

Important Problems for Boards (Electrostatic Potential and Capacitance)

Example 1

Three point-charges of 1 C, 2 C and 3 C are placed at the corners of an equilateral triangle of side 1 m. Find the work done to dissociate this system of charges.

Example 2

Two point-charges A and B of value $+5 \mu\text{C}$ and $+6 \mu\text{C}$ are kept 12 cm apart in air. Calculate the work done when charge B is moved by 2 cm towards charge A.

Example 3

A charge of 8 mC is located at the origin. Calculate the work done in taking a small charge of -2×10^{-9} C from a point P (0, 0, 3 cm) to a point Q (0, 4 cm, 0), via a point R (0, 6 cm, 9 cm). (NCERT Exercise)

Example 4

Two tiny spheres carrying charges $1.5 \mu\text{C}$ and $2.5 \mu\text{C}$ are located 30 cm apart. Find the electric potential:

(a) at the mid-point of the line joining the two charges, and

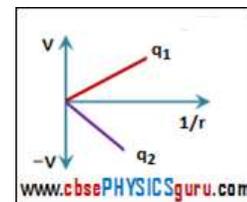
(b) at a point 10 cm from this midpoint in a plane normal to the line and passing through the midpoint.

Example 5

The two graphs shown in figure show the variation of electric potential (V) with $1/r$ (r being the distance of the field point from the point charge) for two-point charges q_1 and q_2 :

(i) What are the signs of the two charges?

(ii) Which of the two charges has a larger magnitude and why?



Example 6

Two charges $-q$ and $+q$ are located at points (0, 0, $-a$) and (0, 0, a), respectively. What is the electrostatic potential at the points A (0, 0, z) and B (x , y , 0)?

Example 7

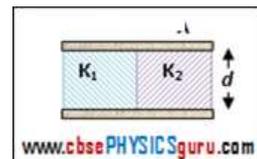
A parallel plate air capacitor has capacitance of 8 pF. What will be the capacitance if the distance between the plates be reduced by half and the space between them is filled with a substance of dielectric constant $K = 6$?

Example 8

Two capacitors of capacitances $2 \mu\text{F}$ and $4 \mu\text{F}$ are connected in series across a battery of emf 6 volt. Capacitors are then disconnected from the battery, and the free ends of connecting wires are joined together. What is the final charge on each capacitor?

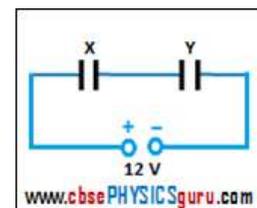
Example 9

Two dielectric slabs of dielectric constants K_1 and K_2 have been filled in between the plates of a capacitor as shown in figure. What will be the capacitance of the capacitor?



Example 10

Two parallel plate capacitors X and Y as shown in figure have the same area of plates and same separation between them. X has air between the plates while Y contains a dielectric medium of $K = 4$. (i) Calculate capacitance of each capacitor if equivalent capacitance of the combination is $4 \mu\text{F}$. (ii) Calculate the potential difference between the plates of X and Y. (iii) What is the ratio of electrostatic energy stored in X and Y?



Example 11

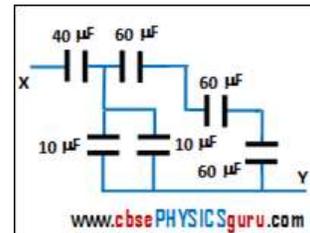
A conducting sphere of radius R , and carrying a charge q is joined to a conducting sphere of radius $2R$, and carrying a charge $-2q$. What is the charge that flows between the spheres?

Example 12

There is an equilateral triangle with one-point charge at each vertex. The charges are $-Q$, $+3Q$ and $-4Q$ respectively. The length of one side of the triangle is L . Determine an expression in simplest form for the electric potential at a point halfway between the $-Q$ and $+3Q$.

Example 13

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



Example 14

Three identical capacitors C_1 , C_2 and C_3 of capacitance $6\ \mu\text{F}$ each are connected to a 12 V battery as shown in the figure. Find (i) charge on each capacitor (ii) equivalent capacitance of the network (iii) energy stored in the network of capacitors.

