JEE MAIN : CHAPTER WISE TEST PAPER-9

SUBJECT :- PHYSICS **DATE.....**
CLASS :- 11th **NAME.....**
CHAPTER :- GRAVITATION **SECTION.....**

(SECTION-A)

1. A mass M splits into two parts m and (M – m), which are then separated by a certain distance. What ratio (m/M) maximies the gravitational force between the parts ?

(A) $\frac{2}{3}$ (B) $\frac{3}{4}$ (C) $\frac{1}{2}$ (D) $\frac{1}{3}$

2. An object is placed at a distance of R/2 from the centre of earth. Knowing mass is distributed uniformly, acceleration of that object due to gravity at that point is: (g = acceleration due to gravity on the surface of earth and R is the radius of earth)

(A) g (B) 2 g
(C) g/2 (D) none of these

3. A planet is moving in an elliptic orbit. If T, V, E, L stand respectivley for its kinetic energy, gravitational potential energy, total energy and magnitude of angular momentum about the centre of force, which of the following statements is correct

(A) T is conserved
(B) V is always positive
(C) E is always negative
(D) L is conserved but the direction of vector $\vec{L}$ changes continuously

4. Two satellites S_1 and S_2 revolve round a planet in the same direction in circular orbits. Their period of revolution are 1 hour and 8 hour respectively. The radius of S_1 is 10^4 km. The velocity of S_2 with respect to S_1 will be

(A) $\pi \times 10^4$ km/hr (B) $\pi/3 \times 10^4$ km/hr
(C) $2\pi \times 10^4$ km/hr (D) $\pi/2 \times 10^4$ km/hr

5. The mass and radius of earth and moon are M_1, R_1 and M_2, R_2 respectively. Their centres are d distance apart. With what velocity should a particle of mass m be projected from the mid point of their centres so that it may escape out to infinity.

(A) $\sqrt{\frac{G(M_1+M_2)}{d}}$ (B) $\sqrt{\frac{2G(M_1+M_2)}{d}}$

(C) $\sqrt{\frac{4G(M_1+M_2)}{d}}$ (D) $\sqrt{\frac{GM_1M_2}{d}}$

6. The escape velocity from the earth does not depend upon

(A) mass of earth
(B) mass of the body
(C) radius of earth
(D) acceleration due to gravity

7. A particle is projected vertically upwards from the surface of the earth (radius R_e) with a speed equal to one fourth of escape velocity. The maximum height attained by it from the surface of the earth is

(A) $\frac{R_e}{5}$ (B) $\frac{R_e}{10}$ (C) $\frac{R_e}{15}$ (D) $\frac{R_e}{20}$

8. Let gravitation field in a space be given as E = – (k/r). If the reference point is at d_i where potential is V_i then relation for potential is :

(A) $V = k \log \frac{1}{V_i} + 0$ (B) $V = k \log \frac{r}{d_i} + V_i$

(C) $V = \log \frac{r}{d_i} + kV_i$ (D) $V = \log \frac{r}{d_i} + \frac{V_i}{k}$

9. Which of the following quantity is conserved for a satellite revolving around the earth in particular orbit?

(A) Angular velocity (B) Force
(C) angular momentum (D) Velocity

10. A uniform circular ring of radius R is fixed in plane. A particle is placed on the axis of the ring at a distance much greater than R and allowed to fall towards the ring under the influence of the ring's gravity. The particle achieves a maximum speed v. The ring is replaced with one of the same (linear) mass density but radius 2R, and the experiment is repeated. What is the new maximum speed of the particle ?

(A) $\frac{1}{2}v$ (B) $\frac{1}{\sqrt{2}}v$ (C) v (D) $\sqrt{2}\,v$

11. Acceleration due to gravity on a planet is 10 times the value on the earth. Escape velocity for the planet and the earth are V_p and V_e respectively Assuming that the radii of the planet and the earth are the same, then

(A) $V_P = 10\ V_e$ (B) $V_P = \sqrt{10}\ V_e$

(C) $V_P = \frac{V_e}{\sqrt{10}}$ (D) $V_P = \frac{V_e}{10}$

12. The escape velocity from a planet is v_0. The escape velocity from a planet having twice the radius but same density will be
(A) $0.5\,v_0$ (B) v_0 (C) $2v_0$ (D) $4v_0$

13. A body starts from rest at a point, distance R_0 from the centre of the earth of mass M, radius R. The velocity acquired by the body when it reaches the surface of the earth will be
(A) $GM\left(\frac{1}{R}-\frac{1}{R_0}\right)$ (B) $2\,GM\left(\frac{1}{R}-\frac{1}{R_0}\right)$
(C) $\sqrt{2GM\left(\frac{1}{R}-\frac{1}{R_0}\right)}$ (D) $2GM\sqrt{\left(\frac{1}{R}-\frac{1}{R_0}\right)}$

14. A satellite revolving in a circular equatorial orbit from west to east appears over a certain point on the equator every 8 hours. Therefore it's period is
(A) 16 hr (B) 8 hr
(C) 6 hr (D) 32 hr

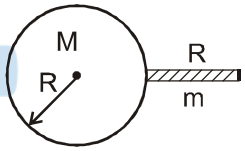
15. Periodic-time of satellite revolving around the earth is - (ρ is density of earth)
(A) Proportional to $\frac{1}{\rho}$
(B) Proportional to $\frac{1}{\sqrt{\rho}}$
(C) Proportional ρ
(D) does not depend on ρ.

16. In case of an orbiting satellite if the radius of orbit is decreased :
(A) its Kinetic Energy decreases
(B) its Potential Energy increase
(C) its Mechanical Energy decreases
(D) its speed decreases

17. In case of earth :
(A) field is zero, both at centre and infinity
(B) potential is zero, both at centre and infinity
(C) potential is same, both at centre and infinity but not zero
(D) potential is maximum at the centre

18. Two particles are held in equilibrium by the gravitational and electrostatic forces between them. Particle-A has mass m_a and charge q_a. Particle-B has mass m_b and charge q_b. The distance between the charges is d. Which of the following changes may cause the charges to accelerate towards one another ?
(A) m_a is doubled and m_b is halved.
(B) m_a is double and m_b is doubled.
(C) q_a is doubled and q_b is doubled.
(D) d is doubled.

19. A uniform thin rod of mass m and length R is placed normally on surface of earth as shown. The mass of earth is M and its radius is R. Then the magnitude of gravitational force exerted by earth on the rod is



(A) $\frac{GMm}{2R^2}$ (B) $\frac{GMm}{4R^2}$
(C) $\frac{4GMm}{9R^2}$ (D) $\frac{GMm}{8R^2}$

20. An object is projected vertically up from the earth's surface with velocity $\sqrt{Rg}$ where R is the radius of the earth and 'g' is the acceleration due to earth on the surface of earth. The maximum height reached by the object.
(A) R (B) 2R (C) 3R (D) 4R

(SECTION-B)

21. Assuming that the law of gravitation is of the form $F = \frac{GMm}{r^3}$ and attractive. A body of mass m revolves in a circular path of radius r around a fixed body of mass M. Find on what power of r will the square of time period depend.

22. Two planets of same density and with radii R_1 and R_2 such that $R_1 = 2R_2$ have gravitation field on the surface g_1 and g_2 and escape velocities v_1 and v_2 respectively. Then find the value of $\frac{v_1}{v_2}$.

23. A body is projected horizontally near the surface of the earth with $\sqrt{1.5}$ times the orbital velocity. The maximum height up to which it will rise above the surface of the earth is 'n' times the radius of earth. Fill 'n' is OMR Sheet.

24. A tunnel is dug along the diameter of the earth. Two balls of mass m and 2m are dropped from the opposite side of the tunnel simultaneously. The collide in the tunnel and stick to each other. What the new amplitude of their oscillation. If amplitude is $\frac{R}{n}$ where R is earth's radius, fill n in OMR sheet.

25. In a double mass system, two masses (one of mass m and the other of 2m) d distance apart rotate about their common centre of mass. Find the value of the period of revolution (in sec).

($G = \frac{2}{3} \times 10^{-10}$ Nm^2/kg^2, m = 2×10^{20} kg, d = $\frac{4}{\pi^{2/3}} \times 10^4$ m)

26. If the areal velocity of one planet is 4 times the areal velocity of other planet, then find the ratio of their radii of circular motion around the sun.

27. A satellite of earth is in near earth circular orbit. What is its speed (in km/s). Round off to nearest integer.

28. Two particles of mass 'm' and 3m are initially at rest an infinite distance apart. Both the particles start moving due to gravitational attraction. At any instant their relative velocity of approach is $\sqrt{\frac{\eta Gm}{d}}$, where 'd' is their separation at that instant. Find η.

29. Calculate the density of the substance (in kg/m^3) of a spherical planet where the daily period of rotation equals 10^5 sec, if it is known that bodies are weightless at the equator of the planet. Round off to nearest integer. (Take G = 6.6×10^{-11} Nm^2/kg^2).

30. Gravitational potential difference between a point on surface of planet and another point 10 m above is 4J /kg. Considering gravitaional field to be uniform , how much work is done by an external agent in moving a mass of 2.0 kg from the surface to a point 5.0 m above the surface slowly.