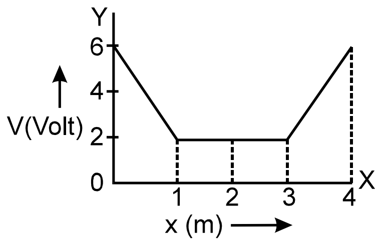
3 Electromagnetism

EXERCISE

267. The variation of electric potential with distance from a fixed point is shown in figure. What is the value of electric field at x = 2m -



(A) Zero (B) 6/2 (C) 6/1 (D) 6/3

268. The electric flux from a cube of edge ℓ is ϕ. What will be its value if edge of cube is made 2ℓ and charge enclosed is halved -
(A) $\phi/2$ (B) 2ϕ (C) 4ϕ (D) ϕ

269. Two point charges repel each other with a force of 100 N. One of the charges is increased by 10% and other is reduced by 10%. The new force of repulsion at the same distance would be-
(A) 100 N (B) 121 N (C) 99 N (D) None of these

270. A positive point charge q is carried from a point B to a point A in the electric field of a point charge +Q at O. If the permittivity of free space is ε_0, the work done in the process is given by (where a = OA and b = OB) -

(A) $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{1}{a}+\frac{1}{b}\right)$ (B) $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{1}{a}-\frac{1}{b}\right)$ (C) $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{1}{a^2}-\frac{1}{b^2}\right)$ (D) $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{1}{a^2}+\frac{1}{b^2}\right)$

271. A spherical charged conductor has σ as the surface density of charge. The electric field on its surface is E. If the radius of the sphere is doubled keeping the surface density of charge unchanged, what will be the electric field on the surface of the new sphere -

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

272.* Three equal and similar charges are placed at (–a, 0, 0), (0, 0, 0) and (+a, 0, 0). What is the nature of equilibrium of the charge at the origin-
(A) Stable when moved along the Y-axis
(B) Stable when moved along Z-axis
(C) Stable when moved along X-axis
(D) Unstable in all of the above cases

273. Two conducting spheres each of radius R carry charge q. They are placed at a distance r from each other, where r > 2 R. The neutral point lies at a distance r/2 from either sphere. If the electric field at the neutral point due to either sphere be E, then the total electric potential at that point will be -
(A) r E/2 (B) r E (C) RE/2 (D) RE

274. Two point charges Q and –3Q are placed certain distance apart. If the electric field at the location of Q be $\vec{E}$, then that at the location of –3Q will be-

(A) $3\vec{E}$ (B) $-3\vec{E}$ (C) $\vec{E}/3$ (D) $-\vec{E}/3$

275.* If a positive charge is shifted from a low-potential region to a high-potential region, the electric potential energy -
(A) increases (B) decreases
(C) remains the same (D) May increase or decrease

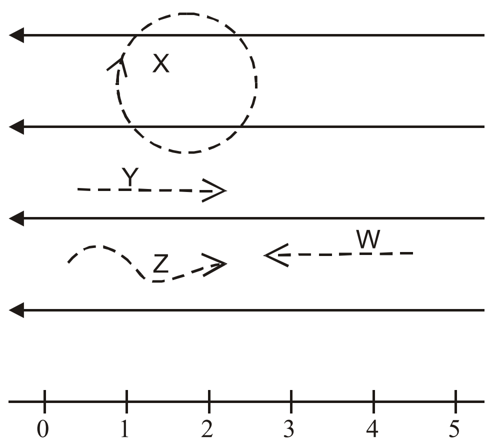
276. A particle of mass 0.002 kg and a charge 1μC is held at rest on a frictionless horizontal surface at a distance of 1m from a fixed charge of 1mC. If the particle is released, it will be repelled. The speed of the particle when it is at a distance of 10m from the fixed charge is -
(A) 60 ms^{-1} (B) 75 ms^{-1} (C) 90 ms^{-1} (D) 100 ms^{-1}

277. A charge Q is placed at each of two opposite corners of a square. A charge q is placed at each of the two opposite corners of the square. If the resultant electric field on Q is zero, then -

(A) $Q = -\frac{q}{2\sqrt{2}}$ (B) $Q = -2\sqrt{2}\,q$ (C) Q = −2q (D) $Q = 2\sqrt{2}\,q$

278.* Two equal positive charges are kept at points A and B. The electric potential at the points between A and B (excluding these points) is studied while moving from A to B. The potential-
(A) Continuously increases (B) Continuously decreases
(C) Increases then decreases (D) Decreases then increases

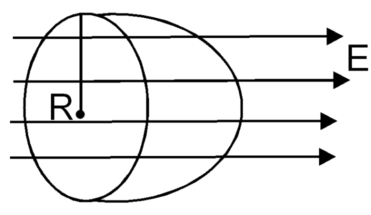
279.* In the diagram (given below) the broken lines represent the paths followed by particles W,X, Y and Z respectively through the constant field E. The numbers below the field represents meters.



If the particles begin and end at rest, and all are positively charged, the same amount of work was done on which particles.
(A) W and Z (B) W, Y and Z (C) Y and Z (D) W, X, Y and Z

280.* In previous question if the particles started from rest and all are positively charge which particles must have been acted upon by a force other than that produced by the electric field.
(A) W and Y (B) X and Z (C) X,Y and Z (D) W, X,Y and Z

281. A hemisphere (radius R) is placed in electric field as shown in fig. Total outgoing flux is -



(A) πR^2E (B) $2\pi R^2E$ (C) $4\pi R^2E$ (D) $(\pi R^2E)/2$

282. Two small balls having equal positive charge Q on each are suspended by two insulating strings at equal length L meter, from a hook fixed to a stand. The whole set up is taken in a satellite into space where there is no gravity. Then the angle θ between two strings and tension in each string is-

(A) 0, $\frac{kq^2}{L^2}$ (B) π, $\frac{kq^2}{2L^2}$ (C) π, $\frac{kq^2}{4L^2}$ (D) $\frac{\pi}{2}, \frac{kq^2}{2L^2}$

283. A metal sphere A of radius R has a charge of Q on it .The field at a point B outside the sphere is E. Now another sphere of radius R having a charge -3Q is placed at point B. The total field at a point mid-way between A and B due to both sphere is-

(A) 4E (B) 8E (C) 12E (D) 16E

284. semicircle of radius R. The electric field at the centre is -

(A) $\frac{2k\lambda}{R}$ (B) $\frac{k\lambda}{2R}$ (C) Zero (D) None

285. The potential of a charged drop is v. This is divided into n smaller drops, then each drop will have the potential as ;
(A) $n^{-1}v$ (B) $n^{2/3}v$. (C) $n^{3/2}v$ (D) $n^{-2/3}$ v

286. When an electric dipole $\vec{P}$ is placed in a uniform electric field $\vec{E}$ then at what angle between $\vec{P}$ and $\vec{E}$ the value of torque will be maximum
(A) 90º (B) 0º (C) 180º (D) 45º

287. An electric dipole is placed along the x-axis at the origin O.A point P is at a distance of 20cm from this origin such that OP makes an angle $\frac{\pi}{3}$ with the x-axis. If the electric field at P makes an angle θ with the x-axis, the value of θ would be

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{3}+\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (C) $\frac{2\pi}{3}$ (D) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

288. Two charged metal spheres of radii R and 2R are temporarily placed in contact and then separated. At the surface of each, the ratio of electric field will be-
(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) 1 : 4

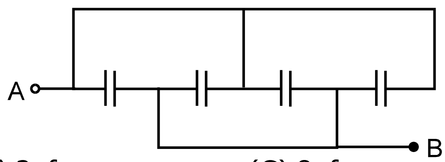
289. Two parallel plate air filled capacitors each of capacitance C, are joined in series to a battery of emf V. The space between the plates of one of the capacitors is then completely filled up with a uniform dielectric having dielectric constant K. The quantity of charge which flows through the battery is -

(A) $\frac{CV}{2}\left(\frac{K-1}{K+1}\right)$ (B) $\frac{CV}{2}\left(\frac{K+1}{K-1}\right)$ (C) CV $\left(\frac{K-1}{K+1}\right)$ (D) CV $\left(\frac{K+1}{K-1}\right)$

290. A capacitor when filled with a dielectric K = 3 has charge Q_0, voltage V_0 and Electric field E_0, If the dielectric is replaced with another one having K = 9, the new value of charge, voltage and field will be respectively-

(A) 3 Q_0, $3V_0$, $3E_0$ (B) Q_0, $3V_0$, $3E_0$ (C) Q_0, $\frac{V_0}{3}$, $3E_0$ (D) Q_0, $\frac{V_0}{3}$, $\frac{E_0}{3}$

291. Four condensers are joined as shown in fig. the capacity of each is 8μf. the equivalent capacity between points A and B will be -



(A) 32 μf (B) 2μf (C) 8μf (D) 16 μf

292. In a parallel plate capacitor, the separation between the plates is 3mm with air between them. Now a 1mm thick layer of a material of dielectric constant 2 is introduced between the plates due to which the capacity increases. In order to bring its capacity of the original value, the separation between the plates must be made-

(A) 1.5 mm (B) 2.5 mm (C) 3.5 mm (D) 4.5 mm