1.

A satellite is moving very close to a planet of density ρ. The time period of the satellite is:

1. $\sqrt{\frac{3\pi}{\rho G}}$ 2. $\left(\frac{3\pi}{\rho G}\right)^{3/2}$

3. $\sqrt{\frac{3\pi}{2\rho G}}$ 4. $\left(\frac{3\pi}{2\rho G}\right)^{3/2}$

2.

The gravitational potential difference between the surface of a planet and 10 m above is 5 J/kg. If the gravitational field is supposed to be uniform, the work done in moving a 2 kg mass from the surface of the planet to a height of 8 m is

1. 2 J 2. 4 J

3. 6 J 4. 8 J

3.

A planet is moving in an elliptical orbit. If *T*, *V*, *E* and *L* stand, respectively, for its kinetic energy, gravitational potential energy, total energy and angular momentum about the centre of force, then

1. T is conserved
2. V is always positive
3. E is always negative
4. magnitude of *L* is conserved but its direction changes continuously

4.

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

1. $-\frac{4Gm}{r}$ 2. $-\frac{6Gm}{r}$

3. $-\frac{9Gm}{r}$ 4. zero

5.

The satellite of mass *m* orbiting around the earth in a circular orbit with a velocity *v*. The total energy will be:

1. $\frac{3}{4}mv^2$ 2. $\frac{1}{2}mv^2$

3. $-\frac{1}{2}mv^2$ 4. mv^2

6.

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

1. Energy 2. Linear momentum
3. Angular momentum 4. Mass

7.

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

8.

The escape velocity for a rocket from earth is 11.2 *km*/*sec*. Its value on a planet where acceleration due to gravity is double that on the earth and diameter of the planet is twice that of earth will be in *km*/*sec*

(a)11.2 (b)5.6

(c)22.4 (d)53.6

9.

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

(a)gr (b)$\sqrt{2gr}$

(c)g/r (d)r/g

10.

The escape velocity of a particle of mass *m* varies as

(a)m^2 (b)m

(c)m^0 (d)m^{-1}

11.

The time period of a simple pendulum on a freely moving artificial satellite is

(a) Zero (b) 2 sec

(c) 3 sec (d) Infinite

12.

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

(a) $v = R\sqrt{\frac{8\pi}{3}Gp}$ (b) $v = M\sqrt{\frac{8\pi}{3}GR}$

(c) $v = \sqrt{2GMR}$ (d) $v = \sqrt{\frac{2GM}{R^2}}$

13.

If radius of earth is R then the height h' at which value of 'g' becomes one-fourth is

(a) $\frac{R}{4}$ (b) $\frac{3r}{4}$

(c) R *(d)* $\frac{R}{8}$

14.

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

(a) $0.2R_\varepsilon$ (b) $2R_\varepsilon$

(c) $0.5R_\varepsilon$ (d) $5R_\varepsilon$

15.

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

(a) $\sqrt{3}V_e$ (b) $3\ V_e$

(c) $\sqrt{2}V_e$ (d) $2\ V_e$

16.

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

17.

A body of mass m is taken to the bottom of a deep mine. Then

(a) Its mass increases

(b) Its mass decreases

(c) Its weight increases

(d) Its weight decreases

18.

How many times is escape velocity, of orbital velocity for a satellite revolving near earth ?

(a) $\sqrt{2}$ *times* (b) 2 *times*

(c) 3 *times* (d) 4 *times*

19.

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

(a) Viscous forces (b) Archimedes uplift

(c) Electrostatic force (d) None of the above

20.

The acceleration due to gravity near the surface of a planet of radius R and density d is proportional to

(a) $\frac{d}{R^2}$ (b) dR^2

(c) dR (d) $\frac{d}{r}$

21.

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

(a) $V_e \propto pR$ (b) $V_e \propto R\sqrt{\rho}$

(c) $V_e \propto \frac{\sqrt{p}}{R}$ (d) $V_e \propto \frac{1}{\sqrt{p}R}$

22.

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

(a) Is doubled (b) Becomes four times

(c) Is reduced to half (d) Is reduced to a quarter

23.

The depth at which the effective value of acceleration due to gravity is $\frac{g}{4}$ is

(a) R (b) $\frac{3R}{4}$

(c) $\frac{R}{2}$ (d) $\frac{R}{4}$

24.

If both the mass and the radius of the earth decrease by 1%, the value of the acceleration due to gravity will

(a) Decrease by 1% (b) Increase by 1%

(c) Increase by 2% (d) Remain unchanged

25.

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

(a) $4\pi G/3gR$ (b) $3\pi R/4gG$

(c) $3g/4\pi RG$ (d)$\pi RG/12G$

26.

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

(a) 3:1 (b) 1:2

(c) 1:1 (d) 2:1

27.

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

(a) 2 (b) $\frac{1}{2}$

(c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}$

28.

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

(a) zero (b) $\frac{3GM}{L^2}$

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

29.

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

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

(c) zero (d) $\sqrt{32}\frac{GM}{L}$

30.

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

(a) Zero (b) F

(c) $F\sqrt{2}$ (d) 2 F

31.

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

1. R/4
2. R
3. 3R/8
4. R/2

32.

The escape velocity of a sphere of mass m is given by (G = universal gravitational constant, M_e= mass of earth and R_e= radius of earth)

(1) $\sqrt{\frac{GM_e}{R_e}}$

(2) $\sqrt{\frac{2GM_e}{R_e}}$

(3) $\sqrt{\frac{2Gm}{R_e}}$

(4) $\frac{GM_e}{R_e}$

33.

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 2 m on the surface of A. What is the height jumped by the same person on the planet B?

(1) $\frac{2}{9}\ m$

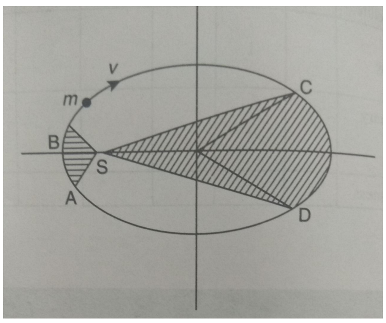
(2) 18 m

(3) 6 m

(4) $\frac{2}{3}\ m$

34.

The figure shows the elliptical orbit of a planet m about the sun S. The shaded area SCD is twice the shaded area SAB. If t_1 is the time for the planet to move from A and B, and t_2 is the time for the planet to move from C to D, then



(1) $t_1 = 4t_2$

(2) $t_1 = 2t_2$

(3) $t_1 = \frac{t_2}{2}$

(4) $t_1 > t_2$

35.

The radius 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

(1) $\frac{3v}{2}$

(2) $\frac{3v}{4}$

(3) 6v

(4) 12v

36.

A particle of mass M is situated at the center of a spherical shell of the same mass and radius a. The magnitude of the gravitational potential at a point situated at $\frac{a}{2}$ distance from the center will be

(1) $-\frac{GM}{a}$

(2) $-\frac{2GM}{a}$

(3) $-\frac{3GM}{a}$

(4) $-\frac{4GM}{a}$

37.

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 the Earth, is

(1) $\sqrt{\frac{2gM}{R^2}}$

(2) $\sqrt{\frac{2GM}{R}}$

(3) $\sqrt{\frac{2GM}{R^2}}$

($) $\sqrt{2gR^2}$

38.

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

(1) 3R

(2) 4R

(3) 5R

(4) 1R

39.

A body of mass 'm' is taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change in potential energy of body will be

(1) -mg2R

(2) $-\frac{2}{3}mgR$

(3)- 3mgR

(4) $-\frac{1}{3}mgR$

40.

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,

(1) the acceleration of S is always directed towards the center of the earth

(2) the angular momentum of S about the center of the earth changes in direction, but its magnitude remains constant

(3) the total mechanical energy of S varies periodically with time

(4) the linear momentum of S remains constant in magnitude

41.

At what height from the surface of earth the gravitation potential and the value of g are $-5.4 \times 10^7\ Jkg^{-1}\ and\ 6.0\ ms^{-2}$ respectively? (Take the radius of earth as 6400 km).

(1) 1400 km

(2) 2000 km

(3) 2600 km

(4) 1600 km

42.

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

(1) 1 : 4

(2) $1\ :\ \sqrt{2}$

(3) 1 : 2

(4) $1 \ : \ 2\sqrt{2}$

43.

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

(1) d = 1 km

(2) $d = \frac{3}{2} \ km$

(3) d = 2 km

(4) $d = \frac{1}{2} \ km$

44.

Two astronauts are floating in gravitational free space after having lost contact with their spaceship. The two will

(1) move towards each other

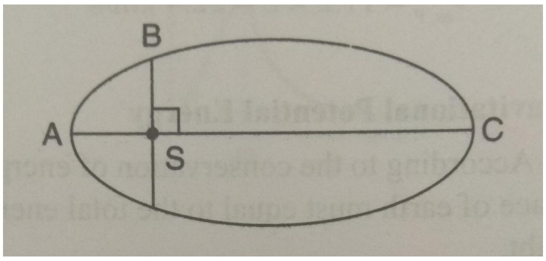
(2) move away from each other

(3) will become stationary

(4) keeping floating at the same distance between them.

45.

The kinetic energies of a planet in an elliptical orbit about the Sun, at position A, B and C are $K_A, \ K_B \ and \ K_C$ respectively. AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then



(1) $K_B < K_A < K_C$

(2) $K_A > K_B > K_C$

(3) $K_A < K_B < K_C$

(4) $K_B > K_A > K_C$

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