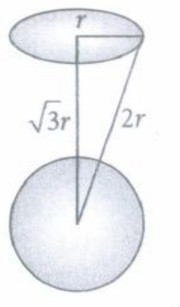
Ravi Maths Tuition Centre

Time : 1 Mins **GRAVITATION 1 1** **Marks : 1414**

1. Value of g is
   a) maximum at poles b) maximum at equator c) same everywhere
   d) minimum at poles
2. (A) An artificial satellite is moving in a circular orbit of the earth. If the gravitational pull suddenly disappears, then it moves with the same speed tangential to the original orbit.
   (R) The orbital speed of a satellite decreases with the increase in radius of the orbit.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false.
   d) If both assertion and reason are false.
   e) If assertion is false but reason is true.
3. A uniform ring of mass m and radius r is placed directly above a uniform sphere of mass M and of equal radius. The centre of the ring is directly above the centre of the sphere at a distance r$\sqrt{3}$ as shown in the figure. The gravitational force exerted by the sphere on the ring will be



a) $\frac{GMm}{8r^2}$ b) $\frac{GMm}{4r^2}$ c) $\sqrt{3}\frac{GMm}{8r^2}$ d) $\frac{GMm}{8r^2\sqrt{3}}$

4. A research satellite of mass 200 kg circles the earth in an orbit radius $\frac{3R_E}{2}$, where R_E 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) 890 N b) 889 N c) 885 N d) 892 N
5. During a journey from earth to the moon and back, the greatest energy required from the space-ship rockets is to overcome:
   a) The earth's gravity at take b) The moon's gravity at lunar landing
   c) The moon's gravity at lunar take off
   d) The point where the pull of the earth and moon are equal but opposite
6. If the earth loses its gravity, then for a body:
   a) weight becomes zero, but not the mass b) mass becomes zero, but not weight
   c) neither mass nor weight is zero d) both mass and weight are zero
7. The mass and diameter of a planet are two times those of the earth. If a seconds pendulum is taken to it, the time period of the pendulum (in seconds) is:
   a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{2}$ c) 2 d) $2\sqrt{2}$
8. The escape velocity of a particle of mass m varies as:
   a) m^2 b) m c) m^0 d) m^{-1}
9. Taking that the earth revolves round the sun in a circular orbit of radius 15×10^{10} m with a time period of 1 year, the time taken by another planet, which is at a distance of 540×10^{10} m, to revolve round the sun in a circular orbit once, will be:
   a) 144 years b) 72 years c) 36 years d) 216 years
10. To put in the orbit, the satellite should be fired as a projectile with:
    a) escape velocity b) twice the escape velocity c) thrice the escape velocity
    d) none of these
11. For a satellite moving in an orbit around the Earth, the ratio of kinetic energy to potential energy is
    a) 2 b) 1/2 c) $1/\sqrt{2}$ d) $\sqrt{2}$
12. Consider a planet whose mass and diameter were both half that of the earth. The gravitational potential energy of an object on its surface compared to that on the earth's surface will be?
    a) Same b) One-half c) Double d) One-fourth
13. 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 E b) Move towards the moon
    c) Will move along with space-ship

d) Will move in an irregular way then fall down to earth.

14. A particle of mass m is placed at the centre of a uniform spherical shell of mass 3m 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) -$\frac{2Gm}{R}$

15. Three particles are projected vertically upward from a point on the surface of earth with velocities

$$v_1 = \sqrt{\frac{2gR}{3}}; v_2 = \sqrt{gR}; v_3 = \sqrt{\frac{4gR}{3}}$$

respectively, where g is acceleration due to gravity on the surface of earth. If the maximum height attained are $h_1 > h_2$ and h_3 respectively, then $h_1 : h_2 : h_3$ is

a) 1:2:3 b) 2:3:4 c) 1:2:4 d) 1:3:5

16. If g_o, g_h and g_d be the acceleration due to gravity at the earth's surface, at height h and at a depth d respectively, then:

a) $g_o > g_h$ and $g_o > g_d$ b) $g_o < g_h$ and $g_o < d$ c) $g_o > g_h$ and $g_o < g_d$

d) $g_o < g_h$ and $g_o > g_d$

17. Two spheres each of mass M and radius R are separated by a distance of r. The gravitational potential at the midpoint of the line joining the centres of the spheres is

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

18. For a satellite moving in on orbit around earth the ration of its potenial energy to kinetic energy is

a) 1 b) -1 c) 2 d) -2

19. (A) For the planets orbiting around the sun, angular speed, linear speed, KE changes with time, but angular momentum remains constant.

(R) No torque is acting on the rotating planet, so its angular momentum is constant.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

20. 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

c) Nothing can be said definitely about the gravitational field   d) None of these

21. At surface of Earth weight of a person is 72 N then his weight at height R/2 from surface of Earth is (R= radius of earth)

    a) 28N   b) 16N   c) 32N   d) 72N

22. A ball is dropped from a spacecraft revolving around the earth at a height of 120 km. What will happen to the ball?

    a) It will go very far in the space   b) It will fall down on the earth gradually

    c) It will move with the same speed, tangentially to the space-craft

    d)
    It will continue to move with the same speed along the original orbit of space-craft

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

    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

24. Two stars of masses m_1 and m_2 are parts of a binary star system. The radii of their orbits are r_1 and r_2 respectively, measured from the centre of mass of the system. The magnitude of gravitational force m1 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) $\frac{G(m_1+m_2)}{(r_1+r_2)^2}$

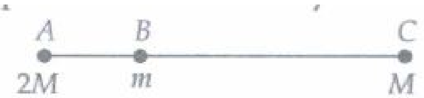
25. If the radius of the earth's orbit is made one-fourth, the duration of a year will become:

    a) 8 times   b) 4 times   c) $\frac{1}{8}$ time   d) $\frac{1}{4}$ time

26. The height at which the weight of a body becomes 1/16th, its weight on the surface of Earth (radius R), is:

    a) SR   b) 15R   c) 3R   d) 4R

27. Particles of masses 2M, m and M are respectively at points A, B and C with AB = l/2(BC). m is muchmuch smallerthanMand at time t=0, they are allat rest. At subsequent times before any collision takes place



    a) m will remain at rest.   b) m will move towards M.   c) m will move towards 2M.
    d) m will have oscillatory motion.

28. A body hanging from a spring stretches it by 1 cm at the earth's surface. How much will the same body stretch the spring at a place 16400 km above the earth's surface? (Radius of the earth = 6400 km)

a) 1.28 cm b) 0.64 cm c) 3.6 cm d) 0.12 cm

29. The angular speed of rotation of the earth is :

a) 7.3×10^{-5} rad S^{-1} b) 7.3×10^{-4} rad S^{-1} c) 7.3×10^{-6} rad S^{-1}
d) 7.3×10^{-3} rad S^{-1}

30. An infinite number of point masses each equal to mare placed at x = 1, x = 2, x = 4, x = 8 .... What is the total gravitational potential at x = 0?

a) - Gm b) -2 Gm c) -4 Gm d) -8 Gm

31. A rocket is fired vertically from the surface of the earth with a speed v. How far from the earth does the rocket go before returning to the earth? (where RE is the radius of the earth and g is acceleration due to gravity)

a) $\frac{R_E v^2}{gR_E - v^2}$ b) $\frac{R_E v^2}{gR_E + v^2}$ c) $\frac{R_E v^2}{2gR_E - v^2}$ d) $\frac{R_E v^2}{2gR_E + v^2}$

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

a) $(1.52)^{2/3} \times 365$ b) $(1.52)^{3/2} \times 365$ c) $(1.52)^2 \times 365$ d) $(1.52)^3 \times 365$

33. A satellite is revolving around the earth in a circular orbit four times the radius of the parking orbit. What will be the time-period of the satellite?

a) 2 days b) 4 days c) 16 days d) None of these

34. How much work per kilogram need to be done to shift a 1 kg mass from the surface of the earth to infinity? (Take acceleration due to gravity = g and radius of the earth = R)

a) g/R b) R/g c) gR d) g/R^2

35. (A) We cannot move even a finger without disturbing all the stars.

(R) Every body in this universe attracts every other body with a force which is inversely proportional to the square of distance between them.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

36. Let A be area swept out by the line joining the earth and the sun during Feb. 1991. The area swept out by the line during a typical week in Feb. 1991 is:

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

37. (A) A person in an artificial satellite revolving around the earth feels weightlessness.

(R) There is no gravitational force on the satellite.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

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

a) 0.0112 km s^{-1} b) 0.112 km s^{-1} c) 11.2 km s^{-1} d) 0.56 km s^{-1}

39. If the earth shrinks such that its mass does not change but radius decreases to one quarter of its original value, then one complete day will take:

a) 96 hrs b) 48 hrs c) 6 hrs d) 1.5 hrs

40. How much energy will be necessary for making a body of 500 kg escape from the earth? (g = 9.8 m/s^2, radius of the earth = 6.4 x 10^6 m)

a) About 9.8 x 10^6 J b) About 6.4 x 10^8 J c) About 3.1 x 10^{10} J

d) About 27.4 x 10^{12} J

41. If there were a smaller gravitational effect, which of the following forces do you think would alter in some respect :

a) Viscous forces b) As it depends on the weight of the body

c) Electrostatic force d) None of the above

42. (A) A spherically symmetric shell produces no gravitational field anywhere.

(R) The field due to various mass elements cancels out, everywhere for a spherically symmetric shell.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

43. If the earth is supposed to be a sphere of radius R, g 300 is the value of acceleration due to gravity at latitude of 30° and g at the equator, the value of g - g 30^0 is:
a) (1/4) ω^2R b) (3/4) ω^2R c) ω^2R d) (1/2) ω^2R

44. A spherical planet has a mass M_P and diameter D_P. A particular 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) $4GM_Pm/D_P^2$

45. 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 the earth
a) (i) only b) (i) and (ii) c) (i), (ii) and (iii) d) (ii), (iii) and (iv)

46. If the change in the value of gat a height h above the surface of the earth is the same as at a depth x below it when both x and h are much smaller than the radius of the earth, then:
a) x = h b) x = 2h c) $x = \frac{h}{2}$ d) $x = \frac{h}{3}$

47. The escape velocity from the Earth is about 11 km/second. The escape velocity from a planet having twice the radius and the same mean density as the Earth is :
a) 22 km/sec b) 11 km/sec c) 5.5 km/sec d) 5.5 km/sec

48. A satellite is launched into a circular orbit of radius R around the earth while a second satellite is launched into an orbit of radius 1.02R. The percentage difference in the time period is:
a) 0.7 % b) 1.0 % c) 1.5 % d) 3.0 %

49. If the gravitational force between two objects were proportional to 1/R; where R is separation between them, then a particle in circular orbit under such a force would have its orbital speed v proportional to:
a) $1/R^2$ b) R^O c) R^I d) 1/R

50. A ball is dropped from a satellite revolving around the Earth at a height of 120km. The ball will:
a)
continue to move with same speed along a straight line tangentially to the satellite at that time
b) continue to move with the same speed along the original orbit of satellite
c) fall down to earth gradually d) go far away in space

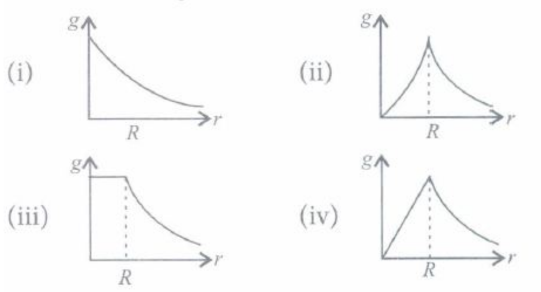
51. The work done to raise a mass m from the surface of the earth to a height h, which is equal to the radius of the earth, is____

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

52. 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 e) r^3

53. The condition for a uniform spherical mass mofradius 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) $(gm/ r)^{1/2} \geq c$

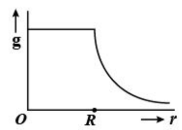
54. The dependence of acceleration due to gravity g on the distance r from the centre of the earth assumed to be a sphere of radius R of uniform density is as shown in the figure.

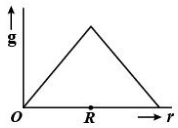


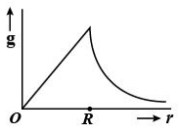
The correct figure is
a) (i) b) (ii) c) (iii) d) (iv)

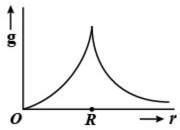
55. If a graph is plotted between T^2 and r^3 for a planet, then its slope will be (where Ms is the mass of the sun)
a) $\frac{4\pi^2}{GM_S}$ b) $\frac{GM_S}{4\pi}$ c) $4\pi GM_S$ d) GM_S

56. Starting form the centre of the carth having radius R, the variation of g (acceleration due to gravity) is shown by

a) 

b) 

c) 

d) 

57. Mass of the moon is 7.34 x 10^{22} kg. If the acceleration due to gravity on the moon is 1.4 m/s^2, the radius of the moon is: (G = 6.667 x 10^{11} Nm^2/Kg^2)
a) 0.56 x 10^4 m b) 1.87 x 10^6 m c) 1.92 x 10^6 m d) 1.01 x 10^8 m

58. Black Hole is
a) super surface of atmosphere b) ozone layer
c) super dense planetary material d) none of these

59. A satellite is orbiting around the earth with total energy E. What will happen if the satellite's kinetic energy is made 2 E?
a) Radius of the orbit is doubled b) Radius of the orbit is halved
c) Period of revolution is doubled d) Satellite escapes away

60. Different points in earth are at slightly different distances from the sun and hence experience different forces due to gravitation. For a rigid body, we know that if various forces act at various points in it, the resultant motion is as if a net force acts on the centre of mass causing translation and a net torque at the centre of mass causing rotation around an axis through the centre of mass. For the earth sun system (approximating the earth as a uniform density sphere)
a) the torque is zero b) the torque causes the earth to spin.
c)
the rigid body result is not applicable since the earth is not even approximately a rigid body.
d) the torque causesthe earth to movearound the sun
61. An artificial satellite moving in a circular orbit around the earth has a total energy E_0. Its potential energy is
a) $-E_0$ b) E_0 c) $2E_0$ d) $-2E_0$
62. A planet is moving in an elliptical orbit around the Sun. If T, V, E and L stand respectively for its kinetic energy, gravitational potential energy, total energy and magnitude of angular momentum about the center of force, which of the following is correct?
a) T is conserved b) V is always positive c) E is always negative
d) L is conserved but direction of vector L changes continuously
63. A satellite with kinetic energy E is revolving round the earth in a circular orbit. The minimum additional kinetic energy required for it to escape into outer space is:
a) $\sqrt{2}$E b) 2E c) E/$\sqrt{2}$ d) E/2 e) E
64. A body is suspended on a spring balance in a ship sailing along the equator with a speed V. If $\omega$is the angular speed of the earth and Wo is the scale reading when the ship is at rest, the scale reading when the ship is sailing will be very close to:
a) W_0 b) $W_0(1+\frac{2\omega V}{g})$ c) $W_0(1\pm\frac{2\omega V}{g})$ d) none of these
65. 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
66. The acceleration due to gravity g and density of the earth ρ are related by which of the following relations?
(where G is the gravitational constant and R_E is the radius of the earth)
a) $\rho=\frac{4\pi GR_E}{3g}$ b) $\rho=\frac{3g}{4\pi GGR_E}$ c) $\rho=\frac{3G}{4\pi gR_E}$ d) $\rho=\frac{4\pi gR_E}{3G}$

67. For a satellite escape velocity is $111\ \mathrm{km/s}$. If the satellite is launched at angle of 60^o with the vertical, then escape velocity will be______

a) $11\ \mathrm{km/s}$ b) $11\sqrt{3}\ \mathrm{km/s}$ c) $\frac{11}{\sqrt{3}}\ \mathrm{km/s}$ d) $33\ \mathrm{km/s}$

68. A planet is moving in an elliptical orbit around the sun. If T,U,E and L stand for its kinetic energy, gravitational potential energy, total energy and magnitude of angular momentum about the centre of force, which of the following is correct?

a) T is conserved b) U is always positive c) E is always negative

d) L is conserved but direction of vector L changes continuously

69. A satellite which is geostationary in a particular orbit is taken to another orbit, the distance of which is twice that of earlier orbit. The time period of the satellite in the second orbit is:

a) 24 hrs b) 48 hrs c) $48\sqrt{2}$ hrs d) $\frac{48}{\sqrt{2}}$ hrs

70. A satellite is moving around the earth with speed u in a circular orbit of radius r. If the orbit radius is decreased by 1%, the speed ofthe satellite will:

a) increase by 1% b) increase by 0.5% c) decrease by 1%

d) decrease by 0.5%

71. 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 e) $\sqrt{12}$v

72. (A) Gravitational potential of earth at every place on it is negative.

(R) Everybody on the earth is bound by the attraction of the earth.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

73. (A) Weight of an object on the earth is more in mid-night than it is at the noon.

(R) At noon gravitational pull on the object by the sun and the earth are oppositely directed and in the mid-night they are in the same direction.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

74. Weightlessness experienced while orbiting the Earth in space-ship, is the result of
a) Inertia b) Acceleration c) Zero gravity d) Free fall towards earth

75. A planet is revolving around the sun in elliptical orbit. Its closest distance from the sun is rand farthest distance is R. If the orbital velocity of the planet closest to the sun be v, then what is the velocity at the farthest point?
a) $\frac{vr}{R}$ b) $\frac{vR}{r}$ c) $v\sqrt{\frac{r}{R}}$ d) $v\sqrt{\frac{R}{r}}$

76. The escape velocity of a body from the earth is u. What is the escape velocity from a planet whose mass and radius are twice those of the earth?
a) 2u b) u c) 4u d) 16u

77. A particle of mass m is subjected to an attractive central force of magnitude k/r^2, k being a constant. If at the instant when the particle is at an extreme position in its closed orbit, at a distance a from the centre of force, its speed is (k/2ma), if the distance of other extreme position is b. Then a/b is
a) 2 b) 3 c) 4 d) 5

78. Two identical spheres of radius R made of the same material are kept at a distance d apart. Then the gravitational attraction between them is proportional to
a) d^{-2} b) d^2 c) d^4 d) d

79. 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) $\sqrt{\frac{2GM}{R}}$ b) $\sqrt{\frac{2GM}{R^2}}$ c) $\sqrt{2gR^2}$ d) $\sqrt{\frac{2GM}{R^2}}$

80. A comet orbits the sun in a highly elliptical orbit. Which of the following quantities remains constant throughout its orbit?
(i) Linear speed

(ii) Angular speed
(iii) Angular momentum
(iv) Kinetic energy
(v) Potential energy
(vi) Total energy
a) (i), (ii), (iii) b) (iii), (iv), (v) c) (iii) and (vi) d) (ii), (iii) and (vi)

81. The escape velocity of a sphere of mass m is given by (G = universal gravitational constant, $M_e =$ mass of the earth and $R_e =$ radius of the earth)____
a) $\sqrt{\frac{GM_e}{R_e}}$ b) $\sqrt{\frac{2GM_e}{R_e}}$ c) $\sqrt{\frac{2GM}{R_e}}$ d) $\frac{GM_e}{R_e^2}$

82. A satellite of mass m is orbiting around the Earth in a circular orbit with a velocity v. What will be its total energy?
a) (3/4) mv^2 b) (1/2) mv^2 c) mv^2 d) -(1/2) mv^2

83. A geostationary satellite is orbiting the earth at a height of 5 R above that surface of the earth, R being the radius of the earth. The time period of another satellite in hours at a height of 2 R from the surface of the earth is_____
a) 5 b) 10 c) $6\sqrt{2}$ d) $\frac{6}{\sqrt{2}}$

84. If the earth were to suddenly contract to half the present radius (without any external torque acting on it), by how much would the day be decreased? [Assume the earth to be a perfect solid sphere of moment of inertia (2/5) MR^2 .]
a) 8 hours b) 6 hours c) 4 hours d) 2 hours e) 1 hours

85. A spherical hole is made in a solid sphere of radius R. The mass of the sphere before hollowing was M. The gravitational field at the centre of the hole due to the remaining mass is:
a) Zero b) $\frac{GM}{8R^2}$ c) $\frac{GM}{2R^2}$ d) $\frac{GM}{R^2}$

86. Which of the following statements is correct regarding the gravitational force?
a) The gravitational force is dependent on the intervening medium
b) The gravitational force is a non-conservative force
c) The gravitational force forms action-reaction pair
d) The gravitational force is a non-central force

87. You are given 32 identical balls all of equal weight except 1 which is heavier than the others. You are given a beam balance but no weight box. What is the minimum number of weighings required to identify the balls of different weight?
a) 3 b) 4 c) 5 d) 6

88. (A) The difference in the value of acceleration due to gravity at poles and equator is proportional to square of angular velocity of earth.
(R) The value of acceleration due to gravity is minimum at the equator and maximum at the pole.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

89. The mass and diameter of a planet have twice the value of the corresponding parameters of Earth. Acceleration due to gravity on the surface of the planet is:
a) 9.8m/sec^2 b) 4.9m/sec^2 c) 980m/sec^2 d) 19.6m/sec^2

90. A point mass m is placed inside a spherical shell of radius R and mass M at a distance $\frac{R}{2}$ from the centre of the shell. The gravitational force exerted by the shell on the point mass is
a) $\frac{GMm}{R^2}$ b) $\frac{2GMm}{R^2}$ c) zero d) $\frac{4GMm}{R^2}$

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

92. If three particles each ofmassM are placed at the corners of an equilateral triangle of side a, the potential energy of the system and the work done if the side of the triangle is changed from a to 2a, are:
a) $\frac{3GM}{a^2}, \frac{3GM}{2a}$ b) $-\frac{3GM^2}{a}, \frac{3GM^2}{2a}$ c) $-\frac{3GM^2}{a^2}, \frac{3GM^2}{4a^2}$ d) $-\frac{3GM^2}{a}, \frac{3GM}{2a}$

93. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3V then the speed of satellite B will be ______
a) 3V/4 b) 6V c) 12V d) 3V/2

94. Assertion: The motion of a particle under the central force is always confined to a plane.
Reason: Angular momentum is always conserved in the motion under a central force.

a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

95. Assertion: Geostationary satellites appear fixed from any point on earth.
Reason: The time period of geostationary satellite is 24 hours.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

96. The escape speed of a body on the earth's surface is 112 km s^{-1}. A body is projected with thrice of this speed. The speed of the body when it escapes the gravitational pull of earth is
a) 11.2 km s^{-1} b) $22.4\sqrt{2}$ km s^{-1} c) $\frac{22.4}{\sqrt{2}}$ km s^{-1} d) $22.4\sqrt{3}$ km s^{-1}

97. The time period of a geostationary satellite at a height 36000 km is 24 hrs. A spy satellite orbits very close to the earth surface (R = 6400 km). What will be its time period?
a) 4 hrs b) 1 hr c) 2 hrs d) 1.5 hrs

98. Orbit velocity of an object of mass m is proportional to:
a) m^0 b) m c) m^2 d) $\frac{1}{m}$

99. Two spheres of masses 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) $\frac{F}{9}$ b) 3 F c) F d) F/3

100. The escape velocity for a body projected vertically upwards from the surface of the earth is II kmlsec. If the body is projected at an angle of 45° with the vertical, the escape velocity will be:
a) $11/\sqrt{2}$ km/ sec b) $11\sqrt{2}$ km /sec c) 2 km/ sec d) 11 km/ sec

101. The distance of Netune and Saturn from Sun are nearly 1013 and 101 meters 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) $1\sqrt{10}$

102. 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 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) $\frac{2r_1r_2}{r_1+r_2}$ d) $\frac{r_1+r_2}{3}$

103. 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 the earth:

a) is the same b) is smaller c) is greater d) varies with its phase

104. The escape velocity from the surface of the earth is v_e. The escape velocity from the surface of a planet whose mass and radius are three times those of the earth, will be____

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

105. Kepler's third law states that square of period of revolution (T) of a planet around the sun, is proportional to third power of average distance r between sun and planet i . e. $T_2 = K\mu^3$ where R^- is conistant. If the masses of sun and planet are M and m respectively then as per Newton's law of gravitation force of attraction between them is $\frac{GMm}{r^2}$, here G is gravitational constant. The relation between G and K is described as _____

a) $GMK = 4\pi^2$ b) K=G c) $K = \frac{1}{G}$ d) $GK = 4\pi^2$

106. The escape velocity on a planet, four times the radius of the earth and having 9 times acceleration due to gravity is:

a) 67.2 km/sec b) 37.4 km/sec c) 403.2 km/sec d) 422.2 km/sec

107. The radius in kilometres to which the present radius of the earth (R = 6400 km) to be compressed so that the escape velocity is increased 10 times, is:

a) 6.4 b) 64 c) 640 d) 4800

108. Two identical spheres each of mass M and radius R are separated by a distance 10R. The gravitational force on mass m placed at the midpoint of the line joining the centres of the spheres is

a) Zero b) $\frac{2GMm}{25R^2}$ c) $\frac{GMm}{25R^2}$ d) $\frac{GMm}{100R^2}$

109. Radius of orbit of satellite of the earth is R. Its kinetic energy is proportional to:

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

110. A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is 20 m. The speed of the car at the top of the hill is between _____________.

a) 14 m/s and 15 m/s b) 15 m/s and 16 m/s c) 16 m/s and 17 m/s
d) 13 m/s and 14 m/s

111. A satellite is placed in a circular orbit around the earth at such a height that it always remains stationary with respect to the earth's surface. In such a case, its height (in km) from the earth's surface is:

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

112. A projectile is fired vertically upwards from the surface of earth with a velocity of kv_e where ve is the escape velocity and k < 1. Neglecting air resistance, the maximum height to which it will rise, measured from the centre of the earth, is (R_E = radius earth)

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

113. A particle of mass ' m ' is kept at rest at a height 3 R from the surface of earth, where ' R ' is radius of earth and 'M' is mass of earth. The minimum speed with which it should be projected, so that it does not return back, is (g is acceleration due to gravity on the surface of earth)_____

a) $\left(\frac{GM}{R}\right)^{\frac{1}{2}}$ b) $\left(\frac{GM}{2R}\right)^{\frac{1}{2}}$ c) $\left(\frac{gR}{4}\right)^{\frac{1}{2}}$ d) $\left(\frac{2g}{4}\right)^{\frac{1}{2}}$

114. 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) $\frac{24}{n^2}hr$ b) 24 n hr c) $\frac{24}{n}hr$ d) 24 n^2 hr

115. A non-homogeneous sphere of radius R has the following density variation:

$$\rho\begin{cases}\rho o; r \leq R/3 \\ \rho o/2; (R/3) < r \leq (3R/4) \\ \rho o \quad /8; (3R/4) < r \leq R\end{cases}$$

The gravitational field at a distance 2R from the centre of the sphere is

a) $0.1\pi GR\rho o$ b) $0.2\pi GR\rho o$ c) $0.3\pi GR\rho o$ d) $0.4\pi GR\rho o$

116. If the polar ice caps of the earth melt, how will it affect the length of day?

a) Length of day would remain unchange b) Length of day would increase
c) Length of day would decrease d) None of the above

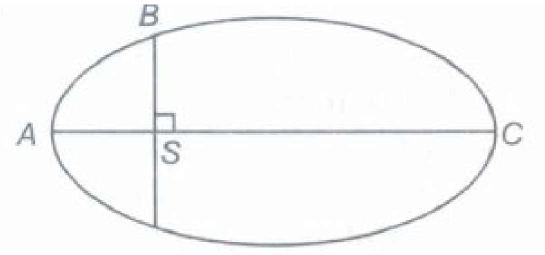
117. Two identical solid copper spheres of radius R are placed in contact with each other. The gravitational attraction between them is proportional to:

a) R^2 b) R^{-2} c) R^4 d) R^{-4}

118. A body is projected upwards with a velocity of 4 x 11.2 km/s from the surface of the earth. What will be the velocity of the body when it escapes the gravitational pull of the earth?

a) 11.2 km/s b) 2 x 11.2 km/s c) 3 x 11.2 km/s d) $\sqrt{15} \times$ 11.2 km/s

119. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and Care K_A, KBand K_C respectively. AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then



a) $K_B > K_A > K_C$ b) $K_A > K_B > K_C$ c) $K_A < K_B < K_C$ d) $K_B < K_A < K_C$

120. The time period Y of the moon of planet mars (mass M_m) is related to its orbital radius R as (G = Gravitational constant)

a) $T_2=\frac{4\pi^2R^3}{GM_m}$ b) $T_2=\frac{4\pi^2GR^3}{M_m}$ c) $T_2=\frac{2\pi^2GR^3}{M_m}$ d) $T^2=4\pi M_mGR^3$

121. If distance between the earth and the sun become four times, then time period becomes:

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

122. The earth's radius is R and acceleration due to gravity at its surface is g. If a body of mass m is sent to a height h = $\frac{R}{5}$ from the earth's surface, the potential energy increases by:

a) mgh b) $\frac{4}{5}$ mgh c) $\frac{5}{6}$ mgh d) $\frac{6}{7}$ mgh

123. Assertion: The gravitational force on a particle inside a spherical shell is zero.
Reason: The shell shields other bodies outside it from exerting gravitational forces on a particle inside.

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

124. The orbital velocity of a satellite very near to the surface of the earth is v.What will be its orbital velocity at an altitude 7 times the radius of the earth?

a) $v/\sqrt{2}$ b) v/2 c) $v2/\sqrt{2}$ d) v/4

125. Both earth and moon are subjected to the gravitational force of the sun. As observed from the sun, the orbit of the moon

a) will be elliptical

b) will not be strictly elliptical because the total gravitational force on it is not central

c) is not elliptical but will necessarily be a closed curve

d)

deviates considerably from being elliptical due to the influence of planets other than earth

126. Suppose radius of the moon's orbit around the earth is doubled. Then its period around the earth will become:

a) 1/2 times b) $\sqrt{2}$ times c) $2^{2/3}$ times d) $2^{3/2}$ times

127. Two satellites of earth, S_1 and S_2 are moving in the same orbit. The mass of S_1 is four times the mass of S_2; Which one of the following statements is true?

a) The potential energies of earth satellites in the two cases are equal

b) S_1 and S_2 are moving with the same speed

c) The kinetic energies of the two satellites are equal

d) The time period of S_1 is four times that of S_2

128. 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 years

129. The eccentricity of Earth's orbit is 0.0167.The ratio of its maximum speed in its orbit to its minimum speed is:

a) 2.507 b) 1.033 c) 8.324 d) 1.000

130. The escape velocity from the surface of the earth is (where R_E is the radius of the earth)

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

131. In the question number 51, the potential at the centre is

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

132. Radius of orbit of satellite of Earth is R. Its kinetic energy is proportional to :

a) 1/R b) $1/\sqrt{R}$ c) R d) 1/R3/2

133. If a body weighing 40 kg is taken inside the earth to a depth to $\frac{1}{4}$ th radius of the earth, the weight of the body at that point is:

a) 40 kg-wt b) 10 kg-wt c) 30 kg-wt d) zero

134. 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 the earth, $R_E = 6.37 \times 10^6$ m, universal constant of gravitation, $G = 6.67 \times 10^{-11}$ N m^2 kg^{-2})

a) 2.4 R_E b) 3.6 R_E c) 4.8 R_E d) 6.6 R_E

135. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98×10^{24} kg) have to be compressed to be a black hole?

a) 10^{-9} m b) 10^{-6} m c) 10^{-2} m d) 100 m

136. Assertion: For a free falling object, the net external force is just the weight of the object.

Reason: In this case the downward acceleration of the object is equal of the acceleration due to gravity.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

137. Potential energy of a satellite having mass 'm' and rotating at a height of 6.4 x 106 m from the Earth centre is :

a) - 0.5 mgRe b) - mgRe c) -2 mgRe d) 4 mgRe

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

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

139. A satellite S is moving in an elliptical orbit aroundthe Earth. The mass of the satellite is very small as compared to the mass of the Earth. Then,

a)

the angular momentum of S about the centre of the Earth changes in direction, but its magnitude remains constant

b) the total mechanical energy of S varies periodically with time

c) the linear momentum of S remains constant in magnitude

d) the acceleration of S is always directed towards the centre of the Earth

140. If there were a reduction in gravitational effect, which ofthe following forces do you think would change in some respect?

a) Magnetic force b) Electrostatic force c) Viscous force d) Archimedes' uplift

141. (A) Even when orbit of a satellite is elliptical, its plane of rotation passes through the centre of earth.

(R) According to law of conservation of angular momentum plane of rotation of satellite always remain same.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.   d) If both assertion and reason are false.

e) If assertion is false but reason is true.

142. Which of the following Kepler's laws is also known as harmonic law?

a) First law   b) Second law   c) Third law   d) None of these

143. A satellite of mass m is orbiting the earth at a height h from its surface. If M is the mass of the earth and R its radius, then how much energy must be spent to pull the satellite out of the earth's gravitational field?

a) $\frac{2GmM}{(R+h)^2}$ b) $\frac{GmM}{2(R+h)^2}$ c) $\frac{2GmM}{(R+h)}$ d) $\frac{GmM}{2(R+h)}$

144. How many times more, the mass of the original star is to be larger than that of the sun for the formation of 'Black Hole'?

a) 2   b) 6   c) 8   d) 10

145. The acceleration due to gravity is g at a point distant rfrom the centre ofthe earth of radius R. If r <R. then:

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

146. Imagine a planet whose diameter and mass are one half of those of the earth. The day's temperature of this planet reaches upto 800 K. (Escape velocity on the surface of the earth is 11.2 km/sec, k = 1.38×10^{-23} Jik and mass of oxygen molecule = 5.3×10^{-26} kg.) Among the following, choose the wrong statement.

a) Oxygen molecules escape from the planet.

b) Oxygen molecules cannot escape from the planet.

c) Oxygen molecules mayor may not escape.   d) None of the above.

147. The acceleration due to gravity at a height 1 km above the Earth is the same as at a depth d below the surface of Earth. Then

a) d = 2km   b) d = 1/2km   c) d = 1km   d) d = 3/2km

148. Which of the following statements is correct regarding the universal gravitational constant G?

a) G has same value in all systems of units.
b) The value of G is same everywhere in the universe
c) The value of G was first experimentally determined by Johannes Kepler
d) G is a vector quantity

149. (A) One does not experience gravitational force in daily life due to objects of same size.
(R) Value of gravitational constant is very small.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false.
d) If both assertion and reason are false.
e) If assertion is false but reason is true.

150. If the radius of orbit of a satellite is changed by a factor of 4, then time period is changed by a factor of:
a) 4 b) 6 c) 8 d) none of these

151. A satellite is orbiting around the earth. By what percentage should we increase its velocity so as to enable it to escape away from the earth?
a) 41.4% b) 50% c) 82.8% d) 100%

152. Kepler's second law is a consequence of
a) conservation of energ b) conservation of linear momentum
c) conservation of angular momentum d) conservation of mass

153. Which of the following statements is true?
a) A geostationary satellite goes around the earth in east-west direction.
b) A geostationary satellite goes around the earth in west-east direction.
c) The time period of a geostationary satellite is 48 hrs.
d)
The angle between the equatorial plane and the orbital plane of geostationary satellite is 90°.

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

155. Work done in taking a mass from one point to another in a gravitational field depends on:

a) the end points only b) the path followed c) the velocity of the mass

d) both the length of the path and the end points

156. If the gravitational force between two objects were proportional to $\frac{1}{R}$ (and not as $\frac{1}{R^2}$), where R is separation between them, then a particle in circular orbit under such a force would have its orbital speed v proportional to____

a) $\frac{1}{R^2}$ b) R^0 c) R d) 1/R

157. The distances from the centre of the earth where the weights of the body are zero and one-fourth that of the weight of body on the surface of the earth are: (Assume R is the radius of the earth)

a) 0, $\frac{R}{4}$ b) 0, $\frac{3R}{4}$ c) $\frac{R}{4}$, 0 d) $\frac{3R}{4}$, 0

158. **Assertion:** The planets move slower when they are farther from the Sun than when they are nearer.

Reason : Angular velocity of a planet is a constant quantity.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertionand reason are true but reason is not the correct explanationof assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

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

a) 1.4×10^6 km b) 1.4×10^7 km c) 1.4×10^8 km d) 1.4×10^9 km

160. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of got the value of acceleration due to gravity at the earth's surface, is

a) $mg_oR^2/2(R+h)$ b) $-mg_oR^2/2(R+h)$ c) $2mg_oR^2/(R+h)$ d) $-2\ mg_oR^2/(R+h)$

161. The time period of an earth satellite in a circular orbit of radius R is 2 days and its orbital velocity is v_0. If time period of another satellite in a circular orbit is 16 days then

a) its radius of orbit is 4R and orbital velocity is v_0

b) its radius of orbit is 4R and orbital velocity is $\frac{v_0}{2}$

c) its radius of orbit is 2R and orbital velocity is v_0

d) its radius of orbit is 2R and orbital velocity is $\frac{v_0}{2}$

162. Weightlessness in satellite is due to

a) zero gravitational acceleration b) zero acceleration c) zero mass

d) None of these

163. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3 V, then the speed of satellite B will be:

a) 3V/4 b) 6V c) 12V d) 3V/2

164. The gravitational potential due to the earth at infinite distance from it is zero. Let the gravitational potential at a point P be -5 J/kg . Suppose, we arbitrarily assume the gravitational potential at infinity to be + 10 J/kg , then the gravitational potential at P will be:

a) -5 J/Kg b) + 5 J/Kg c) -15 J/Kg d) + 15 J/Kg

165. A synchronous relay satellite reflects TV signals and transmits TV programmes from one part of the world to the other because its:

a)

period of revolution is greater than the period of rotation of the earth about its axis

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

c) period of revolution is equal to the period of rotation of the earth about its axis

d) mass is less than the mass of the earth

166. A projectile is fired vertically upwards. It escapes from the earth, when fired with velocity v. If it is to be fired at 45° to the horizontal, what should be its velocity to enable it to escape from the gravitational pull of the earth?

a) $\sqrt{2}v$ b) $v/\sqrt{2}$ c) v d) Some other velocity

167. Match the Column I with Column II.

Column I		Column II	
(A)	Kepler's first law	(P)	$T^2 \propto a^3$
(B)	Kepler's second law	(q)	Inverse square law
(C)	Kepler's third law	(r)	Orbit of planet is elliptical
(D)	Newton's law of gravitation	(s)	Law of conservation of angular momentum

a) A - s, B - p, C - q, D - r b) A - p, B - q, C - r, D -s c) A - r, B - s, C - p, D - q

d) A - s, B - P. C - q, D - s

168. The potential energy of a satellite, having mass m, rotating at a height of 6.4×10^6 m from the earth surface, is____

a) $-mgR_e$ b) $-0.67mgR_e$ c) $-0.5mgR_e$ d) $-0.33mgR_e$

169. Assertion: The gravitational attraction of moon is much less than that of earth.

Reason: Moon is the natural satellite of the earth.

a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false   d) If both assertion and reason are false

170. 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) 14m/s and 15m/s   b) 15m/s and 16m/s   c) 16m/s and 17m/s
d) 13m/s and 14m/s

171. The radius of a planet is 1/4 of the earth's radius and its acceleration due to gravity is double that of the 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 the earth's surface?
a) $\frac{1}{\sqrt{2}}$ b) $\sqrt{2}$ c) $2\sqrt{2}$ d) 2

172. Choose the wrong option.
a)
Inertial mass. is a measure of difficulty of accelerating a body by an external force whereas the gravitational mass isrelevant in determining the gravitational force on it by an external mass.
b) That the gravitational mass and inertial mass are equal is an experimental result.
c)
That the acceleration due to the gravity on Earth is the same for all bodies and is due to the equality of gravitational mass and inertial mass.
d)
Gravitational mass of a particle like proton can depend on the presence of neighbouring heavy objects but the inertial mass cannot.

173. A pendulum beats seconds on the earth. Its time period on a stationary satellite of the earth will be:
a) Zero   b) 1 s   c) 2 s   d) infinity

174. By what percentage the energy of a satellite has to be increased to shift it from an orbit of radius r to 3/2 r?
a) 66.7 %   b) 33.3 %   c) 75 %   d) 20.3 %

175. From a solid sphere of mass M and radius R, a spherical portion R/2 of radius is removed, as shown in the figure. Taking gravitational potential V = 0 at r = ∞, the potential at the centre of the cavity thus formed is (G = gravitational constant)

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

176. 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 remain unchanged, the period of Moon's rotation would be nearly

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

177. The potential energy of a satellite having mass rn and rotating at a height of 6. 4 x 10^6 m from the earth's surface is: (Giyen R = 6.4 x 10^6 m)

a) mgR b) 0.67 mgR c) -mgR/2 d) 0.33 mgR

178. The ratio of escape velocity at earth (V_e) to the escape velocity at a planet (V_p) whose radius and mean density are twice as that of earth is:

a) 1 : 2 b) 1 : $2\sqrt{2}$ c) 1 : 4 d) 1 : $\sqrt{2}$

179. The ratio of the kinetic energy required to be given to the satellite to escape the earth's gravitational field to then kinetic energy required to be given so that the satellite moves in circular orbit just above the earth's atmosphere is:

a) one b) two c) half d) infinity

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

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

181. 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 perpendicular to the major-axis of the orbit drawn from the Sun is :

a) $(r_1 + r_2)/4$ b) $(r_1 + r_2)/ (r_1 - r_2)$ c) $2(r_1 \times r_2)/ (r_1 + r_2)$ d) $(r_1 + r_2)/ 3$

182. LANDSAT series of satellite move in near polar orbits at an altitude of

a) 3600 km b) 3000 km c) 918 km d) 512 km

183. If the radius of the earth decreases by 10%, the mass remaining unchanged, what will happen to the acceleration due to gravity?

a) Decreases by 19% b) Increases by 19% c) Decreases by more than 19%
d) Increases by more than 19%

184. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?

a) 24 N b) 48 N c) 32 N d) 30 N

185. The acceleration due to gravity increases 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

186. If the earth were to cease rotating about its own axis. The increase in the value of g in CGS system at a place of latitude of 45° will be:

a) 2.68 b) 1.68 c) 3.36 d) 0.34

187. (A) We cannot move even a finger without disturbing all the stars of the universe.
(R) Everybody in the universe attracts every other body with a force which is inversely proportional to the square of distance between them.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

188. The satellite of mass m is orbiting around the earth in a circular orbit with a velocity v. What will be its total energy?

a) $\frac{3}{4}mv^2$ b) $\frac{1}{2}mv^2$ c) m^2 d) $-\left(\frac{1}{2}\right)mv^2$

189. If the orbital velocity of the moon is increased by 41.4% of its present value, then the:

a) moon will orbit around the earth with double velocity

b) radius of moon's orbit will become double

c) moon will become a stationary satellite

d) moon will leave its orbit and escape into space

190. Which of the following statements is incorrect regarding the polar satellite?

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

b) Polar satellites are used to study topography of Moon, Venus and Mars.

c) A polar satellite is a high altitude satellite

d) The time period of polar satellite is about 100 minutes.

191. The radius of the earth is 4 times that of the moon and its mass is 80 times that of the moon. If the acceleration due to gravity on the surface of the earth is 10 m/s^2, that on the surface of the moon will be:

a) 1 m/s^2 b) 2 m/s^2 c) 3 m/s^2 d) 4 m/s^2

192. Two spherical bodies of mass M and 5 M and radii R and 2 R respectively are released in free space fwhith initial separation between their centres equal to 12 R. If eyattract each other due to gravitational force only, then the distance covered by the smaller body just before collision, is:
a) 1.5 R b) 2.5 R c) 4.5 R d) 7.5 R

193. If a planet of given density were made larger, its force of attraction for an object on its surface would increase because of the planet's greater mass but would decrease because of greater separation from the object to the centre of the planet. Which effect predominates?
a) Increase in radius b) Increase in mass c) Both affect the attraction equally
d) None of the above

194. The period of a satellite in a circular orbit around a planet is independent of :
a) The mass of the planet b) The radius of the planet
c) The mass of the satellite d) All the three parameters (a), (b) and (c)

195. 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. Mand 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) $\sqrt{2GM/R}$ b) $\sqrt{2GM/R^2}$ c) $\sqrt{2gR^2}$ d) $\sqrt{GM/R^2}$

196. A satellite is orbiting the earth in a circular orbit of radius r. Its
a) kinetic energy varies as r b) angular momentum varies as $\frac{1}{\sqrt{r}}$
c) mear momentum vanes as $\frac{1}{r}$ d) frequency of revolution varies as $\frac{1}{r^{3/2}}$

197. The mass of the earth is 81 times that of the moon and the radius ofthe earth is 3.5 times that of the moon. The ratio of the escape velocity on the surface of the earth to that on the surface of the moon will be:
a) 0.2 b) 2.57 c) 4.81 d) 0.39

198. A simple pendulum has a time period T_1 when on the earth's surface and T_2 when taken to a height 2R above the earth's surface, where R is the radius of the earth. The value of (T_1/T_2) is:
a) 1/9 b) 1/3 c) $\sqrt{3}$ d) 9 e) 3

199. Observers on the 10th, 5th and ground floor of a tall building measure the velocity of a certain raindrop by some accurate method. Surprisingly the velocity of the raindrop measured by the three observers was found to be the same. This is because:
a) there is no gravitational force acting on the drop
b)
gravitational force on the raindrop is balanced by the force produced by the surrounding air

c)
gravitational force on the raindrop is balanced by the upward force of attraction produced by the cloud

d) data is insufficient to predict   e) none of the above

200. (A) Earth has an atmosphere but the moon does not.
(R) Moon is very small in comparison to earth.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.   d) If both assertion and reason are false.
e) If assertion is false but reason is true.

201. A hydrogen balloon released on the moon would:
a) climb with an acceleration of $\frac{9.8}{6}ms^{-2}$ b) climb with an acceleration of9.8x 6m s^{-2}
c) neither climb nor fall   d) fall with an acceleration of

202. A satellite is revolving around the sun in a circular orbit with uniform velocity v. If the gravitational field suddenly disappears, the velocity of the satellite will be:
a) Zero   b) v   c) 2v   d) infinity

203. At the surface of a certain planet acceleration due to gravity is one-quarter of that on the 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 the earth.

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

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

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

204. 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

205. Two identical spheres of same material are in contact with each other. If r be the radius of the sphere, then gravitational attraction between them is proportional to:
a) r   b) r^2 c) r^3 d) r^4

206. Earth is flattened at the poles and bulges at the equator. This is due to the fact that
a) the earth revolves around the sun in an elliptical orbit
b) the angular velocity of spinning about its axis is more at the equator
c) the centrifugal force is more at the equator than at poles   d) none of these

207. A spherical planet far out in space has a mass M_o and diameter D_o .A particle of mass m falling near the surface of this planet will experience an acceleration due to gravity which is equal to:
a) $\frac{M_0}{D_0^2}$ b) $4m\frac{M_0}{D_0^2}$ c) $\frac{4M_0G}{D_0^2}$ d) $m\frac{M_0}{D_0^2}$

208. The metallic bob of a simple pendulum has the relative density S. The time period of this pendulum is T. If the metallic bob is immersed in water, then the new time period is given by:
a) $T=(\frac{\rho-1}{\rho})$ b) $\frac{\rho}{(\rho-1)}T$ c) $\sqrt{(\frac{\rho-1}{\rho})}T$ d) $\sqrt{\frac{\rho}{(\rho-1)}}T$

209. A person will get more quantity of matter (in kg-wt) at:
a) poles   b) at latitude of 60°   c) equator   d) satellite

210. 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_o be V_o, then what is the expression for the gravitational potential (V)?
a) k log (r/ r_0)   b) k log (r_0 / r)   c) V_o + k log (r /r_0)   d) Vo + k log (r_0 / r)

211. 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

212. A particle of mass M is situated at the centre of a spherical shell of same mass and radius R. The gravitational potential at a point situated $\frac{R}{2}$ distance from the centre will be
a) $-\frac{3GM}{R}$ b) $-\frac{2GM}{R}$ c) $-\frac{GM}{R}$ d) $-\frac{4GM}{R}$

213. With what velocity should a particle be projected so that its height becomes equal to radius of earth?
a) $\left(\frac{GM}{R}\right)^{1/2}$ b) $\left(\frac{8GM}{R}\right)^{1/2}$ c) $\left(\frac{2GM}{R}\right)^{1/2}$ d) $\left(\frac{4GM}{R}\right)^{1/2}$

214. Two satellites of masses M_1 and M_2 are revolving around the earth in circular orbits of radii r_1 and r_2. The ratio of their speeds V_1 / v_2 is

a) $\frac{r_1}{r_2}$ b) $\frac{r_2}{r_1}$ c) $\sqrt{\frac{r_1}{r_2}}$ d) $\sqrt{\frac{r_2}{r_1}}$

215. An earth satellite is moved from one stable circular orbit to a farther stable circular orbit. Which one of the following quantities increases?
a) Linear orbital speed b) Gravitational force c) Centripetal acceleration
d) Gravitational potential energy

216. The escape velocity from the earth is 11.2 km/s. The escape velocity from a planet having twice the radius and the same mean density as the earth is:
a) 22.4 km/s b) 11.2 km/s c) 5.6 km/s d) 15.8 km/s

217. A thin rod of length L is bent to form a circle. Its mass is M. What force will act on the mass m placed at the centre of the circle?
a) $\frac{4\pi^2 GMm}{L^2}$ b) $\frac{GMm}{4\pi^2 L^2}$ c) $\frac{2\pi GMm}{L^2}$ d) Zero

218. Kepler's third law states that square of period of revolution (T) of a planet around the Sun, is proportional to third power of average distance r between the Sun and planet, i.e., $T^2=Kr^3$, here K is constant. If the masses of the Sun and planet are M and m respectively, then as per Newton's law of gravitation force of attraction between them is $F=GMm/r^2$, here G is gravitational constant. The relation between G and K is described as
a) $GK=4\pi^2$ b) $GMK=4\pi^2$ c) K=G d) K=I/G

219. Assertion: When distance between two bodies is doubled and also mass of each body is doubled, gravitational force between them remains the same.
Reason: According to Newton's law of gravitation, force is directly proportional to product of the mass of bodies and inversely proportional to the square of the distance between them.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

220. A particle of mass 10^9 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 = 6.67×10^{-11} N-m^2/kg^2)
a) 6.67×10^{-9} J b) 6.67×10^{-10} J c) 13.34×10^{-10} J d) 3.33×10^{-10} J

221. The escape velocity of a sphere of mass m from earth having mass Mand radius R is given by:

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

222. The moon has a mass of $\frac{1}{81}$ that of the earth and a radius of $\frac{1}{4}$ that of the earth. The escape speed from the surface of the earth is 11.2 km/s. The escape speed from the surface of the moon is:

a) 1.25 Km/s b) 2.49 Km/s c) 3.7 Km/s d) 5.6 Km/s

223. Assuming earth to be a sphere of uniform density, what is the value of ' g ' in a mine 100 km below the earth's surface?

(Given, R=6400 km)____

a) $9.65\ \mathrm{m/s^2}$ b) $7.65\ \mathrm{m/s^2}$ c) $5.06\ \mathrm{m/s^2}$ d) $3.10\ \mathrm{m/s^2}$

224. What is the ratio of potential energy to kinetic energy of the moon orbiting around the earth?

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

225. (A) Moon travellers tie heavy weight at their back before landing on moon.

(R) The value of 'g' is small at moon.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

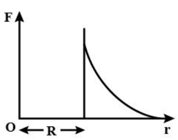
226. A satellite is revolving round the earth in an orbit of radius r with time period T. If the satellite is revolving round the earth in an orbit of radius r+ ($\triangle r << r$) with time period $T+\triangle T$, then:

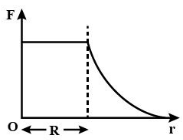
a) $\frac{\triangle T}{T}=\frac{2}{3}\frac{\triangle r}{r}$ b) $\frac{\triangle T}{T}=\frac{3}{2}\frac{\triangle r}{r}$ c) $\frac{\triangle T}{T}=\frac{\triangle r}{r}$ d) $\frac{\triangle T}{T}=-\frac{\triangle r}{r}$

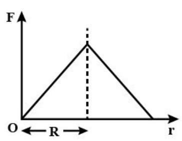
227. A satellite of mass m goes round the earth along a circular path of radius r. Let m_E be the mass of the earth and R_E its radius. Then, the linear speed of the satellite depends on:

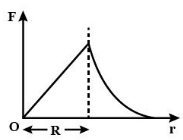
a) m, m_E, r b) m, R_E, r c) M_E only d) m_E and r

228. Which one of the following plots represents the variation of gravitational field on a particle with distance r due to a thin spherical shell of radius R? (r is measured from the centre of the spherical shell)______

a) 

b) 

c) 

d) 

229. The areal velocity and the angular momentum of the planet are related by which of the following relations?
(where m_p is the mass of the planet)

a) $\frac{\Delta \vec{A}}{\Delta t} = \frac{\vec{L}}{2m_p}$ b) $\frac{\Delta \vec{A}}{\Delta t} = \frac{\vec{L}}{m_p}$ c) $\frac{\Delta \vec{A}}{\Delta t} = \frac{2\vec{L}}{m_p}$ d) $\frac{\Delta \vec{A}}{\Delta t} = \frac{\vec{L}}{\sqrt{2}m_p}$

230. If the radius of the earth's orbit around the sun is R and the time period of revolution of the earth around the sun is T. The mass of the sun is:

a) $\frac{GT^3}{4\pi^2R^2}$ b) $\frac{4\pi^2R^2}{GT^2}$ c) $\sqrt{\frac{4\pi^2R^3}{GT^2}}$ d) $[\frac{4\pi^2R^3}{GT^2}]^{1/3}$

231. If M_E is the mass of the earth and R_E its radius, the ratio of the acceleration due to gravity and the gravitational constant is

a) $\frac{R_E^2}{M_E}$ b) $\frac{M_E}{R_E^2}$ c) $M_ER^2_E$ d) $\frac{M_E}{R_E}$

232. Satellite of mass m is in a circular orbit of radius $2R_E$ about the earth. The energy required to transfer it to a circular orbit of radius $4R_E$ is (where M_E and R_E is the mass and radius of the earth respectively)

a) $\frac{GM_Em}{2R_E}$ b) $\frac{GM_Em}{4R_E}$ c) $\frac{GM_Em}{8R_E}$ d) $\frac{GM_Em}{16R_E}$

233. A second pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket____

a) comes down with uniform acceleration
b) moves round the earth in a geostationary orbit
c) moves up with a uniform velocity d) moves up with uniform acceleration

234. A simple pendulum is taken from the equator to the pole. Its period:

a) decreases b) increases c) remains the same
d) decreases and then increases e) becomes infinity

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

a) mgh b) 4/5 mgh c) 5/6 mgh d) 6/1 mgh

236. The mean radius ofthe earth is R, its angular speed about its own axis is ω and the acceleration due to gravity at the earth's surface is g. The cube of the radius of orbit of geostationary satellite will be:

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

237. 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

238. In the question number 72, the change in potential energy is

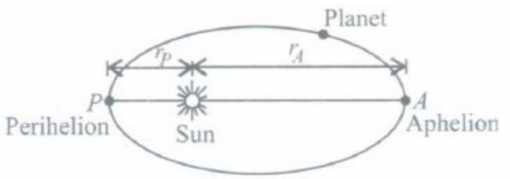
a) $\frac{GM_Em}{8R_E}$ b) $\frac{GM_Em}{16R_E}$ c) $\frac{GM_Em}{2R_E}$ d) $\frac{GM_Em}{4R_E}$

239. 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

240. A rubber ball is dropped from a height of 5 m on a planet where the acceleration due to gravity is not known. On bouncing it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of _____
a) 16 / 25 b) 2/5 c) 3 / 5 d) 9 / 25

241. Infinite number of bodies, each of mass 2 kg are situated on x-axis at distances $1\ \text{m}, 2\ \text{m}, 4\ \text{m}, 8\ \text{m}$, respectively, from the origin. The resulting gravitational potential due to this system at the origin will be___
a) -8/3 G b) -4/3 G c) - 4G d) -G

242. A planet orbits the sun in an elliptical Nth as shown in the figure. Let V_p and V_A be speed of the planet when at perihelion and aphelion respectively. Which of the following relations is correct?



a) $\frac{r_P}{r_A} = \frac{v_A}{v_P}$ b) $\frac{r_P}{r_A} = \frac{v_P}{v_A}$ c) $\frac{r_P}{r_A} = \sqrt{\frac{v_P}{v_A}}$ d) $\frac{r_P}{r_A} = \sqrt{\frac{v_A}{v_p}}$

243. The masses and radii of the earth and the moon are M_1, R_1 and M_2, R_2 respectively. Their centres are at distance d apart. The minimum speed with which a particle of mass m should be projected from a point midway the two centres so as to escape to infinity is:
a) $\sqrt{\frac{2G(M_1+M_2)}{d}}$ b) $\sqrt{\frac{4G(M_1+M_2)}{d}}$ c) $\sqrt{\frac{4GM_1+M_2}{d}}$ d) $\sqrt{\frac{G(M_1+M_2)}{d}}$

244. If g = acceleration due to gravity and V be gravitational potential at a distance r from the centre of the earth (where r > R), then what is the relation between g and V ?
a) g = V/r b) g =-dV /dr c) g = d^2 V/ dr^2 d) g = - V^2 /r^2

245. A particle of mass M is situated at the center of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a/2 distance from the centre, will be
a) - 3GM/a b) - 2GM/a c) - GM/a d) - 4GM/a

246. Two concentric shells have masses M and m and their radii are R and r respectively, where R > r. What is the gravitational potential at their common centre?

a) $-\frac{GM}{R}$ b) $-\frac{GM}{r}$ c) $-G[\frac{M}{R}-\frac{m}{r}]$ d) $-G[\frac{M}{R}+\frac{m}{r}]$

247. A body is at rest on the surface of the earth. Which of the following statements 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.

248. What effect occurs on the frequency of a pendulum, if it is taken from the earth's surface to deep into a mine?
a) Increases b) Decreases c) First increases then decreases d) No effect

249. A satellite is to be placed in equatorial geostationary orbit around earth for communication. The height of such a satellite is
[M_E = 6 X 10^{24}kg, RE = 6400 km, T = 24 h, G = 6.67 X 10^{-11} N m2 kg^{-2}]
a) 3.57 x 10^5 m b) 3.57 x 10^6 m c) 3.57 x 10^7 m d) 3.57 x 10^8 m

250. Which of the following is different from the other?
a) Period of satellite orbiting around the earth very near to its surface.
b) Period of simple pendulum of infinite length.
c) Period of the moon around the earth.
d)
Period of the body dropped in a tunnel bored across the earth and through its centre.

251. A tunnel is dug along a diameter of the earth of mass M_e and radius R_e . The force on a particle of mass m placed in the tunnel at a distance r from the centre is:
a) $\frac{GM_em}{R_e^3}r$ b) $\frac{GM_em}{R_e^3r}$ c) $\frac{GM_emR_e^3}{r}$ d) $\frac{GM_em}{R_e^2}r$

252. 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 tv, where V is its escape velocity from the surface of the Earth. The value off is :
a) $1/\sqrt{2}$ b) $1/\sqrt{3}$ c) 1/2 d) $\sqrt{2}$

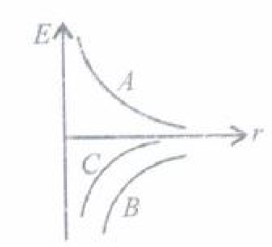
253. The ratio of the energy required to raise a satellite upto a height h above the earth to the kinetic energy of the satellite into the orbit there is: (R = radius of the earth)
a) h : R b) R : 2h c) 2h : R d) R : h

254. Two air bubbles in water:
a) attract each other b) repel each other c) do not exert any force on each other
d) may attract or repel depending upon the distance between them

255. How much deep inside the earth (radius R) should a man go, so that his weight becomes one-fourth ofthat on the earth's surface?

a) $\frac{R}{4}$ b) $\frac{R}{2}$ c) $\frac{3R}{4}$ d) None of these

256. Figure shows the variations of energy E with the orbit radius r of a satellite in circular motion. Choose the correct statement.



a)
A shows the kinetic energy, B shows the total energy and C the potential energy of the satellite
b)
A and B are kinetic energy and potential energy respectively and C the total energy of the satellite
c)
A and B are the potential energy and kinetic energy respectively and C the total energy of the satellite
d)
C and A are the kinetic and potential energies and B the total energy of the satellite

257. In the question number 15, the ratio of the velocity of the satellite at apogee and perigee is
a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) $\frac{1}{6}$

258. The two planets have radii r_1 and r_2 and their densities ρ_1 and ρ_2 respectively. The ratio of acceleration due to gravity on them will be:
a) $r_1\rho_1 : r_2\rho_2$ b) $r_1\rho_1^2 : r_2\rho_2^2$ c) $r_1^2\rho_1 : r_2^2\rho_2$ d) $r_1\rho_2 : r_2\rho_1$

259. Two satellites S_1 and S_2 are revolving round a planet in coplanar and concentric circular orbits of radii R_1 and R_2 in the same direction respectively. Their respective periods of revolution are 1 hr and 8 hr. The radius of the orbit of satellite S_1 is equal to 10^4 km. Their relative speed when they are the closest (in kmph) is:
a) $\pi/2 \times 10^4$ b) $\pi \times 10^4$ c) $2\pi \times 10^4$ d) $4\pi \times 10^4$

260. A satellite A of mass m is at a distance r from the surface of the carth. Another satellite B of mass 2 m is at a distance of 2 r from the earth's surface. Their time periods are in the ratio of____
a) 1: 2 b) 1: 16 c) 1: 32 d) $1:2\sqrt{2}$

261. The magnitudes of gravitational field at distances r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are F_1 and F_2 respectively. Then:

a) $\frac{F_1}{F_2} = \frac{r_1}{r_2}$ if r_1 2 b) $\frac{F_1}{F_2} = \frac{r_2^2}{r_1^2}$ if $r_1 > R$ and $r_2 > R$ c) both (a) and (b)

d) none of the above

262. A small body of mass m falls to the earth from infinite distance away. What will be its velocity on reaching the earth? (Radius of the earth = R, acceleration due to gravity on the surface of the earth is g)

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

263. 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 = g/9 b) g = 27g c) g = 9 g d) g'=3g

264. 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) $48\sqrt{2}$ c) 24 hours d) $24\sqrt{2}$

265. Which of the following planets has two moons phobos and deimos?

a) Jupiter b) Saturn c) Mars d) Earth

266. 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

267. 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) $[2G\frac{(m_1-m_2)}{r}]^{1/2}$ b) $[\frac{2G}{r}(m_1-m_2)]^{1/2}$ c) $[\frac{r}{2G(m_1-m_2)}]^{1/2}$ d) $[\frac{2G}{r}(m_1 m_2)]^{1/2}$

268. If v_e is the escape velocity, v_o, the orbital velocity and v, the velocity of an object around the earth, then the total mechanical energy of the body is + ve when:

a) $v < v_o$ b) $v < v_e$ c) $v = v_e$ d) $v > v_e$

269. Which of the following statements is correct regarding a geostationary satellite?

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

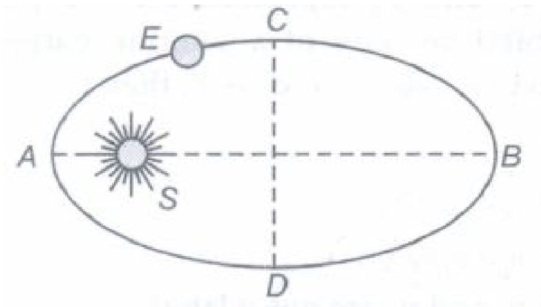
b) A geostationary satellite goes around the earth in west-east direction.

c) The time-period of a geostationary satellite is 48 hours.

d)

The angle between the equatorial plane and the orbital plane of geostationary satellite is 90°.

270. The Earth E moves in an elliptical orbit with the Sun S at one of the foci as shown in figure. Its speed of motion will be maximum at the point:



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

271. 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

272. If a satellite is orbiting the Earth very close to its surface, then the orbital velocity mainly depends on:

a) The mass of the satellite only b) The radius of the Earth only

c) The orbital radius only d) The mass of the Earth only

273. What will happen to the weight of the body at the south pole, ifthe earth stops rotating about its polar axis?

a) No change b) Increases c) Decreases but does not become zero

d) Reduces to zero

274. 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 the gravity on the surface of earth is g and that on the surface of the new planet is g', then_____

a) $g' = g/9$ b) $g' = 27g$ c) $g' = 9\,g$ d) $g' = 3g$

275. If V_e is escape velocity and V_o is orbital velocity of a satellite for orbit close to the Earth's surface, then these are related by :

a) $V_o = \sqrt{2}V_e$ b) $V_o = V_e$ c) $V_e = \sqrt{2V_0}$ d) $V_e = \sqrt{2}V_0$

276. 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 of satellite and radius of the orbit

d) neither the mass of satellite nor the radius of its orbit

277. Two spheres of masses 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/9 b) 3F c) F d) F/3

278. 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 andwhoseradiusis 8100 km?

a) 2790 km/sec b) 27.9 km/sec c) $27.9/\sqrt{5}$ km/sec d) 27.9 $\sqrt{5}$ km/sec

e) $2.79/\sqrt{5}$ km/sec

279. When the distance between the earth and the sun is halved, the duration of year will become:

a) more b) less c) can't be determined d) none of these

280. When you move from equator to pole, the value of acceleration due to gravity (g):

a) increases b) decreases c) remains the same d) increases then decreases

281. The ratio of the earth's orbital angular momentum (about the sun) to its mass is 4.4 x 10^{15}m 2/s. The area enclosed by the earth's orbit is approximately:

a) 7 x 10^{22} m^2 b) 6.02 x 10^{23} m^2 c) 7 x 10^{23} m^2 d) none of these

282. The orbital velocity at a height h above the surface of the earth is 90% of that near the surface of the earth. If the escape velocity at the surface of the earth be v, then its value at the height h will be:

a) 0.99 v b) 0.90 v c) 0.81 v d) 0.11 v

283. If a rocket is fired with a speed v =$2\sqrt{gR}$ near the earth's surface and coasts upwards, its speed in the intersteller space is:

a) $4\sqrt{gR}$ b) $\sqrt{2gR}$ c) $\sqrt{gR}$ d) $\sqrt{4gR}$

284. (A) Earth is continuously pulling moon towards its centre but moon does not fall to earth.

(R) Attraction of sun on moon is greater than that of earth on moon

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false

d) If both assertion and reason are false. e) If assertion is false but reason is true.

285. Consider an earth satellite so positioned that it appears stationary to an observer on the earth and serves the purpose of a fixed relay station for intercontinental transmission of TV and other communications. If the radius of the earth is 6400 km and the acceleration due to gravity on the surface of the earth is 9.8 km/sec^2 , the height of the satellite above the surface of the earth is:

a) 42,400 km b) 36,000 km c) 6,400 km d) 12,800 km

286. In our solar system, the inter-planetary region has chunks of matter (much smaller in size compared to planets) called asteroids. They

a)

will not move around the sun since they have very small masses compared to sun.

b)

will move in an irregular way because of their small masses and will drift awayinto outer space

c) will move around the sun in closed orbits but not obey Kepler's laws.

d) will move in orbits like planets and obey Kepler's laws

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

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

288. An object weighs ION at the north pole of the earth. In a geostationary satellite distant 7R from the centre of the earth (of radius R), the true weight and the apparent weight are:

a) ON, ON b) 0.2N, ON c) 0.2 N, 9.8 N d) 0.2 N, 0.2 N

289. According to Kepler's law, the period of revolution of a planet (T)and its mean distance from the sun (R) are related by the equation:

a) T^2R = constant b) T^2R^{-3} = constant c) TR^3 = constant d) T^3R^3 = constant

290. A projectile attains the escape velocity when:

a) kinetic energy> potential energy b) potential energy> kinetic energy

c) both energies are equal d) no relation between them

291. The values of the acceleration of free fall g on the surface of two planets are the same provided the planets have the same:

a) mass b) radius c) mass/radius d) mass/$(\text{radius})^2$

292. Mass of the earth has been determined through :

a) use of Kepler's $\frac{T^2}{R^3}$ constancy law

b) sampling the density of earth's crust and using earth's radius

c) Cavendish's determination of G and using earth's radius and g at its surface

d) use of periods of satellites at different heights above earth's surface

293. 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) $\sqrt{2}$ KE b) KE c) KE/$\sqrt{2}$ d) none of these

294. Gravitational force between two point masses m and M separated by a distance is F. Now if a point mass 2m is placed next to m in contact with it, the force on M due to m and the total force on M are:

a) 2F, F b) F, 2F c) F, 3F d) F, F

295. Assertion: The force between two finite rigid bodies is not necessarily along the line joining their centre of mass.
Reason: Gravitational force between two particles is central.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false   d) If both assertion and reason are false

296. Assertion: The total energy of a satellite is negative.
Reason: Gravitational potential energy of an object is negative.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false   d) If both assertion and reason are false

297. An asteroid of mass m is approaching earth, initially at a distance 10 R_E with speed Vi' It hits earth with a speed v_i(R_E and M_E are radius and mass of earth), then

a) $v_f^2 = v_i^2 + \frac{2Gm}{R_E}\left(1 + \frac{1}{10}\right)$ 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) $v_f^2 = v_i^2 + \frac{2Gm}{R_E}\left(1 - \frac{1}{10}\right)$

298. Match the Column I with Column II. For a satellite in circular orbit,

Column I		Column II	
(A)	Kinetic energy	(p)	$-\frac{GM_E m}{2r}$
(B)	Potential energy	(q)	$\sqrt{\frac{GM_E}{r}}$
(C)	Total energy	(r)	$-\frac{GM_E m}{r}$
(D)	Orbital velocity	(s)	$\frac{GM_E m}{2r}$

(where M_E is the mass of the earth, m is mass of the satellite and r is the radius of the orbit)
a) A - r, B - s, C - q, D - P   b) A - q, B - p, C - r, D - s   c) A - p, B - q, C - s, D - r
d) A - s, B - r, C - p, D - q

299. Two satellites S and S' revolve around the earth at distances 3R and 6R from the centre of the earth. Their periods of revolution will be in the ratio:

a) 1 : 2 b) 2 : 1 c) 1 : $2^{1.5}$ d) 1 : $2^{0.67}$

300. Mass of the earth is 81 times the mass of the moon and the distance between the earth and the moon is 60 times the radius of the earth. If R is the radius of the earth, then the distance between the moon and the point on the line joining the moon and the earth, where the gravitational force becomes zero is:

a) 30R b) 15R c) 6R d) 5R

301. Which one of the following statements is correct?

a)
The energy required to rocket an orbiting satellite out of earth's gravitational influence is more than the energy required to project a stationary object at the same height (as the satellite) out of earth's influence.

b)
If the zero of potential energy is at infinity, the total energy of an orbiting satellite is negative of potential energy.

c) The first artificial satellite Sputnik I was launched in the year 1950.

d)
The orbital speed of the SYNCOMS (Synchronous communications satellite) is 3.07×10^2 m S^{-1}.

302. Two planets are revolving around the earth with velocities V_1 and V_2 and in radii r_1 and r_2 ($r_1 > r_2$) respectively. Then:

a) $v_1 = v_2$ b) $v_1 > v_2$ c) $v_1 < v_2$ d) $\frac{v_1}{r_1} = \frac{v_2}{r_2}$

303. A satellite is launched in a direction parallel to the surface of earth from a height 390 km with a speed 30.3 Mm hr^{-1}. Speed of the satellite as it reaches its maximum altitude of 3770 km, is:

a) 22.02 Mm hr^{-1} b) 22.20 Mm hr^{-1} c) 20.22 Mm hr^{-1} d) 22.82 Mm hr^{-1}

304. If M = mass of the earth, R = radius of the earth, then what is the gravitational potential at a distance r = R/2 from its centre?

a) $-\frac{GM}{R}$ b) $-\frac{3}{2}\frac{GM}{R}$ c) $-\frac{8GM}{11R}$ d) $-\frac{11GM}{8R}$

305. (A) Escape velocity of a satellite is greater than its orbital velocity.

(R) Orbit of a satellite is within the gravitational field of planet whereas escaping is beyond the gravitational field of planet.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

306. Three uniform spheres, with masses m_A= 350 kg, m_B= 2000 kg and me = 500 kg, have the (x, y) coordinates (0,0) em, (-80,0) cm and (40,0) em respectively. The gravitational potential energy, U, of the system and change in its value in terms of increase or decrease, if the sphere of mass me is removed, may be given as:

a) U = -1.92 x 10^{-4} J and its value shall decrease if the sphere B is removed.

b) U = -1.92 x 10^{-4} J and its value shall increase if the sphere B is removed.

c) U = -1.43 x 10^{-4} J and its value shall decrease if m_B is removed.

d) U = -1.43 x 10^{-4}J and its value shall increase if m^B is removed.

307. The potential energy of a satellite having mass (m) and revolving at a height of 6400 km from the earth is:

a) 2 mg R_e b) mg R_e c) 0.5 mg R_e d) 0

308. Which of the following statements is correct?

a) Acceleration due to gravity increases with increasing altitude

b) Acceleration due to gravity increases with increasing depth

c) Acceleration due to gravity increases with increasing latitude

d) Acceleration due to gravity is independent of the mass of the earth

309. (A) Two satellites A and B are in the same orbit around the earth, B being behind A. Satellite B can overtake satellite A by increasing its speed.

(R) Orbital speeds of two satellite in same orbit may different.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false. e) If assertion is false but reason is true.

310. Assertion: A man sitting in a closed cabin which is falling freely does not experience any gravity.
Reason: Inertial and gravitational mass are equivalent.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

311. The escape velocity of a projectile on the earth's surface is 11.2 k ms^{-1} .A body is projected out with thrice this speed. The speed of the body far away from the earth will be:
a) 2.4 kms^{-1} b) 31.7 kms^{-1} c) 33.6 kms^{-1} d) none of these

312. An astronaut experiences weightlessness in a space satellite. It is because
a) the gravitational force is small at that location in space.
b) the gravitational force is large at that location in space.
c) the astronaut experiences no gravity.
d) the gravitational force is infinitely large at that location in space.

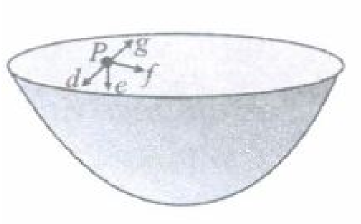
313. At what height from the earth's surface the acceleration due to gravity will be half the value of g at the surface? (Re = 6400 km)
a) 3050 km b) 3240 km c) 2650 km d) None of these

314. 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 $r^{5/2}$, then the square of the time period will be proportional to:
a) r^3 b) r^3 c) $r^{2.5}$ d) $r^{3.5}$

315. Two satellites S_1 and S_2 revolve round a planet in coplanar circular orbits in the same sense. Their periods of revolution are 1 hour and 8 hour respectively. The radius of the 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 (in km/h)
a) $\pi * 10^4$ b) $-\pi * 10^4$ c) $\pi * 10^5$ d) $-\pi * 10^5$

316. If the mass of the Sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is not correct?
a) Time period of a simple pendulum on the Earth would decrease
b) Walking on the ground would become more difficult c) Raindrops will fall faster
d) 'g' on the Earth will not change

317. The direction of gravitational intensity at point P of a hemispherical shell of uniform mass density is indicated by the arrow



a) d b) e c) f d) g

318. The effect of rotation of the earth on the value of acceleration due to gravity is:
a) maximum at the equator and minimum at the poles
b) minimum at the equator and maximum at the poles c) maximum at both places
d) minimum at both places

319. 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 f v, where v is its escape velocity from the surface of the Earth. The value of f is______
a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{3}$ c) $\frac{1}{2}$ d) $\sqrt{2}$

320. A skylab of mass mkg is first launched from the surface of the earth in a circular orbit of radius 2R (from the centre of the earth) and then it is shifted from this circular orbit to another circular orbit of radius 3R. The minimum energy required to place the lab in the first orbit and to shift the lab from first orbit to the second orbit are:
a) $\frac{3}{4}mgR, \frac{mgR}{6}$ b) $\frac{3}{4}mgR, \frac{mgR}{12}$ c) mgR,mgR d) 2 mgR,mgR

321. The eccentricity of the earth's orbit is 0.0167. The ratio of its maximum speed in its orbit to its minimum speed is:
a) 2.507 b) 1.0339 c) 8.324 d) 1.000

322. Two astronauts are floating in gravitational free space after having lost contact with their spaceship. The two astronauts_____
a) Keep floating at the same distance beween them b) move towards each other
c) move away from each other d) will become stationary

323. The total energy of a 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) $\frac{3}{2}mv^2$

324. A particle of mass m is situated at the centre of spherical shell of mass M and radius. The magnitude of the gravitational potential at a point situated at a/2 distance from the centre will be____
a) $\frac{2GM}{a}$ b) $\frac{3GM}{a}$ c) $\frac{4GM}{a}$ d) $\frac{GM}{a}$

325. (A) Space rockets are usually launched in the equatorial line from west to east.
(R) The acceleration due to gravity is minimum at the equ.ator and the earth rotates from west to east a,bout its axis.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

326. Two spherical bodies of mass M and 5M and radii R and 2R 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 before collision is :
a) 4.5 R b) 7.5 R c) 1.5 R d) 2.5 R

327. The acceleration ofa 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) g/9 b) g/3 c) g/4 d) g

328. The mass of moon is 1% of mass of earth. The ratio of gravitational pull of earth on moon and that of moon on earth will be
a) 1:1 b) 1:10 c) 1:100 d) 2:1

329. A small planet is revolving around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force between the planet and the star were proportional to $R^{-5/2}$, then T would be proportional to
a) $R^{3/2}$ b) $R^{3/5}$ c) $R^{7/5}$ d) $R^{7/4}$

330. A body is thrown upward from the earth surface with velocity 5 m/s and from a planet surface with velocity 3 m/s. Both follow the same path. What is the projectile acceleration due to gravity on the planet?
a) 2 m/s^2 b) 3.5 m/s^2 c) 4 m/s^2 d) 5 m/s^2

331. The earth is an approximate sphere. If the interior contained matter which is not of the same density everywhere, then on the surface of the earth, the acceleration due to gravity
a) will be directed towards the centre but not the same everywhere
b) will have the same value everywhere but not directed towards the centre
c) will be same everywhere in magnitude directed towards the centre
d) cannot be zero at any point

332. Assertion: Astronauts in a satellite moving around the earth are in a weightless condition.

Reason: The satellite and its contents are falling freely at the same rate.

a)

If both assertion and reason are true but reason is not the correct explanation of assertion

b) If assertion is true but reason is false c) If both assertion and reason are false

d)

If both assertion and reason are true and reason is the correct explanation of assertion

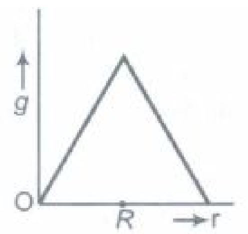
333. If value of acceleration due to gravity at the surface of a sphere is am, then its value will be $a_m/3$ at a distance ____________ from the centre.

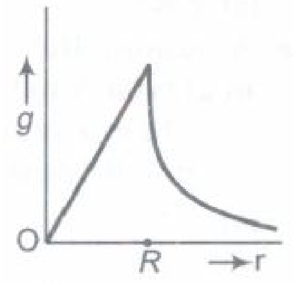
a) $\sqrt{3}$r b) r/$\sqrt{3}$ c) 2$\sqrt{3}$r d) r/3

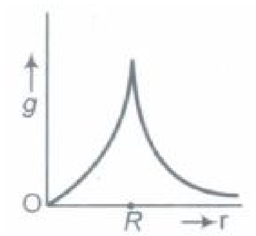
334. Imagine earth is rotating at a very high speed such that weight of a body at the equator is zero. Then number of hours in a day is :

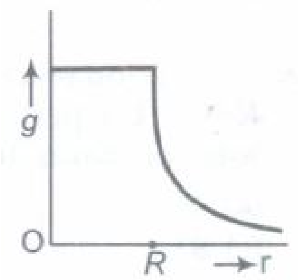
a) $\frac{2\pi}{3600}\sqrt{\frac{g}{R}}$ b) $\frac{2\pi}{3600}\sqrt{\frac{R}{g}}$ c) $\frac{3600}{2\pi}\sqrt{\frac{g}{R}}$ d) $\frac{3600}{2\pi}\sqrt{\frac{R}{g}}$

335. Starting from the centre of the Earth having radius R, the variation of g (acceleration due to gravity) is shown by

a) 

b) 

c) 

d) 

336. Force of gravity is least at:

a) The equator b) The poles c) A point in between equator and any pole

d) None of these

337. A satellite goes along an elliptical path around the earth. The rate of change of arc length swept by the satellite is proportional to:

a) r b) r^2 c) $r^{1/2}$ d) r^{-1}

338. A remote sensing satellite of Earth revolves in a circular orbit at a height of $0.25x10^6$ m above the surface of Earth. If Earth's radius is 6.38x 106 and g=9.8 m/s^2, then the orbital speed of the satellite is:

a) 7.76km/s b) 8.5km/s c) 9.13km/s d) 6.67km/s

339. A satellite of mass m is orbiting around the earth at a height h above the surface of the earth. Mass of the earth is M and its radius is R. The angular momentum of the satellite is independent of:

a) m b) M c) h d) none of these

340. If Rm is the radius of the moon's orbit round the earth, am the acceleration ofthe moon towards the centre of the earth and Re, the radius of the earth, then am is equal to: (if g is the acceleration due to gravity on the surface of the earth)

a) $(\frac{R_e}{R_m})g$ b) $(\frac{R_m}{R_e})g$ c) $(\frac{R_e}{R_m})^2g$ d) $(\frac{R_m}{R_e})^2g$

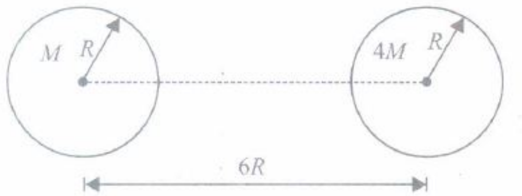
341. Two stars each of mass M and radius R are approaching each other for a head -on collision. They start approaching each other when their separation is r > > R. If their speeds at this separation are negligible, the speed v with which they collide would be

a) $v = \sqrt{GM\left(\frac{1}{R} - \frac{1}{R}\right)}$ b) $v = \sqrt{GM\left(\frac{1}{2R} - \frac{1}{R}\right)}$ c) $v = \sqrt{GM\left(\frac{1}{2R} + \frac{1}{R}\right)}$ d) $v = \sqrt{GM\left(\frac{1}{2R} + \frac{1}{R}\right)}$

342. 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) 44.8 km/s b) 22.4 km/s c) 11.2 km/s (remain unchanged) d) 5.6 km/s

343. Two uniform solid spheres of equal radii R, but mass M and 4M have a centre to centre separation 6R, as shown in figure. A projectile of mass m is projected from the surface of the sphere of mass M directly towards the centre of the second sphere. The minimum speed of the projectile so that it reaches the surface of the second sphere is



a) $\sqrt{\frac{4}{5}\frac{GM}{R}}$ b) $\sqrt{\frac{5}{4}\frac{GM}{R}}$ c) $\sqrt{\frac{3}{5}\frac{GM}{R}}$ d) $\sqrt{\frac{5}{3}\frac{GM}{R}}$

344. The depth at which the value of acceleration due to gravity becomes 1/n times the value at the surface is: (R be the radius of the earth)

a) R/n b) R/n^2 c) R(n-1)/n d) Rn/(n-1) e) Rn

345. The period of revolution of planet A around the Sun is 8 times that of 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

346. Satellites orbiting the earth have a finite life and sometimes debris of satellites fall to the earth. This is because,
a) the solar cells and batteries in satellites run out
b) the laws of gravitation predict a trajectory spiralling inwards
c)
of viscous forces causing the speed of the satellite and hence height to gradually decrease
d) of collisions with other satellites

347. If mass M is split into two parts m and (M - m) which are then separated by a distance, the ratio of $\frac{m}{M}$ that maximises the gravitational force between the two parts is:
a) 1:2 b) 1:1 c) 2:1 d) 1:4

348. Weight of a body of mass m decreases by 1% when it is raised to height h above the earth's surface. Ifthe body is taken to a depth h in a mine, change in its weight is:
a) 2% decrease b) 0.5% decrease c) 1% increase d) 0.5% increase

349. A satellite moves in elliptical orbit about a planet. The maximum and minimum velocities of satellite are 3×10^4 m/s and 1×10^3 m/s 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

350. Two equal masses m and m are hung from a balance whose scale pans differ in vertical height by 'h'. The error in weighing in terms of density of the earth ρ is:
a) π Gpmh b) $\frac{1}{3}\pi$ Gpmh c) $\frac{8}{3}\pi$ Gpmh d) $\frac{4}{3}\pi$ Gpmh

351. For a satellite escape velocity is 11 km/s. If the satellite is launched at an angle of 60° with the vertical, then escape velocity will be :
a) 11 km/s b) $11\sqrt{3}$ km/s c) $11\sqrt{3}$ km/s d) 33 km/s

352. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius 1.0 IR. The time period of the second satellite is larger than that of the first one by approximately:
a) 0.5% b) 1.5% c) 1% d) 3.0%

353. A spaceship is launched into a circular orbit close to the surface of the earth. The additional velocity now imparted to the spaceship in the orbit to overcome the gravitational pull is:
a) 11.2 km/sec b) 8 km/sec c) 3.2 km/sec d) 1.414 x 8 km/sec

354. If the earth be one half its present distance from the sun, number of days in the year will be nearly:
a) 129 b) 30 c) 200 d) 60

355. 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 v_1/v_2 is

a) $(r/r_2)^2$ b) r_2/r_1 c) $(r_1/r_2)^2$ d) r_1/r_2

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

a) Decrease by 2% b) Remain unchanged c) Increase by 2%

d) Increase by 1%

357. In motion of an object under the gravitational influence of another object. Which of the following quantities is not conserved?

a) Angular momentum b) Mass of an object c) Total mechanical energy

d) Linear momentum

358. (A) The plane of the orbit of an artificial satellite must contain the centre of the earth.

(R) For the orbital motion of satellite, the necessary centripetal force is provided by gravitational pull of earth on satellite.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

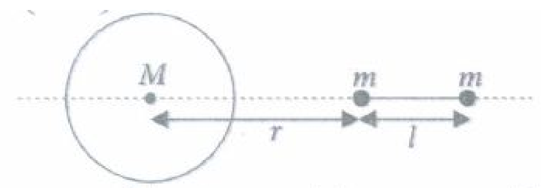
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

359. A large spherical mass M is fixed at one position and two identical point masses m are kept on a line passing through the centre of M (see figure). The point masses are connected by a rigid massless rod of length 1 and this as embly is free to move along the line connecting them. All three masses interact only through their mutual gravitational interaction. When the point mass nearer to M is at a distance r = 3l from M, the tension in the rod is zero for

$m = k\left(\frac{M}{288}\right)$ The value of k is



a) 5 b) 6 c) 7 d) 8

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

a) $3\sqrt{2}$h   b) $1.5\sqrt{2}$h   c) $6\sqrt{2}$h   d) $12\sqrt{2}$h

361. The ratio of the K.E. required to be given to the satellite to escape Earth's gravitational field to the K.E.required to be given so that the satellite moves in a circular orbit just above Earth atmosphere is

a) One   b) Two   c) Half   d) Infinity

362. Consider a satellite going round the Earth in an orbit. Which of the following statements is wrong?

a) It is a freely falling body   b) It suffers no acceleration

c) It is moving with a constant speed   d) Its angular momentum remains constant

363. The escape velocity of a body from the earth depends on

(i) the mass of the body

(ii) the location from where it is projected.

(iii) the direction of projection.

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

a) (i) and (ii)   b) (ii) and (iv)   c) (i) and (iii)   d) (iii) and (iv)

364. A mass m is placed at point P which lies on the axis of a ring of mass Mand radius R at a distance R from its centre. The gravitational force on mass m is

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

365. A man covers 60 metre distance in one minute on the surface of the earth. The distance he will cover on the surface of the moon per minute is: (assuming g_{moon} $\frac{g_{earth}}{6}$)

a) 60 m   b) 60 x 6 m   c) $\frac{60}{6}m$ d) $\sqrt{60}m$

366. If the ratio of radius of the Mars and the earth around the sun is 1.526 then time period of Mars is:

a) 45 year   b) 1.89 year   c) 32 year   d) 48 year

367. A body of mass m falls from a height R above the surface of the earth, where R is the radius of the earth. What is the velocity attained by the body on reaching the ground? (Acceleration due to gravity on the surface of the earth is g)

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

368. A missile launched with a velocity less than escape velocity, the sum of its KE and PE is always:

a) + ve   b) Zero   c) -ve   d) none of these

369. A cosmonaut is orbiting the earth in a space-craft at an altitude h = 630 km with a speed of 8 km/s. If the radius of the earth is 6400 km, the acceleration ofthe cosmonaut is:

a) 9.10 m/s^2 b) 9.80 m/s^2 c) 10.0 m/s^2 d) 9.88 m/s^2

370. (A) The escape velocity of a body of mass m is V_e' The escape velocity of another body of mass 2m for same planet is V_e'

(R) The escape velocity of a body for a given planet is independent of mass of the body.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

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

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

372. As observed from earth, the sun appears to move in an approximate circular orbit. For the motion of another planet like mercury as observed from earth, this would

a) be similarly true

b)
not be true because the force between earth and mercury is not inverse square law

c) not be true because the major gravitational force on mercury is due to sun

d)
not be true because mercury is influenced by forces other than gravitational forces

373. What is the weight of a body at a distance 2r from the centre of the earth if the gravitational potential energy of the body at a distance r from the centre of the earth is U?

a) $\frac{U}{2r}$ b) $\frac{U}{3r}$ c) $\frac{U}{4r}$ d) Ur

374. The dimension of gravitational field is same as that of:

a) momentum b) velocity c) acceleration d) force

375. A satellite of mass m is in a circular orbit of radius $2R_E$ about the earth. The energy required to transfer it to a circular orbit of radius $4R_E$ is (where M_E and R_E is the mass and radius of the earth respectively)

a) $\frac{GM_E m}{2R_E}$ b) $\frac{GM_E m}{4R_E}$ c) $\frac{GM_E m}{8R_E}$ d) $\frac{GM_E m}{16R_E}$

376. A seconds pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket:

a) comes down with uniform acceleration

b) moves round the earth in a geostationary orbit

c) moves up with a uniform velocity d) moves up with uniform acceleration

377. Assertion: The principle of superposition is not valid for gravitational forces.

Reason: Gravitational forces are non-conservative.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

378. Assertion: A central force is such that the force on the planet is along the vector joining the sun and the planet.

Reason: Conservation of angular momentum is valid for any central force.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false d) If both assertion and reason are false

379. The length of a seconds pendulum on the earth when g is 9.8 m/s^2 is I m. The length of a seconds pendulum on a planet, where g = 4.9 m/s^2 , will be:

a) 1 m b) 2 m c) 0.5 m d) 0.25 m

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

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

381. An 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 Hooke's law. c) Less than 5 kg-wt

d) More than 5 kg-wt

382. The distances of two planets from the sun are 10^{13} and 10^{12} m respectively. The ratio of time periods of these two planets is_____

a) $\frac{1}{\sqrt{10}}$ b) 100 c) $10\sqrt{10}$ d) $\sqrt{10}$

383. The mass of the earth is 6 x 10^{24} kg and that of the moon is 7.4 x 10^{22} kg. The potential energy of the system is -7.79 x 10^{28} J. The mean distance between the earth and moon is

(G = 6.67 x 10^{-11} N m^2kg^{-2})

a) 3.8 x 10^8 m b) 3.37 x 10^6 m c) 7.60 x 10^4 m d) 1.9 x 10^2 m

384. If an artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of the escape velocity from the earth, the height of the satellite above the surface of the earth is:

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

385. Satellite A of mass m is revolving round the Earth at a height 'r' from the centre. Another satellite B of mass 2 m is revolving at a height 2r. The ratio of their time periods will be:

a) 1 : 2 b) 1 : 16 c) 1 : 32 d) $1:2\sqrt{2}$

386. The change in PE of a body of mass m placed on the earth when it is taken to a height of R (R = radius of the earth) above the earth surface:

a) mgR b) mgR/2 c) 3mgR/4 d) 2/3 mgR

387. A particle of mass 1 kg is placed at a distance of 4 m from the centre and on the axis of a uniform ring of mass 5 kg and radius 3m. Calculate the work required to be done to increase the distance of the particle from 4 m to $3\sqrt{3}$ m.

a) $\frac{5G}{6}J$ b) $\frac{G}{6}J$ c) $\frac{3G}{2}J$ d) $\frac{2G}{3}J$

388. Two satellites A and B go around the earth in circular orbits at heights of R_A and R_B respectively from the surface of the earth. Assuming the earth to be a uniform sphere of radius R_e, the ratio ofthe magnitudes of their orbital velocities is:

a) $\sqrt{\frac{R_B}{R_A}}$ b) $\frac{R_B+R_e}{R_A+R_e}$ c) $\sqrt{\frac{R_B+R_e}{R_A+R_e}}$ d) $(\frac{R_A}{R_B})^2$

389. 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) $\sqrt{2Emr^2}$ d) $\sqrt{2Emr}$ e) $\sqrt{\frac{E}{2mr^2}}$

390. The density of core of a planet ρ_1 is and that of the outer shell is Pz. The radii of core and that of the planet are R and 2R respectively. Gravitational acceleration at the surface of planet is same as at a depth. The ratio between $\frac{\rho_1}{\rho_2}$.

a) 2.3 b) 4.5 c) 3.2 d) 5.4

391. 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 $\left(\frac{1}{3}\right)^{rd}$ of the force between Band C. Then the distance of C from A is:

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

392. The force on a 1 kg mass on the earth of radius R is 10 N. Then, the force on a satellite revolving around the earth in the mean orbit of radius 3RI2 will be: (mass of satellite is 100 kg)

a) 4.44 x 10^2 N b) 6. 66 x 10^2 N c) 500 N d) 3.33 x 10^2 N

393. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 m/s. To give an initial upward acceleration of 20 m/s^2, the amount of gas ejected per second to supply the needed thrust will be: (Take g =10 m/s^2)

a) 127.5 kg/s b) 187.5 kg/s c) 185.5 kg/s d) 137.5 kg/s

394. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth is R, the radius of the planet would be____

a) 1/2 R b) 2R c) 4R d) 1/4 R

395. A planet revolves around the sun in an elliptical orbit. If v_p and v_a are the velocities of the planet at the perigee and apogee respectively, then the eccentricity of elliptical orbit is given by

a) $\frac{v_p}{v_a}$ b) $\frac{v_p}{v_a}$ c) $\frac{v_p+v_a}{v_p-v_a}$ d) $\frac{v_p-v_a}{v_p+v_a}$

396. If a man at the equator would weigh (3/5) th of his weight, the angular speed of the earth is:

a) $\sqrt{\frac{2g}{5R}}$ b) $\sqrt{\frac{g}{R}}$ c) $\sqrt{\frac{R}{g}}$ d) $\sqrt{\frac{2R}{5g}}$

397. Suppose ge b_e the acceleration due to gravity at the equator and g_p be that at the poles. Assuming the earth to be a sphere of radius Re rotating about its own axis with angular speed ω, then (g_p - g_e) is given by:

a) ω^2/R_e b) $R_e\omega^2$ c) $\omega^2R_e^2$ d) ω^2/R_e^2

398. A ball of mass m is fired vertically upwards from the surface of the earth with velocity nV_e-, where V_e is the escape velocity and n < 1. Neglecting air resistance, to what height will the ball rise? (Take radius of the earth = R)

a) R/n^2 b) R/(1- n^2) c) Rn^2/(1-n^2) d) Rn^2

399. Average distance of the earth from the sun is L_1 If one year of the earth = D days, one year of another planet whose average distance from the sun is L_2 will be

a) $D\left(\frac{L_2}{L_1}\right)^{1/2}$ days b) $D\left(\frac{L_2}{L_1}\right)^{3/2}$ days c) $D\left(\frac{L_2}{L_1}\right)^{2/3}$ days d) $D\left(\frac{L_2}{L_1}\right)$ days

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

a) $\frac{4\pi G}{3gR}$ b) $\frac{3\pi G}{4gR}$ c) $\frac{3g}{4\pi RG}$ d) $\frac{\pi Rg}{12G}$