SINGLE CORRECT OPTION TYPE

1. The height over the earth surface at which weight of body becomes half of its value of surface.
(A) $R_e\left(\sqrt{3}-1\right)$ (B) $R_e\left(\sqrt{2}-1\right)$ (C) $R_e\left(\sqrt{2}+1\right)$ (D) $R_e\left(\sqrt{3}+1\right)$

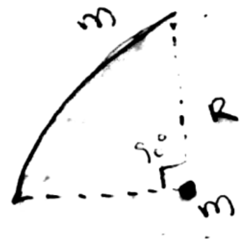
2. Three particles each of mass (m) are placed at the corners of an equilateral triangle of side (d). Calculate the work done in increasing the sides of triangle from d to 2d.
(A) $\frac{3}{2}\frac{Gm}{d^2}$ (B) $\frac{3}{2}\frac{Gm^2}{d^2}$ (C) $\frac{3}{2}\frac{Gm}{d}$ (D) $\frac{3}{2}\frac{Gm^2}{d}$

3. Two particles of masses m_1 and m_2 are initially at rest at infinite separation. When released, find their relative velocity of approach when they are at a separation (d).
(A) $v_{ap}=\sqrt{\frac{2G}{d(m_1+m_2)}}$ (B) $v_{ap}=\sqrt{\frac{2G}{d(m_1+m_2)}}$
(C) $v_{ap}=\sqrt{\frac{2G}{d(m_1-m_2)}}$ (D) $v_{ap}=\sqrt{\frac{2G(m_1+m_2)}{d}}$

4. A satellite of mass 2×10^3kg is to be shifted from an orbit of radius $2R_e$ to another orbit of radius $3R_e$ under ideal conditions. Calculate minimum energy required for this (Given $R_e=6.4\times10^6$ metres)
(A) 1.066×10^{10} J (B) 1.066×10^{12} J (C) 1.066×10^{-10} J (D) 1.066×10^{14} J

5. For a satellite to escape from gravity of planet its orbital speed should be increased by
(A) 43% (B) 50% (C) 41.4% (D) 70%

6. Gravitational attraction on mass (m) due to the quarter ring of same mass (m) and radius (R) as shown is
(A) $\frac{2\sqrt{3}\ Gm^2}{\pi R^2}$ (B) $\frac{2\sqrt{2}\ Gm^2}{\pi R^2}$
(C) $\frac{2\sqrt{3}\ Gm}{\pi R}$ (D) $\frac{2\sqrt{3}\ Gm}{\pi R^2}$

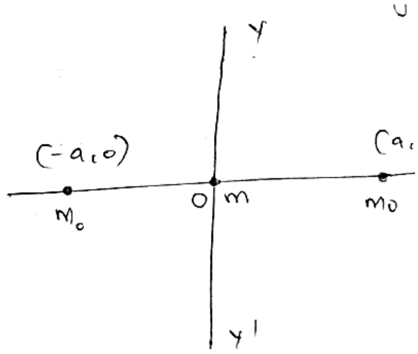


7. If the radius of earth were to shrink by one percent, its mass remaining the same. What would be new acceleration due to gravity on earth surface.
(A) gravity will be increased by 5% (B) gravity will be increased by 2%
(C) gravity will be increased by 10% (D) none

8. A missile is launched at an angle of 60° to the vertical with a velocity $\sqrt{0.75gR}$ from the surface of the earth (R-radius of earth). Find its maximum height from surface of earth. (Neglect air resistance and rotation of earth)
(A) $h\approx0.1R$ (B) $h\approx0.25R$ (C) $h\approx4R$ (D) none

9. A satellite of mass (m_s) revolving in a circular orbit of radius (r_s) around the earth of mass (M) has a total energy E. Its angular momentum will be
(A) $\sqrt{\frac{E}{m_s r_s^2}}$ (B) $\sqrt{\frac{E}{2m_s r_s^2}}$ (C) $\sqrt{2Em_s r_s^2}$ (D) $\sqrt{2Em_s r_s}$

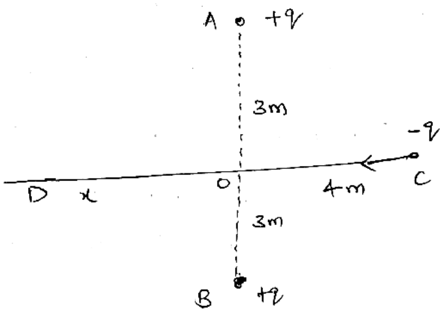
10. In the figure given, for small displacement of particle of mass (m) along y-axis, the motion of the particle is
(A) simple harmonic
(B) motion with constant acceleration
(C) non-oscillatory
(D) none of the above



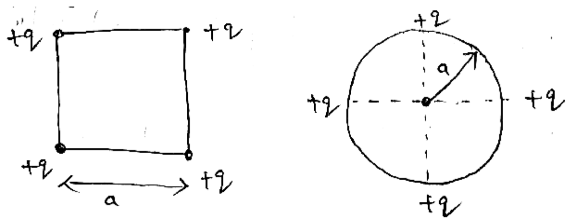
11. A ring of radius (R) is non-uniformly charged with a linear charge density $\lambda = \lambda_0 \cos\theta$ col/m, θ is the angle measured from a reference line through centre. Find electric field at centre of the ring.
(A) $\frac{\lambda_0}{2\varepsilon_0 R}$ (B) $\frac{\lambda_0}{6\varepsilon_0 R}$ (C) $\frac{\lambda_0}{4\varepsilon_0 R}$ (D) $\frac{\lambda_0}{3\varepsilon_0 R}$

12. Identical charges of magnitude Q are placed at $(n-1)$ corners of a regular polygon of (n) sides each corner of the polygon is at a distance (r) from the centre. The field at centre is
(A) $\frac{KQ}{r^2}$ (B) $(n-1)\frac{KQ}{r^2}$ (C) $\frac{n}{n-1}\frac{KQ}{r^2}$ (D) $\frac{(n-1)}{2}\frac{KQ}{r^2}$

13. Two fixed positive charges, each of magnitude 5×10^{-5}C are located at points A and B, separated by a distance of 6m. An equal and opposite charge moves towards them along the line COD, the perpendicular bisector of line AB. The moving charge, when reaches the point C at a distance of 4m from O, has a kinetic energy of 4 Joules. Calculate the distance of farthest point D which the negative charge will reach before retarding towards C.
(A) $x=\sqrt{72}$m (B) $x=\sqrt{81}$m
(C) $x=\sqrt{90}$m (D) $x=\sqrt{60}$m



14. Find the workdone by external agent in changing the configuration of the system from figure (i) to fig (ii).
(A) $\frac{-kq^2}{a}(3+\sqrt{2})$ (B) $\frac{-kq^2}{a}(3-\sqrt{2})$
(C) $\frac{+kq^2}{a}(3+\sqrt{2})$ (D) $\frac{+kq^2}{a}(3-\sqrt{2})$



15. A circular ring of radius (R) with uniform positive charge density (d) per unit length is located in Y–Z plane with its centre at origin O. A particle of mass (m) and positive charge (q) is projected from point (p) $\left[\sqrt{3}R,0,0\right]$ on positive x-axis directly towards O, with initial speed (v). Find smallest value of speed such that particle does not return to P.
(A) $\sqrt{\frac{\lambda q}{\varepsilon_0 m}}$ (B) $\sqrt{\frac{\lambda q}{3\varepsilon_0 m}}$ (C) $\sqrt{\frac{\lambda q}{2\varepsilon_0 m}}$ (D) $\sqrt{\frac{\lambda}{2\varepsilon_0 qm}}$

16. Three charges Q, Q and $(-2Q)$ are placed at the three corners of an equilateral triangle of side (a). Find the dipole moment of the combination.
(A) $p=\sqrt{2}qa$ (B) $p=\sqrt{3}qa$ (C) $p=2qa$ (D) $p=3qa$

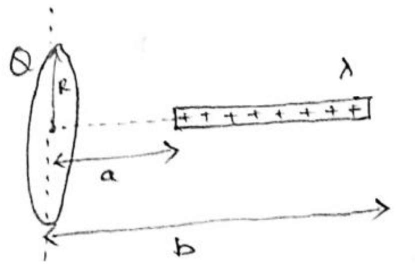
17. A dipole of dipole moment (P) is placed at origin along x-axis. Another dipole of dipole moment (p) is kept at (0, 1, 0) along y-axis. Find potential at (1, 0, 0)

(A) $v = kp\left(\frac{2\sqrt{3}-1}{2\sqrt{2}}\right)$ (B) $v = kp\left(\frac{\sqrt{3}-1}{2\sqrt{2}}\right)$ (C) $v = kp\left(\frac{\sqrt{3}+1}{2\sqrt{2}}\right)$ (D) $v = kp\left(\frac{2\sqrt{2}-1}{2\sqrt{2}}\right)$

18. A ring has a charge (Q) and radius (R). If a charge (q) is placed at its center. Increase in tension in the ring is

(A) $\frac{kQq}{2\pi R^2}$ (B) $\frac{kQq}{\pi R^2}$ (C) $\frac{kQq}{3\pi R^2}$ (D) $\frac{kQq}{4\pi R^2}$

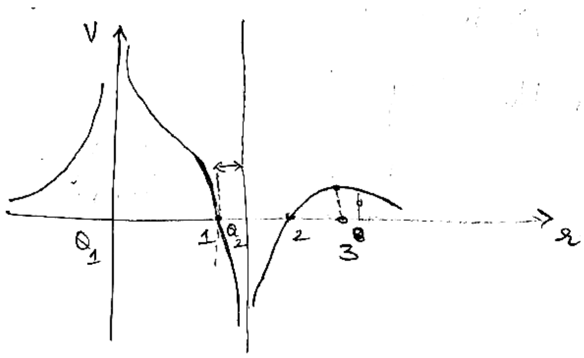
19. The interaction force between the ring of uniform charge (Q) and rod having uniform linear charge density λ.



(A) $KQ\lambda\left(\frac{1}{\sqrt{R^2+a^2}}-\frac{1}{\sqrt{R^2+b^2}}\right)$ (B) $KQ\lambda\left(\frac{1}{\sqrt{R^2+a^2}}+\frac{1}{\sqrt{R^2+b^2}}\right)$

(C) $KQ\lambda\left(\frac{1}{R}-\frac{1}{\sqrt{R^2+b^2}}\right)$ (D) $KQ\lambda\left(\frac{1}{R}+\frac{1}{\sqrt{R^2+b^2}}\right)$

20. Two point charge Q_1 and Q_2 lie along a line, at a distance from each other. Figure shows the potential variation along the line of charge. At which point electric field is zero?



(A) at point 1
(B) at point 2
(C) at point 3
(D) none

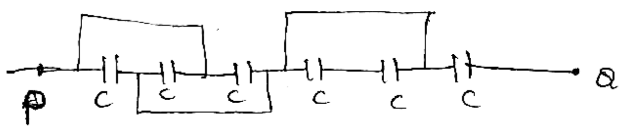
INTEGER TYPE

21. A particle of mass (m) and charge $(+q)$ initially at rest moves through a certain distance in a uniform electric field in time (t_1). Another particle of mass (4m) and charge $(-q)$ also initially at rest takes time (t_2) to move through an equal distance in same field. Neglecting effect of gravity $\frac{t_2}{t_1} = ?$

22. Two satellites A and B of same mass are orbiting earth at altitudes R and 3R respectively, where R is radius of earth. Taking their orbits to be circular, calculate ratio of their kinetic energies.

23. Two point charges $+4e$ and $(+e)$ are kept at at a distance 12 mts apart. At what distance a charge (q) must be placed from charge $(+e)$ so that q is in equilibrium.

24. The equivalent capacitance between P and Q in μF is ____________ where $c = 11\mu F$



25. The period of a satellite in a circular orbit of radius (R) is 1 day. What is the period of another satellite in a circular orbit of radius 4R? (in days)

KEY

1.	B	**2.**	D	**3.**	D	**4.**	A	**5.**	C
6.	B	**7.**	B	**8.**	B	**9.**	C	**10.**	A
11.	C	**12.**	A	**13.**	A	**14.**	B	**15.**	C
16.	B	**17.**	D	**18.**	A	**19.**	A	**20.**	C
21.	2	**22.**	2	**23.**	4	**24.**	6	**25.**	8

❇ ***Wish You all the Best*** ❇