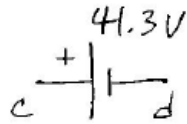


$$P1.11. (a) +16.1 + v_{ab} + 12.9 = 0 \Rightarrow v_{ab} = -29V$$

$$(b) +16.1 + 12.3 + 12.9 + v_{dc} = 0 \Rightarrow v_{dc} = -41.3V$$



$$P1.14. -i_1 + (-3) + (+8) = 0 \Rightarrow i_1 = +5A$$

$$- (+10) + i_2 + 8 = 0 \Rightarrow i_2 = +2A$$

$$v_{ad} + 8 - 20 - (-5) = 0 \Rightarrow v_{ad} = +7V$$

$$v_x - 20 - (-5) + 3 = 0 \Rightarrow v_x = +12V$$

$$P1.16. +v_2 + 12 - 10 = 0 \Rightarrow v_2 = -2V$$

$$(a) -25 + v_1 + 10 = 0 \Rightarrow v_1 = +15V$$

$$-5 + i + 5.6 = 0 \Rightarrow i = -0.6A$$

$$(b) p_{25} = 25 \times 5 = 125W$$

$$p_{12} = -(12)(-0.6) = +7.2W$$

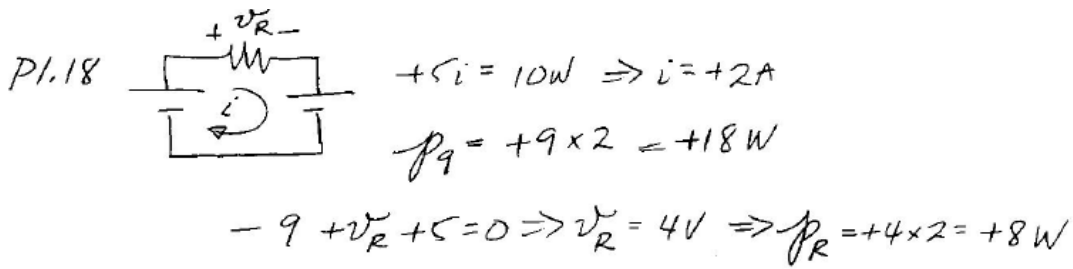
$$\left. \begin{array}{l} p_{25} = 125W \\ p_{12} = 7.2W \end{array} \right\} p_{out} = 125 + 7.2 = 132.2W$$

$$p_{R_1} = +v_1 \times 5 = +(15) \times 5 = +75W$$

$$p_{R_2} = +v_2(-0.6) = +(-2)(-0.6) = +1.2W$$

$$p_{R_3} = +10(5.6) = 56W$$

$$\left. \begin{array}{l} p_{R_1} = 75W \\ p_{R_2} = 1.2W \\ p_{R_3} = 56W \end{array} \right\} p_{in} = 132.2W$$



P1.26. (a) double pole

(b) double throw

(c) $V_{out} = \pm V_{in}$

P1.27. For ON

SW 1	SW 2
a	c
b	d

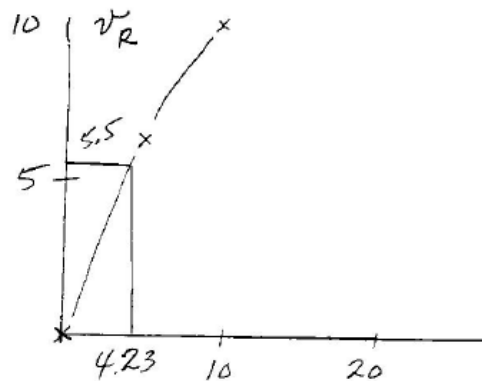
(b) it goes OFF

(c) it goes ON

P1.32. $v(R) = 25 \times \frac{R}{R+5}$

$5.5 = 25 \times \frac{1}{1+15/R}$

$\frac{15}{R} = 3.55 \Rightarrow R = 4.23 \Omega$



P1.35. (a) $0.5 = 5 \times \frac{\frac{1}{R}}{\frac{1}{R} + \frac{1}{150}}$ so $\frac{1}{R} + \frac{1}{150} = \frac{10}{R}$
 $R = 150 \times 9 = 1350 \Omega$

(b) $i^2 R = 833$

$\left(\frac{5/R}{\frac{1}{R} + \frac{1}{150}}\right)^2 \times R = 833 \Rightarrow \frac{1}{R} = \frac{833}{25} \left(\frac{1}{R} + \frac{1}{150}\right)^2$. Let $1/R = x$

$x = 33.3 \left(x^2 + \frac{x}{75} + \left(\frac{1}{150}\right)^2\right)$

(c) next page $x = 1.33 \times 10^{-2} (R = 74.9 \Omega)$ or $3.33 \times 10^{-3} (300 \Omega)$

P1.35(c) $P(R) = \frac{25/R}{\left(\frac{1}{R} + \frac{1}{150}\right)^2}$ so $P(x) = \frac{25x}{\left(x + \frac{1}{150}\right)^2}$

$\frac{dP}{dx} = 0$ yields $x = \frac{1}{150}$ or $R = 150 \Omega$

$P_{max} = \frac{I^2 \times R_{eq}}{2} = \frac{25 \times 150 // 150}{2} = 937.5 W$

P1.39. (a) For $R=0$; $R_{eq} = R_1 = 30 \Omega$

For $R=\infty$, $R_{eq} = R_1 + R_2 = 75 \Omega \Rightarrow R_2 = 45 \Omega$

(b) $45 // R = 22.5 \Rightarrow R = 45 \Omega$

$$P1.41. (a) \quad i = \frac{15}{5 \parallel 7.5 + 10} = 1.15 \text{ A}$$

$$(b) \quad i = \frac{36}{75 + 100 \parallel 150} \times \frac{100 \parallel 150}{100} = 0.160 \text{ A}$$

$$0.267 \text{ A} \times 75 \Omega = v = +20 \text{ V}$$

$$(c) \quad v = 0.5 \times (5 \parallel 10 \parallel 35) \times \frac{20}{20 + 15} = 0.870 \text{ V}$$

$$(d) \quad v = -2 \times (6 \parallel 6) \times \frac{5}{5 + 1} = -5 \text{ V}$$

P1.50 (a) $R_{eq} = 2R \parallel 2R = R$ since no current flows in middle resistor

(b) $R_{eq} = (R \parallel R + R \parallel R) \parallel R = R/2$ since no current flows in farthest R

$$(c) \quad R = R \parallel R \parallel R + (R \parallel R \parallel R \parallel R \parallel R) + (R \parallel R \parallel R)$$

$$= \frac{R}{3} + \frac{R}{6} + \frac{R}{3} = \frac{5}{6} R$$

$$P1.51. \quad R_{eq} = R + R \parallel R_{eq} = R + \frac{1}{\frac{1}{R} + \frac{1}{R_{eq}}} = R + \frac{R R_{eq}}{R + R_{eq}}$$

$$(a) \quad \text{so} \quad R_{eq} (R + R_{eq}) = R (R + R_{eq}) + R R_{eq}$$

$$\frac{R_{eq}}{R} = 1.62, \quad -0.618 \Rightarrow R_{eq} = 1.62 R$$

$$(b) \quad R_{eq} = R + R \parallel 2R_{eq} \Rightarrow R_{eq} (R + 2R_{eq}) = R (R + 2R_{eq}) + 2R R_{eq}$$

$$R_{eq} = 1.78 R, \quad -0.781 R$$

$$P2.29 \quad \frac{v_a - v_b}{7} + \frac{v_a - (0)}{15} = 2 \Rightarrow v_a \left(\frac{1}{7} + \frac{1}{15} \right) + v_b \left(-\frac{1}{7} \right) = 2$$

(a)

$$\frac{v_b - v_a}{7} + \frac{v_b - (0)}{10} = +2 \Rightarrow v_a \left(-\frac{1}{7} \right) + v_b \left(\frac{1}{7} + \frac{1}{10} \right) = +2$$

$$v_a = -6.56 \text{ V}, v_b = +4.38 \text{ V}$$

$$(b) \quad v_{ar} = -6.56, v_{br} = +4.38 \quad v_{ab} = v_{ar} + v_{rb} \\ = -6.56 - 4.38 = -10.9 \text{ V}$$

$$v_{ra} + v_{ab} + v_{br} = 0$$

$$-(-6.56) + (-10.9) + (4.38) = 0$$

$$P2.29(c) \quad v_a' = 2v_{ar} = 2 \times (-6.56) = -13.1 \text{ V}$$

$$v_{br}' = v_{br} = +4.38$$

$$v_{ab}' = v_{ar}' - v_{br}' = -13.1 - 4.38 = -17.5 \text{ V}$$

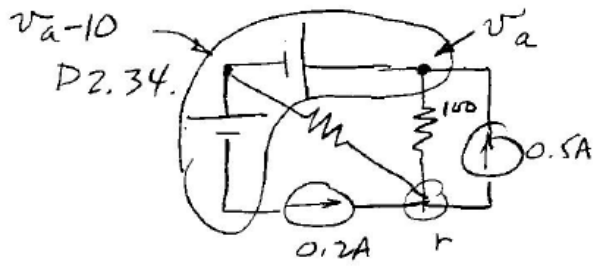
$$v_{ra}' + v_{ab}' + v_{br}' = 0 \quad -(-13.1) + (-17.5) + (4.38) = 0 \quad \checkmark$$

$$P2.31. \quad v_{ar} - 5 = 0 \Rightarrow v_{ar} = v_a = +5$$

$$(a) \quad v_{cr} + 10 = 0 \Rightarrow v_{cr} = v_c = -10$$

$$(b) \quad \frac{v_b - (+5)}{100} + \frac{v_b - (0)}{50} + \frac{v_b - (-10)}{150} = +0.1$$

$$v_b = \frac{0.1 + 0.05 - 10/150}{\frac{1}{100} + \frac{1}{50} + \frac{1}{150}} = 2.27 \Rightarrow i = \frac{2.27}{50} \\ = 4.55 \times 10^{-2} \text{ A}$$



$$\frac{v_a - 10}{100} + \frac{v_a - 10 - 10}{200} = +0.5 - 0.2$$

$$v_a = 23.3 \text{ V}$$

$$i = \frac{23.3}{100} = 0.233$$