DPP - Daily Practice Problems

Chapter-wise Sheets

Date : ______ **Start Time :** ______ **End Time :** ______

PHYSICS

CP16

SYLLABUS : Electrostatic Potential & Capacitance

Max. Marks : 120 **Marking Scheme :** (+4) for correct & (–1) for incorrect answer **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 30 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

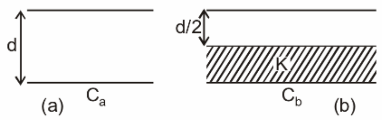
1. If n drops, each charged to a potential V, coalesce to form a single drop. The potential of the big drop will be

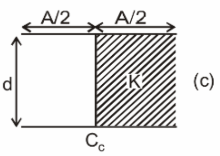
(a) $\frac{V}{n^{2/3}}$ (b) $\frac{V}{n^{1/3}}$ (c) $Vn^{1/3}$ (d) $Vn^{2/3}$

2. 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) $-8\varepsilon_0$

3. 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 (c), 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) $C_a = C_b = C_c$

4. The gap between the plates of a parallel plate capacitor of area A and distance between plates d, is filled with a dielectric whose permittivity varies linearly from $\in_1$ at one plate to $\in_2$ at the other. The capacitance of capacitor is:

(a) $\in_0(\in_1 + \in_2)A/d$

(b) $\in_0(\in_2 + \in_1)A/2d$

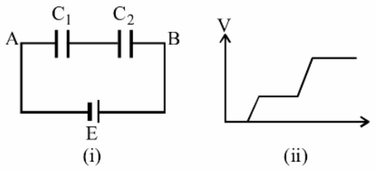
(c) $\in_0 A/[d\ln(\in_2/\in_1)]$

(d) $\in_0(\in_2 - \in_1)A/[d\ln(\in_2/\in_1)]$

RESPONSE GRID 1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ

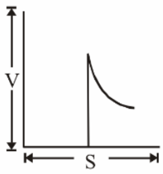
Space for Rough Work

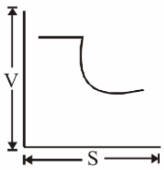
5. Figure (i) shows two capacitors connected in series and connected by a battery. The graph (ii) shows the variation of potential as one moves from left to right on the branch AB containing the capacitors. Then



(a) $C_1 = C_2$ (b) $C_1 < C_2$
(c) $C_1 > C_2$
(d) C_1 and C_2 cannot be compared

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

(a)


(b)


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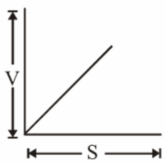
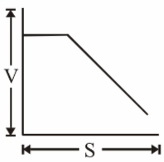
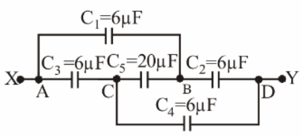


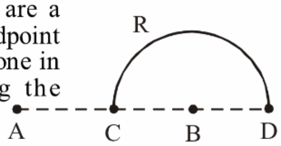
(d)


7. What is the effective capacitance between points *X* and *Y*?



(a) 24 μ*F* (b) 18 μ*F* (c) 12 μ*F* (d) 6 μ*F*

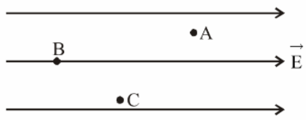
8. Charges $+q$ and $-q$ are placed at points *A* and *B* respectively which are a distance $2L$ apart, *C* is the midpoint between *A* and *B*. The work done in moving a charge $+Q$ along the semicircle *CRD* is



(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) $\frac{qQ}{4\pi\varepsilon_0 L}$

9. A, B and C are three points in a uniform electric field. The electric potential is

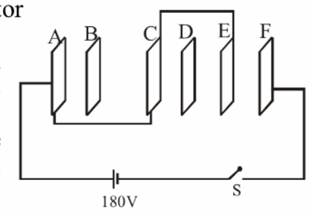


(a) maximum at B
(b) maximum at C
(c) same at all the three points A, B and C
(d) maximum at A

10. 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

11. Identify the false statement.
(a) Inside a charged or neutral conductor, electrostatic field is zero
(b) The electrostatic field at the surface of the charged 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

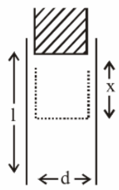
12. A, B, C, D, E, F are conducting plates each of area A and any two consecutive plates separated by a distance d. The net energy stored in the system after the switch S is closed is



(a) $\frac{3\varepsilon_0 A}{2d}V^2$ (b) $\frac{5\varepsilon_0 A}{12d}V^2$

(c) $\frac{\varepsilon_0 A}{2d}V^2$ (d) $\frac{\varepsilon_0 A}{d}V^2$

13. A parallel plate capacitor is made of two plates of length l, width w and separated by distance d. A dielectric slab (dielectric constant K) that fits exactly between the plates is held near the edge of the plates. It is pulled into the capacitor by a force $F = -\frac{\partial U}{\partial x}$ where U is the energy of the capacitor when dielectric is inside the capacitor up to distance x (See figure). If the charge on the capacitor is Q then the force on the dielectric when it is near the edge is:



(a) $\frac{Q^2 d}{2\omega l^2 \varepsilon_o}K$ (b) $\frac{Q^2 \omega}{2dl^2 \varepsilon_0}(K-1)$

(c) $\frac{Q^2 d}{2wl^2 \varepsilon_o}(K-1)$ (d) $\frac{Q^2 w}{2dl^2 \varepsilon_o}K$

RESPONSE GRID					
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	10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	

Space for Rough Work

14. 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) $k\left(\frac{Q_1}{R_1}+\frac{Q_2}{R_2}\right)$

15. An alpha particle is accelerated through a potential difference of 10^6 volt. Its kinetic energy will be

(a) 1 MeV (b) 2 MeV (c) 4 MeV (d) 8 MeV

16. The space between the plates of a parallel plate capacitor is filled with a 'dielectric' whose 'dielectric constant' varies with distance as per the relation:

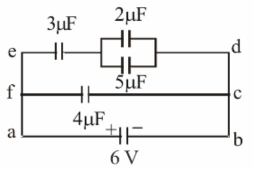
$K(x) = K_o + \lambda x$ (λ = a constant)

The capacitance C, of the capacitor, would be related to its vacuum capacitance C_o for the relation :

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

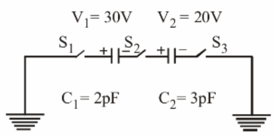
(c) $C = \frac{\lambda d}{ln(1+\lambda d/K_o)}C_o$ (d) $C = \frac{\lambda}{d.ln(1+K_o/\lambda d)}C_o$

17. In the circuit given below, the charge in μC, on the capacitor having 5 μF is



(a) 4.5 (b) 9 (c) 7 (d) 15

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



(a) With S_1 closed $V_1 = 15V, V_2 = 20V$

(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, $V_1 = 30$ V, $V_2 = 20$ V

19. Two thin wire rings each having a radius *R* are placed at a distance *d* apart with their axes coinciding. The charges on the two rings are $+q$ and $-q$. The potential difference between the centres of the two rings is

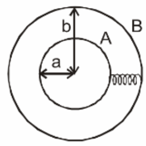
(a) $\frac{q}{2\pi\epsilon_0}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$

(b) $\frac{qR}{4\pi\epsilon_0 d^2}$

(c) $\frac{q}{4\pi\epsilon_0}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$

(d) zero

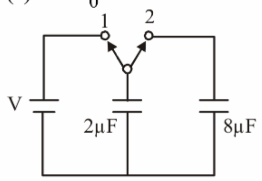
20. Two spherical conductors A and B of radii a and b (b>a) are placed concentrically in air. The two are connected by a copper wire as shown in figure. Then the equivalent capacitance of the system is



(a) $4\pi\varepsilon_0\frac{ab}{b-a}$ (b) $4\pi\varepsilon_0(a+b)$

(c) $4\pi\varepsilon_0 b$ (d) $4\pi\varepsilon_0 a$

21.



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 :

(a) 0% (b) 20% (c) 75% (d) 80%

22. A non-conducting disc of radius 'a' and uniform surface charge density σ is placed on the ground, with its axis vertical. A particle of mass m and positive charge q is dropped, along the axis of the disc, from a height H with zero initial velocity. The particle has $q/m = 4\pi\varepsilon_0 g/\sigma$. Electrostatic potential at H is

(a) $\frac{\sigma}{\varepsilon_0}\left[(a^2+H^2)^{1/2}-H\right]$

(b) $\frac{\sigma}{\varepsilon_0}\left[(a^2+H^2)^{1/2}+H\right]$

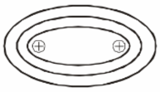
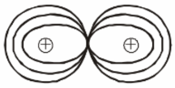
(c) $\frac{\sigma}{2\varepsilon_0}\left[(a^2+H^2)^{1/2}-H\right]$

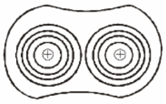
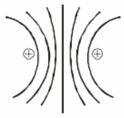
(d) $\frac{\sigma}{2\varepsilon_0}\left[(a^2+H^2)^{1/2}+H\right]$

RESPONSE GRID					
	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ
	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ	

Space for Rough Work

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

(a)  (b) 

(c)  (d) 

24. 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) $\frac{\epsilon_0 (A_1 + A_2)}{2d}$ (b) $\frac{\epsilon_0 A_2}{d}$

(c) $\frac{\epsilon_0 \sqrt{A_1 A_2}}{d}$ (d) $\frac{\epsilon_0 A_1}{d}$

25. 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) $\frac{Q_1 - Q_2}{2C}$

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

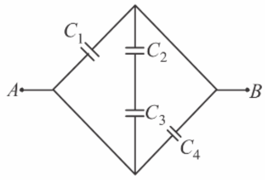
(a) remains a constant because the electric field is uniform

(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

27. In a given network the equivalent capacitance between A and B is [$C_1 = C_4 = 1\ \mu F$, $C_2 = C_3 = 2 \mu F$]



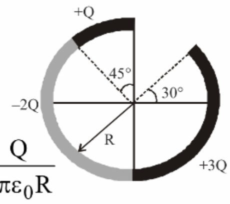
(a) 3 μF (b) 6 μF (c) 4.5 μF (c) 2.5 μF

28. 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

29. Figure shows three circular arcs, each of radius R and total charge as indicated. The net electric potential at the centre of curvature is



(a) $\frac{Q}{2\pi\varepsilon_0 R}$ (b) $\frac{Q}{4\pi\varepsilon_0 R}$

(c) $\frac{2Q}{\pi\varepsilon_0 R}$ (d) $\frac{Q}{\pi\varepsilon_0 R}$

30. A fully charged capacitor has a capacitance 'C'. It is discharged through a small coil of resistance wire embedded in a thermally insulated block of specific heat capacity 's' and mass 'm'. If the temperature of the block is raised by 'ΔT', the potential difference 'V' across the capacitance is

(a) $\frac{mC\Delta T}{s}$ (b) $\sqrt{\frac{2mC\Delta T}{s}}$

(c) $\sqrt{\frac{2ms\Delta T}{C}}$ (d) $\frac{ms\Delta T}{C}$

RESPONSE GRID	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ
	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ		

DAILY PRACTICE PROBLEM DPP CHAPTERWISE CP16 - PHYSICS			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	45	Qualifying Score	60
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work