Solutions

Each answer shows the steps, then the **result**.

2.1

- the **total current into a junction equals the total current out**
- it follows from conservation of **charge**

2.2

- around any closed loop, the **total e.m.f. equals the total p.d.**
- it follows from conservation of **energy**

2.3

- series: $R = R_1 + R_2$

$$R = 4.0\ \Omega + 6.0\ \Omega = \mathbf{10}\ \Omega$$

2.4

- parallel: $1/R = 1/R_1 + 1/R_2$

$$\frac{1}{R} = \frac{1}{4.0\ \Omega} + \frac{1}{4.0\ \Omega} = \frac{1}{2.0\ \Omega} \Rightarrow R = \mathbf{2.0}\ \Omega$$

3.1 A

- three equal resistors in parallel: $R = R_1/3$

$$R = \frac{6.0\ \Omega}{3} = \mathbf{2.0}\ \Omega$$

- **B** is one resistor; **C** is series; **D** would be twelve in parallel

3.2

- series: $R = 3.0\ \Omega + 6.0\ \Omega = 9.0\ \Omega$

$$I = \frac{12\ \text{V}}{9.0\ \Omega} = \mathbf{1.33}\ \text{A}$$

- $V = IR$

$$V_3 = (1.33\ \text{A})(3.0\ \Omega) = \mathbf{4.0}\ \text{V}, \qquad V_6 = (1.33\ \text{A})(6.0\ \Omega) = \mathbf{8.0}\ \text{V}$$

3.3

(a) parallel pair

$$\frac{1}{R_\text{p}} = \frac{1}{4.0\ \Omega} + \frac{1}{4.0\ \Omega} = \frac{1}{2.0\ \Omega} \Rightarrow R_\text{p} = 2.0\ \Omega$$

- total $R = R_1 + R_\text{p} = 2.0\ \Omega + 2.0\ \Omega = \mathbf{4.0}\ \Omega$

$$I = \frac{6.0\ \text{V}}{4.0\ \Omega} = \mathbf{1.5}\ \text{A}$$

(b) $V_\text{p} = IR_\text{p}$

$$V_\text{p} = (1.5\ \text{A})(2.0\ \Omega) = 3.0\ \text{V}$$

- each branch

$$I = \frac{3.0\ \text{V}}{4.0\ \Omega} = \mathbf{0.75}\ \text{A}$$

- the two currents are equal because $R_2 = R_3$

3.4

- Kirchhoff 1: current in = current out

$$I = 5.0\ \text{A} - 2.0\ \text{A} = \mathbf{3.0}\ \text{A}$$