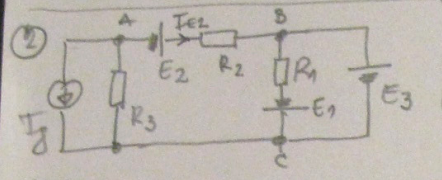


a) $\vec{K}_P = \vec{K}_{P1} + \vec{K}_{P2}$
 $\vec{K}_{P1} = \frac{Q_1}{4\pi\epsilon_r\epsilon_0(3a)^2} \vec{i} = \frac{Q}{36\pi\epsilon_r\epsilon_0 a^2} \vec{i}$
 $\vec{K}_{P2} = \frac{b_2}{2\epsilon_r\epsilon_0} \vec{j} = -\frac{3}{2\epsilon_r\epsilon_0} \vec{j}$
 $\vec{K}_P = \frac{Q}{36\pi\epsilon_r\epsilon_0 a^2} \vec{i} - \frac{3}{2\epsilon_r\epsilon_0} \vec{j}$

b) $\vec{F}_{21} = \vec{K}_2 \cdot Q_1 = \frac{b_2}{2\epsilon_r\epsilon_0} \vec{j} \cdot Q_1 = -\frac{3Q}{2\epsilon_r\epsilon_0} \vec{j}$



MH4: $C=0$

A) $(\frac{1}{R_3} + \frac{1}{R_2}) U_{A0} - \frac{1}{R_2} U_{B0} = -I_g - \frac{E_2}{R_2}$

B) $U_{B0} = E_3 = 10V$

$U_{A0} = \frac{-I_g - E_2/R_2 + E_3/R_2}{\frac{1}{R_3} + \frac{1}{R_2}} = \frac{-1 - 1 + 2}{0.2 + 0.2} = 0$

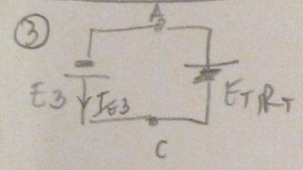
$U_{CA} = -U_{A0} = 0$

$P_{I_g} = U_{CA} I_g = 0$

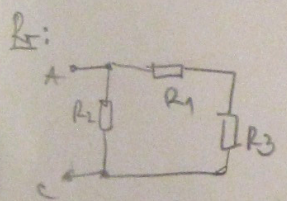
$U_{AB} = -E_2 + R_2 I_{E2} = U_{A0} - U_{B0}$

$I_{E2} = \frac{-U_{B0} + E_2}{R_2} = -1A$

$P_{E2} = E_2 I_{E2} = -5W$

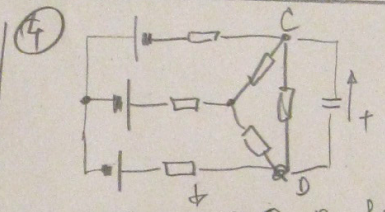


$I_{E3} = \frac{E_3 + E_T}{R_T} = \frac{6+2}{2} = 4A$



$R_T = R_2 || (R_1 + R_3) = \frac{3 \cdot 6}{3+6} = 2\Omega$

$E_T = U_{AC} = E_2 - R_2 \cdot I = E_2 - R_2 \cdot \frac{E_2 + E_1 + R_3 I_g}{R_1 + R_2 + R_3} = 9 - \frac{9+21+3}{3} = -2V$



$R_B = \frac{R_1 R_2}{R_1 + R_2 + R_3} = 3\Omega$
 $R_C = R_D = 3\Omega$

a) $U_{AZ} (\frac{1}{R_4 + R_C} + \frac{1}{R_6 + R_0} + \frac{1}{R_5 + R_D}) = \frac{E_1}{R_4 + R_C} - \frac{E_1}{R_6 + R_0} - \frac{E_1}{R_5 + R_D}$

$U_{AZ} \cdot \frac{3}{9} = -\frac{45}{9} \Rightarrow U_{AZ} = -15V$

$U_C = U_{DC} = R_C I_1 + R_D I_2$

$I_1 = \frac{U_{AZ} - E_1}{R_4 + R_C} = -\frac{60}{9} = -\frac{20}{3}A$

$I_2 = \frac{-U_{AZ} - E_1}{R_5 + R_D} = -\frac{30}{9} = -\frac{10}{3}A$

$U_C = 30V$

$Q_C = C \cdot U_C = 3\mu C$

b) $W_C = \frac{1}{2} Q_C U_C = 45\mu J$

$C = \frac{\epsilon S}{d} \Rightarrow \epsilon = \frac{Cd}{S} = \frac{100 \cdot 10^{-9} \cdot 20 \cdot 10^{-4}}{10 \cdot 10^{-4}} = 10^{-9} \frac{F}{m}$