Electric Current + Circuits
Chapter Problems 4-6, 10-17, 17-20, 27-32

(4) $V \neq IR$ Current $= \frac{\text{charge}}{\text{Time}} = \frac{25C}{45} = 3.125 \frac{C}{s}$

(5) Current $= \frac{\text{Charge}}{\text{Time}}$, so Charge = Current × Time:

$\frac{4\,C}{s} \mid \frac{5\,hrs}{} \mid \frac{60\,min}{1\,hr} \mid \frac{60\,sec}{1\,min} = 72000\,C = 7.2 \times 10^4 C$

(6) How long? = Time?

Current $= \frac{\text{Charge}}{\text{Time}}$ ∴ Time $= \frac{\text{Charge}}{\text{Current}} =$

$\frac{400\,C}{1.5 \frac{C}{s}} = 267\,sec$

(10) $V = IR$, so $I = \frac{V}{R} = \frac{9V}{0.45\Omega} = 20A$

(11) $V = IR = .75A \cdot 360.\Omega = 90V$

(12) $V = IR$ ∴ $R = \frac{V}{I} = \frac{6V}{0.05A} = 120\Omega$

(17) $R = \frac{\rho L}{A} = \frac{100 \times 10^{-9}\,\Omega m \cdot 150\,m}{4 \times 10^{-7}\,m^2} = 375\Omega$

convert to m^2 before solving.

$0.4\,mm^2 \mid \frac{1\,m^2}{1000^2\,mm^2} = 4 \times 10^{-7} m^2$

$L = 7.2\,cm = 0.07\,m$

(18) $R = \frac{\rho \cdot L}{A} \quad \therefore \quad \rho = \frac{R \cdot A}{L}$

$$\rho = \frac{1.75\,\Omega \cdot 8.3\times10^{-6}\,m^2}{0.07\,m} =$$

$$\boxed{\rho = 2\times10^{-4}\,\Omega\cdot m}$$

3.25 mm in diameter

Calculate cross sectional area with $A = \pi r^2$

$r = \frac{D}{2} = \frac{3.25\,mm}{2} = 1.625\,mm$

$A = \pi r^2 = \pi \cdot (1.625\,mm)^2 =$

$8.3\,mm^2$

$$8.3\,mm^2 \left| \frac{1\,m^2}{1000^2\,mm^2} \right. =$$

$8.3\times10^{-6}\,m^2$

(19) $R = \frac{\rho \cdot L}{A}$, so $L = \frac{R \cdot A}{\rho}$

Area $= \pi r^2 =$ ~~$\pi \cdot 6\,mm^2$~~ $=$

$= \pi (1.3\,mm)^2$

$= 5.3\,mm^2 \Rightarrow$ Convert to m^2

$$5.3\,mm^2 \left| \frac{1\,m^2}{1000^2\,mm^2} \right. = 5.3\times10^{-6}\,m^2$$

$$L = \frac{40\,\Omega \cdot 5.3\times10^{-6}\,m^2}{2.65\times10^{-8}\,\Omega\,m} = \boxed{8\times10^{3}\,m}$$

Answer Key is wrong.

(2)

(20) long iron wire.

$R = 12\,\Omega$ $L = 7\,m$, what is Diameter?

↑ Find Area

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

$$\frac{9.71 \times 10^{-8}\,\Omega \cdot m \cdot 7\,m}{12\,\Omega} = 5.7 \times 10^{-8}\,m^2$$

$Area = \pi r^2$ so $r = \sqrt{\frac{Area}{\pi}} = \sqrt{\frac{5.7 \times 10^{-8}\,m^2}{\pi}}$

$r = 1.34 \times 10^{-4}\,m$

$d = 2 \cdot r = 2.69 \times 10^{-4}\,m$

(27) what is P of flash light bulb that draws 0.28A when connected to 6V battery?

$P = IV = 0.28\,A \cdot 6\,V = 0.28\,\frac{C}{s} \cdot 6\,\frac{J}{C} =$

$1.68\,\frac{J}{s} = 1.68\,W$

(28) Hair Dryer

$R = 24\,\Omega$ $V = 120\,V$ what is P?

$P = IV$ and $V = IR$, so $I = \frac{V}{R}$

$P = IV = \frac{V}{R} \cdot V = \frac{V^2}{R}$ $\frac{(120V)^2}{24\,\Omega} = 600\,W$

(29) Toaster

$P = ?$ $I = 15A$ $R = 20\,\Omega$

$P = IV$ and $V = IR$

Substitute for V: $V = IR$

$P = I \cdot I \cdot R = I^2R$

$P = (15A)^2 \cdot 20\,\Omega = 4500\,W$

(30) Mobile Phone

$P = 3.5\,W$ $V = 9\,V$ $R = ?$

$P = IV$ and $V = IR$, so

$R = \frac{V}{I} = \frac{V}{\frac{P}{V}} = \frac{V^2}{P}$

$R = \frac{(9V)^2}{3.5\,W}$ $= 23.1\,\Omega$

substitute from $P = IV \therefore I = \frac{P}{V}$

(31) Electric Motor

$R = 40\,\Omega$ $P = 350\,W$ $I = ?$

$P = IV$ and $V = IR$

$$I = \frac{P}{V} = \frac{P}{IR}$$

$V = IR$

so

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

$$I = \frac{P}{IR}, \text{ so } I^2 = \frac{P}{R}$$

$$\text{so } I = \sqrt{\frac{P}{R}} = \sqrt{\frac{350\,W}{40\,\Omega}} = 2.96\,A$$

(32) $R = 450\,\Omega$ $P = 120\,W$ $V = ?$

$P = IV$ and $V = IR$

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

so

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

$$V^2 = PR$$

$$V = \sqrt{PR} = \sqrt{120\,W \cdot 450\,\Omega}$$

$$V = 232.4\,V$$