6)$m, G=$6.67 \times 10^{-11} Nm^2 Kg^{-2}$.

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9. 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.

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10. A body is to be projected vertically upwards from earth's surface to reach a height of $9R$, where R is the radius of earth. What is the velocity required to do so? Given $g = 10ms^{-2}$ and radius of earth $= 6.4 \times 10^6 m$.

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11. Calculate the energy required to move an earth satellite of mass 10^3 kg from a circular orbit of radius 2R to that of radius 3R. Given mass of the earth, $M = 5.98 \times 10^{24}$ kg and radius of the earth, $R = 6.37 \times 10^6$ m.

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m

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

A. $-E_0$

B. $1.5E_0$

C. $2E_0$

D. E_0

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