Jupiter Academy

Subjects : Physics **PRACTICE PAPER 06**

Total Marks : 180

Physics - Section A (MCQ)

1. The particles A and B of mass m each are separated by a distance r. Another particle C of mass M is placed at the midpoint of A and B. Find the work done in taking C to a point equidistant r from A and B without acceleration (G = Gravitational constant and only gravitational interaction between A, B and C is considered)

A) $\frac{GMm}{r}$ **B)** $\frac{2GMm}{r}$
C) $\frac{3GMm}{r}$ **D)** $\frac{4GMm}{r}$

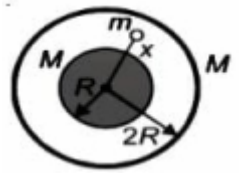
2. If earth suddenly stop rotating, then the weight of an object of mass m at equator will [ω is angular speed of earth and R is its radius]

A) Decrease by $m\omega^2 R$
B) Increase by $m\omega^2 R$
C) Decrease by $m\omega R^2$
D) Increase by $m\omega R^2$

3. If a satellite of mass $400\ kg$ revolves around the earth in an orbit with speed $200\ m/s$ then its potential energy is ..... MJ

A) -1.2 **B)** -8.0 **C)** -16 **D)** -2.4

4. A uniform sphere of mass M and radius R is surrounded by a concentric spherical shell of same mass but radius $2R$. A point mass m is kept at a distance $x(>R)$ in the region bounded by spheres as shown in the figure. The net gravitational force on the particle is .....

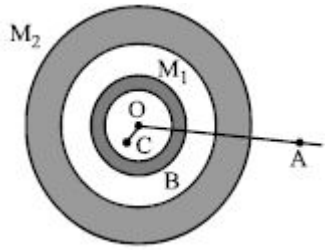


A) $\frac{GMm}{x^2}$ **B)** $\frac{GMmx}{R^3}$
C) $\frac{G(M+m)}{x^2}$ **D)** Zero

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

A) The radius of the moon is $\frac{81}{6}$ of the earth
B) The radius of the earth is $\frac{9}{\sqrt{6}}$ of the moon
C) Moon is the satellite of the earth
D) None of the above

6. Two concentric shells of uniform density of mass M_1 and M_2 are situated as shown in the figure. The forces experienced by a particle of mass m when placed at positions A, B and C respectively are (given $OA = p$, $OB = q$ and $OC = r$)



A) zero, $G\frac{M_1 m}{q^2}$ and $G\frac{(M_1+M_2)m}{p^2}$
B) $G\frac{(M_1+M_2)m}{p^2}, G\frac{(M_1+M_2)m}{q^2}$ and $G\frac{M_1 m}{r^2}$
C) $G\frac{M_1 m}{q^2}, G\frac{(M_1+M_2)m}{p^2}$ and zero
D) $G\frac{(M_1+M_2)m}{p^2}, G\frac{M_1 m}{q^2}$ and zero

7. 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 energy	$(s)\ \frac{GM_E m}{2r}$

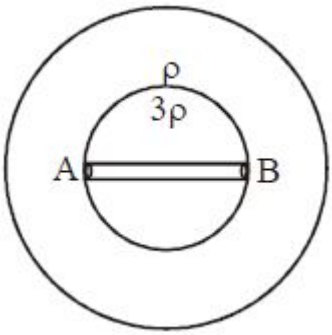
(where M_E is the mass of the earth, m is mass of the satellite and r is the radius of the orbit)

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)** $A-s, B-r, C-p, D-q$

8. If the acceleration due to gravity at earth is 'g' and mass of earth is $80\ times$ that of moon and radius of earth is $4\ times$ that of moon, the value of acceleration due to gravity at the surface of moon will be

A) g **B)** $g/20$ **C)** $g/5$ **D)** $320g$

9. A planet of core density 3ρ and outer crust of density ρ has small tunnel in core. A small particle of mass m is released from end A then time required to reach end B



A) $\sqrt{\frac{\pi}{\rho G}}$ **B)** $\frac{1}{2}\sqrt{\frac{\pi}{\rho G}}$
C) $\pi\sqrt{\frac{1}{\rho G}}$ **D)** $2\pi\sqrt{\frac{1}{\rho G}}$

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

A) Positive
B) Negative
C) Zero
D) May be positive or negative depending upon its initial velocity

11. Two bodies of masses m_1 and m_2 are initially at rest at infinite distance apart. They are then allowed to move towards each other under mutual gravitational attraction. Their relative velocity of approach at a separation distance r between them is

A) $\left[2G\frac{(m_1-m_2)}{r}\right]^{1/2}$ **B)** $\left[\frac{2G}{r}(m_1+m_2)\right]^{1/2}$
C) $\left[\frac{r}{2G(m_1m_2)}\right]^{1/2}$ **D)** $\left[\frac{2G}{r}m_1m_2\right]^{1/2}$

12. If mass of earth decreases by 25% and its radius increases by 50%, then acceleration due to gravity at its surface decreases by nearly ..... $\%$

A) 89 **B)** 67 **C)** 33 **D)** 11

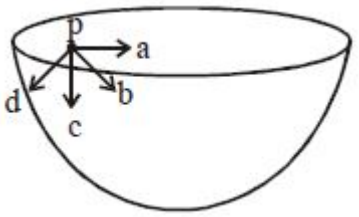
13. If radius of earth contracted by 0.1%, its mass remaining same, then weight of the body at earth's surface will increase by .....$\%$

A) 0.1% **B)** 0.2%
C) 0.3% **D)** Remains same

14. A satellite moving round the earth in a circular orbit of radius r and speed v suddenly loses some of its energy. Then

A) r will increase and v will decrease
B) both r and v will decrease
C) both r and v will increase
D) r will decrease and v will increase

15. Figure shows a hemispherical shell. The direction of gravitational field intensity at point p will be along

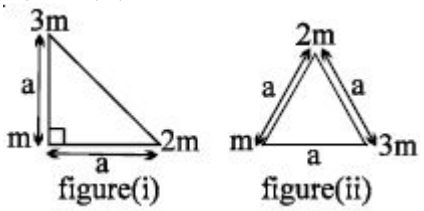


A) a **B)** b **C)** c **D)** d

16. When a satellite in a circular orbit around the earth enters the atmospheric region, it encounters small air resistance to its motion. Then

A) its kinetic energy increases
B) its kinetic energy decreases
C) its angular momentum about the earth decreases
D) (A) and (C) both

17. Consider two configurations of a system of three particles of masses $m, 2m$ and $3m$. The work done by external agent in changing the configuration of the system from figure (i) to figure (ii) is



A) zero
B) $-\frac{6Gm^2}{a}\left(1+\frac{1}{\sqrt{2}}\right)$
C) $-\frac{6Gm^2}{a}\left(1-\frac{1}{\sqrt{2}}\right)$
D) $-\frac{6Gm^2}{a}\left(2-\frac{1}{\sqrt{2}}\right)$

18. The mass and diameter of a planet are twice those of earth. What will be the period of oscillation of a pendulum on this planet if it is a seconds pendulum on earth ?

A) $\sqrt{2}$ second **B)** $2\sqrt{2}$ seconds
C) $\frac{1}{\sqrt{2}}$ second **D)** $\frac{1}{2\sqrt{2}}$ second

19. A particle is projected from the mid - point of the line joining two fixed particles each of mass $'m'$. If the separation between fixed particles is $'l'$, the minimum velocity of projection of the particle so as to escape is equal to

A) $\sqrt{\frac{Gm}{l}}$ **B)** $\sqrt{\frac{Gm}{2l}}$
C) $\sqrt{\frac{2Gm}{l}}$ **D)** $2\sqrt{\frac{2Gm}{l}}$

20. If the radius of the earth be increased by a factor of 5, by what factor its density be changed to keep the value of g the same ?

A) $1/25$ **B)** $1/5$ **C)** $1/\sqrt{5}$ **D)** 5

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

A) Potential energy **B)** Kinetic energy
C) Linear momentum **D)** Angular momentum

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

A) $m\sqrt{GMR_0}$ **B)** $M\sqrt{GmR_0}$
C) $m\sqrt{\frac{GM}{R_0}}$ **D)** $M\sqrt{\frac{GM}{R_0}}$

23. The time period of a satellite of earth is $5\ hours$. If the separation between the centre of earth and the satellite is increased to $4\ times$ the previous value, the new time period will become ..... h

A) 10 **B)** 80 **C)** 40 **D)** 20

24. A hollow spherical shell is compressed to half its radius. The gravitational potential at the centre

A) increases
B) decreases
C) remains same
D) during the compression increases then returns at the previous value.

25. A communications Earth satellite

A) goes round the earth from west to east
B) can be in the equatorial plane only
C) can be vertically above any place on the earth
D) (A) and (B) both

26. If V, R and g denote respectively the escape velocity from the surface of the earth radius of the earth, and acceleration due to gravity, then the correct equation is

A) $V = \sqrt{gR}$ **B)** $V = \sqrt{\frac{4}{3}gR^3}$
C) $V = R\sqrt{g}$ **D)** $V = \sqrt{2gR}$

27. Orbit of a planet around a star is

A) A circle **B)** An ellipse
C) A parabola **D)** A straight line

28. If $g \propto \frac{1}{R^3}$ (instead of $\frac{1}{R^2}$), then the relation between time period of a satellite near earth's surface and radius R will be

A) $T^2 \propto R^3$
B) $T \propto R^2$
C) $T^2 \propto R$
D) $T \propto R$

29. A person sitting in a chair in a satellite feels weightless because

A) The earth does not attract the objects in a satellite
B) The normal force by the chair on the person balances the earth's attraction
C) The normal force is zero
D) The person in satellite is not accelerated

30. 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

31. A satellite which is geostationary in a particular orbit is taken to another orbit. Its distance from the centre of earth in new orbit is 2 times that of the earlier orbit. The time period in the second orbit is

A) 4.8 hours **B)** $48\sqrt{2}$ hours
C) 24 hours **D)** $24\sqrt{2}$ hours

32. Select the correct statement from the following

A) The orbital velocity of a satellite increases with the radius of the orbit
B) Escape velocity of a particle from the surface of the earth depends on the speed with which it is fired
C) The time period of a satellite does not depend on the radius of the orbit
D) The orbital velocity is inversely proportional to the square root of the radius of the orbit

33. There are two planets. The ratio of radius of the two planets is K but ratio of acceleration due to gravity of both planets is g. What will be the ratio of their escape velocity

A) $(Kg)^{1/2}$ **B)** $(Kg)^{-1/2}$
C) $(Kg)^2$ **D)** $(Kg)^{-2}$

34. At what distance from the centre of the earth, the value of acceleration due to gravity g will be half that on the surface ($R =$ radius of earth)

A) $2\,R$ **B)** R
C) $0.414\,R$ **D)** $1.414\,R$

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

A) The gravitational field is necessarily zero
B) The gravitational field is not necessarily zero
C) Nothing can be said definitely about the gravitational field
D) None of these

36. A body weight $500\,N$ on the surface of the earth. How much would it weigh half way below the surface of the earth ..... N

A) 125 **B)** 250 **C)** 500 **D)** 1000

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

A) $2.5 \times 10^{-3}\,rad/s$ **B)** $5.0 \times 10^{-1}\,rad/s$
C) $10 \times 10^{1}\,rad/s$ **D)** $7.8 \times 10^{-2}\,rad/s$

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

A) $1 : 2$ **B)** $2 : 3$ **C)** $2 : 1$ **D)** $4 : 1$

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

A) $0.56 \times 10^{4}\,m$ **B)** $1.87 \times 10^{6}\,m$
C) $1.92 \times 10^{6}\,m$ **D)** $1.01 \times 10^{8}\,m$

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

A) At poles
B) At equator
C) At 45° latitude
D) At 40° latitude

41. R is the radius of the earth and ω is its angular velocity and g_p is the value of g at the poles. The effective value of g at the latitude $\lambda = 60^\circ$ will be equal to

A) $g_p - \frac{1}{4}R\omega^2$
B) $g_p - \frac{3}{4}R\omega^2$
C) $g_p - R\omega^2$
D) $g_p + \frac{1}{4}R\omega^2$

42. A planet is revolving around the sun in a circular orbit with a radius r. The time period is T. If the force between the planet and star is proportional to $r^{-3/2}$, then the square of time period is proportional to

A) $r^{3/2}$ **B)** r^2
C) r **D)** $r^{5/2}$

43. $Assertion$: The earth without atmosphere would be inhospitably cold.
$Reason$: All heat would escape in the absence of atmosphere.

A) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
B) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
C) If the Assertion is correct but Reason is incorrect.
D) If both the Assertion and Reason are incorrect.

44. A planet moving along an elliptical orbit is closest to the sun at a distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are the linear velocities at these points respectively, then the ratio $\frac{v_1}{v_2}$ is

A) $\frac{r_2}{r_1}$ **B)** $\left(\frac{r_2}{r_1}\right)^2$
C) $\frac{r_1}{r_2}$ **D)** $\left(\frac{r_1}{r_2}\right)^2$

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

A) Mass of the earth
B) Mass of the projectile
C) Radius of the projectile's orbit
D) Gravitational constant