PHYSICS III
Dr. Joenathan – Winter 2001

Homework VIII
Chapter 27
27-11, 15, 25, 43, 55, 63

27-11.

$$\frac{1}{R_3} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = 3/R$$

$$R_3 = R/3$$

$$R_2 = \frac{R^2}{2R} = \frac{R}{2}$$

$$R_{AB} = R + \frac{R}{2} + \frac{R}{3} + \frac{R}{2} + R = 3.33R$$

27-15.

$$R_{tot} = 15.0\,\Omega$$

$$I_1 = \frac{\varepsilon}{R_{tot}} = \frac{12.0V}{15.0\Omega} = 0.800A$$

$$\Delta V_1 = I_1 R_1 = (0.800A)(9.00\Omega) = 7.20V$$

$$\Delta V_2 = \Delta V_P = I_1 R_P = I_1\left(\frac{(R_3 + R_4)(R_2)}{R_2 + R_3 + R_4}\right) = 2.40V$$

$$I_{34} = \frac{\Delta V_P}{R_3 + R_4} = \frac{2.40V}{6.00\Omega} = 0.400A$$

$$\Delta V_3 = I_{34} R_3 = (0.400A)(4.00\Omega) = 1.60V$$

$$\Delta V_4 = I_{34} R_4 = \Delta V_P - \Delta V_3 = 2.40V - 1.60V = 0.800V$$

$$\Delta V_5 = I_1 R_5 = (0.800A)(3.00\Omega) = 2.40V$$

27-25.

$\varepsilon_1 - I_1R_1 - \varepsilon_3 - I_2R_3 + \varepsilon_2 - I_1R_2 = 0$

$\varepsilon_2 + I_3R_4 - I_2R_3 = 0$

At junction near positive terminal of ε_2 : $-I_1 + I_2 + I_3 = 0$

$I_1(R_1 + R_2) + I_2R_3 = \varepsilon_1 + \varepsilon_2 - \varepsilon_3$

$(14.0\times10^3\ \Omega)I_1 + (2.00\times10^3\ \Omega)I_2 = 8.00V$

$I_2R_3 - I_3R_4 = \varepsilon_2$

$(2.00\times10^3\ \Omega)I_2 - (4.00\times10^3\ \Omega)I_3 = 4.00V$

$I_1 = 4.35\times10^{-4}A$

$I_2 = 9.57\times10^{-4}A$

$I_3 = -5.22\times10^{-4}A$ (I_3 *is* $5.22\times10^{-4}A$ *but in the direction opposite to that shown.*)

$P_4 = I_3^2R_4 = (5.22\times10^{-4}A)^2(4.00\times10^3\ \Omega)$

$= 1.09\times10^{-3}W$

$P_{\varepsilon_2} = \varepsilon_2 I_2 = (4.00V)(9.57\times10^{-4}A)$

$= 3.83\times10^{-3}W$

$\Delta V_1 = I_1R_1 = (4.35\times10^{-4}A)(6.00\times10^3\ \Omega)$

$= 2.61V$

27-43.

(a)

$$q = C\varepsilon\,(1 - e^{-t|R'C}); R' = R\; + 1.00M\;\Omega$$

$$e^{-t|R'C} = 1 - \frac{q}{C\varepsilon} = 1 - \frac{8.00\times10^{-3}C}{(20.0\times10^{-6}F)\,(500.\,V)} = 0.200$$

$$t = -R'C\,1n(0.200)$$

$$R' = -\frac{t}{C\,1n(0.200)} = -\frac{160.s}{(20.0\times10^{-6}F)1n(0.200)}$$

$$= 4.97\times10^{6}\;\Omega$$

$$R = R' - 1.00\times10^{6}\;\Omega = 3.97\times10^{6}\;\Omega$$

(b)

$$\frac{q}{C} = \Delta V = \varepsilon\, e^{-t/R'C}$$

$$= (500.\,V)\left(e^{\frac{-120.s}{(4.97\times10^{6}\Omega)(20.0\times10^{-6}F)}}\right)$$

$$= 119.V$$

27-63.

$$\varepsilon_1 - I_1R_1 - \varepsilon_2 + I_3R_3 - \varepsilon_3 = 0$$

$$\varepsilon_3 - I_3R_3 - I_2R_2 + \varepsilon_4 - I_2R_4 = 0$$

At junction on negative side of $\varepsilon_2; I_1 - I_2 + I_3 = 0$

$$I_1R_1 - I_3R_3 = \varepsilon_1 - \varepsilon_2 - \varepsilon_3$$

$$(20.0\,\Omega)\,I_1 - (8.00\,\Omega)\,I_3 = 4.00V$$

$$I_3 R_3 + I_2 R_2 + I_2 R_4 = \varepsilon_3 + \varepsilon_4$$

$$(10.0\,\Omega)\,I_2 + (8.00\,\Omega)\,I_3 = 10.0V$$

$$I_1 = 0.345A$$

$$I_2 = 0.709A$$

$$I_3 = 0.364A$$