Homework I Ch. 1 # 13, 21, 24
Ch. 2 # 2, 5, 13, 14, 20, 28, 36

P. 1. 13 12-V battery w/output capacity of 100 ampere-hours. When connected to a 200 watt lamp

a) find the current supplied by the battery

$P = iv$ $P = 200\,W$, $v = 12\,V$

$i = \frac{P}{v}$

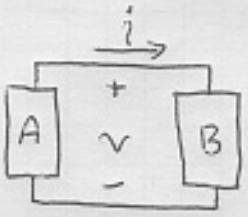
$= \frac{200\,W}{12\,V} = \boxed{\frac{50}{3}\,A \approx 16.\bar{6}\,A}$

b) How long can the battery power the lamp?

$t = (100\,A\cdot h)\left(\frac{3}{50}\,A^{-1}\right)$

$\boxed{t = 6\,h}$

P. 1. 21 Using the given reference marks, find the power transferred & whether the power is transferred from A to B or B to A.



a) Given $v = +33\,V$ and $i = -2.2\,A$ using passive sign convention for B

$P = vi$

$= (33\,V)(-2.2\,A)$

$\boxed{P = -72.6\,W}$ $\boxed{B \text{ to } A}$

b) $v = -12\,V$, $i = -1.2\,mA$

$P = (-12\,V)(-1.2\,mA) = \boxed{14.4\,mW}$ $\boxed{A \text{ to } B}$

c) $v = 37.5\,V$, $i = 40\,mA$

$P = (37.5\,V)(40\,mA) = \boxed{1.5\,W}$ $\boxed{A \text{ to } B}$

d) $v = -15\,V$, $i = -43\,mA$

$P = (-15\,V)(-43\,mA) = \boxed{645\,mW}$ $\boxed{A \text{ to } B}$

P.1.24 Given passive sign convention the voltage across a device is $v(t) = 5\cos(10t)$ V & the current is $i(t) = 0.5\sin(10t)$ A. Calculate power at $t = 0.2$s & $t = 0.4$s & state whether it is absorbing or delivering power.

@ $t = 0.2$s

$$P = iv$$

$$P(t) = 2.5\cos(10t)\sin(10t)\ \text{W}$$

$P(0.2) \approx -0.946$ W delivering power

@ $t = 0.4$s

$P(0.4) \approx 1.24$ W ~~abs~~ absorbing power

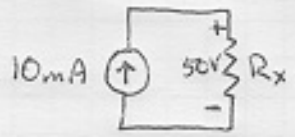
P.2.2 A 6.2 kΩ resistor dissipates 12 mW. Find current.

$$P = i^2R$$

$$i = \sqrt{\frac{P}{R}}$$

$$= \sqrt{\frac{12\ \text{mW}}{6.2\ \text{k}\Omega}} = \sqrt{\frac{60}{31}}\ \text{mA} \approx 1.39\ \text{mA}$$

P.2.5 Find R_x



$$v = iR$$

$$R_x = \frac{50\text{V}}{10\text{mA}}$$

$R_x = 5\ \text{k}\Omega$

$$P = vi$$

$$= (50\text{V})(10\text{mA})$$

$P = 500$ mW

P.2.13 For circuit to the right

a) Identify the nodes & at least three loops.

4 nodes A, B, C, D

Loops ex.
1,3,2 ; 2,4,5 ; 3,6,4 ; 1,5,6 ; 2,3,6,5

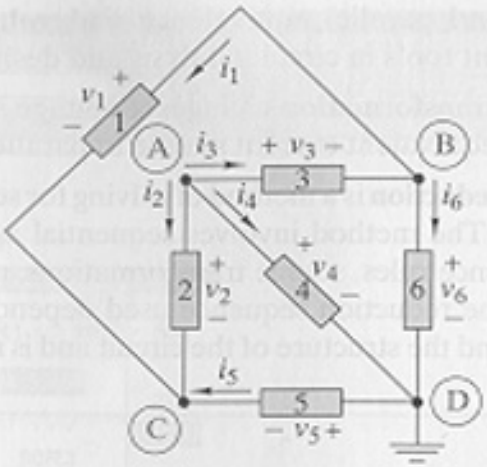


FIGURE P2-13

b) Identify elements in series or in parallel.

None

c) Write KCL & KVL eqns. for the circuit.

KCL

(A) $-i_2 - i_3 - i_4 = 0$
(B) $-i_1 + i_3 - i_6 = 0$
(C) $i_1 + i_2 + i_5 = 0$
(D) $i_4 - i_5 + i_6 = 0$

KVL ex.

loop 1,3,2 $-v_1 + v_2 - v_3 = 0$
loop 2,4,5 $-v_2 + v_4 + v_5 = 0$
loop 3,6,4 $v_3 - v_4 + v_6 = 0$

P.2.14 For the circuit in the previous problem
Find v_1, v_5, & v_6
Given $v_2 = 5V$
$v_3 = -8V$
$v_4 = 3V$

$$v_1 = v_2 - v_3 = 13\,V$$
$$v_5 = v_2 - v_4 = 2\,V$$
$$v_6 = v_4 - v_3 = 11\,V$$

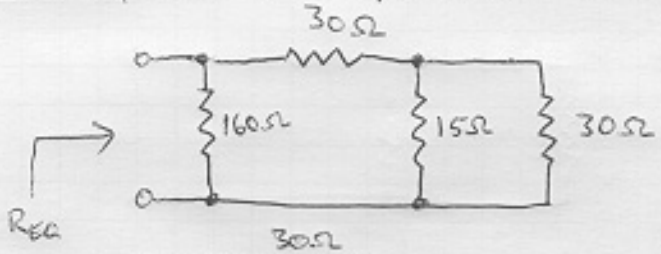
P.2.20 Find v_x & i_x

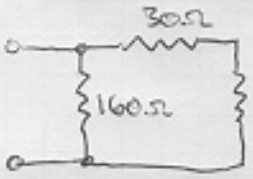
$i_x = -2A$

$v_x = i_x R_x$
$= (-2A)(50\Omega)$

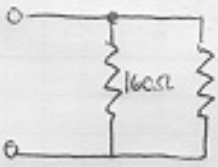
$v_x = -100\,V$

P.2.28 Find the equivalent resistance R_{EQ}

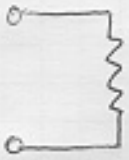




$$R = \frac{(30\Omega)(15\Omega)}{15\Omega + 30\Omega} = 10\Omega$$

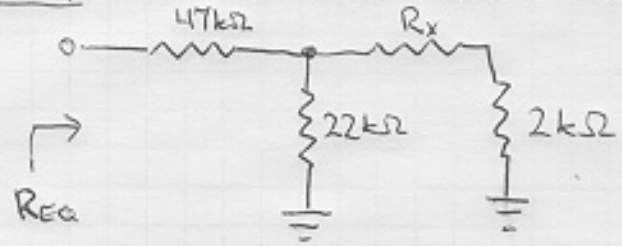


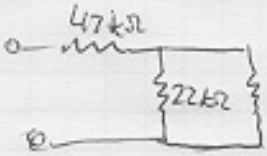
$$R = 30\Omega + 10\Omega = 40\Omega$$



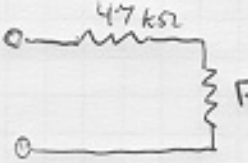
$$R_{EQ} = \frac{(160)(40)}{160+40}\ \Omega = \boxed{32\ \Omega}$$

P.2.36 Find R_x such that $R_{EQ} = 60\,k\Omega$

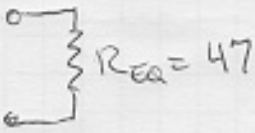




$$R = R_x + 2k\Omega$$



$$R = \frac{22(R_x+2)}{22+R_x+2}\,k\Omega$$



$$R_{EQ} = 47k\Omega + \frac{22(R_x+2)}{22+R_x+2}\,k\Omega$$

Set $R_{EQ} = 60\,k\Omega$

$$60k\Omega = 47k\Omega + \frac{22(R_x+2)}{22+R_x+2}\,k\Omega$$

solve for R_x

$$R_x = \frac{(60-47)(22+2)-(22)(2)}{22+47-60}\,k\Omega$$

$$\boxed{R_x = \frac{268}{9}\,k\Omega \approx 29.\overline{7}\,k\Omega}$$