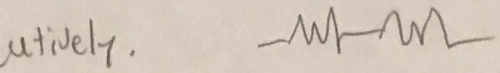
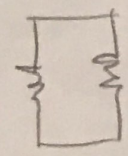
Daren Liu

HW 2

1) A series circuit means that 2 or more resistors are positioned consequtively.

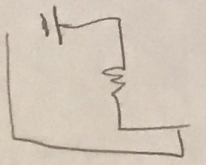


A parallel circuit means that 2 or more resistors are "parallel" to each other but are not in series.



An open circuit is where the resistance of a circuit is ∞.

A short circuit is where the the resistance between two nodes is zero.



A ground node is wher the voltage is 0V.

2) a) 6V

$\Delta i_\Delta = -6$

$i_\Delta = 15 \cdot 10^{-3}\ A$

$\alpha = -\frac{6}{15 \cdot 10^{-3}} \frac{V}{A}$

b) $P = V \times I$

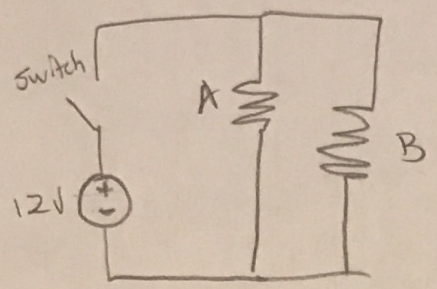
$I = 15 \cdot 10^{-3}\ A$

$V = 6V$

$P = 0.09\ W$

c) Absorbing

3)



The battery can represent the voltage source.
The lamps can represent resistors.
The switch can represent a switch.

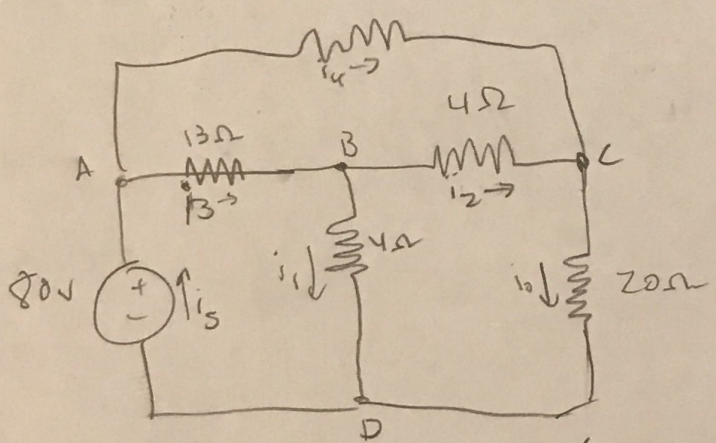
4) $P = IV \quad V = IR \quad I = \frac{V}{R}$

$P = \frac{V^2}{R} \qquad V = -8$

$P = 640 \cdot 10^{-3}\ W$

$R = \frac{V^2}{P} = \frac{64}{(640 \cdot 10^{-3})} = 100\ \Omega$

5) $i_o = 2A$ $\qquad V = IR$



ABDA $\quad -80 + 13i_3 + 4i_4 = 0 \quad 4i_1 + 13i_3 = 80$

BCDA $\quad 4i_2 + 20i_o - 4i_1 = 0 \quad 4i_1 - 4i_2 = 40$

ACBA $\quad 8i_4 - 4i_2 - 13i_3 = 0$

ACDA $\quad -80 + 8i_4 + 40 = 0 \quad 8i_4 = 40$

$i_4 = 5\ A$

Node C

$-i_4 - i_2 + i_0 = 0$

$i_0 = i_4 + i_2$

$2 = 5 + i_2$ $\quad \boxed{i_2 = -3\ A}$

$8(40) - 4(-3) - 13i_3 = 0$

$320 + 12 - 13i_3 = 0$

$4i_1 + 12 = 40$

$\boxed{i_1 = 7\ A}$

$7(4) + 13(i_3) = 80$

$\boxed{i_3 = 4\ A}$

Node A

$i_5 = i_4 + i_3 = 4 + 5 = 9$

b) $P_{13\Omega} = I_3^2 R = (16)(13) = 208\ W$

$P_{4\Omega} = (-3)^2(4) = 36\ W$

$P_{20\Omega} = (2)^2(20) = 80\ W$

$P_{8\Omega} = (5)^2(8) = 200\ W$

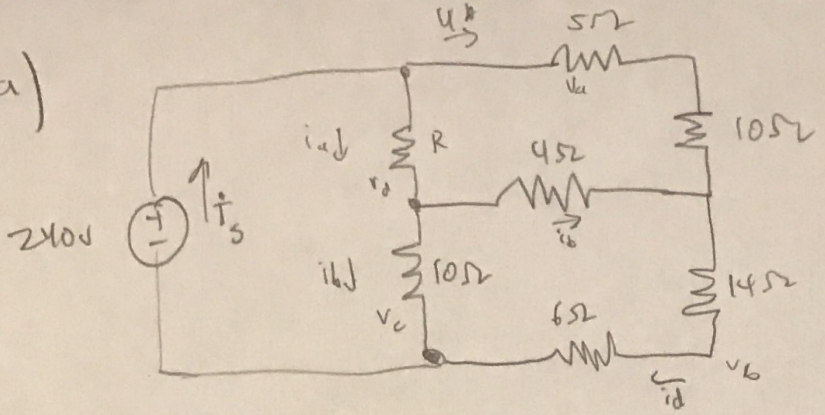
c) $P_{80V} = 80 * i_5 = 80 \cdot 9 = 720\ W$

$P_{dis} = P_{13\Omega} + P_{4\Omega} + P_{8\Omega} + P_{4\Omega} = 208 + 36 + 200 + 80$

$= 720\ W$

$P_{80V} = P_{dis}$

6) a)



$V = IR$

$V_a = (4)(5+b) = 4(15) = 60V$

$-240 + V_a + V_b = 0 \Rightarrow V_b = 180V$

$i_d = \frac{V_b}{14+6} = \frac{180}{20} = 9A$

$i_d = i_b + 4 \Rightarrow i_b = 9-4 = 5A$

$-V_c + 4i_b + V_b = 0 \qquad V_c = 4i_b + V_b = 4(5) + 180 = 200V$

$V_d = 240 - V_c = 40V$

$i_c = \frac{V_c}{10} = \frac{200}{10} = 20A$

$i_a = i_b + i_c = 5 + 20 = 25A$

$R = \frac{V_d}{i_a} = \frac{40}{25} = 1.6A$

b) $i_c = i_a + 4 = 25 + 4 = 29A$

$P_c = 240 i_c = 240 \cdot 29 = 6960W$

7) a) $-12+2i+5i_\Delta = 0 \quad 12 = 2i + 5i_\Delta$

$8i + 2i - 5i_\Delta = 0$

$10i = 5i_\Delta$

$2i = i_\Delta$

$12 = i_\Delta + 5i_\Delta = 6i_\Delta$

$i_\Delta = 2A$

$V_0 = 2 \times i = 2V$

b) $I_1 = i_\Delta + I \quad (I = 1 + 8i_\Delta)$

$= i_\Delta + i + 8i_\Delta = 9i_\Delta + i$

$i_\Delta = 2 \quad i = 1$

$I_1 = 19A$

$V_1 - 8 - V_0 = 0 \quad V_1 = 10V$

$P_1 = 12 \cdot 19 = 228W$

$P_2 = V \times 8i = 8 \cdot 8 \cdot 2 = 128W$

$P_{total} = 356W$

$\overset{5\Omega}{P_1} = i_\Delta^2 \cdot R = (4) \cdot 5 = 20W$

$\overset{2\Omega}{P_2} = 1 \cdot 2 = 2W$

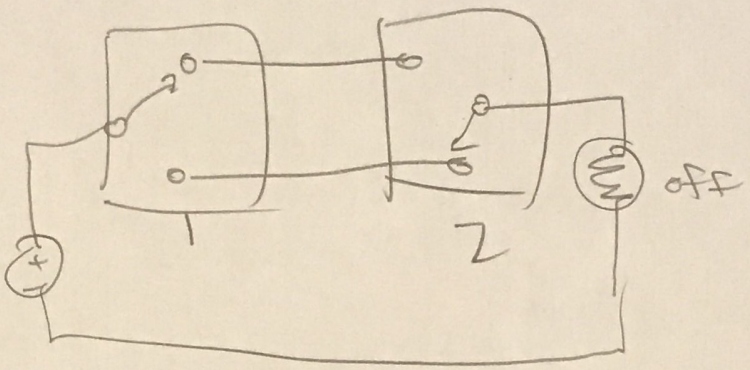
$\overset{2i}{P_3} = 2i \cdot I_1 = 2 \cdot 1 \cdot 19 = 38W$

$P_4 = 8_i \cdot I = 8 \cdot 1 \cdot 17 = 136\,W$

$P_5 = 8 \cdot i \cdot V_1 = 8 \cdot 2 \cdot 10 = 160\,W$

$P_{dis} = 20 + 2 + 38 * 136 + 160 = 356$

8) a)



b)