GPLUS EDUCATION

Date :
Time : **PHYSICS**
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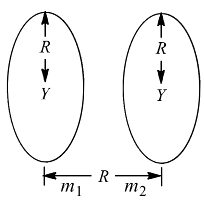
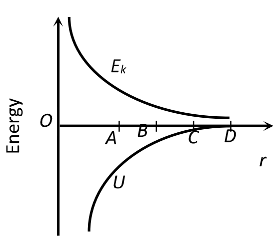
GRAVITATION

Single Correct Answer Type

1. Radius of orbit of satellite of earth is R. Its kinetic energy is proportional to
a) $\frac{1}{R}$ b) $\frac{1}{\sqrt{R}}$ c) R d) $\frac{1}{R^{3/2}}$
2. A satellite is to revolve round the earth in a circle of radius 8000 km. The speed at which this satellite be projected into an orbit, will be
a) 3 km/s b) 16 km/s c) 7.15 km/s d) 8 km/s
3. Time speed of revolution of a nearest satellite around a planet of radius R is T. Period of revolution around another planet, whose radius is 3R but having same density is
a) T b) $3T$ c) $9T$ d) $3\sqrt{3}T$
4. The acceleration due to gravity increase by 0.5 % when we go from the equator to the poles. What will be the time period of the pendulum at the equator which beats seconds at the poles?
a) 1.950 s b) 1.995 s c) 2.050 s d) 2.005 s
5. Two identical thin rings each of radius R are coaxially placed at a distance R. If the rings have a uniform mass distribution and each has mass m_1 and m_2 respectively, then the work done in moving a mass m from centre of one ring to that of the other is



a) $\frac{Gmm_1(\sqrt{2}+1)}{m_2R}$
b) $\frac{Gm(m_1-m_2)(\sqrt{2}+1)}{\sqrt{2}R}$
c) $\frac{Gm\sqrt{2}(m_1+m_2)}{R}$
d) Zero
6. Kepler's second law regarding constancy of aerial velocity of a planet is consequence of the law of conservation of
a) Energy b) Angular momentum c) Linear momentum d) None of these
7. The periodic time of a communication satellite is
a) 6 $hours$ b) 12 $hours$ c) 18 $hours$ d) 24 $hours$
8. The curves for potential energy (U) and kinetic energy (E_k) of a two particle system are shown in figure. At what points the system will be bound

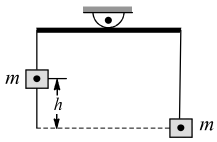


a) Only at point D b) Only at point A c) At point D and A d) At points A, B and C

9. The acceleration of a body due to the attraction of the earth (radius R) at a distance $2R$ from the surface of the earth is ($g =$ acceleration due to gravity at the surface of the earth)

a) $\frac{g}{9}$ b) $\frac{g}{3}$ c) $\frac{g}{4}$ d) g

10. Two equal mass m and m are hung from balance whose scale pans differ in vertical height by h. Calculate the error in weighing. If any, in terms of density of earth ρ.



a) $\frac{2}{3}\pi\rho R^3 Gm$ b) $\frac{8}{3}\pi\rho Gmh$ c) $\frac{8}{3}\pi\rho R^3 Gm$ d) $\frac{4}{3}\pi\rho Gm^2 h$

11. Weight of $1 kg$ becomes 1/6 on moon. If radius of moon is $1.768 \times 10^6\ m$, then the mass of moon will be

a) $1.99 \times 10^{30} kg$ b) $7.56 \times 10^{22} kg$ c) $5.98 \times 10^{24} kg$ d) $7.65 \times 10^{22} kg$

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

a) $-\frac{GMm}{r}$ b) $\frac{GMm}{r}$ c) $\frac{GMm}{2r}$ d) $-\frac{GMm}{2r}$

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

a) The acceleration of S is always directed towards the centre of the earth

b) The angular momentum of S about the centre of the earth changes in direction but its magnitude remains constant

c) The total mechanical energy of S varies periodically with time

d) The linear momentum of S remains constant in magnitude

14. The escape velocity of a body on the surface of the earth is $11.2\ km/s$. If the earth's mass increases to twice its present value and the radius of the earth becomes half, the escape velocity would become

a) $5.6\ km/s$ b) $11.2\ km/s$ (remain unchanged)

c) $22.4\ km/s$ d) $44.8\ km/s$

15. A geostationary satellite is orbiting the earth at a height of $5R$ above the surface of the earth, R being the radius of the earth. The time period of another satellite in hours at a height of $2R$ from the surface of the earth is

a) 5 b) 10 c) $6\sqrt{2}$ d) $\frac{6}{\sqrt{2}}$

16. The escape velocity of a sphere of mass m from earth having mass M and radius R is given by

a) $\sqrt{\frac{2GM}{R}}$ b) $2\sqrt{\frac{GM}{R}}$ c) $\sqrt{\frac{2GMm}{R}}$ d) $\sqrt{\frac{GM}{R}}$

17. Gravitational potential on the surface of earth is (M =mass of the earth, R = radius of earth)

a) $-GM/2R$ b) $-gR$ c) gR d) GM/R

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

a) $a = 1/3, b = 1/3, c = -1/3$ b) $a = 1/2, b = 1/2, c = -1/2$

c) $a = 1/2, b = -1/2, c = 1/2$ d) $a = 1/2, b = -1/2, c = -1/2$

19. If both the masses and radius o the earth, each decreases by 50%, the acceleration due to gravity would

a) Remain same b) Decrease by 50% c) Decrease by 100% d) Increase by 100%

20. A spherical planet for out in space has a mass M_0 and diameter D_0. A particle of mass m falling freely new the surface of this planet will experience an acceleration due to gravity which is equal to

a) GM_0/D_0^2 b) $4mGM_0/D_0^2$ c) $4GM_0/D_0^2$ d) GmM_0/D_0^2

21. Kepler discovered

a) Laws of motion b) Laws of rotational motion
c) Laws of planetary motion d) Laws of curvilinear motion

22. If r represents the radius of the orbit of a satellite of mass m moving around a planet of mass M, the velocity of the satellite is given by
a) $v^2 = g\frac{M}{r}$ b) $v^2 = \frac{GMm}{r}$ c) $v = \frac{GM}{r}$ d) $v^2 = \frac{GM}{r}$

23. The ratio $\frac{g}{g_h}$, where g and g_h are the accelerations due to gravity at the surface of the earth and at a height h above the earth's surface respectively, is
a) $\left(1+\frac{h}{R}\right)^2$ b) $\left(1+\frac{R}{h}\right)^2$ c) $\left(\frac{R}{h}\right)^2$ d) $\left(\frac{h}{R}\right)^2$

24. To an astronaut in a spaceship, the sky appears
a) Black b) White c) Green d) Blue

25. In planetary motion the areal velocity of position vector of a planet depends on angular velocity (ω) and the distance of the planet from sun (r). If so the correct relation for areal velocity is
a) $\frac{dA}{dt} \propto \omega r$ b) $\frac{dA}{dt} \propto \omega^2 r$ c) $\frac{dA}{dt} \propto \omega r^2$ d) $\frac{dA}{dt} \propto \sqrt{\omega r}$

26. Earth binds the atmosphere because of
a) Gravity b) oxygen between earth and atmosphere
c) Both (a) and (b) d) None of the above

27. A point mass is placed inside a thin spherical shell of radius R and mass M at a distance $R/2$ from the centre of the shell. The gravitational force exerted by the shell on the point mass is
a) $\frac{GM}{2R^2}$ b) $-\frac{GM}{2R^2}$ c) Zero d) $\frac{GM}{4R^2}$

28. A man weighs 80 kg on earth surface. The height above ground where he will weigh 40kg, is (radius of earth is 6400 km)
a) 0.31 times r b) 0.41 times r c) 0.51 times r d) 0.61 times r

29. A particle falls towards earth from infinity. It's velocity on reaching the earth would be
a) Infinity b) $\sqrt{2gR}$ c) $2\sqrt{gR}$ d) Zero

30. What is the height the weight of body will be the same as at the same depth from the surface of the earth? Radius of earth is R
a) $\frac{R}{2}$ b) $\sqrt{5}R - R$ c) $\frac{\sqrt{5}R - R}{2}$ d) $\frac{\sqrt{3}R - R}{2}$

31. The time period of geostationary satellite at a height 36000 km is 24 h. A spy satellite orbits earth at a height 6400km. What will be the time period of sky satellite?
(Radius of earth = 6400 km)
a) 5 h b) 4 h c) 3 h d) 12 h

32. The acceleration to gravity at a height 1/20th of the radius of the earth above the earth surface is $9 ms^{-2}$. Its value at a point at an equal distance below the surface of the earth in ms^{-2} is about below the surface of the earth in ms^{-2} is about
a) 8.5 b) 9.5 c) 9.8 d) 11.5

33. Two satellite A and B go round a planet orbits having radii $4R$ and R, respectivly. If the speed of satellite A is $3v$, then speed of satellite B is
a) $\frac{3v}{2}$ b) $\frac{4v}{2}$ c) $6v$ d) $12v$

34. An asteroid of mass m is approaching earth, initially at a distance of 10 R_e with speed v_i. It hits the earth with a speed v_f (R_e and M_e are radius and mass of earth), then
a) $v_f^2 = v_i^2 + \frac{2Gm}{M_e R}\left(1-\frac{1}{10}\right)$ b) $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1+\frac{1}{10}\right)$

c) $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 - \frac{1}{10}\right)$ d) $v_f^2 = v_i^2 + \frac{2Gm}{R_e}\left(1 - \frac{1}{10}\right)$

35. The distance of a geo-stationary satellite from the centre the earth (Radius $R = 6400\ km$) is nearest to
a) 5 R b) 7 R c) 10 R d) 18 R

36. A satellite moves in elliptical orbit about a planet. The maximum and minimum velocities of satellites are $3 \times 10^4 \text{ms}^{-1}$ and $1 \times 10^3 \text{ms}^{-1}$ respectively. What is the minimum distance of satellite from planet, if maximum distance is 4×10^4 km?
a) 4×10^3 km b) 3×10^3 km c) $4/3 \times 10^3$ km d) 1×10^3 km

37. Assuming earth to be a sphere of radius R, if $g_{30°}$ is value of acceleration due to gravity at latitude of 30° and g at the equator, the value of $g - g_{30°}$is
a) $\frac{1}{4}\omega^2 R$ b) $\frac{3}{4}\omega^2 R$ c) $\omega^2 R$ d) $\frac{1}{2}\omega^2 R$

38. Two satellites of earth, S_1 and S_2, are moving in the same orbit. The mass of S_1 is four times the mass of S_2. Which one of the following statements is true?
a) The time period of S_1 is four times that of S_2
b) The potential energies of earth and satellite in the two cases are equal
c) S_1 and S_2 are moving with the same speed
d) The kinetic energies of the two satellites are equal

39. The ratio of acceleration due to gravity at a height h above the surface of the earth and at a depth h below the surface of the earth for $h << $ radius of earth
a) Is constant
b) Increases linearly with h
c) Decreases linearly with h
d) Decreases parabolically with h

40. The weight of an object in the coal mine, sea level, 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) $W_1 > W_2 > W_3$

41. As we go from the equator to the poles, the value of g
a) Remains the same b) Decreases
c) Increases d) Decreases upto a latitude of 45°

42. Spot the *wrong* statement:
The acceleration due to gravity $'g'$ decreases if
a) We go down from the surface of the earth towards its centre
b) We go up from the surface of the earth
c) We go from the equator towards the poles on the surface of the earth
d) The rotational velocity of the earth is increased

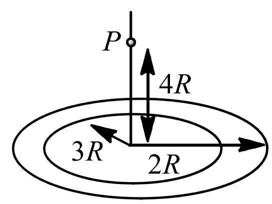
43. The earth revolves about the sun in an elliptical orbit with mean radius $9.3 \times 10^7 m$ in a period of 1 year. Assuming that there are no outside influences
a) The earth's kinetic energy remains constant b) The earth's angular momentum remains constant
c) The earth's potential energy remains constant d) All are correct

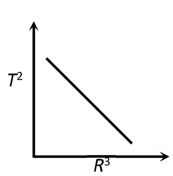
44. The escape velocity of a body from earth's surface is v_e. The escape velocity of the same body from a height equal to $7R$ from earth's surface will be
a) $\frac{v_e}{\sqrt{2}}$ b) $\frac{v_e}{2}$ c) $\frac{v_e}{2\sqrt{2}}$ d) $\frac{v_e}{4}$

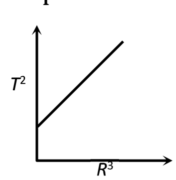
45. The escape velocity from the earth is 11 kms^{-1}. The escape velocity from a planet having twice the radius and the same mean density as the earth would be
a) 5.5 kms^{-1} b) 11 kms^{-1} c) 15.5 kms^{-1} d) 22 kms^{-1}

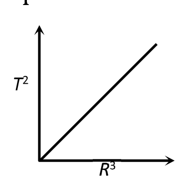
46. If density of earth increased 4 times and its radius become half of what it is, our weight will
a) Be four times its present value b) Be doubled
c) Remain same d) Be halved

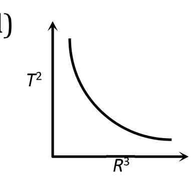
47. The time period of a geostationary satellite is
a) 12 hours b) 24 hours c) 6 hours d) 48 hours
48. The weight of a body on surface of earth is 12.6 N. When it is raised to a height half the radius of earth its weight will be
a) 2.8 N b) 5.6 N c) 12.5 N d) 25. 2N
49. Imagine a light plant revolving around a very massive star in circular orbit of radius r with a period of revolution T. If the gravitational force of attraction between the planet and the star is proportional to $r^{-5/2}$. Then the correct relation is
a) $T^2 \propto r^{5/2}$ b) $T^2 \propto r^{7/2}$ c) $T \propto r^{5/2}$ d) $T^2 \propto r^{7/2}$
50. If V, R and g denote respectively the escape velocity from the surface of the earth radius of the earth, and acceleration due to gravity, then the correct equation is
a) $V = \sqrt{gR}$ b) $V = \sqrt{\frac{4}{3}gR^3}$ c) $V = R\sqrt{g}$ d) $V = \sqrt{2gR}$
51. In an elliptical orbit under gravitational force, in general
a) Tangential velocity is constant b) Angular velocity is constant
c) Radial velocity is constant d) Areal velocity is constant
52. A thin uniform annular disc (see figure) of mass M has outer radius $4R$ and inner radius $3R$. The work required to take a unit mass from point P on its axis to infinity is



a) $\frac{2GM}{7R}(4\sqrt{2}-5)$ b) $-\frac{2GM}{7R}(4\sqrt{2}-5)$ c) $\frac{GM}{4R}$ d) $\frac{2GM}{5R}(\sqrt{2}-1)$
53. If then radius of earth R, then the height h at which the value of g becomes one-fourth, will be
a) $\frac{R}{8}$ b) $\frac{3R}{8}$ c) $\frac{3R}{4}$ d) $\frac{R}{2}$
54. Two small and heavy spheres, each of mass M, are placed a distance r apart on a horizontal surface. The gravitational potential at the mid-point on the line joining the centre of the spheres is
a) Zero b) $-\frac{GM}{r}$ c) $-\frac{2GM}{r}$ d) $-\frac{4GM}{r}$
55. If the mass of moon is $\frac{1}{90}$ of earth^' s mass, its radius is $\frac{1}{3}$ of earth^' sradius and if g is acceleration due to gravity on earth, then the acceleration due to gravity on moon is..
a) $\frac{g}{3}$ b) $\frac{g}{90}$ c) $\frac{g}{10}$ d) $\frac{g}{9}$
56. Which of the following graphs represents the motion of a planet moving about the sun
a)


b)


c)


d)


57. The escape velocity for a body projected vertically upwards from the surface of earth is 11 kms^{-1}. If the body is projected at an angle of 45° with the vertical, the escape velocity will be
a) $11\sqrt{2} kms^{-1}$ b) 22 kms^{-1} c) 11 kms^{-1} d) $11/\sqrt{2}$ ms^{-1}
58. A rocket is launched with velocity 10 km/s. If radius of earth is R, then maximum height attained by it will be
a) $2R$ b) $3R$ c) $4R$ d) $5R$
59. The mass of the earth is 6.00×10^{22} kg. The constant of gravitation $g = 6.67 \times 10^{-11} Nm^2 kg^{-2}$. The

potential energy of the system is -7.73×10^{28} J. The mean distance between earth and moon is
a) 3.80×10^8m b) 3.37×10^6m c) 7.60×10^4m d) 1.90×10^2m

60. Gravitational mass is proportional to gravitational
a) Field b) Force c) Intensity d) All of these

61. 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) $g \propto r$ b) $g \propto r^2$ c) $g \propto r^{-1}$ d) $g \propto r^{-2}$

62. In the following four periods
(i) Time of revolution of a satellite just above the earth's surface (T_{st})
(ii) Period of oscillation of mass inside the tunnel bored along the diameter of the earth (T_{ma})
(iii) Period of simple pendulum having a length equal to the earth's radius in a uniform field of $9.8N/kg(T_{sp})$
(iv) Period of an infinite length simple pendulum in the earth's real gravitational filed (T_{is})
a) $T_{st} > T_{ma}$ b) $T_{ma} > T_{st}$
c) $T_{sp} > T_{is}$ d) $T_{st} = T_{ma} = T_{sp} = T_{is}$

63. The height from the earth surface at which the value of acceleration due to gravity reduces to $1/4^{\text{th}}$ of its value at earth's surface (assume earth to be sphere of radius 6400 km)
a) 6400 km b) 2649 km c) 2946 km d) 1600 km

64. A space ship moves from earth to moon and back. The greatest energy required for the space ship is to overcome the difficulty in
a) Entering the earth's gravitational field
b) Take off from earths field
c) Take off from lunar surface
d) Entering the moon's lunar surface

65. If the mass of earth is 80 times of that of a planet and diameter is double that of planet and $'g'$ on earth is $9.8m/s^2$, then the value of $'g'$ on that planet is
a) 4.9 m/s^2 b) 0.98 m/s^2 c) 0.49 m/s^2 d) 49 m/s^2

66. An iron ball and a wooden ball of the same radius are released from a height $'h'$ in vacuum. The time taken by both of them to reach the ground is
a) Unequal b) Exactly equal c) Roughly equal d) Zero

67. If gravitational force on a body of mass 1.5 kg at point is 45N, then the intensity of the gravitational field at that point is
a) 67.5 N kg^{-1} b) 45 N kg^{-1} c) 30 N kg^{-1} d) 15 N kg^{-1}

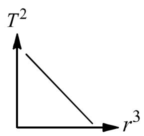
68. A man inside an artificial satellite feels weightlessness because the force of attraction due to earth is
a) Zero at that place
b) Is balanced by the force of attraction due to moon
c) Equal to the centripetal force
d) Non-effective due to particular design of the satellite

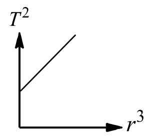
69. A geostationary satellite is orbiting the earth at a height of $6R$ above the surface of the earth; R being the radius of the earth. What will be the time period of another satellite at a height 2.5 R from the surface of the earth?
a) $6\sqrt{2}$ h b) $6\sqrt{2.5}$ h c) $6\sqrt{3}$ h d) 12 h

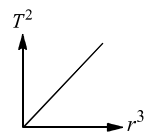
70. If the radius of the earth shrinks by 1%, its mass remaining same, the acceleration due to gravity on the surface of earth will
a) Decrease by 2% b) Decrease by 0.5% c) Increase by 2% d) Increase by 0.5%

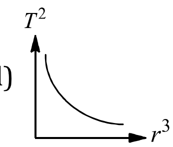
71. If a body describes a circular motion under inverse square field, the time taken to complete one revolution T is related to the radius of the of the circular orbit is
a) $T \propto r$ b) $T \propto r^2$ c) $T^2 \propto r^3$ d) $T \propto r^4$

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

a) 

b) 

c) 

d) 

73. Two identical solid copper spheres of radius R are placed in contact with each other. The gravitational attraction between them is proportional to
a) R^2 b) R^{-2} c) R^4 d) R^{-4}

74. If the density of a small planet is the same as that of earth, while the radius of the planet is 0.2 times that of the earth, the gravitational acceleration of the surface of that planet is
a) 0.2 g b) 0.4 g c) 2 g d) 4 g

75. Acceleration due to gravity on moon is 1/6 of the acceleration due to gravity on earth. If the ratio of densities of earth (ρ_e) and moon (ρ_m) is $\left(\frac{\rho_e}{\rho_m}\right) = \frac{5}{3}$ then radius of moon (R_m) in terms of R_e will be
a) $\frac{5}{18}R_e$ b) $\frac{1}{6}R_e$ c) $\frac{3}{18}R_e$ d) $\frac{1}{2\sqrt{3}}R_e$

76. Gravitational field is
a) Conservative b) Non-conservative c) Electromagnetic d) Magnetic

77. The mass of a planet is six times that of the earth. The radius of the planet is twice that of the earth. If the escape velocity from the earth is v, then the escape velocity from the planet is
a) $\sqrt{3}v$ b) $\sqrt{2}v$ c) v d) $\sqrt{5}v$

78. Acceleration due to gravity is maximum at (R is the radius of earth)
a) A height $\frac{R}{2}$ from the earth's surface
b) The centre of the earth
c) The surface of the earth
d) A depth $\frac{R}{2}$ from the earth's surface

79. An artificial satellite is revolving round the earth in a circular orbit. Its velocity is half the escape velocity. Its height from earth's surface is
a) 6400 km b) 12800 km c) 3200 km d) 1600 km

80. A satellite is revolving round the earth in an orbit of radius r with time period T. If the satellite is revolving round the earth in an orbit of radius $r + \Delta r (\Delta r \ll r)$ with time period $T + \Delta T (\Delta T \ll T)$ then
a) $\frac{\Delta T}{T} = \frac{3}{2}\frac{\Delta r}{r}$ b) $\frac{\Delta T}{T} = \frac{2}{3}\frac{\Delta r}{r}$ c) $\frac{\Delta T}{T} = \frac{\Delta r}{r}$ d) $\frac{\Delta T}{T} = -\frac{\Delta r}{r}$

81. 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) 0.2 R_e b) 2 R_e c) 0.5 R_e d) 5 R_e

82. The escape velocity of a body from the earth is v_e. If the radius of earth contracts to 1/4th of its value, keeping the mass of the earth constant, the escape velocity will be
a) Doubled b) Halved c) Tripled d) Unaltered

83. The ratio of the distances of two planets from the sun is 1.38. The ratio of their period of revolution around the sun is
a) 1.38 b) $1.38^{3/2}$ c) $1.38^{1/2}$ d) 1.38^3

84. A planet in a distant solar system is 10 times more massive than the earth and its radius is 10 times smaller. Given that the escape velocity from the earth is 11kms^{-1}, the escape velocity from the surface of the planet would be
a) 1.1 kms^{-1} b) 11 kms^{-1} c) 110 kms^{-1} d) 0.11 kms^{-1}

85. 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 in
a) $\frac{1}{2}$ lunar month b) $\frac{2}{3}$ lunar month c) $2^{-3/2}$ lunar month d) $2^{3/2}$ lunar month

86. A body is released from a point distance r from the centre of earth. If R is the earth and $r > R$, then the

velocity of the body at the time of striking the earth will be

a) $\sqrt{gR}$ b) $\sqrt{2gR}$ c) $\sqrt{\frac{2gR}{r-R}}$ d) $\sqrt{\frac{2gR(r-R)}{r}}$

87. Two equal masses m and m are hung from a balance whose scale pans differ in height by h. If ρ is the mean density of earth, then the error in weighing is

a) Zero b) $4\pi G\rho mh/3$ c) $8\pi G\rho mh/3$ d) $2\pi G\rho mh/3$

88. A 20 cm long capillary tube is dipped in water. The water rises upto 8 cm. if entire arrangement is put in a freely falling elevator lengths of water column in the capillary tube will be

a) 4 cm b) 8 cm c) 10 cm d) 20 cm

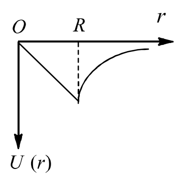
89. A satellite revolves around the earth in an elliptical orbit. Its speed

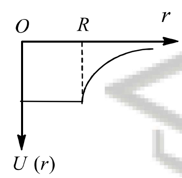
a) Is the same at all points in the orbit
b) Is greatest when it is closest to the earth
c) Is greatest when it is farthest from the earth
d) Goes on increasing or decreasing continuously depending upon the mass of the satellite

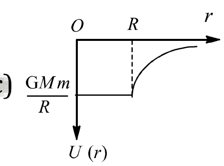
90. A geostationary satellite

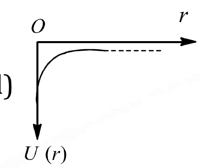
a) Revolves about the polar axis
b) Has a time period less than that of the near earth satellite
c) Moves faster than a near earth satellite
d) Is stationary in the space

91. A shell of mass M and radius R has a point mass m placed at a distance r from its centre.

a) 

b) 

c) 

d) 

92. The angular velocity of the earth with which it has to rotate so that acceleration due to gravity on 60° latitude becomes zero is (Radius of earth = 6400 km. At the poles $g = 10\ ms^{-2}$)

a) $2.5 \times 10^{-3} rad/s$ b) $5.0 \times 10^{-1} rad/s$ c) $1 \times 10^{1} rad/s$ d) $7.8 \times 10^{-2} rad/s$

93. In a satellite, if the time of revolution is T, then KE is proportional to

a) $\frac{1}{T}$ b) $\frac{1}{T^2}$ c) $\frac{1}{T^3}$ d) $T^{-2/3}$

94. Three identical bodies of mass M are located at the vertices of an equilateral triangle of side L. They revolve under the effect of mutual gravitational force in a circular orbit, circumscribing the triangle while preserving the equilateral triangle. Their orbital velocity is

a) $\sqrt{\frac{GM}{L}}$ b) $\sqrt{\frac{3GM}{2L}}$ c) $\sqrt{\frac{3GM}{L}}$ d) $\sqrt{\frac{2GM}{3L}}$

95. Imagine a new planet having the same density as that of earth but it is 3 times bigger than the earth in 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

a) $g' = 2g$ b) $g' = 3g$ c) $g' = 4g$ d) $g' = 5g$

96. An artificial satellite of the earth moves at an altitude to $h = 670$ km along a circular orbit. The velocity of the satellite is

a) 7.5 kms^{-1} b) 8.5 kms^{-1} c) 11.2 kms^{-1} d) 4.5 kms^{-1}

97. Escape velocity of a body of 1 kg mass on a planet is 100 m/sec. Gravitational Potential energy of the body at the Planet is

a) $-5000\ J$ b) $-1000\ J$ c) $-2400\ J$ d) $5000\ J$

98. A particle of mass m is placed at the centre of a uniform spherical shell of mass 3 m and radius R. The gravitational potential on the surface of the shell is

a) $-\frac{Gm}{R}$ b) $-\frac{3Gm}{R}$ c) $-\frac{4Gm}{R}$ d) $-\frac{2Gm}{R}$

99. The work that must be done in lifting a body of weight P from the surface of the earth to a height h is

a) $\frac{PRh}{R-h}$ b) $\frac{R+h}{PRh}$ c) $\frac{PRh}{R+h}$ d) $\frac{R-h}{PRh}$

100. Two spherical planets A and B have same mass but densities in the ratio 8:1. For these planets, the ratio of acceleration due to gravity at the surface of A to its value at the surface of B is

a) 1 : 4 b) 1 : 2 c) 4 : 1 d) 8 : 1

101. 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) 4.8 $hours$ b) $48\sqrt{2}$ $hours$ c) 24 $hours$ d) $24\sqrt{2}$ $hours$

102. An object weighs 10N at the north-pole of the earth. In a geostationary satellite distance $7R$ from the centre of earth (of radius R) what will be its true weight?

a) 3 N b) 5 N c) 2 N d) 0.2 N

103. The value of g decreases inside the surface of earth because

a) A force of upward attraction is applied by the shell of earth above
b) The shell of earth above exerts no net force
c) The distance from the centre of the earth decreases
d) The density of the material at the centre of the earth is very small

104. What is the escape velocity for a body on the surface of a planet on which the acceleration due to gravity is $(3.1)^2 ms^{-2}$ and whose radius is 8100 km

a) 2790 $km.s^{-1}$ b) 27.9 $km.s^{-1}$ c) $\frac{27.9}{\sqrt{5}} km.s^{-1}$ d) $27.9\sqrt{5} km.s^{-1}$

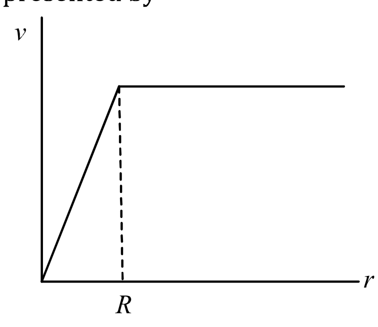
105. If satellite is shifted towards the earth. Then time period of satellite will be

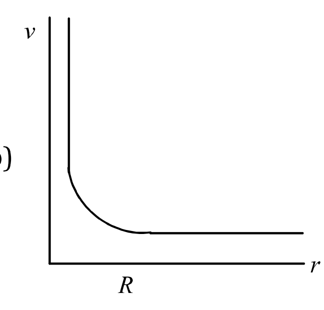
a) Increase b) Decrease c) Unchanged d) Nothing can be said

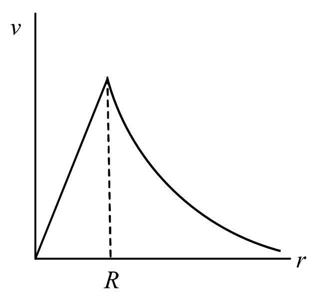
106. A spherically symmetric gravitational system of particles has a mass density

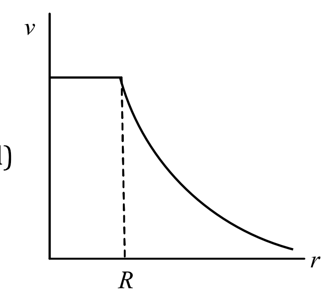
$$\rho = \begin{cases} \rho_0 \text{ for } r \le R \\ 0 \text{ for } r > R \end{cases}$$

where ρ_0 is a constant. A test mass can undergo circular motion under the influence of the gravitational field of particles. Its speed v as a function of distance $r (0 < r < \infty)$ from the centre of the system is represented by

a) 

b) 

c) 

d) 

107. If the angular speed of the earth is doubled, the value of acceleration due to gravity (g) at the north pole

a) Doubles b) Becomes half c) Remains same d) Becomes zero

108. One can easily "weight the earth" by calculating the mass of earth using the formula (in usual notation)

a) $\frac{G}{g}R_E^2$ b) $\frac{g}{G}R_E^2$ c) $\frac{g}{G}R_E$ d) $\frac{G}{g}R_E^3$

109. Pick out the most correct statement with reference to earth satellites

a) Geostationary satellites are used for remote sensing
b) Polar satellites are used for telecommunications
c) INSAT group of satellites belong to geostationary satellites
d) Polar satellites are at a height of about 36,000 km

110. The radius of orbit of a planet is two times that of the earth. The time period of planet is

a) 4.2 $years$ b) 2.8 $years$ c) 5.6 $years$ d) 8.4 $yeasrs$

111. The earth (mass $= 6 \times 10^{24}$kg) revolves around the sun with angular velocity 2×10^{-7} rads^{-1} in a circular orbit of radius 1.5×10^8km. The force exerted by the sun on the earth in newton is

a) Zero b) 18×10^{25} c) 27×10^{39} d) 36×10^{21}

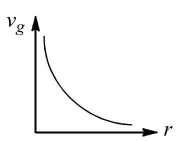
112. If the Earth losses its gravity, then for a body

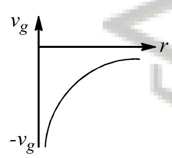
a) Weight becomes zero, but not the mass
b) Mass becomes zero, but not the weight
c) Both mass and weight become zero
d) Neither mass nor weight become zero

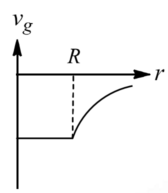
113. The mass of the moon is about 1.2% of the mass of the earth. Compared to the gravitational force the earth exerts on the moon, the gravitational force the moon exerts on earth

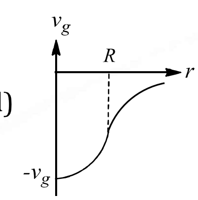
a) Is the same b) Is smaller c) Is greater d) Varies with its phase

114. Select the proper graph between the gravitational potential (v_g) due to hollow sphere and distance (r) from its centre

a) 

b) 

c) 

d) 

115. A person sitting on a chair in a satellite feels weightless because

a) The earth dose not attract the object in a satellite
b) The normal force by the chair on the person balances the earth's attraction
c) The normal force is zero
d) The person in satellite is not accelerated

116. A missile is launched with a velocity less than the escape velocity. The sum of its kinetic and potential energy is

a) Positive
b) Negative
c) Zero
d) May be positive or negative depending upon its initial velocity

117. The ratio of the radii of the planets P_1 and P_2 is a. The ratio of their acceleration due to gravity is b. The ratio of the escape velocities from them will be

a) ab b) $\sqrt{ab}$ c) $\sqrt{a/b}$ d) $\sqrt{b/a}$

118. Weight of a body is maximum at

a) Moon b) Poles of earth c) Equator of earth d) Centre of earth

119. Three weights w, $2w$ and $3w$ are connected to identical spring suspended from a rigid horizontal rod. The assembly of the rod and weights fall freely. The positions of the weight from the rod are such that

a) $3w$ will be farthest
b) w will be farthest
c) All will be at the same distance
d) $2w$ will be farthest

120. 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) $-0.5\ mgR_e$ b) $-mgR_e$ c) $-2\ mgR_e$ d) $4\ mgR_e$

121. The kinetic energy needed to project a body of mass m from the earth surface (radius R) to infinity is
a) $mgR/2$ b) $2\, mgR$ c) mgR d) $mgR/4$

122. The ratio of radii of earth to another planet is $\frac{2}{3}$ and the ratio of their mean densities is $\frac{4}{5}$. If an astronaut can jump to a maximum height of 1.5 m on the earth, with the same effort, the maximum height he can jump on the planet is
a) 1 m b) 0.8 m c) 0.5 m d) 1.25 m

123. There are two planets. The ratio of radius of the two planets is K but ratio of acceleration due to gravity of both planets is g. What will be the ratio of their escape velocity
a) $(Kg)^{1/2}$ b) $(Kg)^{-1/2}$ c) $(Kg)^2$ d) $(Kg)^{-2}$

124. The binding energy of a satellite of mass m in a orbit of radius r is ($R =$ radius of earth, $g =$ acceleration due to gravity)
a) $\frac{mgR^2}{r}$ b) $\frac{mgR^2}{2r}$ c) $-\frac{mgR^2}{r}$ d) $-\frac{mgR^2}{2r}$

125. Two satellites of mass m and $9m$ are orbiting a planet in orbit of radius R. Their periods of revolution will be in the ratio of
a) 1:3 b) 1:1 c) 3:1 d) 9:1

126. At what depth below the surface of the earth, acceleration due to gravity g will be half its value 1600 km above the surface of the earth
a) $4.2 \times 10^6 m$ b) $3.19 \times 10^6 m$ c) $1.59 \times 10^6 m$ d) None of these

127. If ρ is the density of the planet, the time period of nearby satellite is given by
a) $\sqrt{\frac{4\pi}{3G\rho}}$ b) $\sqrt{\frac{4\pi}{G\rho}}$ c) $\sqrt{\frac{3\pi}{G\rho}}$ d) $\sqrt{\frac{\pi}{G\rho}}$

128. Two spheres of mass m and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 3. The gravitational force will now be
a) F b) $\frac{F}{3}$ c) $\frac{F}{9}$ d) $3F$

129. For a body to escape from earth, angle at which it should be fired is?
a) 45° b) > 45° c) < 45° d) any angle

130. If $g \propto \frac{1}{R^3}$ (instead of $\frac{1}{R^2}$), then the relation between time period of a satellite near earth's surface and radius R will be
a) $T^2 \propto R^3$ b) $T \propto R^2$ c) $T^2 \propto R$ d) $T \propto T$

131. If the force inside the earth surface varies as x^n, where r is the distance of body from the centre of earth, then the value of n will be
a) -1 b) -2 c) 1 d) 2

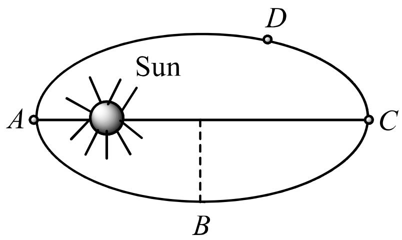
132. The time period of a satellite of earth is 5h. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become
a) 10 h b) 18 h c) 40 h d) 20 h

133. The escape velocity from the earth is 11 kms^{-1}. The escape velocity from a planet having twice the radius and same mean density as that of earth is
a) 5.5 kms^{-1} b) 11 kms^{-1} c) 22 kms^{-1} d) None of these

134. If the value of g acceleration due to gravity at earth surface is 10 ms^{-2}. Its value in ms^{-2} at the centre of the earth, which is assumed to be a sphere of radius R metre and uniform mass density is
a) 5 b) $10/R$ c) $10/2R$ d) Zero

135. If the earth rotates faster than its present speed, the weight of an object will
a) Increase at the equator but remain unchanged at the poles
b) Decrease at the equator but remain unchanged at the poles
c) Remain unchanged at the equator but decrease at the poles
d) Remain unchanged at the equator but increase at the poles

136. The distance of neptune and saturn from sun are nearly 10^{13} and $10^{12}m$ respectively. Assuming that they move in circular orbits, their periodic times will be in the ratio
a) $\sqrt{10}$ b) 100 c) $10\sqrt{10}$ d) $1/\sqrt{10}$
137. At a distance 320 km above the surface of earth, the value of acceleration due to gravity will be lower than its value on the surface of the earth by nearly (radius of earth = 6400 km)
a) 2% b) 6% c) 10% d) 14%
138. If an object of mass m is taken from the surface of earth (radius R) to a height $2R$, then the work done is
a) $2mgR$ b) mgR c) $\frac{2}{3}mgR$ d) $\frac{3}{2}mgR$
139. A thief stole a box full of valuable articles of weight w and while carrying it on his head jumped down from a wall of height h from the ground. Before he reaches the ground, he experienced a load
a) Zero b) $w/2$ c) w d) $2\ w$
140. The gravitational potential energy of a body of mass $'m'$ at the earth's surface is $-mgR_e$. 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) $-2mgR_e$ b) $2mgR_e$ c) $\frac{1}{2}mgR_e$ d) $-\frac{1}{2}mgR_e$
141. An astronaut orbiting the earth in a circular orbit 120 km above the surface of earth, gently drops a spoon out of space-ship. The spoon will
a) Fall vertically down to the earth
b) Move towards the moon
c) Will move along with space-ship
d) Will move in an irregular way then fall down to earth
142. Two bodies of masses m_1 and m_2 are initially at rest at infinite distance apart. They are then allowed to move towards each other under mutual gravitational attraction. Their relative velocity of approach at a separation distance r between them is
a) $\left[2G\frac{(m_1-m_2)}{r}\right]^{1/2}$ b) $\left[\frac{2G}{r}(m_1+m_2)\right]^{1/2}$ c) $\left[\frac{r}{2G(m_1m_2)}\right]^{1/2}$ d) $\left[\frac{2G}{r}m_1m_2\right]^{1/2}$
143. In the solar system, which is conserved
a) Total Energy b) K.E. c) Angular Velocity d) Linear Momentum
144. The total energy of a circularly orbiting satellite is
a) Twice the kinetic energy of the satellite
b) Half the kinetic energy of the satellite
c) Twice the potential energy of the satellite
d) Half the potential energy of the satellite
145. The time period of a simple pendulum on a freely moving artificial satellite is
a) Zero b) 2 sec c) 3 sec d) Infinite
146. A satellite is revolving around the planet. The gravitational force between them varies with $R^{-5/2}$, where R is the radius of the satellite. The square of the time period T will be directly proportional to
a) R^3 b) $R^{7/2}$ c) $R^{3/2}$ d) $R^{5/7}$
147. A body is orbiting very close to the earth's surface with kinetic energy KE. The energy required to completely escape from it is
a) KE b) 2 KE c) $\frac{\text{KE}}{2}$ d) $\frac{3\text{KE}}{2}$
148. A man is standing on an international space station, which is orbiting earth at an altitude 520 km with a constant speed 7.6 km/s. If the man's weight is 50 kg, his acceleration is
a) $7.6km/s^2$ b) $7.6m/s^2$ c) $8.4m/s^2$ d) $10m/s^2$
149. Three or two planets. The ratio of radius of the two planets is K but ratio of acceleration due to gravity of both planets is g. What will be the ratio of their escape velocity?
a) $(Kg)^{1/2}$ b) $(Kg)^{-1/2}$ c) $(Kg)^2$ d) $(Kg)^{-2}$
150. A planet revolves around the sun in an elliptical orbit. The linear speed of the planet will be maximum at



a) D b) B c) A d) C

151. If a man weighs 90 kg on the surface of earth, the height above the surface of the earth of radius R, where the weight is 30 kg is

a) 0.73 R b) $R/\sqrt{3}$ c) $R/3$ d) $\sqrt{3}R$

152. Correct form of gravitational law is

a) $F = -\frac{Gm_1m_2}{r^2}$ b) $\vec{F} = -\frac{Gm_1m_2}{r^2}$ c) $\vec{F} = -\frac{Gm_1m_2}{r^3}\hat{r}$ d) $\vec{F} = -\frac{Gm_1m_2\vec{r}}{r^3}$

153. At what height above the earth's surface does the force of gravity decrease by 10%? The radius of the earth is 6400 km?

a) 345.60 km b) 687.20 km c) 1031.8 km d) 12836.80 km

154. 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) $\sqrt{\frac{E}{mr^2}}$ b) $\frac{E}{2mr^2}$ c) $\sqrt{2\,Emr^2}$ d) $\sqrt{2\,Emr}$

155. A satellite of mass m is circulation around the earth with constant angular velocity. If radius of the orbit is R_0 and mass of the earth M, the angular momentum about the centre of the earth is

a) $m\sqrt{GMR_0}$ b) $M\sqrt{GMR_0}$ c) $m\sqrt{\frac{GM}{R_0}}$ d) $M\sqrt{\frac{GM}{R_0}}$

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

a) 1 : 3 b) 3 : 1 c) 3 : 4 d) 12 : 1

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

a) $\frac{1}{4}mgR$ b) $\frac{1}{2}mgR$ c) mgR d) $2mgR$

158. The acceleration due to gravity on a planet is 1.96 ms^{-2}. If it is safe to jump from a height of 3 m on the earth, the corresponding height on the planet will be

a) 3 m b) 6 m c) 9 m d) 15 m

159. If g_e, g_h and g_d be the accelerations due to gravity at earth's surface, a height h and at depth d respectively. Then

a) $g_e > g_h > g_d$ b) $g_e > g_h < g_d$ c) $g_e < g_h < g_d$ d) $g_e < g_h > g_d$

160. The radius of a planet is 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) $2\sqrt{2}$ d) 2

161. The mass of diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet will be (if it is a second's pendulum on earth)

a) $\frac{1}{\sqrt{2}}s$ b) $2\sqrt{2}\,s$ c) $2s$ d) $\frac{1}{2}s$

162. At what temperature, the hydrogen molecule will escape from earth's surface?

a) 10^1 K b) 10^2 K c) 10^3 K d) 10^4 K

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

a) $v_e \propto \rho R$ b) $v_e \propto \sqrt{\rho R}$ c) $v_e \propto \frac{\sqrt{\rho}}{R}$ d) $v_e \propto \frac{1}{\sqrt{\rho} R}$

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

a) 4 days b) 16 days c) $2\sqrt{2}$ days d) 64 days

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

a) $\frac{R^2}{M}$ b) $\frac{M}{R^2}$ c) MR^2 d) $\frac{M}{R}$

166. What would be the velocity of earth due to rotation about its own axis so that the weight at equator become 3/5 of initial value. Radius of earth on equator is 6400 km

a) $7.4 \times 10^{-4} rad/sec$ b) $6.7 \times 10^{-4} rad/sec$ c) $7.8 \times 10^{-4} rad/sec$ d) $8.7 \times 10^{-4} rad/sec$

167. The rotation period of an earth satellite close to the surface of the earth is 83 min. the satellite in a orbit at a distance of three times earth radii from its surface will be

a) 83 min b) $83 \times \sqrt{8}$ min c) 664 min d) 249 min

168. The escape velocity on earth is

a) 1.12 kms^{-1} b) 11.2 ms^{-1} c) 11.2 kmh^{-1} d) 11.2 kms^{-1}

169. In a gravitational field, at a point where the gravitational potential is zero

a) The gravitational field is necessarily zero
b) The gravitational field is not necessarily zero
c) Nothing can be said definitely about the gravitational field
d) None of these

170. Orbital velocity of earth's satellite near the surface is 7 km/s. When the radius of the orbit is 4 times than that of earth's radius, then orbital velocity in that orbit is

a) 3.5 km/s b) 7 km/s c) 72 km/s d) 14 km/s

171. The time period T of the moon of planet Mars ($mass\ M_m$) is related to its orbital radius R(G = Gravitational constant) as

a) $T^2 = \frac{4\pi^2 R^3}{GM_m}$ b) $T^2 = \frac{4\pi^2 GR^3}{M_m}$ c) $T^2 = \frac{2\pi R^3 G}{M_m}$ d) $T^2 = 4\pi M_m GR^3$

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

a) $R/3$ b) $R/2$ c) $R/4$ d) $R/5$

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

a) $M/6$ b) Zero c) M d) None of these

174. A synchronous satellite goes around the earth once in every 24 h. What is the radius of orbit of the synchronous satellite in terms of the earth's radius (Given mass of the earth, $m_e = 5.98 \times 10^{24} kg$. radius of earth, $r_e = 6.37 \times 10^6 m$, Universal constant of gravitation, $G = 6.67 \times 10^{-11} Nm^2/kg^2$)

a) $2.4r_e$ b) $3.6r_e$ c) $4.8r_e$ d) $6.6r_e$

175. Four particles each of mass M, are located at the vertices of a square with side L. The gravitational potential due to this at the centre of the square is

a) $-\sqrt{32}\frac{GM}{L}$ b) $-\sqrt{64}\frac{GM}{L^2}$ c) Zero d) $\sqrt{32}\frac{GM}{L}$

176. An astronaut on a strange planet finds that acceleration due to gravity is twice as that on the surface of earth. Which of the following could explain this

a) Both the mass and radius of the planet are half as that of earth
b) Radius of the planet is half as that of earth, but the mass is the same as that of earth
c) Both the mass and radius of the planet are twice as that of earth
d) Mass of the planet is half as that of earth, but radius is same as that of earth

177. If g is the acceleration due to gravity on earth's surface, the gain of the potential energy of an object of

mass m raised from the surface of the earth to a height equal to the radius R of the earth is

a) $2mgR$ b) mgR c) $\frac{1}{2}mgR$ d) $\frac{1}{4}mgR$

178. An object weighs 72 N on earth. Its weight at a height of $R/2$ from earth is

a) 32 N b) 56 N c) 72 N d) Zero

179. A point mass m is placed inside a spherical shell of radius R and mass M. at a distance $R/2$ from the centre of the shell. The gravitational force exerted by the shell on the point mass is

a) $\frac{GMm}{R^2}$ b) $-\frac{GMm}{R^2}$ c) Zero d) $4\frac{GMm}{R^2}$

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

a) $\sqrt{\frac{Gm}{R}}$ b) $\sqrt{\frac{Gm}{4R}}$ c) $\sqrt{\frac{Gm}{3R}}$ d) $\sqrt{\frac{Gm}{2R}}$

181. A straight rod of length L extends from $x = a$ to $x = L + a$. Find the gravitational force it, exerts on a point mass m at $x = 0$ if the linear density of rod $\mu = A + Bx^2$

a) $Gm\left[\frac{A}{a} + BL\right]$ b) $Gm\left[A\left(\frac{1}{a} - \frac{1}{a+L}\right) + BL\right]$

c) $Gm\left[BL + \frac{A}{a+L}\right]$ d) $Gm\left[BL - \frac{A}{a}\right]$

182. The escape velocity of an object from the earth depends upon the mass of the earth (M), its mean density, (ρ), its radius (R) and the gravitational constant (G). Thus the formula for escape velocity is

a) $v = R\sqrt{\frac{8\pi}{3}G\rho}$ b) $v = M\sqrt{\frac{8\pi}{3}GR}$ c) $v = \sqrt{2GMR}$ d) $v = \sqrt{\frac{2GM}{R^2}}$

183. Two spheres of radius r and $2r$ are touching each other. The fore of attraction between them is proportional to

a) r^6 b) r^4 c) r^2 d) r^{-2}

184. If the radius of the earth were to shrink by two percent, its mass remaining the same, the acceleration due to gravity on the earth's surface would

a) Decrease by 2% b) Increase by 2% c) Increase by 4% d) Decrease by 4%

185. A projectile is projected with velocity kv_e in vertically upward direction from the ground into the space. (v_e is escape velocity and $k < 1$). If resistance is considered to be negligible then the maximum height from the centre of earth to which it can go, will be : (R = radius of earth)

a) $\frac{R}{k^2+1}$ b) $\frac{R}{k^2-1}$ c) $\frac{R}{1-k^2}$ d) $\frac{R}{k+1}$

186. Mass of moon is 7.34×10^{22} kg. If the acceleration due to gravity on the moon is 1.4 ms^{-2}, the radius of the moon is ($G = 6.667 \times 10^{11}\text{Nm}^2\text{kg}^{-2}$)

a) 0.56×10^4m b) 1.87×10^6m c) 1.92×10^6m d) 1.01×10^8m

187. Choose the correct statement from the following :
Weightlessness of an astronaut moving in a satellite is a situation of

a) Zero g b) No gravity c) Zero mass d) Free fall

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

a) 1 km/sec b) 4 km/sec c) 8 km/sec d) 11.2 km/sec

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

a) Time period b) Orbiting radius c) Tangential velocity d) Angular velocity

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

a) 2.5 R b) 4.5 R c) 7.5 R d) 1.5 R

191. A body weighs w newton at the surface of the earth. Its weight at a height equals to half the radius of the earth, will be

a) $\frac{w}{2}$ b) $\frac{2w}{3}$ c) $\frac{4w}{9}$ d) $\frac{8w}{27}$

192. Suppose the law of gravitational attraction suddenly changes and becomes an inverse cube law i.e. $F \propto 1/r^3$, but still remaining a central force. Then

a) Keplers law of areas still holds

b) Keplers law of period still holds

c) Keplers law of areas and period still hold

d) Neither the law of areas, nor the law of period still holds

193. A planet moves around the sun. At a given point P, it is closest from the sun at a distance d_1 and has a speed v_1. At another point Q, when it is farthest from the sun at a distance d_2, its speed will be

a) $\frac{d_1^2 v_1}{d_2^2}$ b) $\frac{d_2 v_1}{d_1}$ c) $\frac{d_1 v_1}{d_2}$ d) $\frac{d_2^2 v_1}{d_1^2}$

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

a) $(4/5)mgh$ b) $(5/6)mgh$ c) $(6/7)mgh$ d) mgh

195. Orbital velocity of an artificial does not depend upon

a) Mass of the earth b) Mass of the satellite

c) Radius of the earth d) Acceleration due to gravity

196. A body has weight 90 kg on the earth's surface, the mass of the moon is 1/9 that of the earth's mass and its radius is 1/2 that of the earth's radius. On the moon the weight of the body is

a) 45 kg b) 202.5 kg c) 90 kg d) 40 kg

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

a) 880 N b) 889 N c) 890 N d) 892 N

198. A pendulum clock is set to give correct time at the sea level. This clock is moved to hill station at an altitude of 2500 m above the sea level. In order to keep correct time of the hill station, the length of the pendulum

a) Has to be reduced b) Has to be increased

c) Needs no adjustment d) Needs no adjustment but its mass has to be increased

199. 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 geostationary satellite will be

a) $R^2 g/\omega$ b) $R^2\omega^2/g$ c) Rg/ω^2 d) $R^2 g/\omega^2$

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, where v is its escape velocity from the surface of the Earth. The value of f is

a) $\frac{1}{3}$ b) $\frac{1}{2}$ c) $\sqrt{2}$ d) $\frac{1}{\sqrt{2}}$

201. A satellite is revolving around the earth with a kinetic energy E. The minimum addition of kinetic energy needed to make it escape from its orbit is

a) $2E$ b) $\sqrt{E}$ c) $E/2$ d) E

202. How high a man be able to jump on surface of a planet of radius 320 km, but having density same as that of the earth if he jumps 5 m on the surface of the earth (Radius of earth = 6400 km)

a) 60 m b) 80 m c) 100 m d) 120 m

203. The change in the value of g at a height h above the surface of the earth is the same as at a depth d below

the surface of earth. When both d and h are much smaller than the radius of earth, then which one of the following is correct?

a) $d = \frac{h}{2}$ b) $d = \frac{3h}{2}$ c) $d = 2h$ d) $d = h$

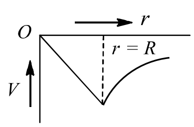
204. A particle is projected vertically upwards from the surface of earth (radius R_e) with a kinetic energy equal to half of the minimum value needed for it to escape. The height to which it rises above the surface of earth is

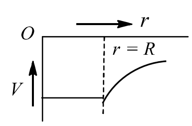
a) R_e b) $2R_e$ c) $3R_e$ d) $4R_e$

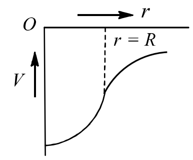
205. The ratio of the radii of planets A and B is k_1 and ratio of acceleration due to gravity on them is k_2. The ratio of escape velocities from them will be

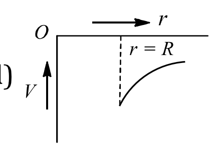
a) $k_1 k_2$ b) $\sqrt{k_1 k_2}$ c) $\sqrt{\frac{k_1}{k_2}}$ d) $\sqrt{\frac{k_2}{k_1}}$

206. P is point at a distance r from the centre of a solid sphere of radius r. The variation of gravitational potential at P (ie, V) and distance r from the centre of sphere is represented by the curve.

a) 

b) 

c) 

d) 

207. If the escape velocity of a planet is 3 times that of the earth and its radius is 4 times that of the earth, then the mass of the planet is (Mass of the earth $= 6 \times 10^{24} kg$)

a) $1.62 \times 10^{22} kg$ b) $0.72 \times 10^{22} kg$ c) $2.16 \times 10^{26} kg$ d) $1.22 \times 10^{22} kg$

208. Two identical satellite A and B are circulating round the earth at the height of R and $2R$ respectively. (where R is radius of the earth). The ratio of kinetic energy of A to that of B is

a) $\frac{1}{2}$ b) $\frac{2}{3}$ c) 2 d) $\frac{3}{2}$

209. What is the binding energy of earth-sun system neglecting the effect of other planets and satellites? (Mass of earth $M_e = 6 \times 10^{24}$kg, mass of the sun $M_x = 2 \times 10^{30}$kg^{-2})

a) 8.8×10^{10} J b) 8.8×10^{3} J c) 5.2×10^{33} J d) 2.6×10^{33} J

210. Which one of the following statements regarding artificial satellite of the earth is incorrect

a) The orbital velocity depends on the mass of the satellite

b) A minimum velocity of 8 km/sec is required by a satellite to orbit quite close to the earth

c) The period of revolution is large if the radius of its orbit is large

d) The height of a geostationary satellite is about 36000 km from earth

211. There are two bodies of masses 100,000 kg and 1000 kg separated by a distance of 1 m. At what distance (in metre) from the smaller body, the intensity of gravitational field will be zero?

a) 1/9 b) 1/10 c) 1/11 d) 10/11

212. The centripetal force acting on a satellite orbiting round the earth and the gravitational force of earth acting on the satellite both equal F. The net force on the satellite is

a) Zero b) F c) $F\sqrt{2}$ d) 2 F

213. The angular velocity of rotation of star (of mass M and radius R) at which the matter start to escape from its equator will be

a) $\sqrt{\frac{2GM^2}{R}}$ b) $\sqrt{\frac{2GM}{g}}$ c) $\sqrt{\frac{2GM}{R^3}}$ d) $\sqrt{\frac{2GR}{M}}$

214. 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) $-\frac{6Gm}{r}$ c) $-\frac{9Gm}{r}$ d) zero

215. A body is acted upon by a force towards a point. The magnitude of the force is inversely proportional to

the square of the distance. The path of body will be

a) Ellipse b) Hyperbola c) Circle d) Parabola

216. Three equal masses of $1kg$ each are placed at the vertices of an equilateral triangle PQR and a mass of $2kg$ is placed at the centroid O of the triangle which is at a distance of $\sqrt{2}\ m$ from each of the vertices of the triangle. The force, in newton, acting on the, mass of $2kg$ is

a) 2 b) $\sqrt{2}$ c) 1 d) Zero

217. The change in potential energy when a body of mass m is raised to a height nR from the centre of earth (R= radius of earth)

a) $mgR\frac{(n-1)}{n}$ b) $nmgR$ c) $mgR\frac{n^2}{n^2+1}$ d) $mgR\frac{n}{n+1}$

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

a) 0, 0 b) $\frac{4GM^2}{3a^2}, 0$ c) $0, \frac{4GM^2}{3a^2}$ d) $\frac{3GM^2}{a^2}, \frac{GM^2}{a^2}$

219. How much energy will be necessary for making a body of 500 kg escape from the earth [$g = 9.8\ ms^{-2}$, radius of earth $= 6.4 \times 10^6$m]

a) About 9.8×10^6J b) About 6.4×10^8J c) About 3.1×10^{10}J d) About 27.4×10^{12}J

220. Two satellites S_1 and S_2 revolve around a planet in coplanar circular orbits in the same sense. Their periods of revolution are 1 h and 8 h respectively. The radius of orbit of S_1 is 10^4 km. When S_2 is closest to S_1, the speed of S_2 relative to S_1 is

a) $\pi \times 10^4\ kmh^{-1}$ b) $2\pi \times 10^4\ kmh^{-1}$ c) $3\pi \times 10^4\ kmh^{-1}$ d) $4\pi \times 10^4\ kmh^{-1}$

221. The tidal waves in the sea are primarily due to

a) The gravitational effect of the moon on the earth

b) The gravitational effect of the sun on the earth

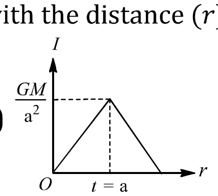
c) The gravitational effect of venus on the earth

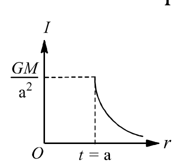
d) The atmospheric effect of the earth itself

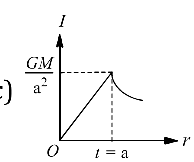
222. If mass of earth is M, radius is R and gravitational constant is G, then work done to take 1 kg mass from earth surface to infinity will be

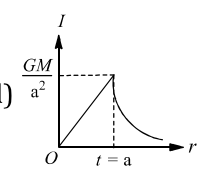
a) $\sqrt{\frac{GM}{2R}}$ b) $\frac{GM}{R}$ c) $\sqrt{\frac{2GM}{R}}$ d) $\frac{GM}{2R}$

223. Which of the following graphs represents correctly the variation of the intensity of gravitational field (I) with the distance (r) from the centre of a spherical shell of mass M and radius a?

a) 

b) 

c) 

d) 

224. The orbital angular momentum of a satellite revolving at a distance r from the centre is L. If the distance is increased to $16r$, then the new angular momentum will be

a) 16 L b) 64 L c) $\frac{L}{4}$ d) 4 L

225. A body of mass m is moved to a height h equal to the radius of the earth. The increase in potential energy is

a) $2\ mgR$ b) mgR c) $mgR/2$ d) $mgR/4$

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

a) $\frac{1}{9}$ b) $\frac{1}{4}$ c) $\frac{1}{16}$ d) $\frac{1}{3}$

227. The mean radius of the earth's orbit round the sun is 1.5×10^{11}. The mean radius of the orbit of mercury round the sun is $6 \times 10^{10} m$. The mercury will rotate around the sun in

a) A year b) Nearly 4 years c) Nearly $\frac{1}{4}$ year d) 2.5 years

228. The mass of the moon is 1/8 of the earth but the gravitational pull is 1/6 of the earth. It is due to the fact that

a) Moon is the satellite of the earth b) The radius of the earth is 8.6 the moon c) The radius of the earth is $\sqrt{8/6}$ of the moon d) The radius of the moon is 6/8 of the earth

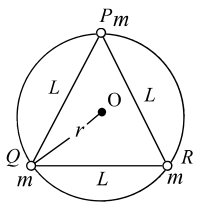
229. Where will it be profitable to purchase 1 kilogram sugar

a) At poles b) At equator c) At 45° latitude d) At 40° latitude

230. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of escape velocity from the earth. The height of the satellite above the earth's surface will be

a) 6000 km b) 5800 km c) 7500 km d) 6400 km

231. Three particles each of mass m rotate in a circle of radius r with uniform angular speed ω under their mutual gravitational attraction. If at any instant the points are on the vertex of an equilateral of side L, then angular velocity ω is



a) $\sqrt{\frac{2Gm}{L^3}}$ b) $\sqrt{\frac{3Gm}{L^3}}$ c) $\sqrt{\frac{5Gm}{L^3}}$ d) $\sqrt{\frac{Gm}{L^3}}$

232. A solid sphere of mass M and radius R has a spherical gravity of radius $\frac{R}{2}$ such that the centre of cavity is at distance $R/2$ from the centre of the sphere. A point mass m is placed inside the cavity at a distance $R/4$ from the centre of sphere. The gravitational pull between the sphere and the point mass m is

a) $\frac{11GMm}{R^2}$ b) $\frac{14GMm}{R^2}$ c) $\frac{GMm}{2R^2}$ d) $\frac{GMm}{R^2}$

233. The changes in potential energy when a body of mass m is raised to a height nR from earth's surface is (R = radius of the earth)

a) $mgR\frac{n}{(n-1)}$ b) mgR c) $mgR\frac{n}{(n+1)}$ d) $mgR\frac{n^2}{(n^2+1)}$

234. A man starts walking from a point on the surface of earth (assumed smooth) and reaches diagonally opposite point. What is the work done by him?

a) Zero b) Positive c) Negative d) Nothing can be said

235. The radius of the earth is R. The height of a point vertically above the earth's surface at which acceleration due to gravity becomes 1% of its value at the surface is

a) 8 R b) 9 R c) 10 R d) 20 R

236. The gravitational potential difference between the surface of a planet and a point 20 m above it is 14 Jkg^{-1}. The work done in moving a 2.0 kg mass by 8.0 m on a slop of 60° from the horizontal is equal to

a) 7 J b) 9.6 J c) 16 J d) 32 J

237. The radius of the earth is about 6400 km and that of the mars is 3200 km. The mass of the earth is about 10 times the mass of the mars. An object weighs 200 N on the surface of earth, its weight on the surface of mars will be

a) 8 N b) 20 N c) 40 N d) 80 N

238. 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) 2 R b) R c) 1.414 R d) 0.414 R

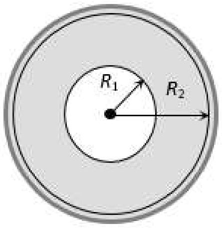
239. Which of the following astronomer first proposed that sun is static and earth rounds sun

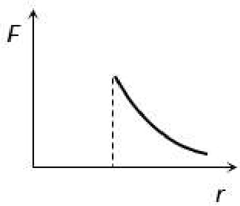
a) Copernicus b) Kepler c) Galileo d) None

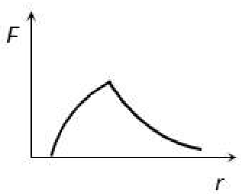
240. The gravitational field in a region is given by $\vec{\mathbf{I}} = (4\hat{\mathbf{i}} + \hat{\mathbf{j}})\text{Nkg}^{-1}$. Work done by this field is zero when a particle is moved along the line

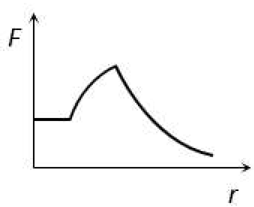
a) $x + y = 6$ b) $x + 4y = 6$ c) $y + 4x = 6$ d) $x - y = 6$

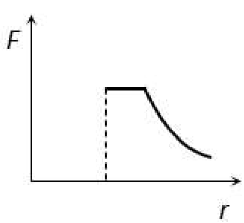
241. A sphere of mass M and radius R_2 has a concentric cavity of radius R_1 as shown in figure. The force F exerted by the sphere on a particle of mass m located at a distance r from the centre of sphere varies as $(0 \le r \le \infty)$



a) 

b) 

c) 

d) 

242. 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 $\lambda = 60°$ will be equal to

a) $g_p - \frac{1}{4}R\omega^2$ b) $g_p - \frac{3}{4}R\omega^2$ c) $g_p - R\omega^2$ d) $g_p + \frac{1}{4}R\omega^2$

243. The escape velocity of a particle of mass m varias as

a) m^2 b) m c) m^0 d) m^{-1}

244. The value of g on the surface of earth is smallest at the equator because

a) The centripetal force is maximum at equator

b) The centripetal force is least at equator

c) The angular speed of earth is maximum at equator

d) The angular speed of earth is least at equator

245. The gravitational potential energy of a body of mass m at a distance r from the centre of the earth is U.

What is the weight of the body at this distance?

a) U b) Ur c) $\frac{U}{r}$ d) $\frac{U}{2r}$

246. If g is the acceleration due to gravity at the earth's surface and r is the radius of the earth, the escape velocity for the body to escape out of earth's gravitational field is

a) gr b) $\sqrt{2\,gr}$ c) g/r d) r/g

247. At what height in km over the earth's pole the free fall acceleration decreases by one percent? (Assume the radius of the earth to be 6400 km)

a) 32 b) 64 c) 80 d) 1.253

248. According to Kepler's law T^2 is proportional to

a) R^3 b) R^2 c) R d) R^{-1}

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

a) $5R$ b) $15R$ c) $3R$ d) $4R$

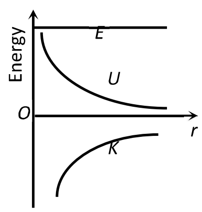
250. Let g be the acceleration due to gravity at earth's surface and K be the rotational kinetic energy of the earth. Suppose the earth's radius decreases by 2% keeping all other quantities same, then

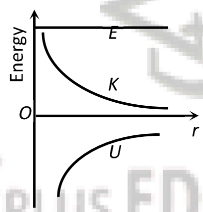
a) g decreases by 2% and K decreases by 4%
b) g decreases by 4% and K increases by 2%
c) g increases by 4% and K increases by 4%
d) g decreases by 4% and K increases by 4%

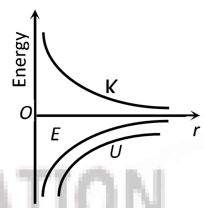
251. A geostationary satellite is revolving around the earth. To make it escape from gravitational field of earth, its velocity must be increased

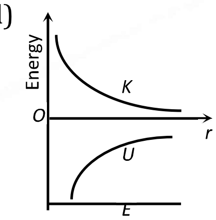
a) 100% b) 41.4% c) 50% d) 59.6%

252. The correct graph representing the variation of total energy (E) kinetic energy (K) and potential energy (U) of a satellite with its distance from the centre of earth is

a) 

b) 

c) 

d) 

253. Two identical satellites are at R and $7R$ away from earth surface, the wrong statement is (R =Radius of earth)

a) Ratio of total energy will be y
b) Ratio of kinetic energies will be y
c) Ratio of potential energies will be y
d) Ratio of total energy will be y but ratio of potential and kinetic energy will be z

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

a) $g/2$ b) $4g$ c) $g/4$ d) $2g$

255. The gravitational force F_g between two objects does not depends on

a) Sum of the masses
b) Product of the masses
c) Gravitational constant
d) Distance between the masses

256. A point $P(R\sqrt{3},0,0)$ lies on the axis of a ring of mass M and radius R. The ring is located in $y-z$ plane with its centre at origin O. A small particle of mass m starts from P and reaches O under gravitational attraction only. Its speed at O will be

a) $\sqrt{\frac{GM}{R}}$ b) $\sqrt{\frac{Gm}{R}}$ c) $\sqrt{\frac{GM}{2R}}$ d) $\sqrt{\frac{Gm}{2R}}$

257. In the previous question, the angular speed of S_2 as actually observed by an astronaut is S_1

a) $\frac{\pi}{2}\text{radh}^{-1}$ b) $\pi\text{ radh}^{-1}$ c) $\frac{2\pi}{3}\text{ radh}^{-1}$ d) $\frac{\pi}{3}\text{ radh}^{-1}$

258. The mass of the moon is 7.34×10^{22} kg and the radius is 1.74×10^{6}m. the value of gravitational field intensity will be

a) 1.45 Nkg^{-1} b) 1.55 Nkg^{-1} c) 1.7 Nkg^{-1} d) 1.62 Nkg^{-1}

259. A body of mass m kg. starts falling from a point $2R$ above the Earth's surface. Its kinetic energy when it has fallen to a point $'R'$ above the Earth's surface [R-Radius of Earth, M-Mass of Earth, G-Gravitational Constant]

a) $\frac{1}{2}\frac{GMm}{R}$ b) $\frac{1}{6}\frac{GMm}{R}$ c) $\frac{2}{3}\frac{GMm}{R}$ d) $\frac{1}{3}\frac{GMm}{R}$

260. If acceleration due to gravity on the surface of a planet is two times that on surface of earth and its radius is double that of earth. Then escape velocity from the surface of that planet in comparison to earth will be

a) $2\ v_e$ b) $3\ v_e$ c) $4\ v_e$ d) None of these

261. Planetary system in the solar system describes

a) Conservation of energy b) Conservation of linear momentum
c) Conservation of angular momentum d) None of these

262. The ratio of the radius of the earth to that of the moon is 10. The ratio of acceleration due to gravity on the earth and on the moon is 6. The ratio of the escape velocity from the earth's surface to that from the moon is

a) 10 b) 6 c) Nearly 8 d) 1.66

263. The depth d at which the value of acceleration due to gravity becomes $1/n$ times the value of the surface, is [R = radius of the earth]

a) $\frac{R}{n}$ b) $R\left(\frac{n-1}{n}\right)$ c) $\frac{R}{n^2}$ d) $R\left(\frac{n}{n+1}\right)$

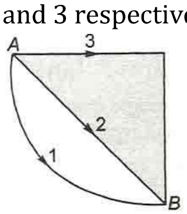
264. If v_e and v_o represent escape velocity and orbital velocity of a satellite corresponding to a circular orbit of radius R, then

a) $v_e = v_o$ b) $\sqrt{2}v_o = v_e$
c) $v_e = v_o/\sqrt{2}$ d) v_e and v_o are not related

265. If the distance between two masses is doubled, the gravitational attraction between them

a) Is doubled b) Becomes four times
c) Is reduced to half d) Is reduced to a quarter

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



a) $W_1 = W_2 = W_3$ b) $W_1 > W_2 > W_3$ c) $W_1 > W_2 < W_3$ d) $W_1 < W_3 < W_2$

267. A satellite whose mass is M, is revolving in circular orbit of radius r around the earth. Time of revolution of satellite is

a) $T \propto \frac{r^5}{GM}$ b) $T \propto \sqrt{\frac{r^3}{GM}}$ c) $T \propto \sqrt{\frac{r}{GM^2/3}}$ d) $T \propto \sqrt{\frac{r^3}{GM^1/4}}$

268. Escape velocity on a planet is v_e. If radius of the planet remains same and mass becomes 4 times, the escape velocity becomes

a) $4v_e$ b) $2v_e$ c) v_e d) $\frac{1}{2}v_e$

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

a) $\frac{mgR}{4}$ b) $\frac{mgR}{2}$ c) mgR d) $2mgR$

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

a) 10 h b) $\frac{6}{\sqrt{2}}$ h c) 6 h d) $6\sqrt{2}$ h

271. A satellite moves round the earth in a circular orbit of radius R making 1 rev/day. A second satellite moving in a circular orbit, moves round the earth ones in 8 days. The radius of the orbit of the second satellite is

a) 8 R b) 4 R c) 2 R d) R

272. A satellite in launched in a circular orbit of radius R around the earth. A second satellite is launch in to an orbit of radius $1.01R$. The period of second satellite is longer than the first one (approximately) by

a) 1.5 % b) 0.5% c) 3% d) 1%

273. Gravitational acceleration on the surface of a planet is $\frac{\sqrt{6}}{11}$ g, where g is the gravitational acceleration on the surface of earth. The average mass density of the planet is $\frac{2}{3}$ times that of the earth. If the escape speed on the surface of the earth is taken on be 11 kms^{-1}, the escape speed on the surface of the planet in kms^{-1} will be

a) 5 b) 7 c) 3 d) 11

274. A solid sphere is of density ρ and radius R. The gravitational field at a distance r from the centre of the sphere, where $r < R$, is

a) $\frac{\rho\pi GR^3}{r}$ b) $\frac{4\pi G\rho r^2}{3}$ c) $\frac{4\pi G\rho R^3}{3r^2}$ d) $\frac{4\pi G\rho r}{3}$

275. A body revolved around the sun 27 times faster than the earth. What is the ratio of their radii

a) 1/3 b) 1/9 c) 1/27 d) 1/4

276. Satellite A and B are revolving around the orbit of earth. The mass of A is 10 times of mass of B. The ratio of time period $\left(\frac{T_A}{T_B}\right)$ is

a) 10 b) 1 c) $\frac{1}{5}$ d) $\frac{1}{10}$

277. A mass M is split into two parts m and $(M - m)$, which are then separated by a certain distance. The ratio m/M which maximizes the gravitational force between the parts is

a) 1 : 4 b) 1 : 2 c) 4 : 1 d) 2 : 1

278. The mass and radius of the sun are $1.99 \times 10^{30} kg$ and $R = 6.96 \times 10^8$ m. The escape velocity of a rocket from the Sun is

a) 11.2 km/s b) 2.38 km/s c) 59/5 km/s d) 618 km/s

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

a) $2R$ b) $\frac{R}{\sqrt{3}}$ c) $\frac{R}{2}$ d) $\sqrt{2}R$

280. The escape velocity for the earth is v_e. The escape velocity for a planet whose radius is four times and density is nine times that of the earth, is

a) $36v_e$ b) $12v_e$ c) $6v_e$ d) $20v_e$

281. The ratio of the radius of a planet $'A'$ to that of planet $'B'$ is $'r'$. The ratio of acceleration due to gravity on the planets is $'x'$. The ratio of the escape velocities from the two planets is

a) xr b) $\sqrt{\frac{r}{x}}$ c) $\sqrt{rx}$ d) $\sqrt{\frac{x}{r}}$

282. A satellite of the earth is revolving in a circular orbit with a uniform speed v. If the gravitational force suddenly disappears, the satellite will

a) Continue to move with velocity v along the original orbit

b) Move with a velocity v, tangentially to the original orbit

c) Fall down with increasing velocity
d) Ultimately come to rest somewhere on the original orbit

283. If the earth stops rotating, the value of g at the equator
a) increases b) decreases c) no effect d) None of these

284. If a planet of given density were made larger (keeping its density unchanged) its force of attraction for an object on its surface would increase because of increased mass of the planet but would decrease because of larger separation between the centre of the planet and its surface. Which effect would dominate?
a) Increase in mass b) Increase in radius
c) Both affect the attraction equally d) None of the above

285. If different planets have the same density but different radii, then the acceleration due to gravity on the surface of the planet is related to the radius (R) of the planet as
a) $g \propto R^2$ b) $g \propto R$ c) $g \propto \frac{1}{R^2}$ d) $g \propto \frac{1}{R}$

286. A mass of 6×10^{24}kg is to be compressed in a sphere in such a way that the escape velocity from the sphere is 3×10^8 m/s. What should be the radius of the sphere?
($G = 6.67 \times 10^{-11}$ N– m^2/kg^2)
a) 9 km b) 9 m c) 9 mc d) 9 mm

287. The gravitational force between two point masses m_1 and m_2 at separation r is given by $F = k\frac{m_1 m_2}{r^2}$
The constant k
a) Depends on system of units only b) Depends on medium between masses only
c) Depends on both (a) and (b) d) Is independent of both (a) and (b)

288. For a satellite moving in an orbit around the earth, the ratio of kinetic energy to potential energy is
a) 2 b) $\frac{1}{2}$ c) $\frac{1}{\sqrt{2}}$ d) $\sqrt{2}$

289. 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 a distance of $2r$ from the earth's centre. Their time periods are in the ratio of
a) 1 : 2 b) 1 : 16 c) 1 : 32 d) $1 : 2\sqrt{2}$

290. The largest and the shortest distance of the earth from the sun are r_1 and r_2, its distance from the sun when it is at the perpendicular to the major axis of the orbit drawn from the sun
a) $\frac{r_1 + r_2}{4}$ b) $\frac{r_1 r_2}{r_1 + r_2}$ c) $\frac{2r_1 r_2}{r_1 + r_2}$ d) $\frac{r_1 + r_2}{3}$

291. The total energy of satellite moving with an orbital velocity v around the earth is
a) $\frac{1}{2}mv^2$ b) $-\frac{1}{2}mv^2$ c) mv^2 d) $\frac{3}{2}mv^2$

292. The potential energy of gravitational interaction of a point mass m and a thin uniform rod of mass M and length l, if they are located along a straight line at distance a from each other is
a) $U = \frac{GMm}{a}\log_e\left(\frac{a+l}{a}\right)$ b) $U = GMm\left(\frac{1}{a} - \frac{1}{a+l}\right)$
c) $U = -\frac{GMm}{l}\log_e\left(\frac{a+l}{a}\right)$ d) $U = -\frac{GMm}{a}$

293. Three identical bodies of mass M are located at the vertices of an equilateral triangle of side L. They revolve under the effect of mutual gravitational force in a circular orbit, circumscribing the triangle while preserving the equilateral triangle. Their orbital velocity is
a) $\sqrt{\frac{GM}{L}}$ b) $\sqrt{\frac{3GM}{2L}}$ c) $\sqrt{\frac{3GM}{L}}$ d) $\sqrt{\frac{2GM}{3L}}$

294. If the diameter of mars is 6760 km and mass one-tenth that of earth. The diameter of earth is 12742 km. If acceleration due to gravity on earth is 9.8 ms^{-2}, the acceleration due to gravity on mass is
a) 34.8 ms^{-2} b) 2.84 ms^{-2} c) 3.48 ms^{-2} d) 28.4 ms^{-2}

295. A clock S is based on oscillation of a spring and clock P is based on pendulum motion. Both clock run at the

same rate on earth. On a planet having the same density as earth but twice the radius,
a) S will run faster than P
b) P will run faster than S
c) Both will run at the same rate as on the earth
d) Both will run at the same rate which will be different from that on the earth

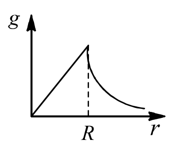
296. The correct option is
a) The time taken in travelling DAB is less than that for BCD
b) The time taken in travelling DAB is greater than that for BCD
c) The time taken in travelling $CDAD$ is less than that for ABC
d) The time taken in travelling CDA is greater than that for ABC

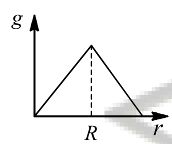
297. In the above Question find apparent weight of the object?
a) 3 N b) Zero c) 2 N d) 0.2 N

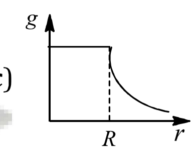
298. The earth revolves round the sun in one year. If the distance between them becomes double, the new period of revolution will be
a) $1/2$ *year* b) $2\sqrt{2}$ *years* c) 4 *years* d) 8 *years*

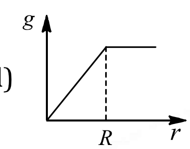
299. At what height h above earth, the value of g becomes $g/2$? (R = radius of earth)
a) $3R$ b) $\sqrt{2}\,R$ c) $(\sqrt{2}-1)R$ d) $\frac{1}{\sqrt{2}}R$

300. When of the following graphs correctly represents the variation of g on earth?

a) 

b) 

c) 

d) 

301. Rockets are launched in Eastward direction to take advantage of
a) The clear sky on Eastesn side b) The thinner atmosphere on this side
c) Earth's rotation d) Earth's tilt

302. If the diameter of mass is 6760 km and mass one-tenth that of earth. The diameter of earth is 12742 km. If acceleration due to gravity on earth is 9.8 ms^{-2}, the acceleration due to gravity on mass is
a) 34.8 ms^{-2} b) 2.48 ms^{-2} c) 3.48 ms^{-2} d) 28.4 ms^{-2}

303. An artificial satellite is moving in a circular orbit around the Earth. The height of the satellite above the surface of Earth is R. Suppose the satellite is stopped suddenly in its orbit and allowed to fall freely. On reaching Earth, its speed will be
a) $\sqrt{gR}$ b) $2\sqrt{gR}$ c) $3\sqrt{gR}$ d) $5\sqrt{gR}$

304. A planet moving along an elliptical orbit is closest to the sun at a distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are the linear velocities at these points respectively. Then the ratio $\frac{v_1}{v_2}$ is
a) $\frac{r_1}{r_2}$ b) $\left(\frac{r_1}{r_2}\right)^2$ c) $\frac{r_2}{r_1}$ d) $\left(\frac{r_2}{r_1}\right)^2$

305. A spherical hollow is made in a lead sphere of radius R such that its surface touches the outside surface of the lead sphere and passes through the centre. The mass of the lead sphere before hollowing was M. The force of attraction that this sphere would exert on a particle of mass m which lies at a distance $d(>R)$ from the centre of the lead sphere on the straight line joining the centres of the sphere and the hollow is
a) $\frac{GM\,m}{d^2}$ b) $\frac{GM\,m}{8d^2}$
c) $\frac{GM\,m}{d^2}\left[1+\frac{1}{8\left(1+\frac{R}{2d}\right)}\right]$ d) $\frac{GM\,m}{d^2}\left[1-\frac{1}{8\left(1-\frac{R}{2d}\right)^2}\right]$

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

a) 3:1 b) 1:2 c) 1:1 d) 2:1

307. A clock S is based on oscillation of a spring and a clock P is based on pendulum motion. Both clocks run at the same rate on earth. On a planet having the same density as earth but twice the radius
a) S will run faster than P
b) P will run faster than S
c) They will both run at the same rate as on the earth
d) None of these

308. Select the correct statement from the following
a) The orbital velocity of a satellite increases with the radius of the orbit
b) Escape velocity of a particle from the surface of the earth depends on the speed with which it is fired
c) The time period of satellite does not depend on the radius of the orbit
d) The orbital velocity is inversely proportional to the square root of the radius of the orbit

309. A body of mass 500 g is thrown upward with a velocity 20ms^{-1} and reaches back to the surface of a planet after 20 s. Then the weight of the body on that planet is
a) 2 N b) 4 N c) 5 N d) 1 N

310. A planet of mass m moves around the sun of mass M in an elliptical orbit. The maximum and minimum distance of the planet from the sun are r^1 and r^2, respectively. The time period of the planet is proportional to
a) $(r_1 + r_2)$ b) $(r_1 + r_2)^{1/2}$ c) $(r_1 - r_2)^{3/2}$ d) $(r_1 + r_2)^{3/2}$

311. Halley's comet has a period of 76, had distance of closest approach to the sun equal to 8.9×10^{10}m. the comet's farthest distance from the sun if the mass of sun is 2×10^{30} kg and $G = 6.67 \times 10^{11}$ in MKS units is
a) 2×10^{12}m b) 2.7×10^{13}m c) 5.3×10^{12}m d) 5.3×10^{13}m

312. If the earth were to spin faster, acceleration due to gravity at the poles
a) increase
b) decreases
c) remain the same
d) depends on how fast it spins

313. Which force in nature exits every where
a) Nuclear force
b) Electromagnetic force
c) Weak force
d) Gravitation

314. Kepler's second law states that the straight line joining the planet to the sun sweeps out equal times. This statement is equivalent to saying that
a) Total acceleration is zero
b) Tangential acceleration is zero
c) Longitudinal acceleration is zero
d) Radial acceleration is zero

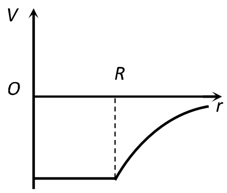
315. Which of the following statement about the gravitational constant is true?
a) It is a force
b) It has no unit
c) It has same value in all system of units
d) It does not depend on the nature of the medium in which the bodies are kept

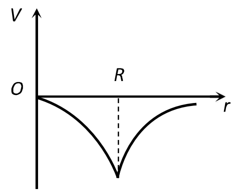
316. A satellite is orbiting around the earth with orbital radius R and time period T. The quantity which remain constant is
a) T/R b) T^2/R c) T^2/R^2 d) T^2/R^3

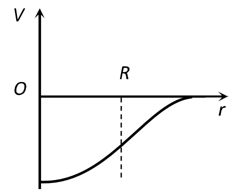
317. Assuming earth to be a sphere of a uniform density, what is the value of gravitational acceleration in a min 100 km below the earth' surface (Given $R = 6400\ km$)
a) 9.66 m/s^2 b) 7.64 m/s^2 c) 5.06 m/s^2 d) 3.10 m/s^2

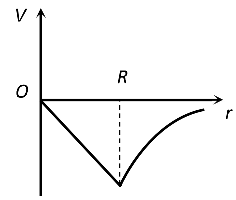
318. The atmosphere is held to the earth by
a) Winds b) Gravity c) Clouds d) None of the above

319. The diagram showing the variation of gravitational potential of earth with distance from the centre of earth is

a) 

b) 

c) 

d) 

320. The escape velocity of an object on a planet whose g value is 9 times on earth and whose radius is 4 times that of earth in km/s is
a) 67.2 b) 33.6 c) 16.8 d) 25.2

321. Infinite number of masses, each 1 kg, are placed along the x-axis at $x = \pm 1\text{m}, \pm 2\text{m}, \pm 4\text{m}, \pm 8\text{m}, \pm 16\text{m}$ ..... The magnitude of the resultant gravitational potential in terms of gravitational constant G at the origin $(x = 0)$ is
a) $G/2$ b) G c) $2G$ d) $4G$

322. There is a mine of depth about 2.0 km. In this mine the conditions as compared to those at the surface are
a) Lower air pressure, higher acceleration due to gravity
b) Higher air pressure, lower acceleration due to gravity
c) Higher air pressure, higher acceleration due to gravity
d) Lower air pressure, lower acceleration due to gravity

323. A satellite of mass m is orbiting close to the surface of the earth (Radius R = 6400 km) has a kinetic energy k. The corresponding kinetic energy of the satellite to escape from the earth's gravitational field is
a) K b) $2K$ c) mgR d) mK

324. What is the intensity of gravitational field at the centre of a spherical shell
a) Gm/r^2 b) g c) Zero d) None of these

325. Two particles each of mass m are moving around a circle of radius R due to their mutual gravitational force of attraction, velocity of each particle is
a) $v = \sqrt{\frac{Gm}{2R}}$ b) $v = \sqrt{\frac{Gm}{R}}$ c) $v = \sqrt{\frac{Gm}{4R}}$ d) None of these

326. Average density of the earth
a) does not depend on g
b) is a complex function of g
c) is directly proportional to g
d) is inversely proportional g

327. Venus looks brighter than other planets because
a) It is heavier than other planets
b) It has higher density than other planets
c) It is closer to the earth than other planets
d) It has no atmosphere

328. A spherical planet has a mass M_P and diameter D_P. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to
a) $4GM_P/D_P^2$ b) GM_Pm/D_P^2 c) GM_P/D_P^2 d) $4GM_Pm/D_P^2$

329. If the radius of earth decreases by 1% and its mass remains same, then the acceleration due to gravity
a) increases by 1% b) decreases by 1% c) increases by 2% d) decreases by 2%

330. Suppose the gravitational force varies inversely as the nth power of distance. Then the time period of a planet in circular orbit of radius R around the sun will be proportional to
a) $R^{\left(\frac{n+1}{2}\right)}$ b) $R^{\left(\frac{n-1}{2}\right)}$ c) R^n d) $R^{\left(\frac{n-2}{2}\right)}$

331. The additional kinetic energy to be provided to a satellite of mass m revolving around a planet of mass M, to transfer it from a circular orbit of radius R_1 to another of radius $R_2 (R_2 > R_1)$ is
a) $GmM\left(\frac{1}{R_1^2} - \frac{1}{R_2^2}\right)$ b) $GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ c) $2GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ d) $\frac{1}{2}GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

332. If the radius of earth's orbit is made $1/4^{th}$, then duration of an year will become
a) 8 times b) 4 times c) 1/8 times d) 1/4 times

333. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The magnitude

of the gravitational potential at a point situated at $a/2$ distance from the centre, will be

a) $\frac{4GM}{a}$ b) $\frac{GM}{a}$ c) $\frac{2GM}{a}$ d) $\frac{3GM}{a}$

334. Read the following statements

S_1 : An object shall weigh more at pole than at equator when weighed by using a physical balance

S_2 : It shall weigh the same at pole and equator when weighed by using a physical balance

S_3 : It shall weigh the same at pole and equator when weighed by using a spring balance

S_4 : It shall weigh more at the pole than at equator when weighed using a spring balance

Which of the above statements is/are correct

a) S_1 and S_2 b) S_1 and S_4 c) S_2 and S_3 d) S_3 and S_4

335. The distance between the earth and the moon is 3.85×10^8m. At what distance from the earth's centre, the intensity of gravitational field will be zero? The masses of earth and moon are 5.98×10^{24} kg and 7.35×10^{22} kg respectively

a) 3.47×10^8m b) 0.39×10^8m c) 1.82×10^8m d) None of these

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

a) gx b) $\frac{gR}{R-x}$ c) $\frac{gR^2}{R+x}$ d) $\left(\frac{gR^2}{R+x}\right)^{1/2}$

337. The gravitational field due to a mass distribution is $1 = \frac{C}{x^2}$ in x direction. Hence C is constant. Taking the gravitational potential to be zero at infinity, potential at x is

a) $\frac{2C}{x}$ b) $\frac{C}{x}$ c) $\frac{2C}{x^2}$ d) $\frac{C}{2x^2}$

338. Reason of weightlessness in a satellite is

a) Zero gravity b) Centre of mass

c) Zero reaction force by satellite surface d) None

339. The relay satellite transmits the T.V. programme continuously from one part of the world to another because its

a) Period is greater than the period of rotation of the earth

b) Period is less than the period of rotation of the earth about its axis

c) Period has no relation with the period of the earth about its axis

d) Period is equal to the period of rotation of the earth about its axis

340. A comet of mass m moves in a highly elliptical orbit around the sun of mass M. The maximum and minimum distances of the comet from the centre of the sun are r_1 and r_2 respectively. The magnitude of angular momentum of the comet with respect to the centre of sun is

a) $\left[\frac{GMr_1}{(r_1+r_2)}\right]^{1/2}$ b) $\left[\frac{GMmr_1}{(r_1+r_2)}\right]^{1/2}$ c) $\left(\frac{2Gm^2r_1r_2}{r_1+r_2}\right)^{1/2}$ d) $\left(\frac{2GMm^2r_1r_2}{r_1+r_2}\right)^{1/2}$

341. Sun is about 330 times heavier and 100 times bigger in radius than earth. The ratio of mean density of the sun to that of earth is

a) 3.3×10^{-6} b) 3.3×10^{-4} c) 3.3×10^{-2} d) 1.3

342. Astronaut is in a stable orbit around the earth when he weighs a body of mass 5 kg. What is reading of spring balance?

a) Spring will not be extended

b) Spring will be extended according to Hook's law

c) Less than 5 kg-wt

d) More than 5 kg-wt

343. 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) $x = 2h$ c) $x = \frac{h}{2}$ d) $x = h^2$

344. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius $4R$. The ratio of their respective periods is

a) 4:1 b) 1:8 c) 8:1 d) 1:4

345. When earth moves around the sun, the quantity which remains constant is

a) Angular velocity b) Kinetic energy c) Potential energy d) Areal velocity

346. If distance between earth and sun become four times, then time period becomes

a) 4 times b) 8 times c) 1/4 times d) 1/8 times

347. The escape velocity for a body projected vertically upwards from the surface of the earth is 11.2 kms^{-1}. If the body is projected in a direction making an angle of 45° with the vertical, the escape velocity will be

a) 11.2 kms^{-1} b) $11.2 \times \sqrt{2}$ kms^{-1} c) 11.2×2 kms^{-1} d) $11.2/\sqrt{2}$ kms^{-1}

348. The period of revolution of planet A around the sun is 8 times that B. The distance of a from the sun is how many times greater than that of B from the sun?

a) 2 b) 3 c) 4 d) 5

349. What does not change in the field of central force

a) Potential energy b) Kinetic energy c) Linear momentum d) Angular momentum

350. If a planet of given density were made larger its force of attraction for an object on its surface would increase because of planet's greater mass but would decease because of the greater distance from the object to the centre of the planet. Which effect predominate?

a) Increases in mass b) Increase in radius
c) Both affect attraction equally d) None of the above

351. The potential energy of 4-particalse each of mass 1 kg placed at the four vertices of a square of side length 1 m is

a) +4.0 G b) −7.5 G c) −5.4 G d) +6.3 G

352. In the above problem, the ratio of the time duration of his jump on the moon to that of his jump on the earth is

a) 1 : 6 b) 6 : 1 c) $\sqrt{6}$: 1 d) 1 : $\sqrt{6}$

353. A mass m is placed at a point B in the gravitational field of mass M. When the mass m is brought from B to near point A, its gravitational potential energy will

a) Remain unchanged b) Increase c) Decrease d) Become zero

354. An artificial of mass $'m'$ revolves around the earth near to its surface then its binding energy is [R_e, g are radius and acceleration due to gravity respectively of the earth]

a) $\frac{1}{2}mg\ R_e$ b) $-\frac{1}{2}mg\ R_e$ c) $mg\ R_e$ d) $-mg\ R_e$

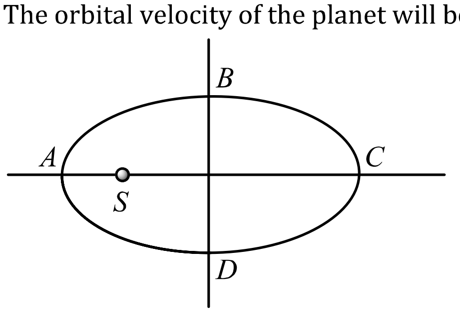
355. Energy required to move a body of mass m from an orbit of radius 2 $R$to $3R$ is

a) $GMm/12R^2$ b) $GMm/3R^2$ c) $GMm/8R$ d) $GMm/6R$

356. The distance of a planet from the sun is 5 times, the distance between the earth and the sun. the time period of the planet is

a) $6^{3/2}T$ yr b) $5^{3/2}T$ yr c) $5^{3/1}T$ yr d) $5^{1/2}T$ yr

357. The orbital velocity of the planet will be maximum at



a) A b) B c) C d) D

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

a) M/R^2 b) m^0 c) mM d) $1/R^{3/2}$

359. The mass of the moon is $\frac{1}{81}$ of the earth but the gravitational pull is $\frac{1}{6}$ of the earth. It is due to the fact that

a) The radius of the moon is $\frac{81}{6}$ of the earth
b) The radius of the earth is $\frac{9}{\sqrt{6}}$ of the moon
c) Moon is the satellite of the earth
d) None of the above

360. Two planets have radii r_1 and r_2 and densities d_1 and d_2 respectively. Then the ratio of acceleration due to gravity on them will be

a) $r_1 d_1 : r_2 d_2$ b) $r_1 d_2 : r_2 d_1$ c) $r_1^2 d_1 : r_2^2 d_2$ d) $r_1 : r_2$

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

a) v_{es} b) $3v_{es}$ c) $\sqrt{3}v_{es}$ d) $\sqrt{5}v_{es}$

362. The moon's radius is 1/4 that of the earth and its mass is 1/80 times that of the earth. If g represents the acceleration due to gravity on the surface of the earth, that on the surface of the moon is

a) $g/4$ b) $g/5$ c) $g/6$ d) $g/8$

363. When a satellite going round the earth in a circular orbit of radius r and speed v loses some of its energy, then r and v change as

a) r and v both will increase
b) r and v both will decrease
c) r will decrease and v will increase
d) r will decrease and v will decrease

364. A particle of mass 10 g 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 $G = 6.67 \times 10^{-11} \text{Nm}^2\text{kg}^2$)

a) 13.34×10^{-10}J b) 3.33×10^{-10}J c) 6.67×10^{-9}J d) 6.67×10^{-10}J

365. Two equal masses m and m are hung from a balance whose scale pan differs in vertical height by $h/2$. The error in weighing in terms of density of the earth ρ is

a) $\frac{1}{3}\pi G\rho mh$ b) $\pi G\rho mh$ c) $\frac{4}{3}\pi G\rho mh$ d) $\frac{8}{3}G\rho mh$

366. In a certain region of space, the gravitational field is given by $-k/r$, where r is the distance and k is a constant. If the gravitational potential at $r = r_0$ be V_0, then what is the expression for the gravitational potential V?

a) $k\log(r/r_0)$ b) $k\log(r_0/r)$ c) $V_0 + k\log(r/r_0)$ d) $V_0 + k\log(r_0/r)$

367. The density of earth in terms of acceleration due to gravity (g), radius of earth (R) and universal gravitational constant (G) is

a) $\frac{4\pi RG}{3g}$ b) $\frac{3\pi RG}{4g}$ c) $\frac{4g}{3\pi RG}$ d) $\frac{3g}{4\pi RG}$

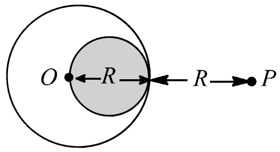
368. The velocity with which is projectile must be fired so that it escapes earth's gravitation does not depend on

a) Mass of the earth
b) Mass of the projectile
c) Radius of the projectile's orbit
d) Gravitational constant

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

370. A solid sphere of uniform density and radius r applies a gravitational force of attraction equal to F_1 on a particle placed at P, distance $2R$ from the centre O of the sphere. A spherical cavity of radius $R/2$ is now made in the sphere as shown in figure. The sphere with cavity now applied an gravitational force F_2 on same particle placed at P. The ratio F_2/F_1 will be



a) 1/2 b) 7/ 9 c) 3 d) 7

371. The height at which the acceleration due to gravity decreases by 36% of its value on the surface of the earth. (The radius of the earth is R)

a) $\frac{R}{6}$ b) $\frac{R}{4}$ c) $\frac{R}{2}$ d) $\frac{2}{3}R$

372. If a planet was suddenly stopped in its orbit, k suppose to be circular, find how much time will it take in falling onto the sun?

a) $\sqrt{2}/8$ times the period of the planet's revolution

b) $4\sqrt{2}$ times the period of the planet's revolution

c) $3\sqrt{2}$ times the period of the planet's revolution

d) 9 times the period of the planet's revolution

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

a) 11.2 kms^{-1} b) $2 \times 11.2 \text{ kms}^{-1}$ c) $3 \times 11.2 \text{ kms}^{-1}$ d) $\sqrt{15} \times 11.2 \text{ kms}^{-1}$

374. A body falls freely under gravity. Its speed is v when it has lost an amount U of the gravitational energy. Then its mass is

a) $\frac{Ug}{v^2}$ b) $\frac{U^2}{g}$ c) $\frac{2U}{v^2}$ d) $2Ugv^2$

375. If the density of the earth is doubled keeping radius constant, find the new acceleration due to gravity? ($g = 9.8 \text{ m/s}^2$)

a) 9.8 m/s^2 b) 19.6 m/s^2 c) 4.9 m/s^2 d) 39.2 m/s^2

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

a) Zero b) $\frac{3GM}{L^2}$ c) $\frac{9GM}{L^2}$ d) $\frac{12}{\sqrt{3}}\frac{GM}{L^2}$

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

a) 6 m b) $\frac{3}{2}$ m c) 2/9 m d) 18 m

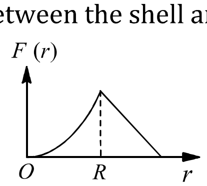
378. A satellite is moving with a constant speed v in a circular orbit about the earth. An object of mass m is ejected from the satellite such that it just escapes from the gravitational pull of the earth. At the time of its ejection, the kinetic energy of the object is

a) $\frac{1}{2}mv^2$ b) mv^2 c) $\frac{3}{2}mv^2$ d) $2mv^2$

379. Two planets of radii in the ratio 2:3 are made from the material of density in the ratio 3:2. Then, the ratio of acceleration due to gravity $\frac{g_1}{g_2}$ at the surface of the two planets will be

a) 1 b) 2.25 c) 4/9 d) 0.12

380. A particle of mass m is located at a distance r from the centre of a shell of mass M and radius R. The force between the shell and mass is $F(r)$. The plot of $F(r)$ *versus* r is

a)


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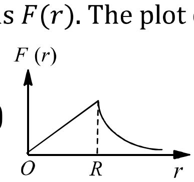
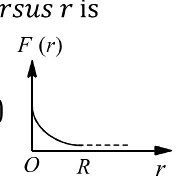
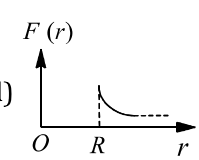


c)


d)


381. The condition for a uniform spherical mass m of radius r to be a black hole is [G = gravitational constant and g = acceleration due to gravity]
a) $(2Gm/r)^{1/2} \leq c$ b) $(2Gm/r)^{1/2} = c$ c) $(2Gm/r)^{1/2} \geq c$ d) $(gm/r)^{1/2} \geq c$
382. If mass of a satellite is doubled and time period remain constant the ratio of orbit in the two cases will be
a) 1 : 2 b) 1 : 1 c) 1 : 3 d) None of these
383. Periodic time of a satellite revolving above Earth's surface at a height equal to R, radius of Earth, is [g is acceleration due to gravity at Earth's surface]
a) $2\pi\sqrt{\frac{2R}{g}}$ b) $4\sqrt{2\pi}\sqrt{\frac{R}{g}}$ c) $2\pi\sqrt{\frac{R}{g}}$ d) $8\pi\sqrt{\frac{R}{g}}$
384. An earth satellite of mass m revolves in a circular orbit of a height h from the surface of the earth. R is the radius of the earth and g is acceleration due to gravity at the surface of the earth. The velocity of the satellite in the orbit is given by
a) $\frac{gR^2}{R+h}$ b) gR c) $\frac{gR}{R+h}$ d) $\sqrt{\frac{gR^2}{R+h}}$
385. At what depth below the surface of the earth, the value of g is the same as that at a height of 5 km?
a) 1.25 km b) 2.5 km c) 5 km d) 10 km
386. Two bodies of masses 2kg and 8kg are separated by a distance of 9 m. the point where the resultant gravitational field intensity is zero is at a distance of
a) 4.5 m from each mass b) 6 m from 2 kg c) 6 m from 8 kg d) 2.5 m from 2 kg
387. A satellite is launched into a circular orbit of radius $'R'$ around earth while a second satellite is launched into an orbit of radius 1.02 R. The percentage difference in the time periods of the two satellites is
a) 0.7 b) 1.0 c) 1.5 d) 3
388. Which of the following statements is correct in respect of a geostationary satellite
a) It moves in a plane containing the Greenwich meridian
b) It moves in a plane perpendicular to the celestial equatorial plane
c) Its height above the earth's surface is about the same as the radius of the earth
d) Its height above the earth's surface is about six times the radius of the earth
389. If g is the acceleration due to gravity on the surface of earth, its value at a height equal to double the radius of earth is
a) g b) $\frac{g}{2}$ c) $\frac{g}{3}$ d) $\frac{g}{9}$
390. A spaceship is launched into a circular orbit close to earth's surface. The additional velocity that should be imparted to the spaceship in the orbit to overcome the gravitational pull is (Radius of earth = 6400 km and g = 9.8 ms^{-2})
a) 11.2 kms^{-1} b) 8 kms^{-1} c) 3.2 kms^{-1} d) 1.5 kms^{-1}
391. If r denotes the distance between the sun and the earth, then the angular momentum of the earth around the sun is proportional to
a) $r^{3/2}$ b) r c) $\sqrt{r}$ d) r^2
392. Escape velocity on the surface of earth is 11.2 km/s. Escape velocity from a planet whose mass is the same as that of earth and radius 1/4 that of earth is
a) 2.8 km/s b) 15.6 km/s c) 22.4 km/s d) 44.8 km/s
393. A satellite is orbiting around the earth. By what percentage should we increase its velocity, so as to enable it escape away from the earth?
a) 41.4% b) 50% c) 82.8% d) 100%
394. The escape velocity from the earth is 11.2 kms $^{-1}$. The escape velocity from a planet having twice the radius and the same mean density is (in kms^{-1})
a) 11.2 b) 5.6 c) 15 d) 22.4
395. In a certain region of space gravitational field is given by $I(Kr)$. Taking the reference point to be at $r = V_0$,

find the potential.

a) $K \log \frac{r}{r_0} + V_0$ b) $K \log \frac{r_0}{r} + V_0$ c) $K \log \frac{r}{r_0} - V_0$ d) $\log \frac{r}{r_0} - V_0 r$

396. The escape velocity of projectile on the earth's surface is 11.2 kms^{-1}. A body is projected out with thrice this speed. The speed of the body for away from the earth will be

a) 22.4 kms^{-1} b) 31.7 kms^{-1} c) 33.6 kms^{-1} d) None of these

397. The change in the gravitational potential energy when a body mass m is raised to a height nR above the surface of the earth is (here R is the radius of the earth)

a) $\left(\frac{n}{n+1}\right) mgR$ b) $\left(\frac{n}{n-1}\right) mgR$ c) $nmgR$ d) $\frac{mgR}{n}$

398. Mass M is divided into two parts xM and $(1-x)M$. For a given separation, the value of x for which the gravitational attraction between the two pieces becomes maximum is

a) $\frac{1}{2}$ b) $\frac{3}{5}$ c) 1 d) 2

399. A satellite is moving around the earth with speed v in a circular orbit of radius r. If the orbit radius is decreased by 1%, its speed will

a) Increase by 1% b) Increase by 0.5% c) Decrease by 1% d) Decrease by 0.5%

400. If the height of a satellite from the earth is negligible in comparison to the radius of the earth R, the orbital velocity of the satellite is

a) gR b) $gR/2$ c) $\sqrt{g/R}$ d) $\sqrt{gR}$

401. The escape velocity for a body of mass 1 kg from the earth's surface is 11.2 kms^{-1}. The escape velocity for a body of mass 100 kg would be

a) $11.2 \times 10^2 \text{kms}^{-1}$ b) 112 kms^{-1} c) 11.2 kms^{-1} d) $11.2 \times 10^{-2} \text{kms}^{-1}$

402. Weight of a body of mass m decreases by 1% when it is raised to height h above the earth's surface. If the body is taken on a depth h in a mine, change in its weight is

a) 0.5% decrease b) 2% decrease c) 0.5% increase d) 1% increase

403. An earth satellite is moved from one stable circular orbit to farther stable circular orbit. Which one of the following quantities increase?

a) Linear orbit speed b) Gravitational force
c) Centripetal acceleration d) Gravitational potential energy

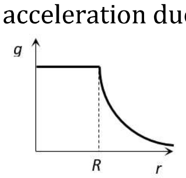
404. g_e and g_p denote the acceleration due to gravity on the surface of the earth and another planet whose mass and radius are twice to that of the earth, then

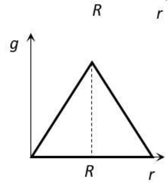
a) $g_p = \frac{g_e}{2}$ b) $g_p = g_e$ c) $g_p = 2g_e$ d) $g_p = \frac{g_e}{\sqrt{2}}$

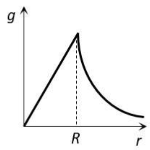
405. Who among the following gave first the experimental value of G

a) Cavendish b) Copernicus c) Brook Teylor d) None of these

406. Assuming the earth to have a constant density, point out which of the following curves show the variation of acceleration due to gravity from the centre of earth to the points far away from the surface of earth

a) 

b) 

c) 

d) None of these

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

a) 1:2 b) 2:1 c) 3:5 d) 5:3

408. According to Kelper's law of planetary motion if T represent time period and r is orbital radius, then for two planets these are related as

a) $\left(\frac{T_1}{T_2}\right)^3 = \left(\frac{r_1}{r_2}\right)^3$ b) $\left(\frac{T_1}{T_2}\right)^{\frac{3}{2}} = \frac{r_1}{r_2}$ c) $\left(\frac{T_1}{T_2}\right)^4 = \left(\frac{r_1}{r_2}\right)^3$ d) $\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{r_1}{r_2}\right)^3$

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

a) 12 b) 60 c) 112 d) 6

410. A satellite is placed in a circular orbit around earth at such a height that it always remains stationary with respect to earth surface. In such case, its height from the earth surface is

a) 32000 km b) 36000 km c) 6400 km d) 4800 km

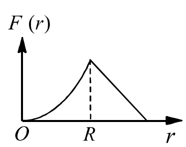
411. Out of the following, the only correct statement about satellites is

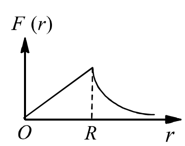
a) A satellite cannot move in a stable orbit in a plane passing through the earth's centre
b) Geostationary satellites are launched in the equatorial plane
c) We can use just one geostationary satellite for global communication around the globe
d) The speed of satellite increases with an increase in the radius of its orbit

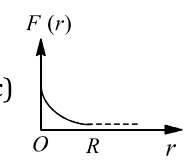
412. Acceleration due to gravity is g on the surface of the earth. Then the value of the acceleration due to gravity at a height of 32 km above earth's surface is (Assume radius of earth to be 6400 km)

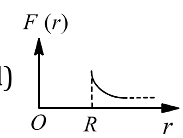
a) 0.99 g b) 0.8 g c) 1.01 g d) 0.9 g

413. In the above problem, if the shell is replaced by a sphere of same mass and radius then the graph of $F(r)$ $versus$ r will be

a) 

b) 

c) 

d) 

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

a) $\frac{3}{2}V$ b) $\sqrt{\frac{3}{2}}V$ c) $\sqrt{\frac{2}{3}}V$ d) $\frac{2}{3}V$

415. A body is projected with velocity of 2×11.2 km/s from the form the surface of earth. The velocity of the body when it escapes the gravitational pull of earth is

a) $\sqrt{3} \times 11.2$ km/s b) 11.2 km/s c) $\sqrt{2} \times 11.2$ km/s d) 0.5×11.2 km/s

416. The escape velocity of a body on the earth's surface is v_e. A body is thrown up with a speed $\sqrt{5}\, v_e$. Assuming that the sun and planets do not influence the motion of the body, velocity of the body at infinite distance is

a) Zero b) v_e c) $\sqrt{2}v_e$ d) $2v_e$

417. The period of a satellite in a circular orbit of radius R is T, the period of another satellite in a circular orbit of radius $4R$ is

a) $4T$ b) $T/4$ c) $8T$ d) $T/8$

418. Two point masses A and B having masses in the ratio 4:3 are separated by a distance of 1 m. When another

point mass C of mass M is placed in between A and B, the force between A and C is $\frac{1}{3}$rd of the force between B and C. Then the distance of C from A is

a) $\frac{2}{3}$ m b) $\frac{1}{3}$ m c) $\frac{1}{4}$ m d) $\frac{2}{7}$ m

419. A rocket is sent vertically up with a velocity v less than the escape velocity from the earth. Taking M and r as the mass and radius of earth, the maximum height h attained by the rocket is given by the following expression

a) $v^2R^2/\,(2GR - Mv)$ b) $v^2R^2/\,(2GR + v^2R)$

c) $v^2R^2/\,(2GR - v^2R)$ d) $v^2R^2/\,(2GRv + RM)$

420. A particle of mass m is thrown upwards from the surface of the earth, with a velocity u. The mass and the radius of the earth are, respectively, M and R. G is gravitational constant and g is acceleration due to gravity on the surface of the earth. The minimum value of u so that the particle does not return back to earth, is

a) $\sqrt{2gR^2}$ b) $\sqrt{\frac{2GM}{R^2}}$ c) $\sqrt{\frac{2GM}{R}}$ d) $\sqrt{\frac{2gM}{R^2}}$

421. 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

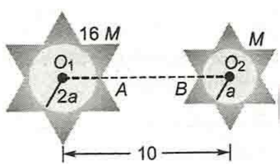
a) The mass of the brass ball on this planet is a quarter of its mass as measured on earth

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

422. Distance between the centres of two stars is 10 a. The masses of these stars are M and 16 M and their radii a and $2a$ respectively. A body of mass m is fired straight from the surface of the larger star towards the smaller star. The minimum initial speed for the body to reach the surface of smaller star is



a) $\frac{2}{3}\sqrt{\frac{GM}{a}}$ b) $\frac{3}{2}\sqrt{\frac{5GM}{a}}$ c) $\frac{2}{3}\sqrt{\frac{5GM}{a}}$ d) $\frac{3}{2}\sqrt{\frac{GM}{a}}$

423. At a given place where, acceleration due to gravity is g ms^{-2}, a sphere of lead of density d kgm^{-2} is gently released in a column of liquid of density ρ kgm^{-3}. If $d > \rho$, the sphere will

a) Fall vertically with an acceleration of g ms^{-2} b) Fall vertically with no acceleration

c) Fall vertically with an acceleration $g\left(\frac{d-\rho}{d}\right)$ d) Fall vertically with an acceleration ρ/d

424. The orbital speed of Jupiter is

a) Greater than the orbital speed of earth b) Less than the orbital speed of earth

c) Equal to the orbital speed of earth d) Zero

425. A body is at rest on the surface of the earth. Which of the following statement is correct?

a) No force is acting on the body

b) Only weight of the body acts on it

c) Net downward force is equal to the net upward force

d) None of the above statement is correct

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

a) $(n+1)^2$ b) $(n+1)^{-2}$ c) $(n+1)^{-1}$ d) $(n+1)$

427. If suppose moon is suddenly stopped and then released (given radius of moon is one-fourth the radius of earth)and the acceleration of moon with respect to earth is 0.0027 ms^{-2}), then the acceleration of the

moon just before striking the earth's surface is (Take g = 10 ms^{-2})

a) 0.0027 ms^{-2} b) 5.0 ms^{-2} c) 6.4 ms^{-2} d) 10 ms^{-2}

428. The effect of rotation of the earth on the value of acceleration due to gravity is

a) g is maximum at the equator and maximum at the poles

b) g is minimum at the equator and maximum at the poles

c) g is maximum at the both poles

d) g is minimum at the both poles

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

a) 4 b) 9 c) 64 d) 27

430. The value of g on the earth's surface is 980 cms^{-2}. Its value at a height of 64 km from the earth's surface is

a) 960.40 cms^{-2} b) 984.90 cms^{-2} c) 982.45 cms^{-2} d) 977.55 cms^{-2}

431. What should be the angular speed of earth in rad^{-1} so that a body 5kg weighs zero at the equator? (Take g = 10 ms^{-2} and radius of earth = 6400 km)

a) 1/1600 b) 1/800 c) 1/400 d) 1/80

432. The acceleration due to gravity about the earth's surface would be half of its value on the surface of the earth at an altitude of ($R = 4000\ mile$)

a) 1200 $mile$ b) 2000 $mile$ c) 1600 $mile$ d) 4000 $mile$

433. An artificial satellite moving in circle orbit around the earth has a total (kinetic + potential) energy E_0. Its potential energy and kinetic energy respectively are

a) $2E_0$ and $-2E_0$ b) $-2E_0$ and $-3E_0$ c) $2E_0$ and $-E_0$ d) $-2E_0$ and $-E_0$

434. Two identical trains P and Q move with equal speeds on parallel tracks along the equator. P moves from east to west and Q from west to east

a) Data is sufficient to arrive at a conclusion

b) Both exert equal force on track

c) Train Q exerts force on track

d) Train P exerts greater force on track

435. A person will get more quantity of matter in kg-wt at

a) Poles b) at latitude of 60° c) Equator d) Satellite

436. 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) E_k b) $2\ E_k$ c) $\frac{1}{2}E_k$ d) $3\ E_k$

437. Force of gravity is least of

a) The equator b) The poles

c) A point in between equator and any pole d) None of these

438. The speed of earth's rotation about its axis is ω. Its speed is increased to x times to make the effective acceleration due to gravity equal to zero at the equator, then x is around (g = 10ms^{-2}, R = 6400 km)

a) 1 b) 8.5 c) 17 d) 34

439. A body weighs 700 $g\ wt$ 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) 200 $g\ wt$ b) 400 $g\ wt$ c) 50 $g\ wt$ d) 300 $g\ wt$

440. The escape velocity of a planet having mass 6 times and radius 2 times as that of earth is

a) $\sqrt{3}\ V_e$ b) $3\ V_e$ c) $\sqrt{2}\ V_e$ d) $2\ V_e$

441. The bodies situated on the surface of earth at its equator, becomes weightless, when the earth has KE about it axis

a) mgR b) $2\ mgR/5$ c) $MgR/5$ d) $5MgR/2$

442. The depth from the surface of the earth of radius R at which the acceleration due to gravity will be 75% of the value on the surface of the earth is

a) $R/4$ b) $R/2$ c) $3R/4$ d) $R/8$

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

a) $F \propto \frac{1}{R^2}$ b) $F \propto R$ c) $F \propto R^4$ d) $F \propto \frac{1}{R}$

444. If a planet consists of a satellite whose mass and radius were both half that of the earth, the acceleration due to gravity at its surface would be (g on earth $= 9.8\ m/\sec^2$)

a) $4.9 m/\sec^2$ b) $8.9 m/\sec^2$ c) $19.6 m/\sec^2$ d) $29.4 m/\sec^2$

445. At what height from the ground will the value of $'g'$ be the same as that in 10 km deep mine below the surface of earth

a) 20 km b) 10 km c) 15 km d) 5 km

446. 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 $10m/s^2$ and $6400km$ respectively

a) 6.4×10^{11} $Joules$ b) 6.4×10^{8} $Joules$ c) 6.4×10^{9} $Joules$ d) 6.4×10^{10} $Joules$

447. The acceleration due to gravity on a planet is same as that on earth and its radius is four times that of earth. What will be the value of escape velocity on that planet if it is v_e on earth

a) v_e b) $2v_e$ c) $4v_e$ d) $\frac{v_e}{2}$

448. The gravitational field due to a mass distribution is $I = k/x^3$ in the x-direction (k is a constant). Taking the gravitational potential to be zero at infinity, its value at a distance $x/\sqrt{2}$ is

a) k/x b) $k/2x$ c) k/x^2 d) $k/2x^2$

449. A uniform ring of mass M and radius r is placed directly above a uniform sphere of mass $8M$ and of same radius R. The centre of the ring is at a distance of $d = \sqrt{3}R$ from the centre of the sphere. The gravitational attraction beween the sphere and the ring is

a) $\frac{GM^2}{R^2}$ b) $\frac{3GM^2}{2R^2}$ c) $\frac{2GM^2}{\sqrt{2}R^2}$ d) $\frac{\sqrt{3}GM^2}{R^2}$

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

a) 8 km/sec b) 11.2 km/sec c) 4 km/sec d) 6 km/sec

451. A satellite in a circular orbit of radius R has a period of 4 h. Another satellite with orbital radius $3R$ around the same planet will have a period (in hour)

a) 16 b) 4 c) $4\sqrt{27}$ d) $4\sqrt{8}$

452. What will be the acceleration due to gravity at height h if $h >> R$. Where R is radius of earth and g is acceleration due to gravity on the surface of earth

a) $\frac{g}{\left(1+\frac{h}{R}\right)^2}$ b) $g\left(1-\frac{2h}{R}\right)$ c) $\frac{g}{\left(1-\frac{h}{R}\right)^2}$ d) $g\left(1-\frac{h}{R}\right)$

453. 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 proportional to $R^{-3/2}$, then T^2 is proportional to

a) R^3 b) $R^{5/2}$ c) $R^{3/2}$ d) $R^{7/2}$

454. The period of moon's rotation around the earth is nearly 29 $days$. If moon's mass were 2 fold, its present value and all other things remained unchanged, the period of moon's rotation would be nearly

a) $29\sqrt{2}$ $days$ b) $29\sqrt{2}$ $days$ c) 29×2 $days$ d) 29 $days$

455. Which is constant for a satellite in orbit

a) Velocity b) Angular momentum c) Potential energy d) Acceleration

456. Two bodies of masses 100 kg and 1000 kg are separated by distance of 1 m. What is the intensity of gravitational field at the mid point of the line joining them?

a) 6.6×10^{-11}Nm^{2}kg^{-2} b) 2.4×10^{-8}Mkg^{-1} c) 2.4×10^{-7}Nkg^{-1} d) 2.4×10^{-6}Nkg^{-1}

457. What will be the effect on the weight of a body placed on the surface of earth, if earth suddenly starts rotating with half of its angular velocity of rotation?

a) No effect
b) Weight will increase
c) Weight will decrease
d) Weight will become zero

458. One goes from the centre of the earth to a distance two third the radius of the earth, where will the acceleration due to gravity be the greatest?
a) At the centre of the earth
b) At a height half the radius of the earth
c) At a height one-third the radius of the earth
d) At a height two-third the radius of the earth

459. The gravitational attraction between the two bodies increases when their masses are
a) Reduced and distance is reduced
b) Increased and distance is reduced
c) Reduced and distance is increased
d) Increased and distance is increased

460. A particle of mass m is placed inside a spherical shell, away from its centre. The mass of the shell is M
a) The particle will move towards the centre if $m < M$, and away from the centre if $m > M$
b) The particle will move towards the centre
c) The particle will oscillate about the centre of shell
d) The particle will remain stationary

461. Two planets of mean distance d_1 and d_2 from the sun and their frequencies are n_1 and n_2 respectively then
a) $n_1^2 d_1^2 = n_2 d_2^2$
b) $n_2^2 d_2^3 = n_1^2 d_1^3$
c) $n_1 d_1^2 = n_2 d_2^2$
d) $n_1^2 d_1 = n_2^2 d_2$

462. If satellite is revolving around a planet of mass M in an elliptical orbit of semi-major axis a, find the orbital speed of the satellite when it is at a distance r from the focus
a) $v^2 = GM\left[\frac{2}{r} - \frac{1}{a}\right]$
b) $v^2 = GM\left[\frac{2}{r^2} - \frac{1}{a}\right]$
c) $v^2 = GM\left[\frac{2}{r^2} - \frac{1}{a^2}\right]$
d) $v^2 = G\left[\frac{2}{r} - \frac{1}{a}\right]$

463. Two stars of mass m_1 and m_2 are parts of a binary system. The radii of their orbits are r_1 and r_2 respectively, measured from the C.M. of the system. The magnitude of gravitational force m_1 exerts on m_2 is
a) $\frac{m_1 m_2 G}{(r_1 + r_2)^2}$
b) $\frac{m_1 G}{(r_1 + r_2)^2}$
c) $\frac{m_2 G}{(r_1 + r_2)^2}$
d) $\frac{(m_1 + m_2)}{(r_1 + r_2)^2}$

464. If the earth were to suddenly contract to $\frac{1}{n}$ th of its present radius without any change in its mass, the duration of the new day will be nearly
a) $\frac{24}{n}$h
b) $24n$ h
c) $\frac{24}{n^2}$h
d) $24n^2$h

465. A man can jump to a height of 1.5 m on a planet A. What is the height he may be able to jump on another planet whose density and radius are, respectively, one-quarter and one-third that of planet A
a) 1.5 m
b) 15 m
c) 18 m
d) 28 m

466. The value of escape velocity on a certain planet is 2 km s^{-1}. Then, the value of orbital speed for a satellite orbiting close to its surface is
a) 112 kms^{-1}
b) 1 kms^{-1}
c) $\sqrt{2}$ Kms^{-1}
d) $2\sqrt{2}$ kms^{-1}

467. The maximum vertical distance through which a full dressed astronaut can jump on the earth is 0.5 m. Estimate the maximum vertical distance through which he can jump on the moon, which has a mean density 2/3rd that of earth and radius one quarter that of the earth
a) 1.5 m
b) 3 m
c) 6 m
d) 7.5 m

468. Assuming that the earth is a sphere of radius R_E with uniform density, the distance from its centre at which the acceleration due to gravity is equal to $\frac{g}{3}$ (g is the acceleration due to gravity on the surface of earth) is
a) $\frac{R_E}{3}$
b) $\frac{2R_E}{3}$
c) $\frac{R_E}{2}$
d) $\frac{R_E}{4}$

469. Radius of earth is around 6000 km. The weight of body of height of 6000 km from earth surface becomes

a) Half b) One-fourth c) One third d) No change

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

a) 0.15 kms^{-1} b) 5 kms^{-1} c) 2.5 kms^{-1} d) 0.5 kms^{-1}

471. Geostationary satellite

a) Falls with g towards the earth b) Has period of 24 hrs

c) Has equatorial orbit d) Above all correct

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

a) 1032 b) 1023 c) 1024 d) 1043

473. The mass of a planet that has a moon whose time period and orbital radius are T and R respectively can be written as

a) $4\pi^2R^3G^{-1}T^{-2}$ b) $8\pi^2R^3G^{-1}T^{-2}$ c) $12\pi^2R^3G^{-1}T^{-2}$ d) $16\pi^2R^3G^{-1}T^{-2}$

474. Choose the correct statement from the following. The radius of the orbit of a geostationary satellite depends upon

a) Mass of the satellite, its time period and the gravitational constant

b) Mass of the satellite, mass of the earth and the gravitational constant

c) Mass of the earth, mass of the satellite, time period of the satellite and the gravitational constant

d) Mass of the earth, time period of the satellite and the gravitational constant

475. The diameters of two planets are in the ratio 4:1 and their mean densities in the ratio 1:2. The acceleration due to gravity on the planets will be in ratio

a) 1 : 2 b) 2 : 3 c) 2 : 1 d) 4 : 1

476. Given radius of Earth $'R'$ and length of a day $'T'$ the height of a geostationary satellite is [G-Gravitational Constant, M-Mass of Earth]

a) $\left(\frac{4\pi^2GM}{T^2}\right)^{1/3}$ b) $\left(\frac{4\pi GM}{R^2}\right)^{1/3}-R$ c) $\left(\frac{GMT^2}{4\pi^2}\right)^{1/3}-R$ d) $\left(\frac{GMT^2}{4\pi^2}\right)^{1/3}+R$

477. According to Kepler, the period of revolution of a planet (T) and its mean distance from the sun (r) are related by the equation

a) $T^3r^3=$ constant b) $T^2r^{-3}=$ constant c) $Tr^3=$ constant d) $T^2r=$ constant

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

I. Mass of the planet

II. Mass of the particle escaping

III. Temperature of the planet

IV. Radius of the planet

Select the correct answer from the codes given below :

a) I and II b) II and IV c) I and IV d) I, III and IV

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

a) 11.2 m/sec b) 112 km/sec c) 11.2 km/sec d) 11200 km/sec

480. Escape velocity on the earth

a) Is less than that on the moon b) Depends upon the mass of the body

c) Depends upon the direction of projection d) Depends upon the height from which it is projected

481. The weight of an astronaut, in an artificial satellite revolving around the earth, is

a) Zero b) Equal to that on the earth

c) More than that on the earth d) Less than that on the earth

482. The acceleration due to gravity becomes $\left(\frac{g}{2}\right)$

($g=$ acceleration due to gravity on the surface of the earth) at a height equal to

a) $4R$ b) $\frac{R}{4}$ c) $2R$ d) $\frac{R}{2}$

483. The orbit of geostationary satellite is circular, the time period of satellite depends on
(i) mass of the satellite
(ii) mass of the earth
(iii) radius of the orbit
(iv) height of the satellite from the surface of earth
Which of the following correct?
a) (i) only b) (i) and (ii) c) (i), (ii) and (iii) d) (ii), (iii) and (iv)

484. If suddenly the gravitational force of attraction between earth and a satellite revolving around it becomes zero, then the satellite will
a) Continue to move in its orbit with same velocity
b) Move tangentially to the original orbit with the same velocity
c) Become stationary in its orbit
d) Move towards the earth

485. The value of $'g'$ at a particular point is 9.8 m/s^2. Suppose the earth suddenly shrinks uniformly to half its present size without losing any mass. The value of $'g'$ at the same point (assuming that the distance of the point from the centre of earth does not shrink) will now be
a) 4.9 m/sec^2 b) 3.1 m/sec^2 c) 9.8 m/sec^2 d) 19.6 m/sec^2

486. A spring balance is graduated on sea level. If a body is weighed with this balance at consecutively increasing heights from earth's surface, the weight indicated by the balance
a) Will go on increasing continuously b) Will go on decreasing continuously
c) Will remain same d) Will first increase and then decrease

487. The acceleration due to gravity near the surface of a planet of radius R and density d is proportional to
a) $\frac{d}{R^2}$ b) dR^2 c) dR d) $\frac{d}{R}$

488. 320 km above the surface of earth, the value of acceleration due to gravity is nearly 90% of its value on the surface of the earth. Its value will be 95% of the value on the earth's surface
a) Nearly 160 km below the earth's surface
b) Nearly 80 km below the earth's surface
c) Nearly 640 km below the earth's surface
d) Nearly 320 km below the earth's surface

489. In some region, the gravitational field is zero. The gravitational potential in this region
a) Must be variable b) Must be constant c) Cannot be zero d) Must be zero

490. A body of weight 500 N on the surface of the earth. How much would it weigh half-way below the surface of the earth?
a) 125 N b) 250 N c) 500 N d) 1000 N

491. LANDSAT series of satellites move in near polar orbits at an altitude of
a) 3600 km b) 3000 km c) 918 km d) 512 km

492. 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) $1/\sqrt{2}$ d) $\sqrt{3}$

493. The force of gravitation is
a) Repulsive b) Electrostatic c) Conservative d) Non-conservative

494. Two astronauts have deserted their space ships in a region of space far from the gravitational attraction of any other body. Each has a mass of 100 kg and they are 100 m apart. They are initially at rest relative to one another. How long will it be before the gravitational attraction brings them 1 cm closer together?
a) 2.52 days b) 1.41 days c) 0.70 days d) 0.41 days

495. Distance of geostationary satellite from the surface of earth $radius(R_e = 6400\ km)$ in terms of R_e is
a) 13.76 R_e b) 10.76 R_e c) 6.56 R_e d) 2.56 R_e

496. The gravitational force between a point like mass M and an infinitely long, thing rod of linear mass density perpendicular to distance L from M is

a) $\frac{MG\lambda}{L}$ b) $\frac{1}{2}\frac{MG\lambda}{L}$ c) $\frac{2MG\lambda}{L^2}$ d) Infinite

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

a) Decrease by 2% b) Remain unchanged c) Increase by 2% d) Become zero

498. For a body lying on the equator to appear weightless, what should be the angular speed of the earth?(Take $g = 10\text{ms}^{-2}$; radius of earth = 6400 km)

a) 0.125 rads^{-1} b) 1.25 rads^{-1} c) $1.25 \times 10^{-3}\text{rads}^{-1}$ d) $1.25 \times 10^{-2}\text{rads}^{-1}$

499. Two metallic spheres each of mass M are suspended by two strings each of length L. The distance between the upper ends of strings is L. The angle which the strings will make with the vertical due to mutual attraction of the spheres is

a) $\tan^{-1}\left[\frac{GM}{gL}\right]$ b) $\tan^{-1}\left[\frac{GM}{2gL}\right]$ c) $\tan^{-1}\left[\frac{GM}{gL^2}\right]$ d) $\tan^{-1}\left[\frac{2GM}{gL^2}\right]$

500. Hubble's law states that the velocity with which milky ways is moving away from the earth is proportional to

a) Square of the distance of the milky way from the earth
b) Distance of milky way from the earth
c) Mass of the milky way
d) Product of the mass of the milky way and its distance from the earth

501. If the moon is to escape from the gravitational field of the earth forever, it will require a velocity

a) 11.2 kms^{-1} b) Less than 11.2 kms^{-1}
c) Slightly more than 111.2 kms^{-1} d) 22.4 kms^{-1}

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

a) The mass of the satellite
b) Radius of its orbit
c) Both the mass and radius of the orbit
d) Neither the mass of the satellite nor the radius of its orbit

503. The orbital speed of an artificial satellite very close to the surface of the earth is V_o. Then the orbital speed of another artificial satellite at a height equal to three times the radius of the earth is

a) $1\ V_o$ b) $2\ V_o$ c) $0.5\ V_o$ d) $4\ V_o$

504. A particle is fired vertically upwards from the surface of earth and reaches a height 6400 km. The initial velocity of the particle is ($R = 6400$ km, $g = 10\text{ms}^{-2}$)

a) 11.2 ms^{-1} b) 8 kms^{-1} c) 3.2 kms^{-1} d) None of these

505. The masses and radii of the earth and moon are M_1, R_1 and M_2, R_2 respectively. Their centres are distance d apart. The minimum velocity with which a particle of mass m shoule be projected from a point midway between their centres so that it escapes to infinity is

a) $2\sqrt{\frac{G}{d}(M_1 + M_2)}$ b) $2\sqrt{\frac{2G}{d}(M_1 + M_2)}$ c) $2\sqrt{\frac{Gm}{d}(M_1 + M_2)}$ d) $2\sqrt{\frac{Gm(M_1 + M_2)}{d(R_1 + R_2)}}$

506. Where can a geostationary satellite be installed

a) Over any city on the equator b) Over the north or south pole
c) At height R above earth d) At the surface of earth

507. At some point the gravitational potential and also the gravitational field due to earth is zero. The speed is

a) On earth's surface b) Below earth's surface
c) At a height R_e from earth's surface (R_e = radius of the earth) d) At infinity