PHYSICS

BOOKS - MARVEL PHYSICS (HINGLISH)

GRAVITATION

Multiple Choice Questions

1. Tidal waves in the sea are primarily due to

A. the gravitational effect of venus on the earth

B. the gravitational effect of the moon on the earth

C. the atmospheric effect of the earth itself

D. the gravitational effect of the sun on the earth

Answer: B

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2. Two spheres of masses M_1 and M_2 and separated by a distance d are situated in air and the gravitational force of attraction between them is F. If the two spheres are kept in a liquid of specific gravity 5 then the gravitational force between them will be

A. 5 F

B. $\frac{F}{5}$

C. F

D. $\sqrt{F}$

Answer: C

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3. The values of the acceleration due to gravity on two planets are $g_1 - g_2$, then the two planets must have the same

A. raduis

B. mass

C. $\left(\frac{\text{mass}}{\text{radius}}\right)^2$

D. $\frac{\text{mass}}{(\text{radius})^2}$

Answer: D

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4. At the surface of a certain planet acceleration due to gravity is one - quarter of that on earth If a brass ball is transported to this planet , then which one of the following statements is not correct ? .

A. The mass of the brass ball on this planet is a quarter of its mass as measured on earth.

B. The weight of the brass ball on this planet is a quarter of the weight as measured on earth.

C. The brass ball has the same mass on the other planet as on earth.

D. The brass ball has the same volume on the other planet as on earth.

Answer: A

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5. If G is the universal constant of gravitation and g is the acceleration due to gravity, then the dimensions of $\frac{G}{g}$ are

A. $LM^{1}T^{0}$

B. $L^{2}M^{-1}T^{0}$

C. $L^{-2}M^{1}T^{2}$

D. $L^{3}M^{-2}T^{1}$

Answer: B

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6. If the earth suddenly shrinks (without changing mass) to half of its present radius, then acceleration due to gravity will be

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

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

C. 2 g

D. 4 g

Answer: D

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7. The mean radius of a planet is 6.67×10^3 km. The acceleration due to gravity on its surface is $10 m/s^2$. If $G = 6.67 \times 10^{-11} Nm^2/kg^2$, then the mass of the planet will be $\left[R = 6.67 \times 10^6 m\right]$

A. $6.67 \times 10^{20} kg$

B. $6.67 \times 10^{24} kg$

C. $9.8 \times 10^{23} kg$

D. $13.34 \times 10^{23} kg$

Answer: B

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8. A force of 75 Newton acts on a body of mass 2.5 kg at a certain point. The intensity of the gravitational field at that point is

A. 15 N/kg

B. 30 N/kg

C. 45 N/kg

D. 20 N/kg

Answer: B

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9. A man weighs 'W' on the surface of the earth and his weight at a height 'R' from surface of the earth is (R is Radius of the earth)

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

B. $W' = \frac{W}{3}$

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

D. $W' = 2W$

Answer: C

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10. The acceleration due to gravity on the surface of the moon $= \frac{1}{6}$ the acceleration due to gravity on the surface of the earth. What will be the mass of a steel ball on the surface of the moon, if its mass on the surface of the earth is 6 kg ?

A. 1 kg

B. zero

C. 6 kg

D. 36 kg

Answer: C

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11. 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

A. 20 kg - wt

B. 40 kg - wt

C. 60 kg - wt

D. 80 kg - wt

Answer: A

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12. 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. $4.9m / s^2$

B. $9.8m / s^2$

C. $19.6m / s^2$

D. $15m / s^2$

Answer: C

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

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

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

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

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

Answer: A

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

A. $3:5$

B. $1:2$

C. $5:3$

D. $2:1$

Answer: D

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15. A body weighs $700gm$ wt on the surface of the earth. How much will it weigh on the surface of a planet whose mass is $\frac{1}{7}$ and radius is half that of the earth

A. 100 gram wt

B. 200 gram wt

C. 300 gram wt

D. 400 gram wt

Answer: D

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16. A satellite of mass 2000 kg is revolving around the earth in a circular orbit of radius 4×10^4 km. The gravitational force exerted by the satellite on the earth is ________. [Mass of the earth $= 6 \times 10^{24} kg, G = 6.67 \times 10^{-11} Nm^2 / kg^2$]

A. $5 \times 10^8 N$

B. $5 \times 10^3 N$

C. $5 \times 10^5 N$

D. $5 \times 10^4 N$

Answer: A

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17. The time period of a simple pendulum inside a starionary lift is 2 second. What would be its period, when the lift moves upwards with an acceleration $\frac{g}{4}$?

A. 2 sec

B. $\frac{4}{\sqrt{5}}$ sec

C. $\sqrt{5}$ sec

D. 4 sec

Answer: B

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18. A mass of 1 kg is supended by a string. It is

(i) lifted up with an acceleration $4.9m/s^2$

(ii) lowered with an acceleration $4.9m/s^2$

Then the ration of the tension in the string in the two cases is

A. $3:1$

B. $1:3$

C. $2:1$

D. $1:2$

Answer: A

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19. A simple pendulum of length L is taken from earth to a planet where the acceleration due to gravity is doubled. What should be its new lenths so that its periodic time is not changed ?

A. L

B. 2L

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

D. 3L

Answer: B

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20. 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. it will be 100 times more

B. it will be $\frac{1}{100}$ times

C. both forces will be equal

D. it will be 50 times

Answer: C

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21. Two bodies of equal masses situated at diametically opposite points go around a circle of radius R under the action of their mutual gravitational attraction. The speed (v) of each body is given by

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

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

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

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

Answer: B

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22. The unit of g/G is

A. kg/m

B. kg/m^2

C. m^2/kg

D. m/kg

Answer: B

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23. The acceleration due to gravity on the moon is $\frac{1^{th}}{6}$ that on the earth. If the earth and the moon are assumed to have the same density, then the radius of the moon is

A. $6R_e$

B. $\frac{1}{6}R_e$

C. $\frac{1}{3}R_e$

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

Answer: B

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24. A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively

A. g, g

B. $g - a, g + a$

C. a and g

D. $g - a, g$

Answer: D

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

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

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

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

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

Answer: C

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26. The acceleration due to gravity on a planet is $1.96m / s^2$. If a boy can safely jump from a height of 2 m on the earth, then the coorresponding safe height on the planet will be

A. 2.5 m

B. 5 m

C. 7.5 m

D. 10 m

Answer: D

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

A. R^2

B. R^3

C. R^{-3}

D. R^4

Answer: D

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28. 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. Zero N

B. $18 \times 10^{25} N$

C. $27 \times 10^{39} N$

D. $36 \times 10^{21} N$

Answer: D

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29. Two planets have the same average density but their radii are R_1 and R_2. If acceleration due to gravity on these planets be g_1 and g_2 respectively, then

A. $\frac{g_1}{g_2} = \frac{R_1^3}{R_2^3}$

B. $\frac{g_1}{g_2} = \frac{R_2}{R_1}$

C. $\frac{g_1}{g_2} = \frac{R_1^2}{R_2^2}$

D. $\frac{g_1}{g_2} = \frac{R_1}{R_2}$

Answer: D

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

A. $\frac{4mGM_0}{D_0^2}$

B. $\frac{4GM_0}{D_0^2}$

C. $\frac{GmM_0}{D_0^2}$

D. $\frac{GM_0}{D_0^2}$

Answer: B

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31. If density of earth increased 4 times and its radius become half of what it is, our weight will

A. remain same

B. be four times its present value

C. be halved

D. be doubled

Answer: D

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32. A man can jump 2 m high on the surface of the earth. How high he can jump on a planet where the acceleration due to gravity is $\frac{g}{12}$, where g is the acceleration due to gravity on the surface of the earth ?

A. 12 m

B. 18 m

C. 24 m

D. 30 m

Answer: C

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33. The densities of two planets are in the ratio of 2 : 3 and their radii are in the ratio of 1 : 2. What is the ratio of acceleration due to gravity at their surfaces ?

A. $1:3$

B. $3:1$

C. $1:9$

D. $9:4$

Answer: A

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34. A binary star system consists of two stars of masses M_1 and M_2 revolving in circular orbits of radii R_1 and R_2 respectively. If their respective time periods are T_1 and T_2, then

A. $T_1 > T_2$ if $R_1 > R_2$

B. $T_1 > T_2$ if $M_1 > M_2$

C. $T_1 = T_2$

D. $\frac{T_1}{T_2} = \left(\frac{R_1}{R_2}\right)^{3/2}$

Answer: C

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35. Average density of the earth

A. is inversely proportional to g

B. does not depend upon g

C. is a complex function of g

D. is directly proportional to g

Answer: D

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36. 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. $g' = 9g$

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

C. $g' = 27g$

D. $g' = 3g$

Answer: D

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37. The rotation of earth is responsible for the acceleration due to gravity to be

A. different at different latitudes

B. minimum at the poles

C. same at all places

D. maximum at the equator

Answer: A

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38. 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 increase

B. would decrease

C. would remain unchanged

D. may increase or decrease

Answer: A

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39. 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. $\sqrt{2}$

B. 1

C. 2

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

Answer: C

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40. Two identical spheres each of mass M and radius R are separated by a distance 3R. The force of attraction between them is proportional to

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

B. R^4

C. R^2

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

Answer: B

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41. A man weighs $80kg$ on the surface of earth of radius r. At what height above the surface of earth his weight will be $40kg$?

A. 1000 km

B. 1500 km

C. 2650 km

D. 2900 km

Answer: C

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42. The distance between the centres of the Moon and the earth is D. The mass of the earth is 81 times the mass of the Moon. At what distance from the centre of the earth, the gravitational force will be zero?

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

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

C. $\frac{9D}{10}$

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

Answer: C

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43. 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. 890 N

B. 892 N

C. 889 N

D. 880 N

Answer: C

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

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

B. R

C. $\sqrt{2}R$

D. 2 R

Answer: D

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45. Two spheres of masses (m) and (M - m) are prepared from a sphere of mass M. They are kept at a distance x. For what ratio of $\frac{m}{M}$ will the gravitational attraction between them be maximum ?

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

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

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

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

Answer: C

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46. The mass of a sphereical planet is 5 times the mass of the earth, but its diameter is the same as that of the earth. How much work is done in lifting a stone of mass 3 kg through a distance of 1 m on the planet ? [g on the surface the earth $= 10m / s^2$]

A. 100 J

B. 150 J

C. 200 J

D. 50 J

Answer: B

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47. Three uniform spheres, A, B and C each of mass M and radius R are kept in such a way that each sphere touches the other two. What is the magnitude of the gravitational force acting on A due to B and C ?

A. $\frac{\sqrt{3}GM^2}{4R^2}$

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

C. $\frac{3GM^2}{4R^2}$

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

Answer: A

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48. F is the gravitational force between two point masses m_1 and m_2 , separated by a distance d. A point mass $2m_1$ is then brought near m_1. What is the total force on m_2 ?

A. 2 F

B. 3 F

C. F

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

Answer: B

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49. Suppose that the gravitational force between two bodies separated by a distance R becomes inversely proportional to R (and not as $\frac{1}{R^2}$ as given by Newton's law of gravitation). Then the speed of a particle moving in a circular orbit of radius R under such a force would be proportional to

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

B. R^0

C. R

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

Answer: B

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50. The acceleration due to gravity on the planet A is 8 times the acceleration due to gravity on the planet B. A man jumps to a height of 2.5 m on the surface of A. What is the height of jump by the same person on the planet B ?

A. 12 m

B. 16 m

C. 20 m

D. 24 m

Answer: C

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

A. zero and same

B. same and zero

C. zero and zero

D. two times and zero

Answer: B

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52. The density of a newly discovered planet is twice that of the 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 be R, then radius of the planet would be

A. 4 R

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

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

D. 2 R

Answer: B

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53. Two bodies A and B of masses 50 kg and 100 kg are kept at a distance of 2 m on the surface of the earth. The gravitational force of attraction between them is F. A and B are then taken to the moon and are kept at the same distance of 2 m. The acceleration due to gravity on the surface of the moon $= \frac{g}{6}$, where g is the acceleration due to gravity on the earth. What will be the gravitational force of attraction between A and B on the surface of the moon ?

A. 6 F

B. $\frac{F}{6}$

C. F

D. $\sqrt{F}$

Answer: C

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54. 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 = $6.67 \times 10^{-11} Nm^2 kg^{-2}$

A. $2 \times 10^{-25} m / s^2$

B. $4 \times 10^{-25} m / s^2$

C. $3.1 \times 10^{-20} m / s^2$

D. $8.5 \times 10^{-20} m / s^2$

Answer: B

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55. Three particles each of mass m are placed at the three corners of an equilateral triangle of side L. A particle of mass M is kept at the midpoint of any one side. What is the force acting on M, due to this system of 3 particles ?

A. $\frac{GMm}{4L^2}$

B. $\frac{3}{4}\frac{GMm}{L^2}$

C. $\frac{4}{3}\frac{GMm}{L^2}$

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

Answer: C

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56. If the radius of the earth were to shrink by 1% its mass remaining the same, the acceleration due to gravity on the earth's surface would

A. decrease by 1%

B. increase by 1%

C. increase by 2%

D. decrease by 2%

Answer: C

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57. A body weight 45 N on the surface of the earth. What is the gravitational force acting on it due to the earth at a height equal to half the radius of the earth ?

A. 40 N

B. 25 N

C. 20 N

D. 15 N

Answer: C

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58. A planet has the same size as that of the earth but its mass is 4 times the mass of the earth. What is the energy required to lift a stone of mass 5 kg vertically upwards through 3 m, on the planet ? [g on the surface of the earth $= 10m/s^2$]

A. 300 J

B. 350 J

C. 500 J

D. 600 J

Answer: D

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59. Assume that the acceleration due to gravity on the surface of the moon is 0.2 times the acceleration due to gravity on the surface of the earth. If R_e is the maximum range of a projectile on the earth's surface, what is the maximum range on the surface of the moon for the same velocity of projection

A. $5R_e$

B. $0.2R_e$

C. $0.5R_e$

D. $2R_e$

Answer: A

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60. Two objects of masses m and $4m$ are at rest at an infinite separation. They move towards each other under mutual gravitational attraction. If G is the universal gravitaitonal constant, then at separation r

A. The total energy of the system is not zero

B. The force between them is not zero

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

D. All the above are true

Answer: D

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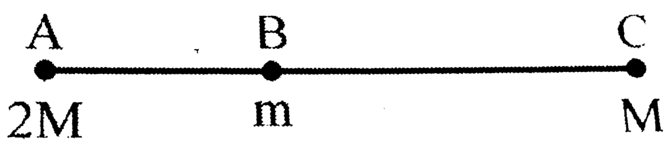
61. Particles of masses 2M, m and M are respectively at points A, B and C with $AB = \frac{1}{2}$ (BC). M is much smaller than M and at time t = 0, they are all at rest given in the figure. At subsequent times before any collision takes place.



A. m will remain at rest

B. m will move towards M

C. m will move towards 2 M

D. m will have oscillatory motion

Answer: C

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62. How much faster than it's normal rate should the earth rotate about it's axis so that the weight of the body at the equator becomes zero $\left(R = 6.4 \times 10^6 m, g = 9.8 m / s^2\right)$ (in times)

A. 7

B. 17

C. 27

D. 37

Answer: B

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63. 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

A. $9.8m/s^2$

B. $19.6m/s^2$

C. $980m/s^2$

D. $4.9m/s^2$

Answer: D

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64. The length of a second's pendulum is 1 m on the earth. If the mass and diameter of a planet than that of earth, then the length of the second's pendulum on the planet will be

A. 4m

B. 2m

C. 1m

D. 0.5m

Answer: D

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65. A satellite is revolving around the earth in a circular orbit at an altitude h where the acceleration due to gravity is g'. If the earth is a sphere of radius R then the period of the satellite is give by

A. $T = 2\pi\sqrt{\frac{h}{g'}}$

B. $T = 2\pi\sqrt{\frac{R}{g'}}$

C. $T = 2\pi\sqrt{\frac{R+h}{g'}}$

D. $T = 2\pi\sqrt{\frac{R-h}{g'}}$

Answer: C

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66. The orbital velocity for an earth satellite near the surface of the earth is 8 km/sec. If the radius of the orbit is 4 times the radius of the earth, its orbital velocity will be

A. 8 km/s

B. 16 km/s

C. 4 km/s

D. $8\sqrt{2}km / s$

Answer: C

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

A. (365×8) days

B. (365×4) days

C. $\left(\frac{365}{4}\right)$ days

D. $\left(\frac{365}{8}\right)$ days

Answer: D

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68. Two satellites X and Y are moving in circular orbits of radii R and 2R respectively, around the same planet. What is the ratio of their critical velocities ?

A. $\sqrt{2} : 1$

B. $\sqrt{3} : 1$

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

D. $1 : 2$

Answer: A

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69. Two satellites orbiting around the earth have their critical speeds in the ratio 4 : 5. What is the ratio of their orbital radii ?

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

B. $\frac{4}{5}$

C. $\frac{25}{16}$

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

Answer: C

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70. The critical speed of a satellite orbiting very close to the surface of the earth is $\left[g = 10m / s^2\right.$ and $\left.R = 6.4 \times 10^{-6} m\right]$

A. $8 \times 10^3 m / s$

B. $4 \times 10^3 m / s$

C. $16 \times 10^4 m / s$

D. $2 \times 10^4 m / s$

Answer: A

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71. Two satellites are moving at heights of R and 5R above the surface of the earth of radius R. The ratio of their velocitirs $\left(\frac{V_1}{V_2}\right)$ is

A. $\sqrt{5} : 1$

B. $1 : 1$

C. $\sqrt{3} : \sqrt{2}$

D. $\sqrt{3} : 1$

Answer: D

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72. Two satellites of masses 80 kg and 120 kg revolve round a planet in circular orbits of radii 16 R and 9 R respectively, where R is radius of the planet. The ratio of the speeds of satellites will be

A. $\frac{80}{120}$

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

C. $\frac{16}{25}$

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

Answer: D

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73. The critical speed of a satellite of mass 500 kg is 20 m/s. What is the critical speed of a satellite of mass 1000 kg moving in the same orbit ?

A. 0 m/s

B. 20 km/hour

C. 72 m/s

D. 72 km/hour

Answer: D

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

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

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

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

D. $\frac{8W}{15}$

Answer: C

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75. A satellite of mass m is circulating around the earth with constant angular velocity. If the radius is R_0 and mass of earth is M, then the angular momentum about the centre of the earth is

A. $M\sqrt{GmR_0}$

B. $m\sqrt{GMR_0}$

C. $m\sqrt{\frac{R_0}{GM}}$

D. $M\sqrt{\frac{Gm}{R_0}}$

Answer: B

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76. The period of a satellite moving very close to the surface of the earth of radius R is 84 minute. What will be the period of the same satellite, if is is taken at a distance of 3R from the surface of the earth ?

A. 84 min

B. 84×4 min

C. 84×8 min

D. $84\sqrt{8}$ min

Answer: C

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77. When a satellite revolves around the sun in a circular orbit of radius a with a period of revolution T, and if K is a positive constant, then

A. $T = Ka^2$

B. $T = Ka^3$

C. $T = Ka^{3/2}$

D. $T = Ka^{2/3}$

Answer: C

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78. If T is the period of a satellite revolving very close to the surface of the earth and if ρ is the density of the earth, then

A. $T \propto \rho$

B. $T \propto \frac{1}{\rho}$

C. $T \propto \sqrt{\rho}$

D. $T \propto \frac{1}{\sqrt{\rho}}$

Answer: D

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79. A satellite is orbiting around the earth. If both gravitational force and centripetal force on the satellite is F, then, net force acting on the satellite to revolve around the earth is

A. 2 F

B. zero

C. F

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

Answer: C

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80. Two planets at mean distance d_1 and d_2 from the sun and their frequencies are n and n respectively then

A. $n_1^2 d_1^2$

B. $n_1^3 d_1^2 = n_2^3 d_2^2$

C. $n_1^2 d_1^3 = n_2^2 d_2^3$

D. $n_1 d_1 = n_2 d_2$

Answer: C

Watch Video Solution

81. Two satellites of masses M and 4M are orbiting the earth in a circular orbit of radius r. Their frequencies of revolution are in the ratio of

A. $1 : 4$

B. $4 : 1$

C. $1:2$

D. $1:1$

Answer: D

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82. The distances of two planets A nad B from the sun are $10^{12}m$ and $10^{11}m$ and their periodic times are T_A and T_B respectively. If their orbits are assumed to be circular, then the ratio of their periodic times $\left(\frac{T_A}{T_B}\right)$ will be

A. 10

B. 100

C. $10\sqrt{10}$

D. $10\sqrt{3}$

Answer: C

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83. The time of revolution of planet A round the sun is 8 times that of another planet B. The distance of planet A from the sun is how many B from the sun

A. $4:1$

B. $1:2$

C. $3:1$

D. $1:4$

Answer: D

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84. A satellite going around the earth suddenly loses height and starts moving in an orbit of smaller radius. Then its periodic time

A. will not changed

B. is increased

C. is decreased

D. may increase or decrease

Answer: C

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85. An artificial satellite is moving in a circular orbit around the earth, with a speed which is equal to half the magnitude of the escape velocity from the earth. What is the height of the satellite above the surface of the earth ?

A. 2 R

B. R

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

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

Answer: B

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86. Two satellites A and B go around a planet in circular orbits of radii 4 R and R respectively. If the speed of the satellite A is 3 V, then the speed of the satellite B will be

A. 12 V

B. 3 V

C. 6 V

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

Answer: C

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87. A satellite going around the earth suddenly loses height and starts moving in a lower orbit. The speed of the satellite

A. does not change

B. is decreased

C. is increased

D. may increase or decrease

Answer: C

Watch Video Solution

88. Orbital radius of a satellite S of earth is four times that s communication satellite C. Period of revolution of S is :-

A. 4 days

B. 8 days

C. 12 days

D. 2 days

Answer: B

Watch Video Solution

89. The earth revolves around the sun in an elliptical orbit. It has a speed v_1 when it is at the minimum distance d_1 from the sun. When it is at the maximum distance d_2 from the sun, its speed is

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

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

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

D. $v_1 \left(\frac{d_1}{d_2}\right)^2$

Answer: B

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90. 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. fall down with increasing velocity

B. ultimately come to rest somewhere on the original orbit

C. move with a velocity v, tangentially to the original orbit

D. continue to move with velocity v along the original orbit

Answer: D

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91. If the orbital velocity of a planet is given by $v = G^a M^b R^c$ then

A. $a = \frac{1}{2}, b = \frac{1}{2}, c = -\frac{1}{2}$

B. $a = \frac{1}{2}, b = -\frac{1}{2}, c = \frac{1}{2}$

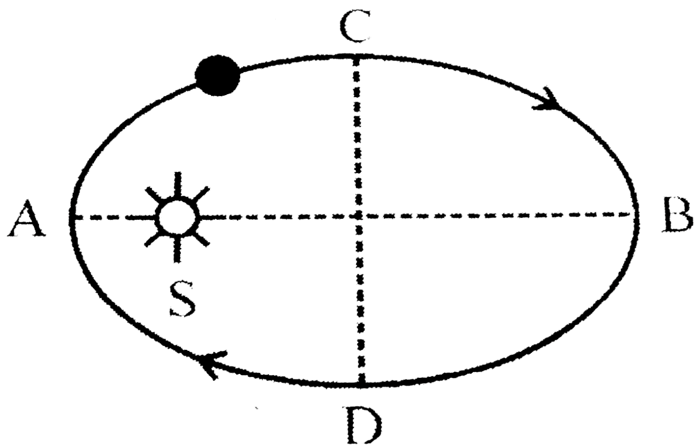
C. $a = \frac{1}{2}, b = -\frac{1}{2}, c = -\frac{1}{2}$

D. $a = \frac{1}{3}, b = \frac{1}{3}, c = -\frac{1}{3}$

Answer: A

Watch Video Solution

92. The earth E moves in an elliptical orbit around the sun, with the sun S at one of the foci as shown in the figure. Its maximum and minimum speeds of motion will be at points



A. A and C

B. A and B

C. C and D

D. B and D

Answer: B

View Text Solution

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

A. $3 \times 10^8 km$

B. $4.5 \times 10^8 km$

C. $6 \times 10^8 km$

D. $9 \times 10^8 km$

Answer: C

Watch Video Solution

94. What is the periodic times of a satellite revolving very close to the surface of the earth, of density ρ ?

A. $\sqrt{\frac{3\pi}{\rho G}}$

B. $\sqrt{\frac{5\pi}{\rho G}}$

C. $\sqrt{\frac{2\pi}{\rho G}}$

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

Answer: A

Watch Video Solution

95. 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. $1:2\sqrt{2}$

Answer: D

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96. 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. What is the time period of another satellite orbiting at a height of 2.5 R from the surface of the earth ?

A. 6.2 hour

B. 8.48 hour

C. 9.5 hour

D. 11.6 hour

Answer: B

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

A. both the mass and radius of the orbit

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

C. the mass of the satellite

D. radius of its orbit

Answer: C

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98. 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. S_1 and S_2 are moving with the same speed

B. The kinetic energies of the two satellites are equal

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

D. The potential energies of earth and satellite in the two cases are equal

Answer: A

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99. If the sun and the planets carried huge amounts of opposite charges

A. all the three Kepler's laws would still be valid

B. only the third law will be valid

C. only the second law will be valid

D. the first law will still be valid

Answer: A

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

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

C. gh

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

Answer: A

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101. Two satellites are in the parking orbits around the earth. Mass of one is 5 times that of the other. The ratio of their periods of revolution is

A. 25

B. $\sqrt{5}$

C. 1

D. $\sqrt[3]{5}$

Answer: C

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102. A satellite can be in a geostationary orbit around earth in an orbit of radius r. If the angular velocity of earth about its axis doubles, a satellite can now be in a geostationary orbit aroun earth radius

A. 2R

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

C. $\frac{R}{2^{1/3}}$

D. $\frac{R}{4^{1/3}}$

Answer: D

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103. A geostationary satellite orbites around the earth in a circular orbit of radius 36000 km Then, the time period of a spy satellite orbiting a few hundred km above the earth's surface $(R_e = 6400 km)$ will approximately be

A. 4h

B. 2h

C. 1h

D. $1/2h$

Answer: B

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104. 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. 730

B. 182.5

C. 129

D. 64.5

Answer: C

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105. A particle moves in a circular path with decreasing speed . Choose the correct statement.

A. its angular momentum remains constant

B. its resultant acceleration is towards the centre

C. particle moves in a spiral path with decreasing radius

D. the direction of angular momentum remains constant

Answer: D

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106. A satellite is orbiting just above the surface of the earth with period T. If d is the average density of the earth and G is the universal constant of gravitation, the quantity $\frac{3\pi}{Gd}$ represents its

A. periodic time

B. square of the period

C. cube of the periodic time

D. square root of the period

Answer: B

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107. The periodic time of a satellite is 3 hours. If the separation between the earth and the satellite is increased by 4 time its previous value, the new periodic time will be

A. period of rotation of the earth about its own axis

B. period of rotation of the moon about the earth

C. half the period of a geostationary satellite

D. twice the period of rotation of the earth

Answer: A

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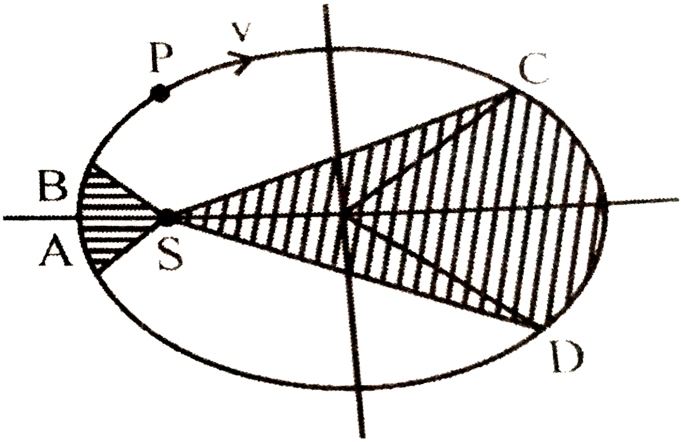
108. The figure shows elliptical orbit of a planet P about the sun S. The shaded area CSD is twice the shaded area ASB. If t_1 is the time taken by the planet to mmove from C to D and t_2 is the time to move from A to B, then



A. $t_1 > t_2$

B. $t_1 = 4t_2$

C. $t_1 = 2t_2$

D. $t_1 = t_2$

Answer: C

View Text Solution

109. The mean radius of the earth is R, its angular speed on its own axis is ω and the acceleration due to gravity at earth's surface is g. The cube of the radius of the orbit of a geo-stationary satellite will be

A. $R^2 g / \omega^2$

B. $Rg\omega^2$

C. $R^2 g / \omega$

D. $R^2 \omega^2 / g$

Answer: A

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110. Under the influence of the Coulomb field of charge $+Q$, a charge $-q$ is moving around it in an elliptical orbit. Find out the correct statement(s).

A. The angular momentum of the charge - q is constant

B. The linear momentum of the charge-q is constant

C. The angular velocity of the charge-q is constant

D. The linear speed of the charge-q is constant

Answer: A

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

A. Angular momentum

B. Energy

C. Linear momentum

D. Mass

Answer: A

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112. 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 :

A. $2^{-3/2}$ lunar month

B. $2^{3/2}$ lunar month

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

D. $\frac{2}{3}$ lunar month

Answer: A

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113. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. if the gravitational force of attraction between the planet and the star is proportational to $R^{-5/2}$, then

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

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

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

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

A. $R^{5/2}$

B. $R^{3/2}$

C. R^3

D. $R^{7/2}$

Answer: D

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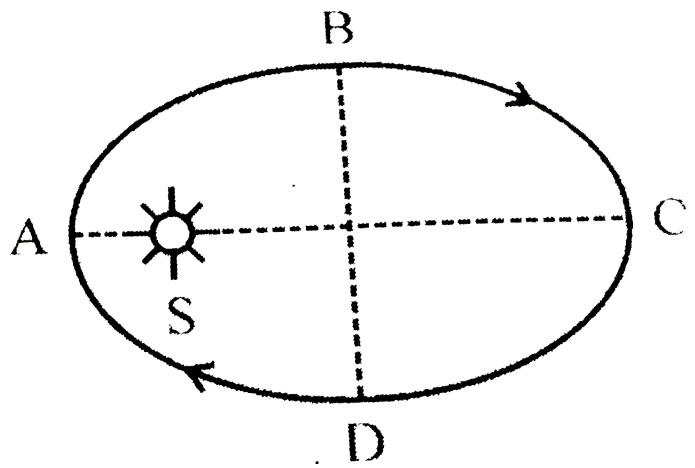
114. A planet is revolving around the sun in an elliptical path as shown in the figure. The correct option is



A. The time taken in travelling CDA is greater than that for ABC

B. The time taken in travelling CDA is less than that for ABC

C. The time taken in travelling DAB is greater than that for BCD

D. The time taken in travelling DAB is lessa than that for BCD

Answer: D

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115. In planetary motion the areal velocity of possition vector of a planet depends of angular velocity (ω) and the distance of the planet from sun (r). If so the correct relation for areal velocity is

A. $\frac{dA}{dt} \propto \omega r^2$

B. $\frac{dA}{dt} \propto \omega r$

C. $\frac{dA}{dt} \propto \sqrt{\omega r}$

D. $\frac{dA}{dt} \propto \omega^2 r$

Answer: A

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116. A double star is a system of two stars of masses m and $2m$, rotating about their centre of mass only under their mutual gravitational attraction. If r is the separation between these two stars then their time period of rotation about their centre of mass will be proportional to

A. $T = 2\pi\sqrt{\frac{L^3}{2mG}}$

B. $T? = 2\pi\sqrt{\frac{L^3}{3mG}}$

C. $T = 2\pi\sqrt{\frac{L^3}{4mG}}$

D. $T = 2\pi\sqrt{\frac{L^3}{mG}}$

Answer: B

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117. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius (1.01) R. The period of the second satellite is larger than the first one by approximately

A. 1.5%

B. 3.0%

C. 1.0%

D. 0.5%

Answer: A

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118. Three point masses each of mass 'm' are kept at the corners of an equilateral triangle of side L. The system rotates about the centre of the triangle without any change in the separation of masses during the rotation. If T is the periodic time of rotatio then

A. $T \propto \frac{1}{L^2}$

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

C. $T \propto m^{1/2}$

D. $T \propto L^{3/2}$

Answer: D

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119. The ratio of the earth's orbital angular momentum (about the Sun) to its mass is $4.4 \times 10^{15} m^2 s^{-1}$. The area enclosed by the earth's orbit is approximately-__________m^(2).

A. $7 \times 10^{22} m^2$

B. $1 \times 10^{22} m^2$

C. $3 \times 10^{22} m^2$

D. $5 \times 10^{22} m^2$

Answer: A

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120. A satellite of mass m and radius R is moving in a circular orbit of radius r around a planet of mass M.

A. The magnitude of its angular momentum with respect to the centre of the orbit is $m\sqrt{GMr}$, where G is the gravitation constant and the direction of L is perpendicular to the plane of the orbit

B. The magnitude of its angualr momentum is $mR\sqrt{2gr}$ where is the acceleration due to gravity on the surface of the planet

C. The direction of angular momentum is parallel to the plane of the orbit

D. The direction of angular momentum is inclined to the plane of the orbit

Answer: A

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121. If the distance between the earth and the sun becomes $1/4th$ of its present value, then its period of revolution around the sun will become

A. $\left(\frac{365}{4}\right)$days

B. (365×4) days

C. (365×8) days

D. $\left(\frac{365}{8}\right)$ days

Answer: D

Watch Video Solution

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

A. $\sqrt{2Emr}$

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

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

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

Answer: B

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123. Kepler's second law of motion states that the straight line joining the planet to sun sweeps out equal areas in equal intervals of time. This statement is equivalent to saying that

A. longitudinal acceleration is zero

B. total acceleration is zero

C. radius acceleration is zero

D. tangential acceleration is zero

Answer: D

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124. The escape velocity for a body of mass 1 kg from the earth's surface is 11.2km/s. The escape velocity of another body of mass 10 kg will be

A. 112km/s

B. 1.12 km/s

C. 1120 km/s

D. 11.2km/s

Answer: D

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

A. $\sqrt{gR}$

B. $\sqrt{2gR}$

C. 2gR

D. gR

Answer: B

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126. 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 ?

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

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

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

C. gR

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

Answer: C

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127. How much energy should be supplied to a body of mass 500kg, so that it can escape from the gravitational pull of the earth? $\left[g = 10 m / s^2\right.$ and $\left.R = 6400 km\right]$

A. $6.4 \times 10^{10} J$

B. $3.2 \times 10^{10} J$

C. $6.4 \times 10^{8} J$

D. $3.2 \times 10^{6} J$

Answer: B

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128. The mass and diameter of a planet are half of thast of the earth. The ratio of gravitational potential energy of a body on the surface of the planet to that on the surface of the earth is

A. $1:1$

B. $1:2$

C. $3:1$

D. $1:4$

Answer: A

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129. A satellite of mass m is Launched from the earth's surface in a circular orbit. If M and R denote the mas and radius of the earth respectively, then the total energy of the satellite at an altitude 2R is

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

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

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

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

Answer: D

Watch Video Solution

130. The total amount of work that must be done on a body of mass m so that it escapes from the gravitational influence of a planet of radius R and mass M is given by

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

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

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

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

Answer: A

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131. 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. $1.25km/s$

B. $2.5m/s$

C. $5m/s$

D. $10m/s$

Answer: B

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132. The K.E. of a satellite moving in a circular orbit around a planet is $1.5 \times 10^{10} J$. What is its potential energy?

A. 0.75×10^{10}J

B. -3×10^{10}J

C. $3 \times 10^{10} J$

D. 6×10^{9}J

Answer: B

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133. The total energy of a satellite moving in a circular orbit is $\left[-1.5 \times 10^{9} J\right]$. What is its bilding energy?

A. $3 \times 10^{0} J$

B. 1.5×10^{9}J

C. 0.75×10^{10}J

D. 4.5×10^{10}J

Answer: B

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134. The ratio of the kinetic energy required to be given to a satellite to escape from the earths gravity to the kinetic energy required to be given to it so that it moves in a circular orbit just above the eart's surface is:

A. $\sqrt{2}$

B. 4

C. $2\sqrt{2}$

D. 2

Answer: D

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135. The escape velocity from a spherical satellite is v_e. The escape velocity from another satellite of double the radius and half the mean density will be

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

B. $2V_e$

C. $\sqrt{2}V_2$

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

Answer: C

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

A. $1:1$

B. $1:2$

C. $2:1$

D. $3:1$

Answer: A

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137. The percentage by which the moon should move faster, so that it escapes from the gravitational field of the earth is:

A. 41.4%

B. 20%

C. 50%

D. 64.3%

Answer: A

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

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

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

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

Answer: A

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139. The radius of a planet is $\frac{1}{4}$ of earth's radius and its acceleration due to gravity is double that of earth's acceleration due to gravity. How many times will the escape velocity at the planet's surface be as compared to its value on earth's surface

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

B. $\sqrt{2}$

C. 2

D. $2\sqrt{2}$

Answer: A

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140. The escape speed of a particle on the surface of the earth is 11.2km/second. A body is projectwith thrice this speed from the surface of the earth. What is the speed of the body in the outer space far away from the earth?

A. $22.4 km / s$

B. $33.6 km / s$

C. $31.7 km / s$

D. $5.6 km / s$

Answer: C

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141. If the gravitational potential energy of a body on a planet is numerically equal to . U and the escape velocity of the same body is V_e, then

A. $\dfrac{U}{V_e}=m\sqrt{\dfrac{GM}{2R}}$

B. $\dfrac{U}{V^e}=\dfrac{mGM}{R}$

C. $\dfrac{U}{V_e}=m\sqrt{\dfrac{GM}{2R}}$

D. $\dfrac{U}{V_e}=m\sqrt{\dfrac{2R}{GM}}$

Answer: C

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142. A satellite with kinetic energy E_k is revolving round the earth in a circular orbit. How much more kinetic energy should be given to it so that it may just escape into outer space

A. $2E_K$

B. $3E_k$

C. E_K

D. $E_{K/2}$

Answer: C

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143. Two planets A and B have the same material density. If the radius of A is twice that of B, then the ratio of the escape velocity $\frac{v_A}{v_B}$ is

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

B. $2:1$

C. $\sqrt{2}:1$

D. $1:\sqrt{2}$

Answer: B

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144. For the moon to cease to remain the earth's satellite, its orbital velocity has to increase by a factor of

A. 2

B. $\sqrt{2}$

C. $\sqrt{3}$

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

Answer: B

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145. A body of mass m is to be moyed to infinity from the earth's surface. If R is the radius of the earth, then the kinetic energy that should be imparted to the body is

A. infinity

B. mgR

C. 2mgR

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

Answer: B

Watch Video Solution

146. 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. $11.2km/s$

B. $5.6km/s$

C. $22.4km/s$

D. $44.8km/s$

Answer: C

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147. The gravitational potential due to the earth is minimum at

A. the surface of the earth

B. the centre of the earth

C. a distance equal to 5 times the radius of the earth

D. an infinite distance

Answer: B

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148. If the graviational potential at the surface of the earth is assumed to be zero, then the potential at infinity is given by

A. 0

B. $\propto$

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

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

Answer: D

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149. The escape velocity of a body on the surface of the earth is V_e. What is the escape velocity on a planet whose radius is thrice the radius of the earth and whose mass is double the mass of the earth?

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

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

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

D. $\frac{\sqrt{3}}{2}V_e$

Answer: B

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150. A body is projected from the surface of the earth with thrice the escape velocity (V_e) from the surface of the earth. What will be its velocity, when it will escape the gravitational pull?

A. $2\sqrt{2}V_e$

B. $2V_e$

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

D. $4V_e$

Answer: A

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151. For a satellite revolving around the earth

A. its P.E. and K.E. are +ve and the total energy is negative

B. its P.E. and K.E. are -ve but the total energy is positive

C. its P.E. and total energy are negative but the K.E. is positive

D. its P.E. and total energy are positive but its K.E. is negative

Answer: C

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152. For a satellite moving in an orbit around the earth, ratio of kinetic energy to potential energy is

A. 1

B. $\sqrt{2}$

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

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

Answer: C

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153. A body projected from the surface of the earth attains a height equal to the radius of the earth. The velocity with which the body was projected is

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

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

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

D. $\sqrt{\frac{5GM}{4R}}$

Answer: B

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154. The dimensional formula for gravitational potential is

A. $[V] = [M^0 L^2 T^{-2}]$

B. $[V] = [M^1 L^2 T^{-1}]$

C. $[V] = [M^0 L^2 T^2]$

D. $[V] = [M^1 L^2 T^2]$

Answer: A

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155. There is no atomosphere on moon because

A. it is close to the earth

B. its surface temperature is $-10^{\circ} C$

C. the escape velocity of gas molecules is less than their rms velocity on the moon

D. the escape velocity of the gas molecules is more than their rms velocity on the moon

Answer: C

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156. The binding energy of an artifical satellite moving in a circular orbit is $4 \times 10^{9} J$. What is the potential energy of the satellite?

A. -4×10^9J

B. $-8 \times 10^9 J$

C. $2 \times 10^9 J$

D. 6×10^9J

Answer: B

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157. A spacecraft is launched in a circular orbit very close to earth. What additional velocity should be given to the spacecraft so that it might escape the earth's gravitational pull.

A. $11.2km/s$

B. $3.3km/s$

C. $8km/s$

D. $20.2km/hour$

Answer: B

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158. The earth revolves about the sun in an elliptical orbit with mean radius $9.3 \times 10^7 m$ in a period of 1 year. Assuming that there are no outside influences

A. The earth's potential energy remains constant

B. The earth's kinetic energy remains constants

C. The earth's angular momentum remains constant

D. The earth's linear momentum remains constant

Answer: C

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159. The gravitational potential energy of body of mass 'm' at the earth's surface -mgR_e. Its gravitational potential energy at a height R_e from the earth's surface will be (here R_e is the radius of the earth)

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

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

C. $2mgR_e$

D. $-2mgR_e$

Answer: A

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160. How much energy will be necessary for making a body of 500 kg escape from the earth

$\left[g = 9.8 ms^2, \quad \text{radius of earth} \quad = 6.4 \times 10^6 m\right]$

A. $6.4 \times 10^8 J$

B. $3.2 \times 10^{10} J$

C. $6.4 \times 10^{12} J$

D. $3.2 \times 10^6 J$

Answer: B

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161. If the radius of a planet is R and its density is ρ , the escape velocity from its surface will be

A. $v_e \propto R\sqrt{\rho}$

B. $v_e \propto \frac{1}{\sqrt{\rho R}}$

C. $V_e \propto \rho R$

D. $V_e \propto \frac{\sqrt{\rho}}{R}$

Answer: A

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

A. $11.2kms^{-1}$

B. $1.112kms^{-1}$

C. $15.8kms^{-1}$

D. $22.4kms^{-1}$

Answer: C

Watch Video Solution

163. On any planet, the presence of atmosphere implies ($C_{rms} =$ root mean square velocity of molecules and $v_s =$ escape velocity)

A. $C_{rms} < V_e$

B. $C_{rms} > V_e$

C. $C_{rms} = V_e$

D. $C_{rms} = 0$

Answer: A

Watch Video Solution

164. A satellite of mass m is revolving around the earth at a distancer r from the centre of the earth. What is its total energ?

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

B. $-\frac{GMm}{2r}$

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

D. $+\frac{GMm}{2r}$

Answer: B

Watch Video Solution

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

A. the linear momentum of S remains constant in magnitude

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

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

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

Answer: D

Watch Video Solution

166. An ideal spring with spring constant k is hung from the ceiling and a block of mass M is attached to its lower end. The mass is released with the spring initially unstretched. Then the maximum extension in the spring is

A. $\frac{4Mg}{K}$

B. $\frac{2Mg}{K}$

C. $\frac{Mg}{K}$

D. $\frac{Mg}{2K}$

Answer: B

Watch Video Solution

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

A. m^2

B. m^1

C. m^3

D. m^0

Answer: D

Watch Video Solution

168. 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. E is always negative

B. L is conserved but direction of vector L changes

C. U is always positive

D. T is conserved

Answer: A

Watch Video Solution

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

A. the mass of the body

B. the direction of projection

C. the latitude and altitude of the location, from where the body is launched

D. none of the above

Answer: C

Watch Video Solution

170. If a satellite is moved from one stable circular orbit to a farther stable circular orbit, then the following quantity increases

A. Linear orbital speed

B. Gravitational force

C. Centripetal accelerations

D. Gravitational P.E.

Answer: D

Watch Video Solution

171. For a satellite the escape velocity is 11km/s. If the satellite is launched at an angle of 30° with the vertical, then the escape velocity will be

A. $11\sqrt{3}km / s$

B. $11km / s$

C. $5.5km / s$

D. $\frac{11}{\sqrt{3}} km / s$

Answer: B

Watch Video Solution

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

A. mgh

B. $\frac{3}{4}mgh$

C. $\frac{4}{5}mgh$

D. $\frac{5}{6}mgh$

Answer: D

Watch Video Solution

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

A. mgR

B. 2 mgR

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

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

Answer: C

Watch Video Solution

174. The escape velocity of a body from the surface of the earth is expressed in terms of density and diameter of the earth, it is found that it is

A. directly proportional to the mass of the body

B. directly proportional to the diameter of the earth

C. inversely proportional to the diameter of the earth

D. inversely proportional to the density of the earth

Answer: B

Watch Video Solution

175. A body is projected vertically upwards from the surface of the earth. If its kinetic energy is equal to half of its minimum value required to escape from the gravitational influece, then the height upto which it rises is

A. 4R

B. 3R

C. 2R

D. R

Answer: D

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176. 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. 110km/s

B. 11km/s

C. $1.1km/s$

D. $0.11km/s$

Answer: A

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177. Four particles each of mass m are placed at the vertices of a square of side l. the potential at the centre of square is

A. $\frac{4\sqrt{2}Gm}{L}$

B. $-\frac{4\sqrt{2}Gm}{L}$

C. zero

D. $-\frac{8\sqrt{2}Gm}{L^2}$

Answer: B

Watch Video Solution

178. The magnitude of gravitational potential energy of a body at a distance r from the centre of earth is u. Its weight at a distance 2r from the centre of earth is

A. $4 \times 10^{-3} N$

B. $4 \times 10^{-2} N$

C. $8 \times 10^{-2} N$

D. $8 \times 10^{-3} N$

Answer: B

Watch Video Solution

179. A body situated on the surface of the earth, of mass M and radius R, at its equator, becomes weightless, when the rotational kinetic energy of the earth, reaches a critical value K. The value of K is given by

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

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

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

D. $\frac{1}{5}MgR$

Answer: D

Watch Video Solution

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

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

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

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

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

Answer: C

Watch Video Solution

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

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

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

C. mv^2

D. $-\left(\frac{1}{2}\right)mv^2$

Answer: D

Watch Video Solution

182. 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. $6.67 \times 10^{-9} J$

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

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

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

Answer: B

183. The kinetic energy needed to project a body of mass m from the earth's surface to infinity is

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

B. mgR

C. 2mgR

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

Answer: B

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

A. GMm/6R

B. $GMm/12R^2$

C. $GMm/8R$

D. $GMm/3R^2$

Answer: A

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185. A body is kept in a gravitational field. Its binding energy

A. will be zero, if it is at rest

B. will start increasing its speed is increased

C. will remain constant for any speed

D. will be maximum if it is at rest

Answer: D

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186. An artificial earth satellite is taken from a higher orbit to a lower orbit i.e. $r_2 < r_1$. In this process, the gravitational potential energy

A. is increased

B. does not change

C. is decreased

D. is doubled

Answer: C

Watch Video Solution

187. Two identical satellite are at R and $7R$ away from earth surface, the wrong statement is (R =radius of earth)

A. The ratio of their total energies will be 4 but the ratio of their potential and kinetic energies will be 2

B. The ratio of their potential energies will be 4

C. The ratio of their kinetic energies will be 4

D. The ratio of their total energies will be 4

Answer: A

Watch Video Solution

188. Escape velocity of a body $1kg$ mass on a planet is $100ms^{-1}$. Gravitational potential energy of the body at that planet is

A. 5000J

B. $-5000J$

C. $-2400J$

D. $-1000J$

Answer: B

Watch Video Solution

189. A body of mass m kg falling from a distance 3R above the earth's surface. What is its kinetic enrgy when it reaches a distance 'R' above the surface of the earth of radius R and mass M ?

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

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

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

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

Answer: D

Watch Video Solution

190. The gravitational field due to a mass distribution is $E = K / x^3$ in the x - direction. (K is a constant). Taking the gravitational potential to be zero at infinity, its value at a distance x is

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

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

C. $\frac{K}{2x}$

D. $\frac{K}{x}$

Answer: B

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191. A mass of $6 \times 10^{24} kg$ is to be compressed in a sphere in such a way that the escape velocity from its surface is $3 \times 10^{8} m / s$. Find the radius of the sphere (in mm).

A. 9 mm

B. 9cm

C. 9 km

D. 9m

Answer: A

Watch Video Solution

192. The radius and mass of earth are increased by 0.5%. Which of the following statements are true at the surface of the earth

A. Escape velocity will remain unchanged

B. g will increase

C. Potential energy will remain unchanged

D. g will decrease

Answer: B

Watch Video Solution

193. Two bodies of masses m and 4m 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. $-\frac{4Gm}{r}$

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

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

Answer: D

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194. 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. 6.4×10^8 joule

B. 6.4×10^9 joule

C. 6.4×10^{10} joule

D. 6.4×10^{11} joule

Answer: C

Watch Video Solution

195. 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. E_0

D. $2E_0$

Answer: D

Watch Video Solution

196. 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. $2mv^2$

Answer: B

Watch Video Solution

197. The maximum vertical distance through which a fully dressed astronaut can jump on the earth is $0.5m$. If mean density of the Moon is two-third that of the earth and radius is one quarter that of the earth, the maximum vertical distance through which he can jump on the Moon and the ratio of the time of duration of the jump on the Moon to hold on the earth are

A. 1.5m

B. 3m

C. 6m

D. 7.5m

Answer: B

Watch Video Solution

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

A. 2

B. $\sqrt{2}$

C. $\sqrt{2}+1$

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

Answer: B

Watch Video Solution

199. A body of mass m is placed on the earth surface is taken to a height of $h=3R$, then, change in gravitational potential energy is

A. $\dfrac{mgR}{2}$

B. $\dfrac{mgh}{R}$

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

D. $\frac{3}{4}mgR$

Answer: D

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200. The earth is assumed to be a sphere of radius R. A platform is arranged at a height R from the surface of the earth. The escape velocity of a body from this platform is fv_e, where v_e is its escape velocity from the surface of the earth. Find the value of f.

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

B. $\sqrt{2}$

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

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

Answer: A

Watch Video Solution

201. 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. $4mgR_e$

B. $-2mgR_e$

C. $-0.5mgR_e$

D. $-mgR_e$

Answer: C

Watch Video Solution

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

A. $2h : R$

B. $h : 2R$

C. $R : h$

D. $h : R$

Answer: A

Watch Video Solution

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

A. $\sqrt{gR}$

B. $2\sqrt{gR}$

C. $3\sqrt{gR}$

D. $4\sqrt{gR}$

Answer: A

Watch Video Solution

204. By what percent the energy of the satellite has to be increased to shift it from an orbit of radius r to

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

A. 20%

B. 40%

C. 0.3333

D. 66.66%

Answer: C

Watch Video Solution

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

A. $4\sqrt{\frac{GM}{x}}$

B. $\sqrt{\frac{4\sqrt{2}GM}{x}}$

C. $\sqrt{\frac{8\sqrt{2}GM}{x}}$

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

Answer: C

Watch Video Solution

206. A body is projected with a velocity equal to twice the escape velocity (v_e) from the surface of the earth. With what velocity it will travel in interplanetary space?

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

B. $\frac{\sqrt{6GM}}{R}$

C. $\frac{\sqrt{5GM}}{R}$

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

Answer: B

Watch Video Solution

207. A roket of mass M is launched vertically upwards from trhe surface of the earth with an intial speed v . Assuming the radius of the earth to be R and negligible air resistance, the maximum height attained by the roket above the surface of the earth

is

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

B. $R\left(\frac{gR}{2v^2-1}\right)$

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

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

Answer: C

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

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

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

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

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

Answer: D

Watch Video Solution

209. W is the weight of a man on the surface of the earth. What would be his weight, if he goes to a depth (h) equal to the radius of the earth, below the surface of the earth?

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

B. $W' = 0$

C. $W' = \frac{W}{3}$

D. $W' = \frac{W}{4}$

Answer: B

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210. Assuming the earth as a sphere of uniform density. the acceleration due to gravity half way towards the centre of the earth will be

A. 0.25g

B. 0.50g

C. 0.125g

D. 0.75g

Answer: C

Watch Video Solution

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

A. 3R

B. 9R

C. 18R

D. 6R

Answer: B

Watch Video Solution

212. A man weighs 100kg on the surface of the earth of radius R. At what height above the surface of the earth, he will weigh 50 kg?

A. 0.41R

B. 0.51R

C. 0.31R

D. 0.61R

Answer: A

Watch Video Solution

213. At what depth below the surface of the earth, is the value of g same as that at a height of 10km from the surface of the earth?

A. 5km

B. 10km

C. 20km

D. 40km

Answer: C

Watch Video Solution

214. If the weight of a man on the surface of the earth is 75kg, then his weight on the surface of the moon will be

A. 150 kg-wt

B. 50 kg-wt

C. 12.5 kg-wt

D. 25 kg-wt

Answer: C

Watch Video Solution

215. If a body weight 100 N on the surface of the earth, then how much it would weigh at a depth of R/2 bellow the surface of the earth of radius R?

A. 50N

B. 75 N

C. 100 N

D. 25 N

Answer: A

Watch Video Solution

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

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

B. $g' \propto r$

C. $g' \propto \frac{1}{r}$

D. $g' \propto r^2$

Answer: B

Watch Video Solution

217. A man standing on the equator feels that he is completely weightless. For this the angular of rotation of the earth about its axis, must be

A. $\sqrt{2gR}$

B. $\sqrt{gR}$

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

D. $\sqrt{\frac{g}{R}}$

Answer: D

Watch Video Solution

218. Assuming the earth to be a sphere of uniform density, how much would a body of weight 200N, weigh at a distance of $\frac{R}{2}$ from the centre of the earth?

[R is the radius of the earth.]

A. 100N

B. 200N

C. 400N

D. 150N

Answer: A

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219. If R is the radius of the earth, then the value of acceleration due to gravity at a height h from the surface of the earth will become half its value on the surface of the earth if

A. $h = 2R$

B. h=R

C. $h = (\sqrt{2} + 1)R$

D. $h = (\sqrt{2} - 1)R$

Answer: D

Watch Video Solution

220. An accurate pendulum clock is mounted on ground floor of a high building. How much time will it lose or gain in one day if its is transferred to top storey of a building which is h = 200m higher than the ground floor? Radius of earth is 6.4×10^6

A. will gain in time

B. will lose in time

C. will show the correct time

D. will stop working

Answer: B

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221. R is the radius of the earth and ω is its angular velocity and g_p is the value of g at the poles. The effective value of g at the latitude $\lambda = 60^\circ$ will be equal to

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

B. $g_p - (R\omega^2)$

C. $g_p - \frac{R\omega^2}{2}$

D. $g(p) - \frac{3}{4}R\omega^2$

Answer: B

Watch Video Solution

222. R is the radius of the earth and ω is its angular velocity and g_p is the value of g at the poles. The effective value of g at the latitude $\lambda = 60^\circ$ will be equal to

A. 45°

B. 30°

C. 60°

D. 90°

Answer: B

Watch Video Solution

223. A simple pendulum has the same periodic time (T) at the top of a mountain of height (h) and at the bottom of a mine having a depth d . What is the relation between h and d?

A. d=h

B. d=2h

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

D. d=3h

Answer: B

Watch Video Solution

224. At what distance from the centre of the earth, the value of acceleration due to gravity g will be half that on the surface (R = radius of earth)

A. 1.414R

B. R

C. 0.414R

D. 2R

Answer: A

Watch Video Solution

225. At what altitude will the acceleration due to gravity be 25% of that at the earth's surface (given radius of earth is R)?

A. R

B. $\frac{3}{8}R$

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

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

Answer: A

Watch Video Solution

226. If it is assumed that the spinning motion of earth increases, then the weight of a body on equator

A. becomes double

B. increases

C. remains constant

D. decreases

Answer: D

Watch Video Solution

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

A. $w_1 = w_2 = w_3$

B. $w_1 < w_2 < w_3$

C. $w_1 > w_2 > w_3$

D. $w_1 < w_2 > w_3$

Answer: D

Watch Video Solution

228. 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 $6400km$.

A. 0.01

B. 0.0075

C. 0.005

D. 0.0025

Answer: C

Watch Video Solution

229. A body is taken to a height of nR from the surface of the earth . The ratio of acceleration due to gravity on the surface to that at the altitude is

A. $(n+1)^{-2}$

B. $(n+1)^{2}$

C. $(n+1)$

D. $(n+1)^{-3}$

Answer: B

Watch Video Solution

230. A body of mass m is moved from the centre of the earth to a infinite distance from its centre. The value of g will

A. not change in magnitude and direction

B. increase from zero to infinity

C. increase from zero to g and then decrease from g to zero

D. decrease from infinity to zero

Answer: C

Watch Video Solution

231. Let the acceleration due to gravity be g_1 at a height h above the earth's surface g_2 at a depth d below the earth's surface. If $g_1 = g_2, h < < R$ and $d < < R$ then

A. d=h

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

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

D. d=2h

Answer: D

Watch Video Solution

232. If the earth stops rotating, then the weight of an object at the north pole will

A. decrease

B. increase

C. have twice its value at south pole

D. remain thee same

Answer: D

Watch Video Solution

233. Acceleration due to gravity is ' g ' on the surface of the earth. The value of acceleration due to gravity at a height of 32 km above earth's surface is (Radius of the earth = 6400 km)

A. 0.9g

B. 0.99g

C. 1.01g

D. 0.8g

Answer: B

Watch Video Solution

234. If the change in the value of g at a height h above the surface of the earth is the same as at a depth x below it, then (both x and h being much smaller than the radius of the earth)

A. x=h

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

C. x=2h

D. $x = h^2$

Answer: C

Watch Video Solution

235. If the radius of the earth was to shringk by 2% its mass remaining same the acceleraton due to gravity on the earth surface would be

A. increase by 2%

B. increase by 4%

C. decrease by 2%

D. decrease by 4%

Answer: B

Watch Video Solution

236. The linear speed of a particle at the equator of the earth due to its spin motion is V . What is its linear speed latitude 60° ?

A. 2V

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

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

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

Answer: B

Watch Video Solution

237. The angular speed of earth's rotation about its own axis is ω. When its angular speed is increased to n time its original angular speed, the acceleration due to gravity at the equator becomes zero. What is the value of n?

[R is the equatorial radius of the earth]

A. $\omega\sqrt{\frac{g}{R}}$

B. $\frac{1}{\omega}\sqrt{\frac{g}{R}}$

C. $\frac{\omega g}{R}$

D. $\frac{Rg}{\omega}$

Answer: B

Watch Video Solution

238. Determine the decrease in the weight of a body when it is taken 32 km below the earth surface. Take radius of the earth as 6400 km.

A. 1%

B. 2%

C. 1.5%

D. 5%

Answer: A

Watch Video Solution

239. The acceleration due to gravity at a depth d below the surface of the earth is 20% of its value at the surface. What is the value of d if the radius of the earth=6400km ?

A. 5120km

B. 4600km

C. 7350km

D. 2840km

Answer: A

Watch Video Solution

240. In order to make the effective acceleration due to gravity at the equator to zero, the numerical value of the angular velocity of rotation of the earth should be

[Radius of the earth=6400 km, $g = 10\frac{m}{s^2}$]

A. $\frac{1}{400}$ rad/s

B. $\frac{1}{200}$ rad/s

C. $\frac{1}{800}$ rad/s

D. $\frac{1}{500}$ rad/s

Answer: C

Watch Video Solution

241. Which one of the following option is wrong?

A. Acceleration due to gravity decreases with incresing altitude

B. Acceleration due to gravity decreases with increasing depth (assume the earth to be a sphere of uniform density)

C. Acceleration due to gravity increases with increasing latitude

D. Acceleration due to gravity is independent of the mass of the earth

Answer: D

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

A. 7.8×10^{-2} rad/s

B. 0.5×10^{-3} rad/s

C. 1×10^{-3} rad/s

D. 2.5×10^{-3} rad/s

Answer: D

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243. The astronaut in a satellite, moving in a circular orbit around the earth, experiences a feeling of weightlessness because

A. the gravitational force acting acting on the astronaut is zero

B. acceleration due to gravity of the earth is zero

C. the astronaut is in an inertial frame of reference

D. the floor of the satellite does not produce any reaction on the astronaut

Answer: D

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244. Time period of pendulum, on a satellite orbiting the earth, is

A. T

B. 2T

C. zero

D. infinite

Answer: D

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245. When a lift is moving up with a uniform speed of 1 m/s. the weight of a man recorded bby a weighing machine in the lift is 70 kg . If the lift starts moving down with a uniform speed of 2 m/s, the weight of the man recorded by the weighing machine will be

A. 72kg

B. 70kg

C. 68 kg

D. 75kg

Answer: B

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246. A satellite which is geostationary in a particular orbit is taken to another orbit. Its distance from the centre of earth in new orbit is 2 times that of the earlier orbit. The time period in the second orbit is

A. 24 hours

B. 48 hours

C. $48\sqrt{2}$ hours

D. $\frac{48}{\sqrt{2}}$ hours

Answer: C

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247. Where can a geostationary satellite be installed

A. At the surface of the earth

B. Over the north or south pole

C. Over any city on the equator

D. At a height R above the surface of the earth

Answer: C

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248. Weightlessness experienced while orbiting the earth in space-ship, is the result of

A. Acceleration

B. Free fall towards the earth

C. Inertia

D. Zero gravity

Answer: B

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249. Which one of the following is true?

A. A polar satellite goes around the earth's pole in north-south direction

B. A geostationary satellite goes around the earth in east-west direction

C. A geostationary satellite goes around the earth in south-north direction

D. A polar satellite goes around the earth in east-west direction

Answer: A

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250. A communication satellite is revolving around the earth very close to the surface of the earth of radius R . Then the period of communication satellite depends upon

A. mass of the satellite

B. radius of the earth

C. mass of the satellite and the radius of the earth

D. height of the satellite and mass of the earth

Answer: B

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251. What is the height of a geostationary satellite in terms of M, R, G and T? (T=Length of the day and the other symbols have their usual meanings in the following options.)

A. $\left(\frac{GMT^2}{4\pi^2}\right)^{1/3}+R$

B. $\left(\frac{GMT^2}{4\pi^2}\right)^{1/3}-R$

C. $\left(\frac{4\pi^2GM}{T^2}\right)^{1/3}$

D. $\left(\frac{4\pi GM}{R^2}\right)^{1/3} - R$

Answer: B

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252. 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. $\left(\frac{R^2 g}{\omega}\right)^{1/3}$

B. $\left(\frac{R^2 \omega^2}{g}\right)^{1/3}$

C. $\left(\frac{R^2 g}{\omega^2}\right)^{1/3}$

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

Answer: C

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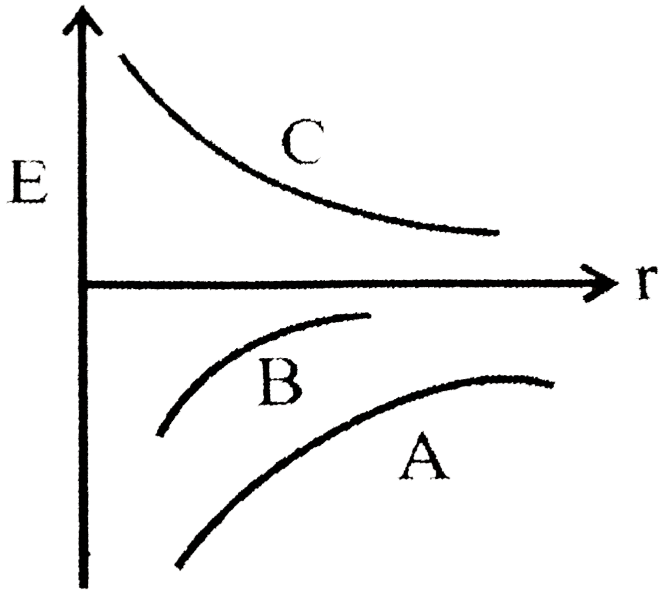
253. An artificial satellite is made to move in circular orbits of different radii around the earth. The variations of its K.E.,P.E. and total energy (E) in different orbits is shown in the figure by different curves.

Then for satellites



A. A represents the K.E., B the P.E. and C the total energy

B. A represents the P.E.,Bthe K.E. and C the total energy

C. A represents the P.E.,Bthe total energy and C the K.E.

D. A represents the total energy, B the K.E. and C the P.E.

Answer: C

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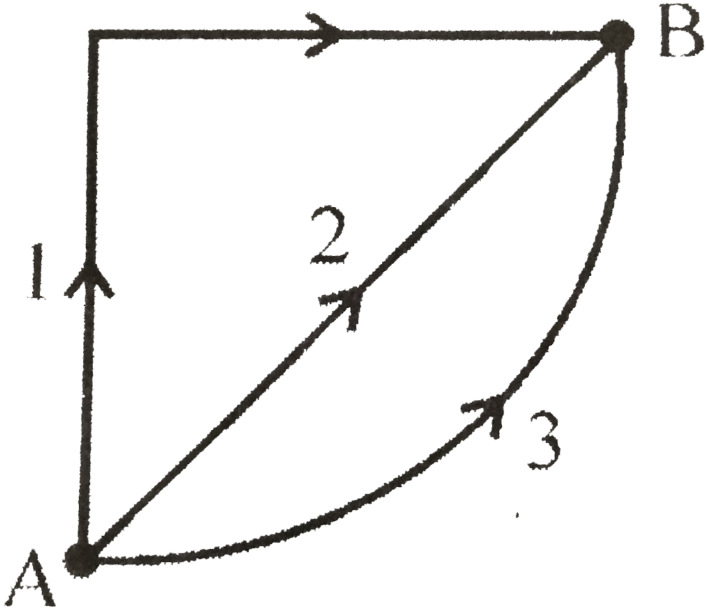
254. If W_1, W_2 and W_3 represent the work done in moving a particle from A to B along three different paths 1,2 and 3 respectively (as shown), in the gravitational field of a point mass m, then correct relation between W_1, W_2 and W_3 is



A. $W_1 > W_2 > W_3$

B. $W_1 = W_2 = W_3$

C. $W_1 < W_2 < W_3$

D. $W_2 > W_1 W_3$

Answer: B

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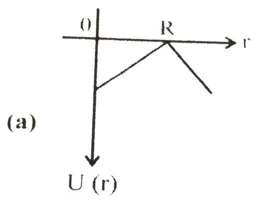
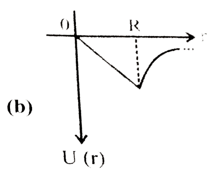
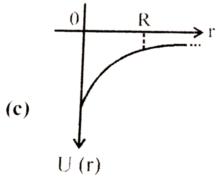
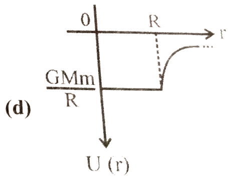
255. A shell of mass M and radius R has point mass m placed at a distance r from its centre. The gravitational potential energy U(r) vs r will be

A. 

B. 

C. 

D. 

Answer: D

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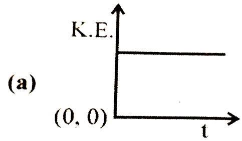
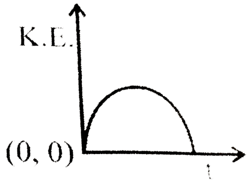
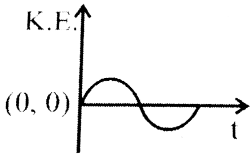
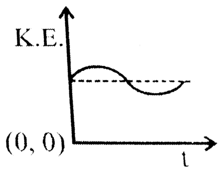
256. Which of the diagrams shown in figure. Most closely shows the variation inkinetic energy of the earth as it moves once around the sun in its elliptical orbit ?

A. 

B. 

C. 

D. 

Answer: D

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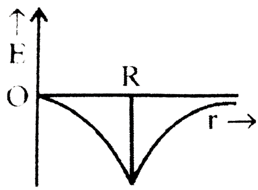
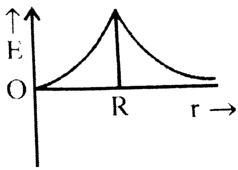
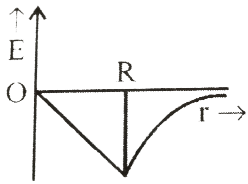
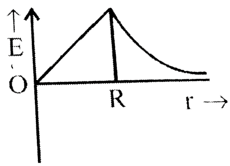
257. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by

A. 

B. 

C. 

D. 

Answer: D

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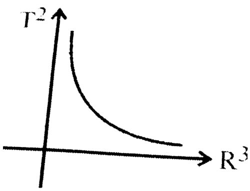
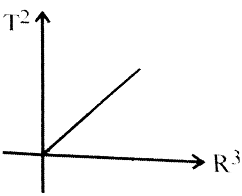
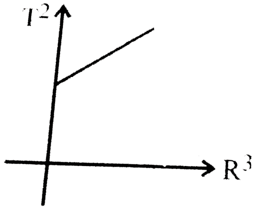
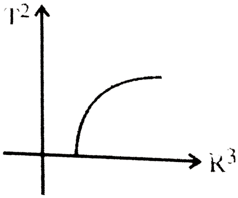
258. Which of the following graph depicts relation between time period (T) and radius of orbit (r) of a planet ?

A. 

B. 

C. 

D. 

Answer: B

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259. The dimensions of universal gravitational constant are :-

A. $[L^1 M^0 T^0]$

B. $[L^2M^1T^0]$

C. $[L^{-1}M^1T^{-2}]$

D. $[L^3M^{-1}T^{-2}]$

Answer: D

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260. A planet is revolving around a star in a circular orbit of radius R with a period T. If the gravitational force between the planet and the star is proportional to $R^{-3/2}$, then

A. $T^2 \propto R^{5/2}$

B. $T^2 \propto R^{-7/2}$

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

D. $T^2 \propto R^4$

Answer: A

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

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

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

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

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

Answer: C

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262. The value of gravitational acceleration 'g' at a height 'h' above the earth's surface is $\frac{g}{4}$, then (R = __________) (where R = radius of the earth)

A. h = R

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

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

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

Answer: A

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263. The ratio of binding energy of a satellite at rest on earth's surface to the binding energy of a satellite of same mass revolving around of the earth at a height h above the earth's surface is (R = radius of the earth).

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

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

C. $\frac{R+h}{R}$

D. $\frac{R}{R+h}$

Answer: A

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264. The depth 'd' at which the value of acceleration due to gravity becomes $\frac{1}{n}$ times the value at the earth's surface is (R = radius of earth)

A. $d = R\left(\frac{n}{n-1}\right)$

B. $d = R\left(\frac{n-1}{2n}\right)$

C. $d = R\left(\frac{n-1}{n}\right)$

D. $d = R^2\left(\frac{n-1}{n}\right)$

Answer: C

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Test Your Grasp 2

1. A body weights 72 N on the surface of the earth. What is the gravitational force acting on it due to the earth at a height to half the radius of the earth from the surface ?

A. 16 N

B. 32 N

C. 8 N

D. 48 N

Answer: B

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2. What would be the acceleration due to gravity on the surface of a planet if its radius is $\frac{1}{4}$ the radius of the earth and its mass is $\frac{1}{80}$th the mass of the earth

?

A. $g_p = \frac{g}{2}$

B. $g_p = \frac{g}{5}$

C. $g_p = \frac{g}{3}$

D. $g_p = \frac{g}{4}$

Answer: B

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3. The acceleration due to gravity on the moon is

1//6th of that on the earth. If a man can jump upto a height of 1 m on the surface of the earth, how high he can jump on the surface of the moon ?

A. 3 m

B. 4 m

C. 6 m

D. 8 m

Answer: C

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4. The weight of a man in a lift moving upwards with an acceleration 'a' is 600 N. When the lift moves downwards with the same acceleration his weight is found to be 360 N. The real weight of the man is

A. 380 N

B. 600 N

C. 480 N

D. 700 N

Answer: C

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5. If there would have been a smaller gravitational effect, then which one of the following force could be affected ?

A. Viscous force

B. Weak nuclear force

C. Archimedes uplift

D. Electrostatic force

Answer: C

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6. The orbital velocity of an artifical satellite in a circular orbit just above the earth's surface is V_0. For a satellite orbiting at an altitude of half of earth's radius, the orbital velocity is

A. $\frac{2}{3}V_0$

B. $\sqrt{\frac{2}{3}}V_0$

C. $\frac{3}{2}V_0$

D. $\sqrt{\frac{3}{2}}V_0$

Answer: B

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7. If ρ is the mean density of the earth and R is its radius, then the critical speed of a satellite revolving very close to the surface of earth is :

A. $2R\sqrt{\frac{G\pi\rho}{3}}$

B. $2R\sqrt{\frac{3G}{\pi\rho}}$

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

D. $2R\sqrt{\frac{3}{G\pi\rho}}$

Answer: A

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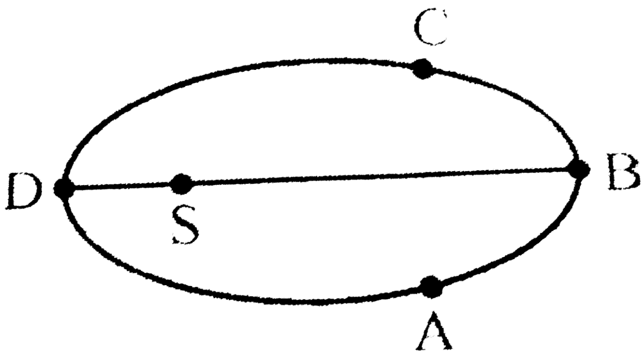
8. A planet revolves in an elliptical orbital around the sun. The kinetic energy of the planet will be maximum at



A. A

B. B

C. C

D. D

Answer: D

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9. What would be the duration of the year, if the distance between the earth and the sun gets doubled ? [Assume the earth's orbit to be a circular one]

A. 1032 days

B. 365 days

C. 129 days

D. 556 days

Answer: A

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10. If the potential energy of a body at a height h from the surface of the earth is $\frac{mgR}{2}$, then

A. h = 2R

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

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

D. h = R

Answer: D

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11. An artificial satellite of mass 200 kg, revolves around the earth in an orbit of average radius 6670 km. What is its orbital kinetic energy ? $\left[M_{\text{earth}} = 6 \times 10^{24} kg, G = 6.67 \times 10^{-11} N - m^2 / kg^2\right]$

A. 3×10^9 joule

B. 6×10^9 joule

C. 9×10^9 joule

D. 7.5×10^9 joule

Answer: B

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

A. 11.2 km/s

B. $\sqrt{15} \times 11.2$ km/s

C. 2×11.2 m/s

D. 10×11.2 km/s

Answer: B

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

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

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

C. $\frac{1}{T^{2/3}}$

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

Answer: C

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14. The acceleration due to gravity at the pols and the equator is g_p and g_e respectively. If the earth is a sphere of radius R_E and rotating about its axis with angular speed ω and $g_p - g_e$ given by

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

B. $R\omega^2$

C. $R^2\omega^2$

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

Answer: B

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15. Two persons A and B are trying to measure the value of acceleration due to gravity (g) of the earth. A goes high up in a ballon while B goes down in a mine. The value of 'g' measured by

A. A and B goes on incresing

B. A and B goes on decreasing

C. A goes on increasing and that by B goes on decreasing

D. A goes on decreasing and that by B goes on increasing

Answer: B

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16. 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 $R = 6400 km$.

A. 1200 km

B. 1600 km

C. 2000 km

D. 2200 km

Answer: B

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

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

B. $\frac{Rn}{n-1}$

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

D. Rn

Answer: C

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18. A satellite is orbiting around the earth at a mean radius of 16 times that of the geostationary orbit. What is the period of the satellite ?

A. 64 days

B. 32 days

C. 16 days

D. 8 days

Answer: A

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19. The radius of the earth is $6400km$ and $g = 10m/\sec^2$. In order that a dody of $5kg$ weight zero at the equator, the angular speed of the earth is

A. $\frac{1}{80}$ radian/sec.

B. $\frac{1}{800}$ radian/sec.

C. $\frac{1}{200}$ radian/sec.

D. $\frac{1}{400}$ radian/sec.

Answer: B

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20. For a planet, the graph of T^2 against r^3 is plotted. The slope of the graph is

A. $4\pi GM$

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

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

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

Answer: B

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