Name: Key Id#:   Sect#:
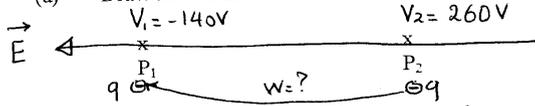
1. Consider two points in an electric field. The potential at point P_1 is $V_1 = -140$ V, and the potential at point P_2 is $V_2 = 260$ V.

    (a) Draw the electric field lines between points P_1 and P_2.

    $\vec{E}$ ◁————————

    $V_1 = -140V$ $V_2 = 260V$

    × P_1 × P_2

    q ⊖ $W = ?$ ⊖ q

    (b) How much work is required in moving a charge $q = -12$ μC from point P_2 to point P_1.

    $$W = \Delta U = q \Delta V = \left(-12\times10^{-6}\right)\left(V_1 - V_2\right)$$
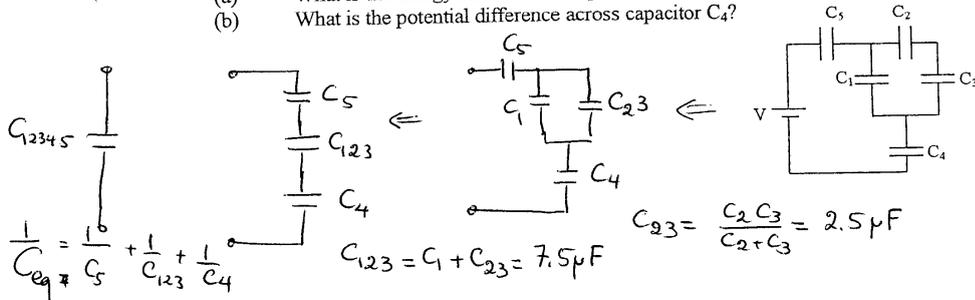 $$= \left(-12\times10^{-6}\right)\left(-140-260\right) = 4.8\times10^{-3}\ J$$

    $W > 0 \Rightarrow$ It is done by an external agent.

2. In the figure, the battery has a potential difference of 50 V and the five capacitors each having a capacitance of 5 μF.

    (a) What is the energy stored in the capacitor C_5?

    (b) What is the potential difference across capacitor C_4?

$C_{23} = \dfrac{C_2 C_3}{C_2+C_3} = 2.5\,\mu F$

$C_{123} = C_1 + C_{23} = 7.5\,\mu F$

$\dfrac{1}{C_{eq}} = \dfrac{1}{C_5} + \dfrac{1}{C_{123}} + \dfrac{1}{C_4}$

$C_{eq} = 1.88\,\mu F$

$\Rightarrow q_{eq} = C_{eq} V = 1.88\,\mu F \times 50V = 93.75\,\mu C$

$\Rightarrow q_5 = q_{123} = q_4 = 93.75\,\mu C$

$\Rightarrow U_5 = \dfrac{1}{2}\dfrac{q_5^2}{C_5} = \dfrac{1}{2}\dfrac{\left(93.75\times10^{-6}\right)^2}{5\times10^{-6}} = \boxed{8.8\times10^{-4}\ J}$

$V_4 = \dfrac{q_4}{C_4} = \dfrac{93.75\times10^{-6}}{5\times10^{-6}} = \boxed{18.75\ V}$