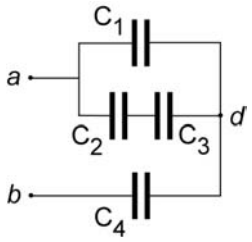
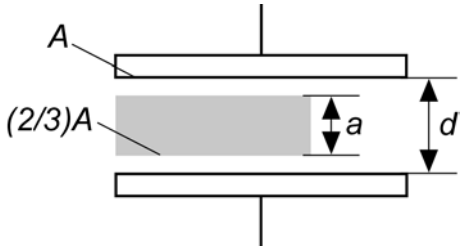
1. In the following circuit, $C_1 = C_2 = C_3 = C_4 = 8\ \mu F$, and $V_{ab} = V_a - V_b = 20$ V.

(a) (8 points) Find the equivalent capacitance between *a* and *b*;
(b) (8 points) Find the charge on each capacitor;
(c) (4 points) Find the potential difference across each capacitor.



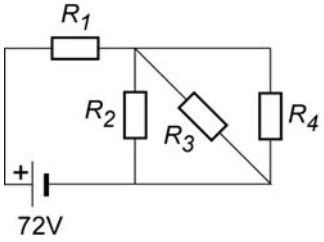
2. A slab of dielectric material with $\kappa = 6$, thickness *a* and area *(2/3)A* is inserted between the plates of an air parallel-plate capacitor with plate area *A* and plate separation *d*. Here $d \geq a$.

(a) (10 points) Find the capacitance C of the capacitor in this arrangement in terms of the capacitance C_0 when the dielectric slab is removed;
(b) (5 points) Find the capacitance C in terms of C_0 when $a = 0$;
(c) (5 points) Find the capacitance C in terms of C_0 when $a = d$.



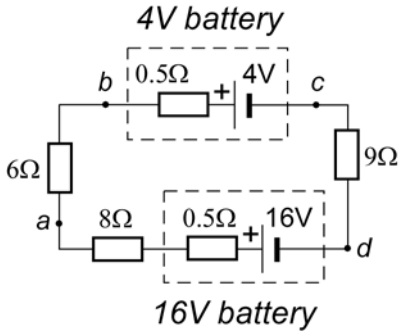
3. In the following direct-current circuit, $R_1 = R_2 = R_3 = R_4 = 6\ \Omega$, and $\varepsilon = 72$ V with negligible internal resistance.

(a) (10 points) find the power dissipated in R_1 and R_2;
(b) (10 points) Now remove R_4 from the circuit, and find the current through each of the remaining three resistors.



4. In the following direct-current circuit,

(a) (8 points) Find the magnitude and direction of the current in the circuit;
(b) (6 points) Find the terminal voltage of the 4V battery, $V_{bc} = V_b - V_c$;
(c) (6 points) Find the potential difference $V_{ad} = V_a - V_d$.



5. In the following direct-current circuit,

(a) (10 points) Find the current (direction and magnitude) in each branch;
(b) (10 points) Find the potential difference $V_{ab} = V_a - V_b$.