QUESTIONS FROM COMPETITIVE EXAMS

2.1 Electric flux, Gauss's Theorem and Its Applications

(MHT-CET 2002)

1. Ampere second is unit of
   a) capacitance b) charge c) energy d) power

(MHT-CET 2004)

2. A cylinder is charged by 10 μC. Length of cylinder is 1 km and radius is 1 mm. Surface density of charge of cylinder is
   a) 1.59×10^{-4} C/m^2 b) 1.59×10^{-2} C/m^2 c) 1.59×10^{-3} C/m^2 d) 1.59×10^{-5} C/m^2

3. If charge q is induced on outer surface of sphere of radius R, then intensity at a point P at a distance S from its centre is
   a) inversely proportional to $(S + R)^2$ b) inversely proportional to R^2
   c) inversely proportional to S^2 d) directly proportional to S^2

(MHT-CET 2005)

4. Unit of electric flux is
   a) Vm b) V/m c) Nm/C d) C/Nm

5. Consider a sphere of radius R and a cylinder of length L. If both have same charge density σ and E_s and E_c are electric intensities at a point at a distance r from axes of sphere and cylinder respectively, then E_s is equal to
   a) $\frac{E_c R}{r}$ b) $\frac{E_c r}{R}$ c) $\frac{2E_c r}{R}$ d) $\frac{E_c r}{2R}$

(MHT-CET 2007)

6. Three charges +5 C, +7 C and –4 C are situated within a body and charges –5 C, –7 C and +4 C are situated outside the body. The T.N.E.I over the closed surface is
   a) -8 C b) 0 c) +8 C d) 10 C

(MHT-CET 2008)

7. Electric intensity at a point just outside a charged conductor of any shape is
   a) $\frac{\sigma}{\epsilon_0 K}$ b) $\frac{\sigma}{2\epsilon_0 K}$ c) $\frac{2\sigma}{\epsilon K}$ d) $\frac{\sigma^2}{2\epsilon K}$

(MHT-CET 2009)

8. A charged oil drop is suspended in uniform field of 3×10^4 V/m so that it neither falls nor rises. The charge on the oil drop will be (take mass of drop = 9.9×10^{-15} kg & g = 10 m/s^2)
   a) 3.3×10^{-18} C b) 3.2×10^{-18} C c) 1.6×10^{-18} C d) 4.8×10^{-18} C

(MHT-CET 2010)

9. The electric intensity outside a charged sphere of radius R at a distance r (r > R) is
   a) $\frac{\sigma R^2}{\varepsilon_0 r^2}$ b) $\frac{\sigma r^2}{\varepsilon_0 R^2}$ c) $\frac{\sigma R}{\varepsilon_0 r}$ d) $\frac{\sigma r}{\varepsilon_0 R}$

(MHT-CET 2011)

10. A charged cylinder of radius 3 mm has surface density of charge 4 μC/m^2. It is placed in a medium of dielectric constant 6.28. The electric intensity at a point at a distance of 1.5 m from its axis is
    a) 144 V/m b) 2.44 V/m c) 3 V/m d) 0.5 V/m

(MHT-CET 2014)

11. Surface density of charge on a sphere of radius 'R' in terms of electric intensity 'E' at distance 'r' in free space is (ϵ_0 = permittivity of free space)

a) $\epsilon_0 E\left(\frac{R}{r}\right)^2$ b) $\frac{\epsilon_0 ER}{r^2}$ c) $\epsilon_0 E\left(\frac{r}{R}\right)^2$ b) $\frac{\epsilon_0 Er}{R^2}$

12. In air, a charged soap bubble of radius 'r' is in equilibrium having outside and inside pressures equal. The charge on the bubble is (ϵ_0 = permittivity of free space, T = surface tension of soap solution)

a) $4\pi r^2\sqrt{\frac{2T\epsilon_0}{r}}$ b) $4\pi r^2\sqrt{\frac{4T\epsilon_0}{r}}$ c) $4\pi r^2\sqrt{\frac{6T\epsilon_0}{r}}$ d) $4\pi r^2\sqrt{\frac{8T\epsilon_0}{r}}$

(MH-CET 2015)

13. The electric field intensity at a point near and outside the surface of a charged conductor of any shape is 'E_1'. The electric field intensity due to uniformly charged infinite thin plane sheet is 'E_2'. The relation between 'E_1' and 'E_2' is

a) $2E_1 = E_2$ b) $E_1 = E_2$ c) $E_1 = 2E_2$ d) $E_1 = 4E_2$

(MH-CET 2018)

14. The expression for electric field intensity at a point outside uniformly charged thin plane sheet is (d is the distance of point from plane sheet)

a) independent of d
b) directly proportional to $\sqrt{d}$
c) directly proportional to d
d) directly proportional to $\frac{1}{\sqrt{d}}$

(MH-CET 2019)

15. In air, a charged soap bubble of radius 'R' breaks into 27 small soap bubbles of equal radius 'r'. Then the ratio of mechanical force acting per unit area of big soap bubble to that of a small soap bubble is

a) $\frac{9}{1}$ b) $\frac{1}{81}$ c) $\frac{1}{3}$ d) $\frac{3}{1}$

(MH-CET 2020)

16. A metal sphere of radius 1 m is charged with 10^{-2} C in air. Its bulk modulus is $\frac{10^{11}}{4\pi^2}\frac{N}{m^2}$. The volume strain in the sphere is

a) $\frac{10^{-15}}{6\varepsilon_0}$ b) $\frac{10^{-15}}{16\varepsilon_0}$ c) $\frac{10^{-15}}{8\varepsilon_0}$ d) $\frac{10^{-15}}{2\varepsilon_0}$

(MH-CET 2021)

17. A plane surface area 200 cm^2 is kept in a uniform electric field of intensity 200 N/C. If the angle between the normal to the surface and the field is 60°, then the electric flux through the surface is

a) 200 Nm^2/C
b) 4 Nm^2/C
c) 100 Nm^2/C
d) 2 Nm^2/C

2.2 Electric Potential

(MHT-CET 2006)

18. The energy required to move a charge of 0.25 C between two points is 4×10^{20} eV. The potential difference between them is

a) 100 V b) 256 V c) 200 V d) 128 V

(MHT-CET 2014)

19. Two concentric spheres kept in air have radii 'R' and 'r'. They have similar charge and equal surface charge density 'σ'. The electric potential at their common centre is (ϵ_0 = permittivity of free space)

a) $\frac{\sigma(R+r)}{\epsilon_0}$ b) $\frac{\sigma(R-r)}{\epsilon_0}$ c) $\frac{\sigma(R+r)}{2\epsilon_0}$ d) $\frac{\sigma(R+r)}{4\epsilon_0}$

20. Two charges of equal magnitude 'q' are placed in air at a distance '2a' apart and third charge '-2q' is placed at midpoint. The potential energy of the system is

(ϵ_0 = permittivity of free space)

a) $-\frac{q^2}{8\pi\epsilon_0 a}$ b) $-\frac{3q^2}{8\pi\epsilon_0 a}$ c) $-\frac{5q^2}{8\pi\epsilon_0 a}$ d) $-\frac{7q^2}{8\pi\epsilon_0 a}$

(MH-CET 2015)

21. An electron of mass 'm' and charge 'q' is accelerated from rest in a uniform electric field of strength 'E'. The velocity acquired by it as it travels a distance 'l' is

a) $\left[\frac{2Eql}{m}\right]^{1/2}$ b) $\left[\frac{2Eq}{ml}\right]^{1/2}$ c) $\left[\frac{2Em}{ql}\right]^{1/2}$ d) $\left[\frac{Eq}{ml}\right]^{1/2}$

2.3 Conductors and Insulators

(MH-CET 2019)

22. Three concentric conducting spherical shells carry charges as follows : + 4 Q on the inner shell, –2 Q on the middle shell and –5 Q on the outer shell. The charge on the inner surface of the outer shell is

a) 0 b) 4 Q c) -Q d) -2 Q

2.4 Dielectrics and Polarization

(MH-CET 2020)

23. Which of the following is an example of polar molecule ?

a) H_2O b) O_2 c) H_2 d) CO_2

(MH-CET 2021)

24. Choose the correct relation between polarization 'P' and electric susceptibility 'χ_e' of dielectric material. (E = electric field)

a) $P = \frac{\chi}{E^2}$ b) $P = \frac{\chi}{E}$ c) $P = \chi E$ d) $P = \chi^2 E$

(MH-CET 2022)

25. The electric dipole moment per unit volume of electric dipole is

a) polarisation b) diffraction c) interference d) reflection

(MH-CET 2022)

26. Which of the following molecules is a polar molecule ?

a) Oxygen (O_2)
b) Hydrogen (H_2)
c) Carbon dioxide (CO_2)
d) Hydrogen Chloride (HCl)

2.5 Capacity of Conductor and Concept of Condenser

(MH-CET 2019)

27. The quantity of charge required to raise its potential by one unit is

a) capacity of conductor
b) inductance of conductor
c) resistance of conductor
d) none of these

(MH-CET 2021)

28. An arrangement which increases charge storing capacity without an appreciable increase in its potential is

a) resistor
b) conductor
c) inductor
d) capacitor

2.6 Capacity of Parallel Plate Condenser

(MH-CET 2001)

29. A capacitor of 20 μF charged upto 500 V is connected in parallel with another capacitor of 10 μF, which is charged upto 200 V. Then, the common potential will be

a) 400 V
b) 200 V
c) 100 V
d) 50 V

(MHT-CET 2002)

30. The capacity of a parallel plate condenser is 12 μF. Its capacity, when the separation between plates is doubled and area is halved, will be

a) 3 μF
b) 12 μF
c) 6 μF
d) 1.5 μF

(MHT-CET 2004)

31. In a parallel plate capacitor with air, the distance between the plates is reduced to half and the space is filled with dielectric of constant 4. If initial capacity of capacitor is 2 μF, then final value of capacity is

a) 4 μF
b) 8 μF
c) 16 μF
d) 2 μF

(MHT-CET 2009)

32. In a parallel plate capacitor, the capacity increases if

a) area of plate is decreased
b) distance between plates increases
c) area of plate is increased
d) dielectric constant decreases

(MHT-CET 2011)

33. If A is the area of each plate, charge on it is q and potential difference is V then the distance between the parallel plates of capacitor is

a) $\frac{\varepsilon_0 AV}{2q}$
b) $\frac{\varepsilon_0 AV}{q}$
c) $\frac{2\varepsilon_0 AV}{q}$
d) $\frac{AV}{q}$

(MH-CET 2019)

34. In a parallel plate air capacitor the distance between plates is reduced to one fourth and the space between them is filled with a dielectric medium of constant 2. If the initial capacity of the capacitor is 4 μF, then its new capacity is

a) 8 μF
b) 18 μF
c) 44 μF
d) 32 μF

(MH-CET 2022)

In a parallel plate capacitor, the capacity can be increased by decreasing

a) the distance between plates
b) value of dielectric constant
c) area of the plates
d) permeability of the medium

2.7 Effect of Dielectrics on Capacity

(MHT-CET 2006)

A parallel plate capacitor has a capacity C. If a medium of dielectric constant K is introduced between plates, the capacity of capacitor becomes

a) $\frac{C}{K}$
b) $\frac{C}{K^2}$
c) $M^2 C$
d) KC

(MHT-CET 2009)

If a dielectric is inser'..u in charged capacitor (battery removed), the quantity that remains const- .. is

a) capac'.ance
b) potential
c) intensity
d) charge

(MH-CET 2016)

Two identical parallel plate air capacitors are connected in series to a battery of e.m.f. 'V'. If one of the capacitors is completely filled with dielectric material of constant 'K', then potential difference of the other capacitor will become

a) $\frac{K}{V(K+1)}$
b) $\frac{KV}{K+1}$
c) $\frac{K-1}{KV}$
d) $\frac{V}{K(K+1)}$

2.8 Energy of a Charged Condenser

(MHT-CET 2003)

39. If a 4 μF capacitor is charged to 1 kV, then energy stored in the capacitor is

a) 1 J
b) 4 J
c) 6 J
d) 2 J

(MHT-CET 2007)

40. Energy stored in a condenser of capacity 10 μF, charged to 6 KV is used to lift a mass of 10 gm. The height to which the body can be raised is

a) 180 m
b) 18 m
c) 1836 m
d) 1800 m

(MHT-CET 2008)

41. A string is compressed by 2 mm by a force of 8 N and a condenser charged through a potential difference of 200 V possesses a charge of 80 μC. The ratio of the energies stored in the two bodies is

a) 1
b) 3/2
c) 2
d) 1/2

(MHT-CET 2010)

42. Capacity of a capacitor is 48 μF. When it is charged from 0.1 C to 0.5 C, change in energy stored is

a) 2500 J
b) 2.5×10^{-3} J
c) 2.5×10^{6} J
d) 2.42×10^{-2}

(MH-CET 2016)

43. The amount of work done in increasing the voltage across the plates of capacitor from 5 V to 10 V is 'W'. The work done in increasing it from 10 V to 15 V will be

a) W
b) 0.6 W
c) 1.25 W
d) 1.67 W