Problem Set 12: Parallel and Series Circuits

12.1 Appliances are connected in a parallel arrangement in the home. This is done so that if one device fails, power isn't cut off from the rest of the appliances.

12.2 R = 30 ohms
R_T = 30 * 12 = 360 ohms

12.3 [a] V = 12 V
V_T = 2 * 12 = 24 V

[b] R = 60 ohms
I = 24/60 = 0.4 Amps

[c] R $= (+20^{-1})^{-1}$
$= 6.67\ \Omega$

[d] The bulbs in parallel will glow brighter as they have a larger overall current draw due to their lower total resistance. This leads in more power being supplied to the lights.

12.4 V = 32 – 12 = 20 V
I = 4 A
R = 20/4
= 5 Ω

12.5 [a] V = 18 V
R $= 3 + (2^{-1} + 2^{-1})^{-1}$
$= 4\ \Omega$

[b] V = IR
R = 18/4
= 4.5 A

[c] The most current will be drawn when both switches are closed. When both switches are closed, the total resistance is lower and hence more current is drawn.

[d] R = 5 ohms
t = 3 x 60
= 18/5
= 3.6 A
P $= I^2R$
$= (3.6)^2 \times 5$
= 64.8 W
W = Pt
= 64.8 x 60 x 3
$= 1.17 \times 10^4$ J

12.6 [a] $V = 12$ V

$R_{Rheostat} = 0$ to 150 ohms

$R_T = 300 + 0 + 2 = 302$ ohms

$V = IR$

$I = 12/302$

$= 3.97 \times 10^{-2}$ Amps

$R_T = 300 + 150 + 2 = 452$ ohms

$I = 12/452$

$= 2.65 \times 10^{-2}$ Amps

[b] Circuit B is the same as Circuit A – all elements are in series (no change from previous question)

[c] $R_T = 2 + 0$ (Rheostat = 0 creates a short circuit) $= 2$ ohms

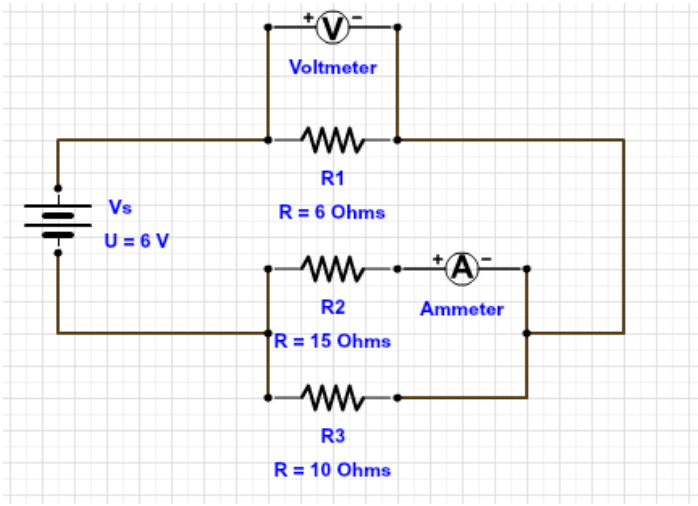
$I = 12/2 = 6$ Amps

$R_T = 2 + (150^{-1} + 300^{-1})^{-1} = 102$ ohms

$I = 12/102 = 1.18 \times 10^{-1}$ Amps

[d] Circuit C [1.18×10^{-1} to 6 Amps]

12.7 [a]



[b] $V = 6$ V

$R_T = 6 + (15^{-1} + 10^{-1})^{-1}$

$= 12$ ohms

$I_S = 6/12$

$= 0.5$ Amps

$V_{Voltmeter} = 0.5 \times 6$

$= 3$v

[c] voltage over parallel branch

$V = 6 - 3 = 3$ V

$I = 3/15$

$= 0.2$ Amps

12.8 [a] $R_T = (4^{-1} + 8^{-1} + 40^{-1})^{-1}$

$= 2.5$ ohms

[b] $R = 4$ ohms

$I = 2$ A

$V = IR = 2 \times 4 = 8$ V

[c] $R = 8$ ohms

$V = IR$

$I = 8/8 = 1$ A

[d] $R = 40$ ohms

$V = IR$

$I = 8/40 = 0.2$ A