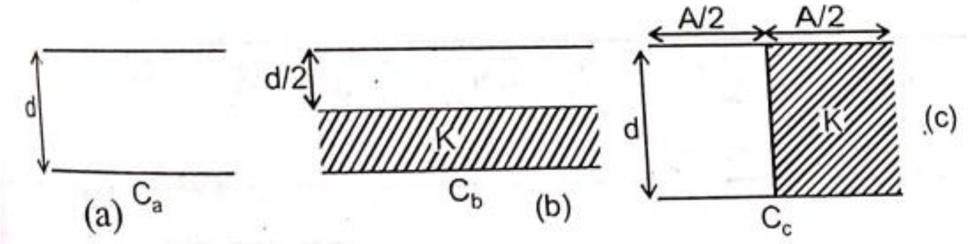
ELECTRIC POTENTIAL AND CAPACITANCE (UT-3)

1. **The electric potential V(x) in a region around the origin is given by V(x)=4x^2 volts. The electric charge enclosed in a cube of 1 m side with its centre at the origin is (in coulomb)**

(a) $8\varepsilon_0$ (b) $-4\varepsilon_0$ (c) 0 (d) $-8\varepsilon_0$

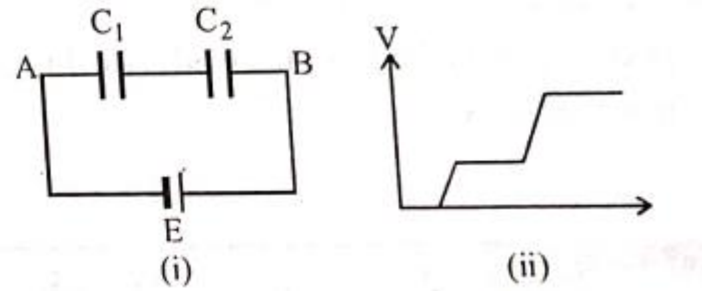
2. **The capacitance of a parallel plate capacitor is C_a (Fig. a). A dielectric of dielectric constant K is inserted as shown in fig (b) and (c). If C_b and C_c denote the capacitances in fig (b) and then**



(a) both $C_b, C_c > C_a$ (b) $C_c > C_a$ while $C_b > C_a$

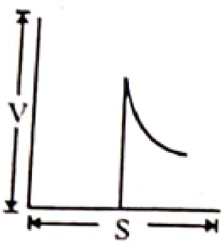
(c) both $C_b = C_c < C_a$ (d) $C_a = C_b = C_c$

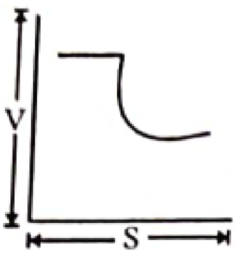
3. **Figure (i) shows two capacitors connected in series and connected by a battery. The graph (ii) shows the variation of potential as one moves from left to right on the branch AB containing the capacitors. Then**

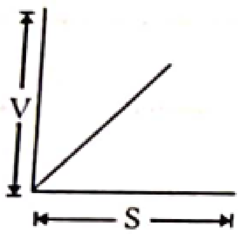


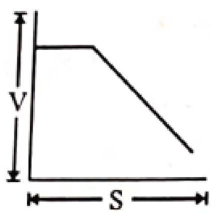
(a) $C_1 = C_2$ (b) $C_1 < C_2$ (C) $C_1 > C_2$ (d) C_1 and C_2 cannot be copmared

4. **In a hollow spherical shell, potential (V) changes with respect to distance (s) from centre as**

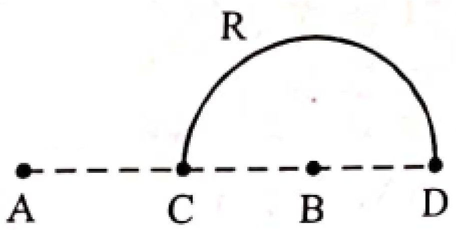
a) 

b) 

c) 

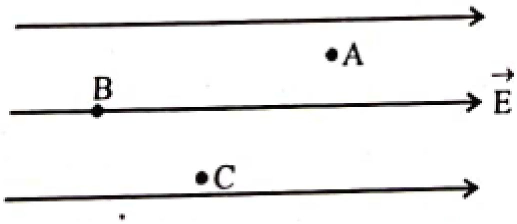
d) 

5. **Charges +q and -q are placed at points A and B respectively which are a distance 2 L apart, C is the midpoint between A and B. The work done in moving a charge +ℚ along the**



a) $\frac{qQ}{2\pi\varepsilon_0 L}$ b) $\frac{qQ}{6\pi\varepsilon_0 L}$ c) $-\frac{qQ}{6\pi\varepsilon_0 L}$ d) $\frac{qQ}{4\pi\varepsilon_0 L}$

6. **A, B and Care three points in a uniform electric field. The electric potential is**



(a) maximum at B (b) maximum at C
(c) same at all the three points A, B and C (d) maximum at A

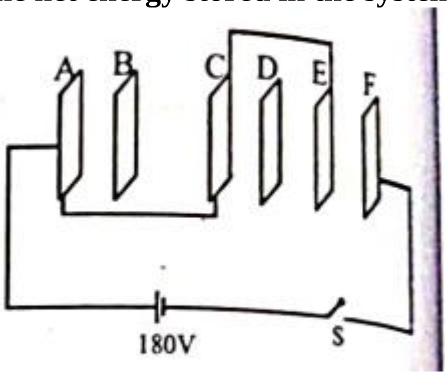
7. **A unit charge moves on an equipotential surface from a point A to point B, then**

(a) $V_A - V_B = +ve$ (b) $V_A - V_B = 0$ (c) $V_A - V_B = -ve$ (d) it is stationary

8. **Identify the false statement.**

(a) Inside a charged or neutral conductor, electrostatic field is zero
(b) The electrostatic field at the surface of the char conductor must be tangential to the surface at any point
(c) There is no net charge at any point inside the conductor
(d) Electrostatic potential is constant throughout the volume of the conductor

9. **A, B,C, D, E, F are conduct-ing plates each of area A and any two consecutive plates separated by a distance d. The net energy stored in the system after the switch S is closed is**



a) $\frac{3\varepsilon A}{2d}v^2$ b) $\frac{5\varepsilon_0 A}{12d}v^2$ c) $\frac{\varepsilon_0 A}{2d}v^2$ d) $\frac{\varepsilon_0 A}{2d}v^2$

10. **Two concentric, thin metallic spheres of radii R_1 and R_2 $(R_1 > R_2)$ bear charges Q_1 and Q_2 respectively. Then the potential at distance r between R_1 and R_2 will be** $\left(K = \frac{1}{4\pi\varepsilon_0}\right)$

a) $K\left(\frac{Q_1 + Q_2}{r}\right)$ b) $K\left(\frac{Q_1}{r} + \frac{Q_2}{R_2}\right)$ c) $K\left(\frac{Q_2}{r} + \frac{Q_1}{R_1}\right)$ d) $K\left(\frac{Q_1}{R_1} + \frac{Q_2}{R_2}\right)$

11. **The space between the plates of a parallel plate capacitot filled with a 'dielectric' whose 'dielectric constant' varies: with distance as per the relation:**

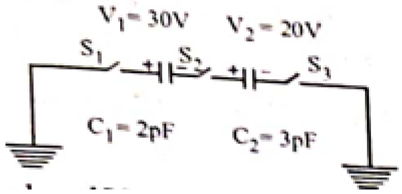
$K(x) = K_O + \lambda x (\lambda = a\,constant)$

Capacitance C, of the capacitor, would be related to 115 vacuum capacitance C_O for the relation :

a) $C = \frac{\lambda d}{\ln(1 + K_o \lambda d)} C_o$ b) $C = \frac{\lambda}{d.\ln(1 + K_o \lambda d)} C_o$

c) $C = \frac{\lambda d}{\ln(1 + \lambda d / K_o)} C_o$ d) $C = \frac{\lambda}{d.\ln(1 + K_o \backslash \lambda d)} C_o$

12. **For the circuit shown in figure, which of the following statements is true ?**

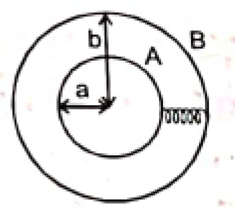


(a) With S_1 closed V_1=15 V, V_2=20 V (b) With S_3 closed V_1= V_2=25 V
(c) With S_1 and S_2 closed V_1=V_2=0 (d) With S_1 and S_3 closed, V_1=30V, V_2=20 V

13. Two thin wire rings each having a radius R are placed at a distance d apart with their axes coinciding. The charges the two rings are +q and –q. The potentialon between the centres of the two rings is

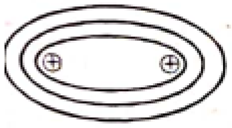
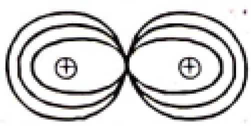
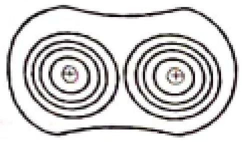
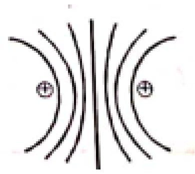
a) $\frac{q}{2\pi \in_0}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$ b) $\frac{qR}{4\pi \in_0 d^2}$ c) $\frac{q}{4\pi \in_0}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$ d) Zero

14. Two spherical conductors A and B of radii a and b(b>a) are placed concentrically in air. The two are connected by a copper wire as shown in figure. Then the equivalent capacitance of the system is

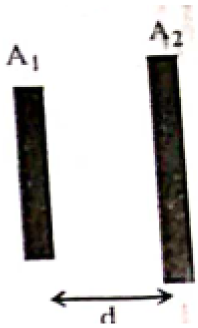


a) $4\pi \in_0 \frac{ab}{b-a}$ b) $4\pi \in_0 (a+b)$ c) $4\pi \in_0 b$ d) $4\pi \in_0 a$

15. Which of the following figure shows the correct equipotential surfaces of a system of two positive charges?

a) 
b) 
c) 
d) 

16. The capacitance of the capacitor of plate areas A_1 and A_2 (A_1<A_2) at a distance d as shown in figure is



a) $\frac{\in_0 (A_1+A_2)}{2d}$ b) $\frac{\in_0 A_2}{d}$ c) $\frac{\in_0 \sqrt{A_1 A_2}}{d}$ d) $\frac{\in_0 A_1}{d}$

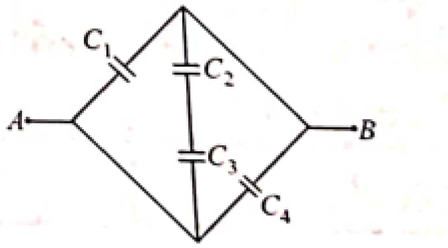
17. Two identical metal plates are given positive charges Q_1 and Q_2 (Q_1) respectively. If they are now brought close together to form a parallel plate capacitor with capacitance C, the potential difference between them is

(a) $\frac{Q_1+Q_2}{2C}$ (b) $\frac{Q_1+Q_2}{C}$ (c) $\frac{Q_1-Q_2}{C}$ (d) $\frac{Q_1-Q_2}{2C}$

18. A positively charged particle is released from rest in an uniform electric field. The electric potential energy of the charge

(a) remains a constant because the electric field is uniform
(b) increases because the charge moves along the electric field
(c) decreases because the charge moves along the electric field
(d) decreases because the charge moves opposite to the electric field

19. **In a given network the equivalent capacitance between A and B is [C_1=C_4=1 μF, C_2=C_2=2μF**



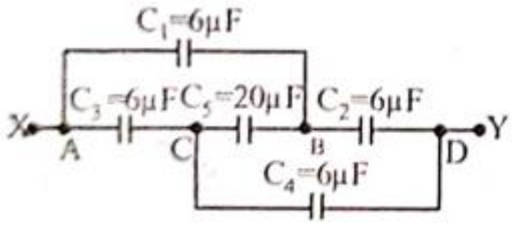
a) $3\mu F$ b) $6\mu F$ c) $4.5\mu F$ d) $2.5\mu F$

20 **A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an insulating handle. As a result the potential difference between the plates**

(a) does not change (b) becomes zero (c) increases (d) decreases

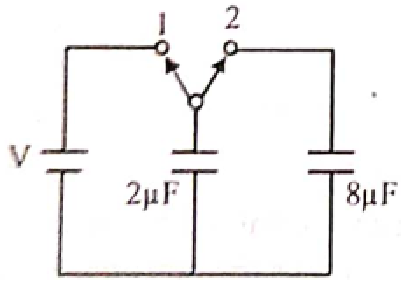
PART-II (NUMERICAL/INTEGER TYPE QUESTIONS)

21. **What is the effective capacitance (in μF) between points X and Y ?**



22. **An alpha particle is accelerated through a potential difference of 10^6 volt. Then what is its kinetic energy (in MeV)?**

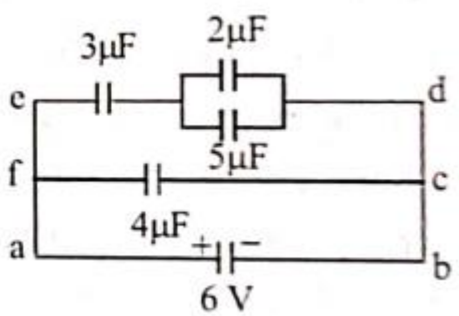
23. **A capacitor of 2μF is charged as shown in the diagram. When the switch S is turned to position 2**



the percentage of its stored energy dissipated is ?

23. **If n drops, each charged to a potential V, coalesce to form a single drop. If the potential of the big drop will be n^xV then find the value of x ?**

25. **In the circuit given below, what is the charge in μC, on the capacitor having 5 μF ?**



KEY SHEET

1) **c**	2) **a**	3) **c**	4) **b**	5) **c**	6) **a**	7) **b**	8) **b**	9) **c**	10) **c**
11) **c**	12) **d**	13) **a**	14) **c**	15) **c**	16) **d**	17) **c**	18) **c**	19) **a**	20) **c**
21) **6**	22) **2**	23) **80**	24) **0.66**	25) **9**					