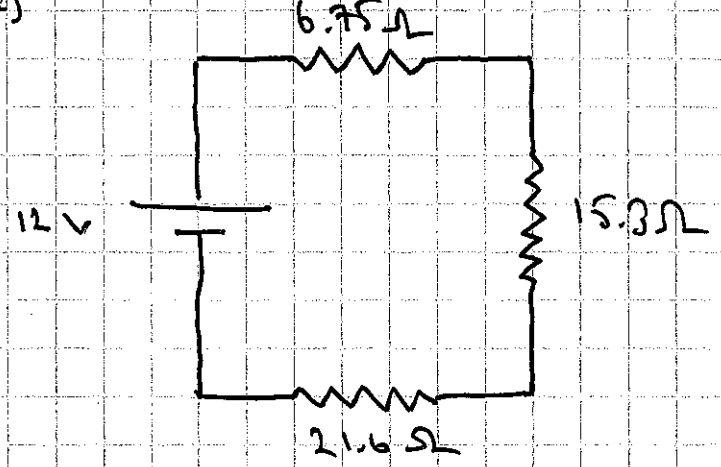
# Exam Review - Problem Set 3

① $I = \frac{V}{R} = \frac{1.5}{3.5} = \boxed{0.43\ A}$

② $V = IR = (6.25)(17.6) = \boxed{110\ V}$

③ a)




b) $R_{eq} = 6.75 + 15.3 + 21.6 = \boxed{43.65\ \Omega}$

c) $I = \frac{V}{R_{eq}} = \frac{12}{43.65} = \boxed{0.275\ A}$

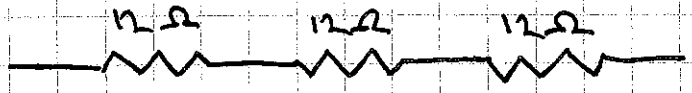
④ a) $R_{eq} = 12 + 12 + 12 = \boxed{36\ \Omega}$

b) $\frac{1}{R} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12}$

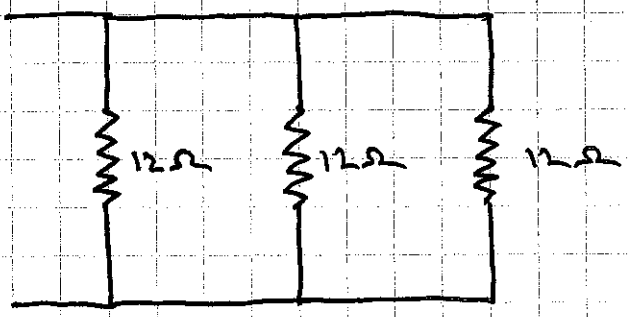
$\frac{1}{R} = \frac{3}{12}$

$R = \frac{12}{3} = \boxed{4\ \Omega}$

④ c) Series




Parallel



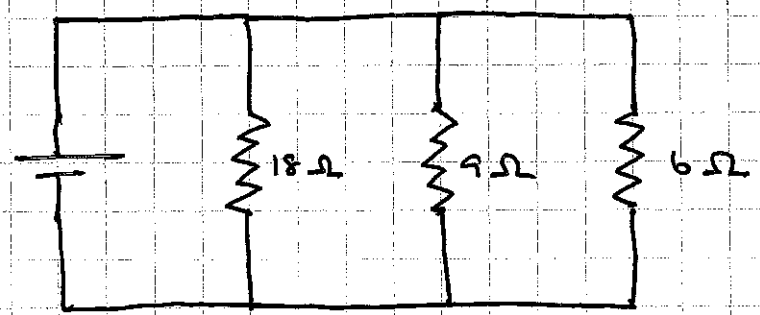

⑤ a) $R = \frac{V}{I} = \frac{7.50}{0.50} = \boxed{15\ \Omega}$

b) $A = \pi r^2 = \pi \left(\frac{2 \times 10^{-3}}{2}\right)^2 = 3.14 \times 10^{-6}\ m^2$

$R = \rho \frac{L}{A}$

$\rho = \frac{RA}{L} = \frac{(15)(3.14 \times 10^{-6})}{6.24} = \boxed{7.55 \times 10^{-6}\ \Omega \cdot m}$

⑥ a)




continues on next page

⑥ a) continued

$$\frac{1}{R} = \frac{1}{18} + \frac{1}{9} + \frac{1}{6}$$

$$= \frac{1}{18} + \frac{2}{18} + \frac{3}{18}$$

$$\frac{1}{R} = \frac{6}{18}$$

$$R = \frac{18}{6} = \boxed{3\ \Omega}$$

b) 9 Ω Resistor

$$V = IR = (4)(9) = 36\ V$$

∴ Battery = $\boxed{36\ V}$ (all are in parallel, ∴ all have same voltage)

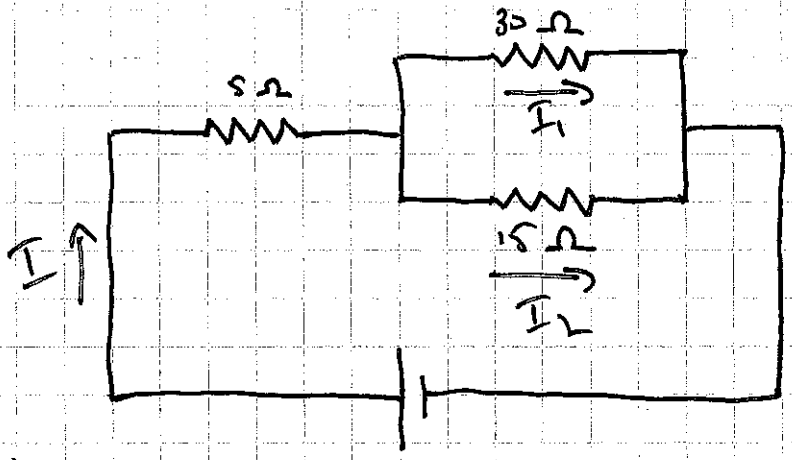
c) 18 Ω

$$I = \frac{V}{R} = \frac{36}{18} = \boxed{2\ A}$$

6 Ω

$$I = \frac{V}{R} = \frac{36}{6} = \boxed{6\ A}$$

⑦

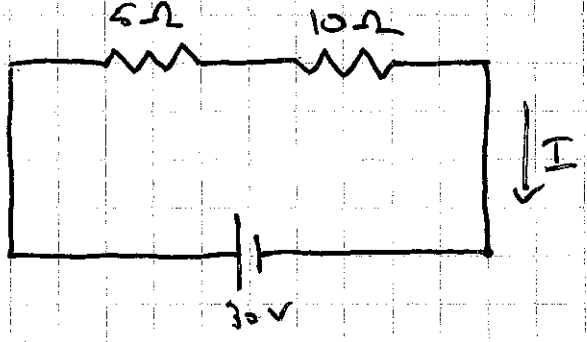



$$\frac{1}{R} = \frac{1}{30} + \frac{1}{15}$$

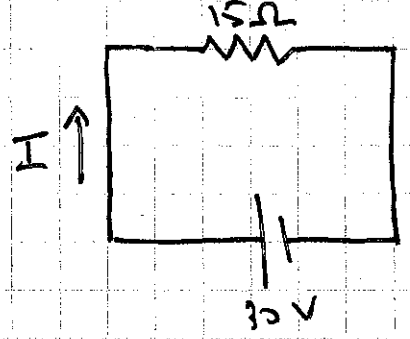
$$\frac{1}{R} = \frac{1}{30} + \frac{2}{30}$$

$$\frac{1}{R} = \frac{3}{30}$$

$$R = \frac{30}{3} = 10\ \Omega$$




$$R = 5 + 10 = 15\ \Omega$$




$$I = \frac{V}{R}$$

$$= \frac{30}{15}$$

$$I = 2\text{A}$$

$$V_5 = IR$$

$$= (2)(5)$$

$$V_5 = 10\ \text{V}$$

$$V_{10} = 30 - V_5$$

$$= 30 - 10$$

$$V_{10} = 20\ \text{V}$$

$V_{30} = 30\ \text{V}$

$V_{15} = 30\ \text{V}$

} both are $= V_{10}$

$$I_1 = \frac{V}{R} = \frac{20}{30}$$

$$I_1 = 0.67\ \text{A}$$

$$I_2 = \frac{V}{R} = \frac{20}{15}$$

$$I_2 = 1.33\ \text{A}$$

(8) $V_5 = V_4$

$\therefore V_5 = 4\ V$

$$R_5 = \frac{V_5}{I_5} = \frac{4}{1} = 4\ \Omega$$

$$I_4 + I_5 = I_{total}$$

$$I_4 + 1 = 2$$

$$I_4 = 1\ A$$

$$R_4 = \frac{V_4}{I_4} = \frac{4}{1} = 4\ \Omega$$

$$I_1 + I_3 = I_{total}$$

$$I_1 + 1.5 = 2$$

$$I_1 = 0.5\ A$$

$$I_2 = I_1 = 0.5\ A$$

$$I_6 = I_{total} = 2\ A$$

$$V_1 = I_1 R_1$$

$$= (0.5)(5)$$

$$V_1 = 2.5\ V$$

continues on next page

(8)

$$R_2 = \frac{V_2}{I_2} = \frac{3.5}{0.5} = 7\ \Omega$$

$$V_3 = V_1 + V_2 = 2.5 + 3.5 = 6\ V$$

$$R_3 = \frac{V_3}{I_3} = \frac{6}{1.5} = 4\ \Omega$$

$$V_6 = I_6 R_6 = (2)(2) = 4\ V$$

$$V_{source} = V_3 + V_4 + V_6$$

$$= 6 + 4 + 4$$

$$V_{source} = 14\ V$$

$$R_{eq} = \frac{V_{source}}{I_{source}} = \frac{14}{2} = 7\ \Omega$$

| | V | I | R |
|---|---|---|---|
| Source | 14 | 2 | 7 |
| $R_1$ | 2.5 | 0.5 | 5 |
| $R_2$ | 3.5 | 0.5 | 7 |
| $R_3$ | 6 | 1.5 | 4 |
| $R_4$ | 4 | 1 | 4 |
| $R_5$ | 4 | 1 | 4 |
| $R_6$ | 4 | 2 | 2 |

⑨ $V = -N \frac{\Delta \Phi}{\Delta t}$

$= -(325)\left(\frac{1.15 \times 10^{-5}}{0.001}\right)$

$V = \boxed{-3.74\ V}$

⑩ $A = \pi r^2 = \pi (0.1)^2 = 0.0314\ m^2$

$V = -N \frac{\Delta \Phi}{\Delta t}$

$= -(1)\left[0 - \frac{(5.6)(0.0314)}{0.1}\right]$

$V = \boxed{0.1758\ V}$

⑪
- increasing R will decrease I
- the field of the outer loop (primary field) is out of the page
- flux is decreasing (since B is decreasing, since I is decreasing)
- ∴ secondary field is also out of the page
- ∴ induced current is **counterclockwise**

(12) $V = vBL$

$= (0.15 \text{ m/s})(0.8 \text{ T})(0.12 \text{ m})$

$V = \boxed{0.0144 \text{ V}}$

(13) $\frac{N_s}{N_p} = \frac{V_s}{V_p}$

$\frac{N_s}{75} = \frac{2400}{120}$

$N_s = \frac{75(2400)}{120} = \boxed{1500}$

(14) a) $\frac{V_s}{V_p} = \frac{N_s}{N_p}$

$\frac{V_s}{120} = \frac{1}{5}$

$V_s = \frac{120}{5} = \boxed{24 \text{ V}}$

b) $I = \frac{V}{R}$

$= \frac{24}{15}$

$I = \boxed{1.6 \text{ A}}$

(14) c) $P = IV$

$= (1.6)(24)$

$P = \boxed{38.4\ \omega}$

d) $\frac{I_p}{I_s} = \frac{N_s}{N_p}$

$\frac{I_p}{1.6} = \frac{1}{5}$

$I_p = \frac{1.6}{5} = \boxed{0.32\ A}$