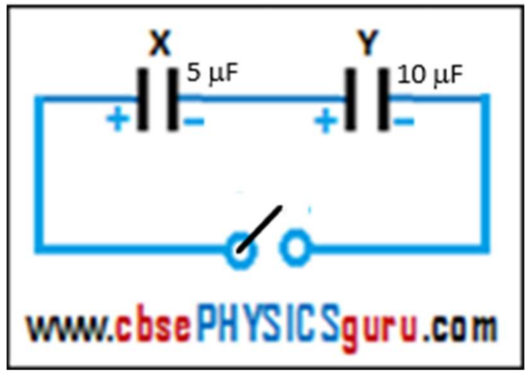
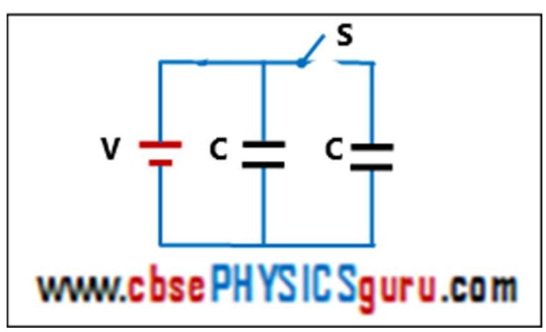
ENERGY STORED IN A CAPACITOR AND SHARING OF CHARGES

1. Capacitor X is charged to a potential of 100 V and capacitor Y is charged to a potential of 75 V. What are the charges on X and Y after key is closed, as shown in figure?
(a) $\frac{250}{3}\,\mu C, \frac{500}{3}\,\mu C$ (b) $\frac{500}{3}\,\mu C, \frac{500}{3}\,\mu C$ (c) $\frac{1250}{3}\,\mu C, \frac{1250}{3}\,\mu C$ (d) $\frac{750}{3}\,\mu C, \frac{250}{3}\,\mu C$



2. The plates of a parallel plate capacitor have an area of 100 cm^2 each and are separated by 2.5 mm. The capacitor is charged to 200 V. The energy stored in the capacitor is:
(a) 7.08×10^{-7} J (b) 7.08×10^{-5} J (c) 7.2×10^{2} J (d) 7.8×10^{7} J
3. A parallel plate capacitor has plate of area A and separation d. It is charged to a potential difference V_0. The charging battery is disconnected and the plates are pulled apart to three times the initial separation. The work required to separate the plates is:
(a) $\frac{\varepsilon_0 A V_0^2}{4d}$ (b) $\frac{\varepsilon_0 A V_0^2}{3d}$ **(c)** $\frac{\varepsilon_0 A V_0^2}{d}$ (d) $\frac{2\varepsilon_0 A V_0^2}{d}$
4. Two conducting spheres of radii 5 cm and 10 cm are given a charge of 15 μC each. After connecting the spheres by a copper wire, the charge on the smaller sphere is equal to:
(a) 5 μC **(b)** 10 μC (c) 12 μC (d) 15 μC
5. Two spherical conductors A and B of radii 1 cm and 2 cm are uniformly charged. If the spheres are connected by a conducting wire then in equilibrium conditions, the ratio of the magnitude of the electric fields at the surfaces of spheres of A and B is:
(a) 1 :4 (b) 1: 2 (c) 4 :1 **(d)** 2: 1
6. A capacitor of capacitance 4 μF is charged to 80 V and another capacitor of capacitance 6 μF is charged to 30 V. When they are connected together, the energy lost by the 4 μF capacitor is:
(a) 7.8 mJ (b) 4.8 mJ (c) 3.0 mJ (d) 3.5 mJ
7. A parallel plate capacitor of capacity C_o is charged to a potential V_0. (i) The energy stored in the capacitor when the battery is disconnected and the plate separation doubled is U_1. (ii) The energy stored in the capacitor when the charging battery is kept connected and the separation between the capacitor plates is doubled is U_2. Then U_1/U_2 is:
(a) 1 (b) 2 (c) 3 **(d)** 4
8. The figure shows two identical parallel plate capacitors connected to a battery with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant (or relative permittivity) 3. Find the ratio of the total electrostatic energy stored in capacitors before and after the introduction of dielectric:
(a) 1/5 (b) 2/5 **(c)** 3/5 (d) 4/5



9. N identical drops, each of capacitance C and charged to a potential V, coalesce to form a bigger drop. Then the ratio of the energy stored in the big drop to that in each small drop is:
(a) N: 1 **(b)** $N^{5/3}$: 1 (c) $N^{4/3}$: 1 (d) $N^{2/3}$: 1
10. Two charged spherical conductors of radii R_1 and R_2 are connected by a wire. Then the ratio of surface charge densities of the spheres $\frac{\sigma_1}{\sigma_2}$ is:
(a) $\frac{R_2}{R_1}$ (b) $\frac{R_1}{R_2}$ (c) $\sqrt{\frac{R_1}{R_2}}$ (d) 1
11. A parallel plate capacitor is charged to a potential difference of 20 volts. It is then discharged through a resistance for 5 seconds and its potential drops by 4 volts. Calculate the fraction of energy stored in the capacitance:
(a) 0.24 (b) 0.48 (c) 0.80 **(d)** 0.64
12. A capacitor of capacitance 2 μF 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) 40 % (b) 60 % **(c)** 80 % (d) 0%