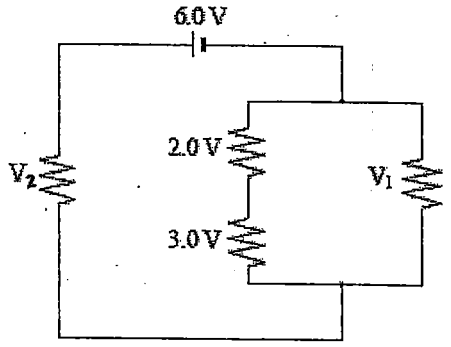
Electric Circuits Worksheet

1. What are the potential differences, V_1 and V_2, in the circuit shown?



V_1 in parallel w/ 2.0V & 3.0V

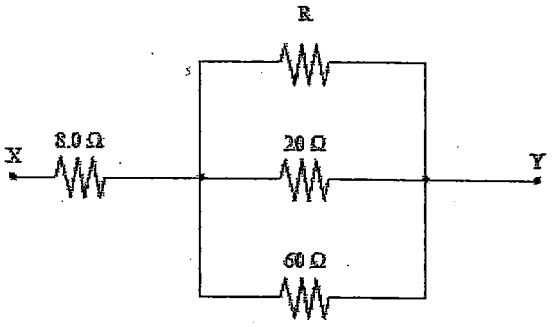
$V_1 = 5.0V$

V_1 in series w/ V_2

$6.0 = V_1 + V_2$

$V_2 = 1.0V$

2. The total resistance between points X and Y is 14.0 Ω. What is the value of R ?



$R_T = 14.0\ \Omega$

$14 = 8.0 + R_{eq}$

$R_{eq} = 6.0\ \Omega$

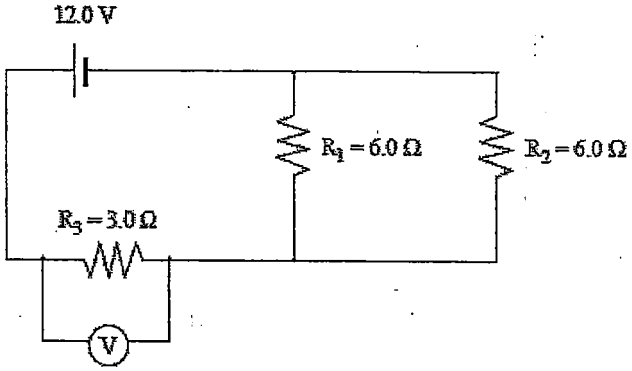
$\frac{1}{6} = \frac{1}{20} + \frac{1}{60} + \frac{1}{R}$

$\left(\frac{1}{6} - \frac{1}{20} - \frac{1}{60}\right)^{-1} = R$

$R = 10\ \Omega$

3. A voltmeter is connected across a 3.0 Ω resistor in the circuit shown. What is the reading on the voltmeter?

Need I_3 to find



$R_{eq}\ (R_1 \& R_2) = \left(\frac{1}{6} + \frac{1}{6}\right)^{-1} = 3.0\ \Omega$

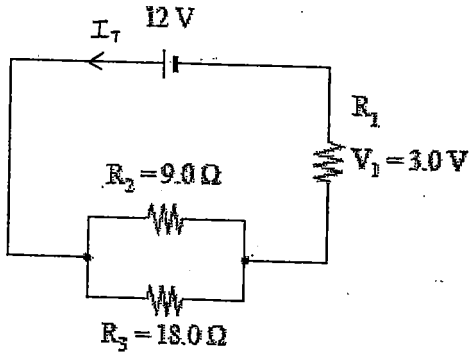
$R_T = R_3 + R_{eq} = 6.0\ \Omega$

$I_T = \frac{V_T}{R_T} = \frac{12.0}{6.0} = 2.0A$

$I_3 = I_T = 2.0A$ $\qquad V_3 = I_3 R_3 = (2.0)(3.0)$

$V_3 = 6.0V$

4. Find the current through the battery in the circuit shown.



$R_{eq}\ (R_2 \& R_3) = \left(\frac{1}{9} + \frac{1}{18}\right)^{-1} = 6\ \Omega$

$V_{(2\&3)} = \overset{V_T - V_1}{12 - 3} = 9\ V$

$I_{2\&3} = I_T = \frac{V_{2\&3}}{R_{2\&3}} = \frac{9}{6} = 1.5A$

$I_T = 1.5A$

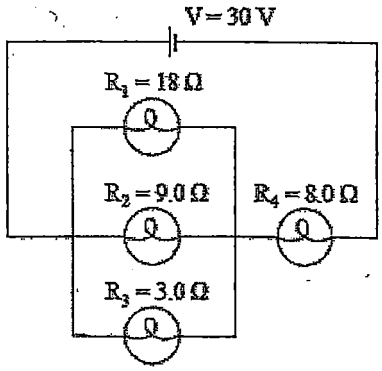
or $I_2 = \frac{9.0}{9.0} = 1.0A$

$I_3 = \frac{9.0}{18.0} = 0.5A$

$I_T = I_2 + I_3$

$= 1.5V$

5. Find the current in the 8.0 Ω bulb shown.



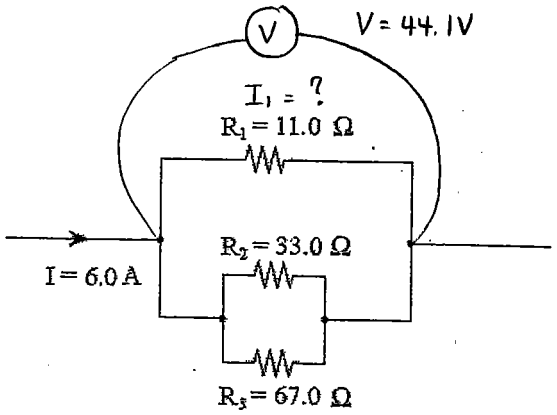
$R_{eq} = \left(\frac{1}{18} + \frac{1}{9} + \frac{1}{3}\right)^{-1} = 2\ \Omega$

$R_T = 2 + 8 = 10\ \Omega$

$I_T = \frac{V_T}{R_T} = \frac{30}{10} = 3\ A$

$I_4 = I_T = 3A$

6. The diagram shows part of an electrical circuit. What is the current through resistor R_1?



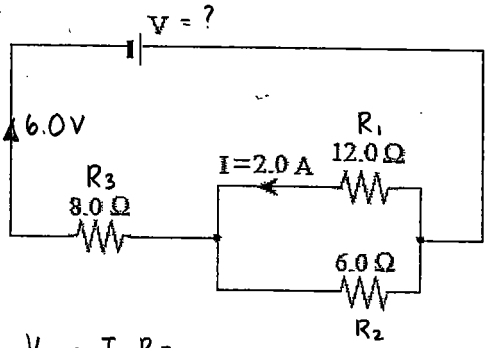
$R_{2\&3} = \left(\frac{1}{33} + \frac{1}{67}\right)^{-1} = 22.11\ \Omega$

$R_{eq(1\&2\&3)} = \left(\frac{1}{22.11} + \frac{1}{11}\right)^{-1} = 7.35\ \Omega$

$V_{eq} = IR = (6.0)(7.35) = 44.1\ V$ $\quad V_1 = V_{eq} = 44.1\ V$

$I_1 = \frac{V_1}{R_1} = \frac{44.1}{11} = 4\ A$

7. What is the voltage, V, of the power supply shown in the circuit?



$V_1 = I_1 R_1 = (2.0)(12) = 24\ V$
$V_2 = 24\ V$
} same, in parallel

$I_1 = 2.0\ A$

$I_2 = \frac{V_2}{R_2} = \frac{24}{6} = 4.0\ A$

$I_3 = I_T = I_1 + I_2$
$= 2.0 + 4.0 = 6.0\ A$

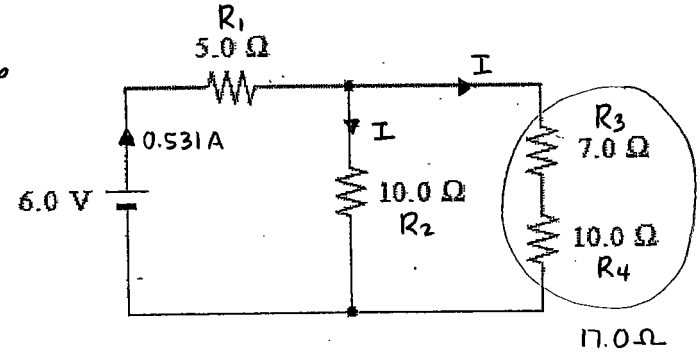
$V_3 = I_3 R_3 = (6.0)(8.0)$
$= 48\ V$

$V_T = 24 + 48 = 72\ V$

or $R_T = 8 + \left(\frac{1}{12} + \frac{1}{6}\right)^{-1}$
$= 8 + 4 = 12\ \Omega$

$V_T = I_T R_T$
$= (6.0)(12)$
$= 72V$

8. What is the current through the 7.0 Ω resistor? How much charge flows through the 7.0 Ω resistor in a 30 second interval?



$R_T = 5 + \left(\frac{1}{10} + \frac{1}{7+10}\right)^{-1}$
$= 5 + \left(\frac{1}{10} + \frac{1}{17}\right)^{-1}$
$= 5 + 6.296$
$= 11.296\ \Omega$

$I_T = \frac{V_T}{R_T} = \frac{6.0}{11.296}$
$= 0.531\ A$

$V_1 = (0.531)(5) = 2.655\ V$

$V_2 = V_T - V_1$
$= 6.0 - 2.655$
$= 3.345V$

$V_2 = V_{3\&4}$

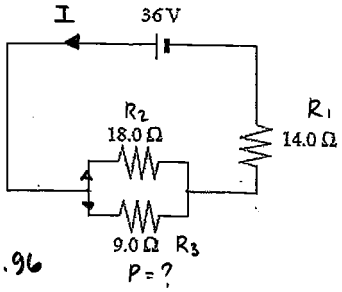
$I_3 = \frac{V_{3\&4}}{R_{3\&4}} = \frac{3.345}{7+10} = 0.197A$

or $I_2 = \frac{3.345}{10} = 0.335A$

$I_3 = I_T - I_2$
$I_3 = 0.531 - 0.335 = 0.196A$

9. What is the power dissipated in the 9.0 Ω resistor in the following circuit?

$$R_T = 14 + \left(\frac{1}{9.0} + \frac{1}{18}\right)^{-1} = 14 + 6 = 20\ \Omega$$



$$I_T = \frac{36}{20} = 1.8\ A$$

$$V_1 = I_1 R_1 = (1.8)(14) = 25.2\ V$$

$$V_2 = V_3 = \overset{V_T}{36} - \overset{V_1}{25.2} = 10.8\ V$$

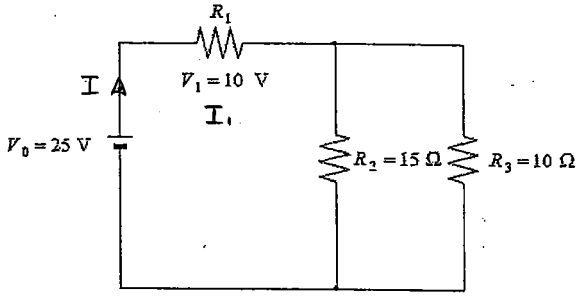
$$I_3 = \frac{10.8}{9} = 1.2\ A$$

$$P = IV = (1.2)(10.8) = 12.96$$

P = 13 W

10. In the following circuit, what is the power dissipated by resistor R_1 ?

$$V_2 = V_3 = \overset{V_T}{25} - \overset{V_1}{10} = 15\ V$$



$$I_2 = \frac{15}{15} = 1\ A$$

$$I_3 = \frac{15}{10} = 1.5\ A$$

$$I_1 = I_T = \overset{I_2}{1} + \overset{I_3}{1.5} = 2.5\ A$$

$$P_1 = I_1 V_1 = (2.5)(10) = 25\ W$$