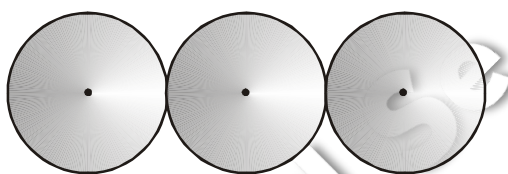


EXERCISE

Multiple choice questions

- Two metal spheres of equal radius r and equal densities are touching each other. The force of attraction F between them is
 - $F \propto r^4$
 - $F \propto r^6$
 - $F \propto r^2$
 - $F \propto \frac{1}{r^2}$
- Two bodies 'A' and 'B' having masses ' m ' and ' $2m$ ' respectively are kept at a distance ' d ' apart. A small particle is to be placed so that the net gravitational force on it, due to the bodies A and B, is zero. Its distance from the mass A should be
 - $x = \frac{d}{1 + \sqrt{2}}$
 - $x = \frac{d}{1 + \sqrt{4}}$
 - $x = \frac{d}{1 + \sqrt{3}}$
 - $x = \frac{d}{1 + \sqrt{6}}$
- Three uniform spheres each of mass ' m ' and radius ' r ' are placed in contact as shown. Find net force of gravitation on second sphere.

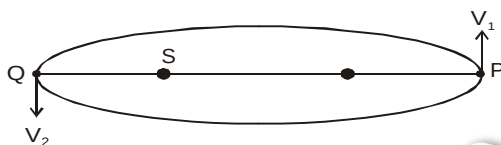


- $\frac{5Gm^2}{16r^2}$
 - $\frac{Gm^2}{16r^2}$
 - zero
 - $\frac{Gm^2}{r^2}$
- Find the separation between two massive particles each of mass 5 mg if they experience a gravitational force of 6.66 dyne.
 - 5 mm
 - 5 μm
 - 5 nm
 - 5 cm
 - An apple falls towards the earth because the earth attracts it. The apple also attracts the earth by the same force. Why do we not see the earth rising towards the apple ?
 - Acceleration of the earth is very large when compared to that of apple
 - Acceleration of the earth is equal to that of apple
 - Acceleration of the earth is very small when compared to that of apple
 - None of these
 - 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
 - $\frac{F}{3}$
 - $\frac{F}{9}$
 - $3F$
 - F
 - Gravitational force is a
 - long range attractive force
 - long range repulsive force
 - short range repulsive force
 - short range attractive force
 - If the distance between the earth and moon is reduced to half of its original, the gravitational force between them will the existing force.
 - become 2 times
 - become 8 times
 - become 4 times
 - become 6 times
 - The gravitational force of attraction between two bodies at a certain distance is 70 N. If the distance of separation between them is doubled, then find the percentage change in force of attraction.
 - Decreases by 25 %
 - Decreases by 75 %
 - Increases by 50 %
 - Increases by 75 %

10. Calculate the force of gravity between a 3 kg newborn baby and a 75 kg doctor standing 1 m away.
 (1) 3.5×10^{-7} N (2) 6×10^{-4} N (3) 2×10^{-6} N (4) 1.5×10^{-8} N
11. The centripetal force on a satellite revolving around the earth is F . The gravitational force of the earth is also F . The net force on the satellite is
 (1) $2F$ (2) zero (3) F (4) $F/2$
12. According to Kepler's third law, the orbital period T of a planet around the Sun varies with its mean distance r from the Sun as

- (1) r^2 (2) $\frac{1}{r^2}$ (3) $r^{\frac{3}{2}}$ (4) $r^{\frac{-3}{2}}$

13. The figure shown below is an elliptical orbit along which a planet revolves round the sun. Let the velocity of planet at P and Q positions be V_1 and V_2 respectively. Then, the possible relationship between magnitudes of V_1 and V_2 is



- (1) $V_1 < V_2$ (2) $V_1 = V_2$ (3) $V_1 > V_2$ (4) Cannot be determined
14. Which of the following statements are true ?
 (i) The orbit of a planet is elliptical with the sun at one of its foci.
 (ii) The line joining the planet and the sun sweeps equal areas in equal intervals of time.
 (iii) The square of the mean distance of a planet from the sun is proportional to the cube of its orbital period.
 (1) Only (i) and (ii) (2) Only (ii) and (iii) (3) Only (i) and (iii) (4) (i), (ii) and (iii)
15. If the distance between the earth and the sun were half the present value then the number of days in a year would have been
 (1) 64.5 (2) 129 (3) 182.5 (4) 730
16. If the radius of the earth were to be increased by a factor of 3, by what factor would its density have to be changed to keep 'g' the same ?
 (1) 3 (2) $1/3$ (3) 6 (4) $1/6$
17. A body weighs 900 N on the earth. Find its weight on a planet whose density is $\frac{1}{3}$ rd the density of earth and radius is $\frac{1}{4}$ th that of the earth.
 (1) 75 N (2) 500 N (3) 62 N (4) 320 N
18. If the radius of the earth reduces by half of the value of the present radius and mass remains same, the acceleration due to gravity
 (1) decreases 4 times (2) remains constant (3) increases 4 times (4) decreases 2 times
19. The mass and diameter of a planet are two times those of Earth. If a seconds pendulum is taken to it, the time period of the pendulum in seconds is
 (1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{2}$ (3) 2 (4) $2\sqrt{2}$
20. 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 earth is R , the radius of planet would be
 (1) $\frac{R}{4}$ (2) $\frac{R}{2}$ (3) $2R$ (4) $4R$

21. If G is universal gravitational constant and g is acceleration due to gravity, then the unit of the quantity $\frac{G}{g}$ is
 (1) kg-m^2 (2) kg/m (3) kg/m^2 (4) m^2/kg
22. The acceleration due to gravity g and mean density of earth ρ are related by which of the following relations ?
 [G = gravitational constant and R = radius of earth]
 (1) $\rho = \frac{4\pi g R^2}{3G}$ (2) $\rho = \frac{4\pi g R^3}{3G}$ (3) $\rho = \frac{3g}{4\pi G R}$ (4) $\rho = \frac{3g}{4\pi G R^3}$
23. A spherical planet, far out in space, has a mass M_0 and diameter D_0 . A particle of mass m falling freely near the surface of this planet will experience acceleration due to gravity which is equal to
 (1) $\frac{GM_0}{D_0^2}$ (2) $\frac{4mGM_0}{D_0^2}$ (3) $\frac{4GM_0}{D_0^2}$ (4) $\frac{Gm}{D_0^2}$
24. **Assertion** : When a body is thrown up, the acceleration due to gravity at the topmost point is zero.
Reason : The acceleration due to gravity is always directed downwards towards the centre of the earth for a freely falling body.
 (1) Both assertion and reason are correct and reason is the correct explanation of assertion.
 (2) Both assertion and reason are true but reason is not the correct explanation of assertion.
 (3) Assertion is true but reason is false.
 (4) Assertion is false but reason is true.
25. A food packet is released from a helicopter which is rising steadily at 3 ms^{-1} . After two seconds how far is the food packet below the helicopter?
 (1) 9.8 m (2) 19.6 m (3) 29.4 m (4) 39.2 m
26. A particle is projected vertically upwards from a point A on the ground. It takes t_1 seconds to reach a point B at a height 'h' from A but still continues to move up. If it takes further t_2 seconds from B to the ground again, then find maximum height reached.
 (1) $\frac{g(t_1 + t_2)^2}{2}$ (2) $\frac{g(t_1 + t_2)^2}{4}$ (3) $\frac{g(t_1 + t_2)^2}{6}$ (4) $\frac{g(t_1 + t_2)^2}{8}$
27. A stone is dropped into a well in which the level of water is h below the top of the well. If 'v' is velocity of sound, the time T after which the splash is heard is given by
 (1) $T = \frac{2h}{v}$ (2) $T = \sqrt{\frac{2h}{g}} + \frac{h}{v}$ (3) $T = \sqrt{\frac{2h}{v}} + \frac{h}{g}$ (4) $T = \sqrt{\frac{h}{2g}} + \frac{2h}{v}$
28. If we neglect the air resistance, the time taken by a freely falling body to reach the ground will not depend upon
 (1) Height of free fall (2) Acceleration due to gravity
 (3) Mass of the body (4) Speed with which body strikes the ground
29. Two rubber balls of the same size are both dropped on the Earth and on the Moon. One ball is solid, and one is hollow. The approximate gravitational field strength on the Earth is 10 N/kg and on the moon is 1.7 N/kg. Which ball has the greatest force acting on it ?
- | Type of ball | Where dropped |
|--------------|---------------|
| (1) Hollow | On the Earth |
| (2) Hollow | On the Moon |
| (3) Solid | On the Earth |
| (4) Solid | On the Moon |
30. A particle is taken to a height of $2R_e$ above the earth's surface, where R_e is the radius of the earth. If it is dropped from this height, its acceleration will be
 (1) 3.1 m/s^2 (2) 5.1 m/s^2 (3) 1.1 m/s^2 (4) 2.1 m/s^2

31. Variation of 'g' w.r.t. height or depth is correctly represented by



32. If the change in the value of 'g' at a height h above the surface of the earth is the same as at a depth x below it, when both x and h are much smaller than the radius of the earth, then the relation between x and h is
 (1) $x = h$ (2) $x = 2h$ (3) $x = 3h$ (4) $x = 4h$

33. At what height should a body be taken above the surface so that the acceleration due to gravity becomes 1% of its value at the surface of the earth (of radius R) ?

- (1) $4R$ (2) $6R$ (3) $9R$ (4) $100R$

34. **Assertion :** A tennis ball bounces higher on hills than in plains.

Reason : Acceleration due to gravity on the hill is greater than that on the surface of earth.

- (1) Both assertion and reason are correct and reason is the correct explanation of assertion.
 (2) Both assertion and reason are true but reason is not the correct explanation of assertion.
 (3) Assertion is true but reason is false.
 (4) Assertion is false but reason is true.

35. How much below from the surface of the earth does g become half of its value at the earth's surface? (Assume earth to be a homogeneous sphere of radius R meter)

- (1) R (2) $\frac{R}{2}$ (3) $2R$ (4) $\frac{R}{4}$

36. If ' R ' is the radius of earth, the height at which the weight of a body becomes $\frac{1}{4}$ th of its weight on the surface of the earth is

- (1) $2R$ (2) R (3) $\frac{R}{2}$ (4) $\frac{R}{4}$

37. Purchasing 1 kilogram of sugar will be profitable at

- (1) equator (2) poles (3) at $27\frac{1}{2}^\circ$ latitude (4) $57\frac{1}{2}^\circ$ latitude

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

- (1) 1 (2) 2 (3) 3 (4) 4

39. At what height is the value of 'g' half that on the surface of earth ? (R = radius of the earth)

- (1) $0.414R$ (2) R (3) $2R$ (4) $3.5R$

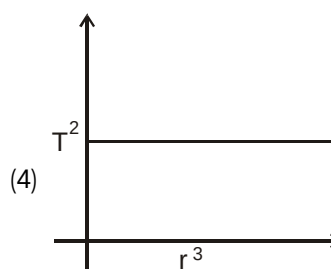
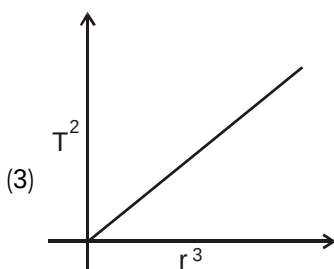
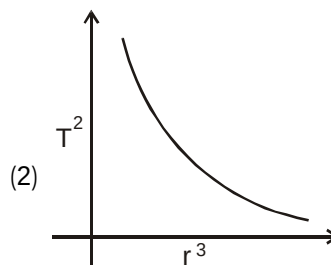
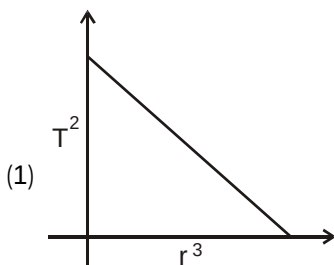
40. A body is taken to a height of $(\sqrt{2} - 1) R_e$ above the earth's surface, where R_e is the radius of the earth. If it is dropped from this height, its acceleration will be :

- (1) 9.8 m/s^2 (2) 6.5 m/s^2 (3) 4.9 m/s^2 (4) 2.5 m/s^2

41. A spring balance is graduated on sea level. A body of mass 1 kg is weighed at consecutively increasing heights from the earth's surface, then what would be the weight indicated by the balance ?

- (1) Weight will go on increasing continuously (2) Weight will go on decreasing continuously
 (3) Weight will remain same (4) Weight will first increase and then decrease

42. 1 kg wt is equal to
(1) 9.8 N (2) 980 N (3) 98 N (4) none of these
43. The mass of a body at the centre of Earth is
(1) zero (2) unity (3) remains unchanged (4) infinity
44. The weight of a rock on the moon is 200.6 N. What is its mass on the earth ?
(Take g of earth = 9.8 m s^{-2} , g of moon = 1.7 m s^{-2})
(1) 20 kg (2) 118 kg (3) 200 kg (4) 1180 kg
45. A man of weight W is standing on a lift which is moving upwards with an acceleration ' a '. The apparent weight of the man is
(1) $W\left(1 + \frac{a}{g}\right)$ (2) $W\left(1 - \frac{a}{g}\right)$ (3) $W\left(1 - \frac{a^2}{g^2}\right)$ (4) W
46. If the earth loses its gravity, then for a body
(1) Weight becomes zero but not the mass (2) Mass becomes zero but not the weight
(3) Both mass and weight becomes zero (4) Neither mass nor weight becomes zero
47. A person in a lift will experience weightlessness when the lift moves :
(1) down with an acceleration equal to ' g '
(2) up with an acceleration equal to ' g '
(3) up with a constant velocity
(4) down with an acceleration equal to ' $g/6$ '
48. **Assertion** : If an earth satellite moves to a lower orbit, the speed of satellite increases.
Reason : The speed of satellite is a constant quantity for all orbits of earth.
(1) Both assertion and reason are correct and reason is the correct explanation of assertion.
(2) Both assertion and reason are true but reason is not the correct explanation of assertion.
(3) Assertion is true but reason is false.
(4) Assertion is false but reason is true.
49. 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 in the earlier orbit. The time period in the second orbit is
(1) 4.8 hours (2) $48\sqrt{2}$ hours (3) 24 hours (4) $24\sqrt{2}$ hours
50. Which of the following graphs is true for the motion of a satellite revolving round the earth ? (' T ' is the time period of a satellite and ' r ' is the distance of the satellite from the centre of earth)



51. A satellite goes round the earth along a circular path with its centre at the centre of the earth and the radius equal to the distance between the centre of the earth and the satellite. If M is mass of the earth, r is radius of the circular path and G is universal gravitational constant, the period of revolution of the satellite will be
- (1) $2\pi\sqrt{\frac{r^3}{GM}}$ (2) $2\pi\sqrt{\frac{GM}{r^3}}$ (3) $2\pi\sqrt{GMr^3}$ (4) zero
52. The period of a satellite in a circular orbit around a planet is independent of
- (1) The mass of the planet (2) The radius of the planet
(3) The mass of the satellite (4) All of the above
53. The ratio of time periods of two satellites revolving around the earth in the orbits of radii 1 : 4 will be
- (1) 1 : 4 (2) 4 : 1 (3) 1 : 8 (4) 8 : 1
54. **Assertion** : The time period of geostationary satellite is 24 hours.
Reason : Geostationary satellite must have the same time period as the time taken by the earth to complete one rotation about its axis.
- (1) Both assertion and reason are correct and reason is the correct explanation of assertion.
 (2) Both assertion and reason are true but reason is not the correct explanation of assertion.
 (3) Assertion is true but reason is false.
 (4) Assertion is false but reason is true.
55. The escape velocity of a particle of mass m varies as
- (1) m^2 (2) m (3) m^{-1} (4) m^0
56. The escape velocity from the earth's surface is V_e . The velocity of a satellite while orbiting just above the earth's surface is V_0 . Then the relation between these velocities is
- (1) $V_e = \sqrt{2}V_0$ (2) $V_e = \frac{1}{\sqrt{2}}V_0$ (3) $V_e = V_0$ (4) $V_e = 2V_0$
57. **Assertion** : Two different planets have same escape velocity.
Reason : Value of escape velocity is a universal constant.
- (1) Both assertion and reason are correct and reason is the correct explanation of assertion.
 (2) Both assertion and reason are true but reason is not the correct explanation of assertion.
 (3) Assertion is true but reason is false.
 (4) Assertion is false but reason is true.
 (5) Both assertion and reason are false.
58. Knowing that the mass of moon is $1/81$ times that of earth and its radius is $1/4$ the radius of earth. If the escape velocity at the surface of the earth is 11.2 km/s, then the value of escape velocity at the surface of the moon is
- (1) 2.5 km/s (2) 0.14 km/s (3) 5 km/s (4) 8 km/s
59. Time period of a simple pendulum in a satellite is
- (1) infinite (2) zero (3) 2 sec (4) cannot be calculated
60. Reason of weightlessness in a satellite is
- (1) Zero gravity (2) No atmosphere
(3) Zero reaction force by satellite surface (4) None of the above

ANSWERS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	1	3	2	3	4	1	3	2	4	3	3	1	1	2	2	1	3	4	2
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	4	3	3	4	2	4	2	3	3	3	2	2	3	3	2	2	1	2	1	3
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	1	3	2	1	1	1	3	2	3	1	3	3	1	4	1	5	1	1	3