

Honors Physics – Ch 18 Practice Answers

1) $R_1 = 16 \text{ k}\Omega$
 $R_2 = 22 \text{ k}\Omega$
 $R_3 = 32 \text{ k}\Omega$
 $R_{eq} = 82 \text{ k}\Omega$

$$R_4 = R_{eq} - R_1 - R_2 - R_3 = 82 \text{ k}\Omega - 16 \text{ k}\Omega - 22 \text{ k}\Omega - 32 \text{ k}\Omega = \boxed{12 \text{ k}\Omega}$$

2) $R = 450 \Omega$
 $R_1 = R$
 $R_2 = 2.0R$
 $R_3 = 0.50R$

$$R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \right)^{-1} = \left(\frac{1}{450 \Omega} + \frac{1}{900 \Omega} + \frac{1}{220 \Omega} \right)^{-1}$$
$$R_{eq} = \left(0.0022 \frac{1}{\Omega} + 0.0011 \frac{1}{\Omega} + 0.0045 \frac{1}{\Omega} \right)^{-1} = \left(0.0078 \frac{1}{\Omega} \right)^{-1} = \boxed{1.3 \times 10^2 \Omega}$$

3) $L = 3.22 \times 10^5 \text{ km}$
 $\ell = 1.00 \times 10^3 \text{ km}$
 $\text{ratio} = 1.0 \times 10^{-2} \Omega/\text{m}$
 $\Delta V = 1.50 \text{ V}$

$$R_{eq} = N \left(\frac{1}{R} \right) \quad \text{where } N = \frac{L}{\ell} \text{ and } R = (\text{ratio})\ell$$
$$R_{eq} = \left[\frac{L}{(\text{ratio})\ell^2} \right]^{-1} = \left[\frac{3.22 \times 10^8 \text{ m}}{(1.0 \times 10^{-2} \Omega/\text{m})(1.00 \times 10^6 \text{ m})^2} \right]^{-1} = 31 \Omega$$
$$I = \frac{\Delta V}{R_{eq}} = \frac{1.50 \text{ V}}{31 \Omega} = \boxed{0.048 \text{ A}}$$

4) $\Delta V = 650 \text{ V}$
 $R = 1.0 \times 10^2 \Omega$

$$I = \frac{\Delta V}{R} = \frac{650 \text{ V}}{1.0 \times 10^2 \Omega} = \boxed{6.5 \text{ A}}$$

5) $\text{ratio} = 1.22 \times 10^{-2} \Omega/\text{m}$
 $\ell = 1813 \text{ km}$

a. $R = (\text{ratio})(\ell) = (1.22 \times 10^{-2} \Omega/\text{m})(1.813 \times 10^6 \text{ m}) = \boxed{2.21 \times 10^4 \Omega}$

b. $R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} \right)^{-1} = \left(\frac{2}{R} + \frac{4}{R} + \frac{5}{R} + \frac{20}{R} \right)^{-1}$

$$R_{eq} = \left(\frac{31}{R} \right)^{-1} = \left(\frac{31}{1.00 \times 10^{10} \Omega} \right)^{-1} = \boxed{3.23 \times 10^8 \Omega}$$

$R_1 = \frac{1}{2}R$
 $R_2 = \frac{1}{4}R$
 $R_3 = \frac{1}{5}R$
 $R_4 = \frac{1}{20}R$

6) $\Delta V = 24 \text{ V}$
 $R_1 = 2.0 \text{ } \Omega$
 $R_2 = 4.0 \text{ } \Omega$
 $R_3 = 6.0 \text{ } \Omega$
 $R_4 = 3.0 \text{ } \Omega$

$$R_{12} = R_1 + R_2 = 2.0 \text{ } \Omega + 4.0 \text{ } \Omega = 6.0 \text{ } \Omega$$

$$R_{34} = \left(\frac{1}{R_3} + \frac{1}{R_4} \right)^{-1} = \left(\frac{1}{6.0 \text{ } \Omega} + \frac{1}{3.0 \text{ } \Omega} \right)^{-1}$$

$$R_{34} = \left(0.17 \frac{1}{\Omega} + 0.33 \frac{1}{\Omega} \right)^{-1} = \left(0.50 \frac{1}{\Omega} \right)^{-1} = 2.0 \text{ } \Omega$$

$$R_{eq} = \left(\frac{1}{R_{12}} + \frac{1}{R_{34}} \right)^{-1} = \left(\frac{1}{6.0 \text{ } \Omega} + \frac{1}{2.0 \text{ } \Omega} \right)^{-1}$$

$$R_{eq} = \left(0.17 \frac{1}{\Omega} + 0.50 \frac{1}{\Omega} \right)^{-1} = \left(0.67 \frac{1}{\Omega} \right)^{-1} = 1.5 \text{ } \Omega$$

$$I = \frac{\Delta V}{R_{eq}} = \frac{24 \text{ V}}{1.5 \text{ } \Omega} = \boxed{16 \text{ A}}$$

7) $\Delta V = 2.00 \times 10^3 \text{ V}$
 $I = 1.0 \times 10^{-8} \text{ A}$
 $R_1 = r$
 $R_2 = 3r$
 $R_3 = 2r$
 $R_4 = 4r$

$$R_{eq} = \frac{\Delta V}{I} = \frac{2.00 \times 10^3 \text{ V}}{1.0 \times 10^{-8} \text{ A}} = \boxed{2.0 \times 10^{11} \text{ } \Omega}$$

$$R_{12} = R_1 + R_2 = r + 3r = 4r$$

$$R_{34} = R_3 + R_4 = 2r + 4r = 6r$$

$$R_{eq} = \left(\frac{1}{R_{12}} + \frac{1}{R_{34}} \right)^{-1} = \left(\frac{1}{4r} + \frac{1}{6r} \right)^{-1}$$

$$R_{eq} = \left(\frac{3+2}{12r} \right)^{-1} = \left(\frac{5}{12r} \right)^{-1} = \frac{12}{5} r$$

$$r = \frac{5}{12} R_{eq} = \frac{5}{12} (2.0 \times 10^{11} \text{ } \Omega) = \boxed{8.3 \times 10^{10} \text{ } \Omega}$$
