

Electrostatic Potential & Capacitance

[PHYSICS BY RAJAT SACHDEV] [9580951094]

① Two point charges q and $-2q$ are kept 'd' distance apart. Find the location of the point relative to charge ' q ' at which potential due to this system of charges is zero. [Ans - $d/3$]

② Show that the electric field at any point is equal to the negative of the potential gradient at that point.

③ Sketch and explain the equipotential surfaces for -
(a) a point charge (ii) two point charges $+q$ and $-q$ separated by a small distance (iii) two point charges $+q$ and $+q$ separated by a small distance (iv) a uniform electric field.

④ Two charges of magnitude 5 nC and -2 nC are placed at points $(2\text{ cm}, 0, 0)$ and $(x\text{ cm}, 0, 0)$ in a region of space, where there is no other external field. If the electrostatic potential energy of the system is $-0.5\text{ }\mu\text{J}$. what is the value of x ? [Ans - $x = 4\text{ cm}$]

⑤ An isolated sphere has a capacitance $50\text{ }\mu\text{F}$.
(i) Calculate its radius. (ii) How much charge should be placed on it to raise its potential to 10^4 V ?
[A (i) 45 cm (ii) $0.5\text{ }\mu\text{C}$]

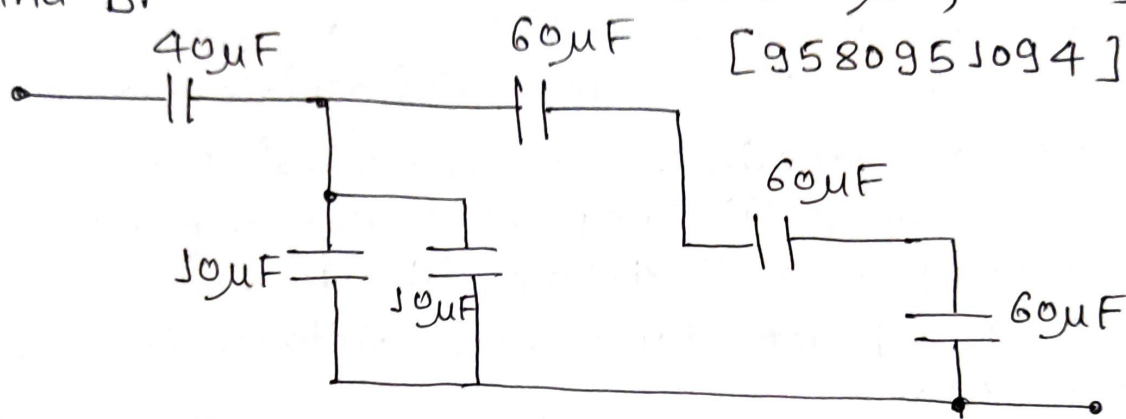
⑥ What is a parallel plate capacitor? Derive an expression for its capacitance. On what factors does the capacitance of a parallel plate capacitor depend?

⑦ Two capacitors of capacitance of $6\text{ }\mu\text{F}$ and $12\text{ }\mu\text{F}$ are connected in series with a battery. The voltage across the $6\text{ }\mu\text{F}$ capacitor is 2 V . Compute the total battery voltage. [9580951094] [Ans - 3 V]

⑧ Two capacitors have a capacitance of $5\text{ }\mu\text{F}$ when connected in parallel and $1.2\text{ }\mu\text{F}$ when connected in series. Calculate their capacitances. [Ans - $2\text{ }\mu\text{F}$ & $3\text{ }\mu\text{F}$]

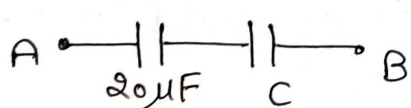
⑨ Find the equivalent capacitance of the combination of capacitors between the points A and B as shown in figure. Also calculate the total charge that flows in the circuit when a 100 V battery is connected between the points A and B.

[Ans - $20\mu\text{F}$, 2mC]



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⑩ The equivalent capacitance of the combination between A and B in figure is $4\mu\text{F}$



(i) $5\mu\text{F}$, (ii) $48\mu\text{F}$ (iii) 2.4V , 9.6V

- (i) Calculate capacitance of the capacitor C.
 (ii) Calculate charge on each capacitor if a 12V battery is connected across terminal A and B.
 (iii) What will be the potential drop across each capacitor?

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⑪ A 12pF capacitor is connected to a 50V battery. How much electrostatic energy is stored in the capacitor? If another capacitor of 6pF is connected in series with it with the same battery connected across the combination, find the charge stored and potential difference across each other.

[Ans - $2 \times 10^{-10}\text{C}$, $\frac{50}{3}\text{V}$, $\frac{100}{3}\text{V}$]

⑫ Explain the changes in the value (i) charge on plates (ii) electric field (iii) p.d between plates (iv) Capacitance (v) energy stored when battery is connected and disconnected.