$\boxed{20.1}$

$q = 35\,C$
$t = 1.0 \times 10^{-3}\,s.$

$\therefore \quad I \equiv \frac{q}{t} = \frac{35\,C}{1.0 \times 10^{-3}\,s.} = \boxed{35{,}000\,A.}$

$\boxed{20.5}$

$R = 11\,\Omega$
$V = 240\,V$
$I = ?$

Since $V = IR$

$$I = \frac{V}{R} = \frac{240\,V}{11\,\Omega} = 21.8182\,A$$

Rounded to two significant figures, $I = \boxed{22\,A}$

$\boxed{20.11}$

$$\left.\begin{array}{l} I = 1200\,A \\ V = 1.6\times10^{-2}\,V \end{array}\right\} \quad R = \frac{V}{I} = \frac{1.6\times10^{-2}\,V}{1200\,A.} = 1.33\times10^{-5}\,\Omega$$

$\rho_{cu} = 1.72\times10^{-8}\ \Omega\cdot m$ (from table #1 in chapter 20)

$L = 0.24\,m$

Since $R = \frac{\rho L}{A} \longrightarrow A = \frac{\rho L}{R} = \frac{(1.72\times10^{-8}\,\Omega\text{-}m)(0.24\,m)}{1.33\times10^{-5}\,\Omega} = 3.096\times10^{-4}\,m^2$

Because the cable is cylindrical, the cross-sectional area is

$$A = \pi r^2 \longrightarrow r^2 = \frac{A}{\pi}$$

$$\therefore\ r = \sqrt{\frac{A}{\pi}} = \sqrt{\frac{3.096\times10^{-4}\,m^2}{\pi}} = \boxed{9.9\times10^{-3}\,m.}$$

$\boxed{20.21}$

$R = 24\Omega$

$V = 120V$

$P = ?$

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

$\boxed{20.43}$

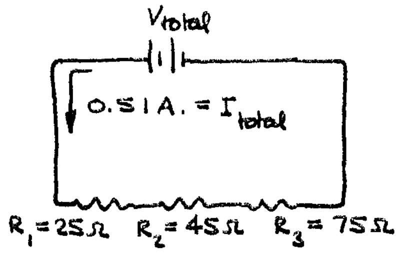


fig 1.

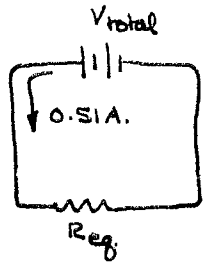


fig. 2.

a. For series resistors, $R_{eq} = R_1 + R_2 + \cdots$

$$\therefore\ R_{eq} = 25\,\Omega + 45\,\Omega + 75\,\Omega = \boxed{145\,\Omega}$$

b. Since series resistors pass the same current, $I_1 = I_2 = I_3 = 0.51\,A. = I_{total}$

$$\therefore\ V_1 = I_1 R_1 = (0.51\,A)(25\,\Omega) = 12.75\ V$$
$$V_2 = I_2 R_2 = (0.51\,A)(45\,\Omega) = 22.95\ V$$
$$V_3 = I_3 R_3 = (0.51\,A)(75\,\Omega) = 38.25\ V$$

The potential difference across all three resistors is the sum of the potential differences across each resistor:

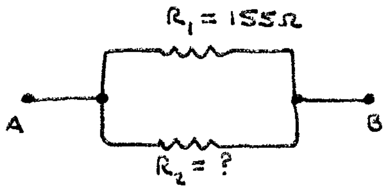
$V_{total} = V_1 + V_2 + V_3 = 73.95\ V$ or rounded to two significant figures

$$V_{total} = \boxed{74\ V}$$

An alternate (and faster) way is suggested in figure 2. From ohm's law,

$$V_{total} = I_{total} R_{eq} = (0.51\,A)(145\,\Omega) = 73.95\ V \quad \text{or} \quad \boxed{74\ V}$$

$\boxed{20.48}$



$R_{AB} = R_{eq} = 115\,\Omega$

Since the equivalent resistance of parallel resistors is related by

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

$$\frac{1}{R_2} = \frac{1}{R_{eq}} - \frac{1}{R_1} = \frac{1}{115\,\Omega} - \frac{1}{155\,\Omega} = 2.24403 \times 10^{-3}\ \Omega^{-1}$$

$$\therefore\ R_2 = \frac{1}{2.24403 \times 10^{-3}\ \Omega^{-1}} = 445.625\ \Omega$$

Rounded to three significant figures

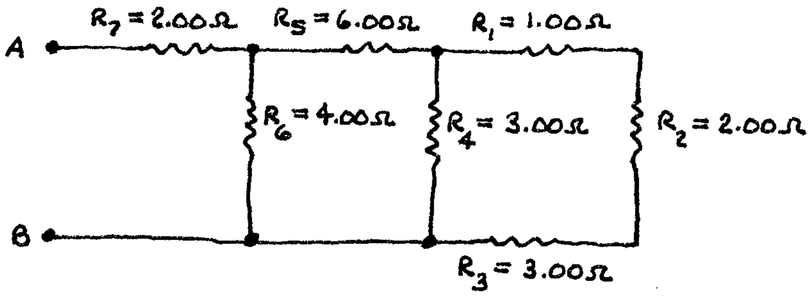
$R_2 = \boxed{446\ \Omega}$

$\boxed{20.49}$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{16\,\Omega} + \frac{1}{8\,\Omega} = \frac{3}{16\,\Omega}$$

$$\therefore\ R_{eq} = \frac{16}{3}\,\Omega = \boxed{5\tfrac{1}{3}\,\Omega}$$

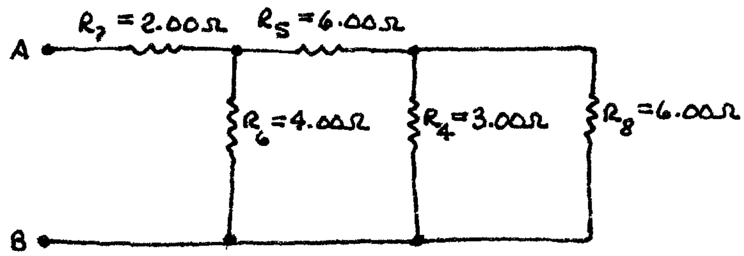
$\boxed{20.58}$



Replace R_1, R_2, and R_3 with R_8:

$$R_8 = R_1 + R_2 + R_3$$

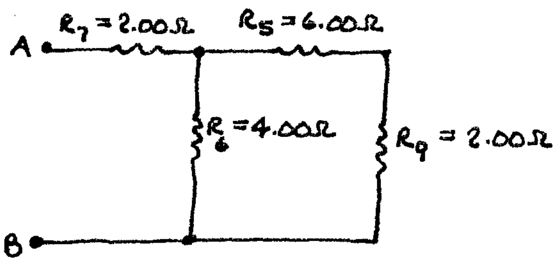
$$R_8 = 1.00\Omega + 2.00\Omega + 3.00\Omega = 6.00\Omega$$



Replace R_4 and R_8 with R_9:

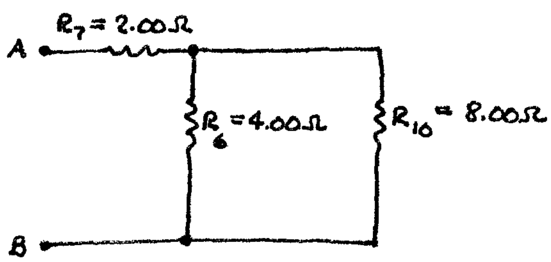
$$\frac{1}{R_9} = \frac{1}{R_4} + \frac{1}{R_8} = \frac{1}{3.00\Omega} + \frac{1}{6.00\Omega} = \frac{3}{6.00\Omega}$$

$$R_9 = 2.00\Omega$$



Replace R_5 and R_9 with R_{10}:

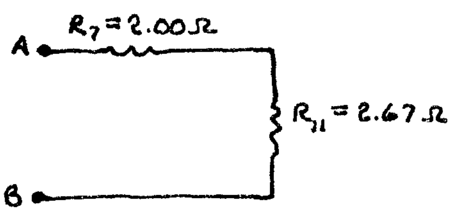
$$R_{10} = R_5 + R_9 = 6.00\Omega + 2.00\Omega = 8.00\Omega$$



Replace R_6 and R_{10} with R_{11}:

$$\frac{1}{R_{11}} = \frac{1}{R_6} + \frac{1}{R_{10}} = \frac{1}{4.00\Omega} + \frac{1}{8.00\Omega} = \frac{3}{8.00\Omega}$$

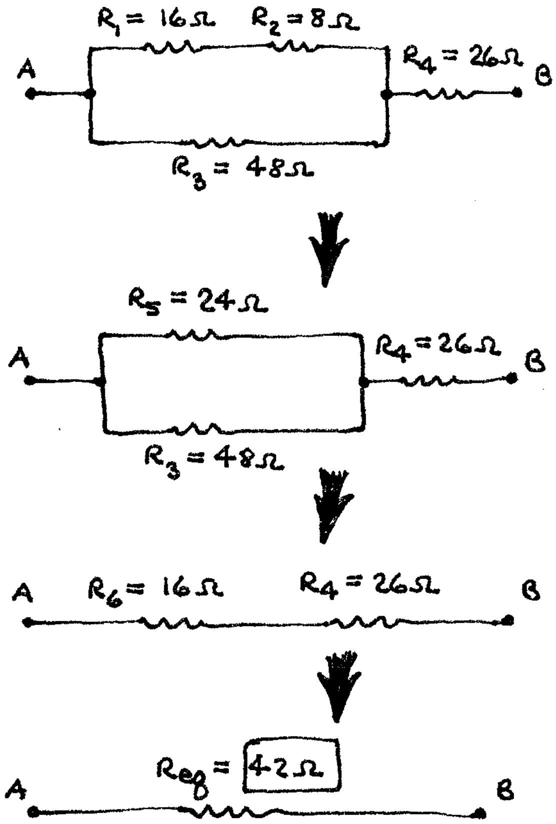
$$R_{11} = \frac{8.00\Omega}{3} = 2.67\Omega$$



Replace R_7 and R_{11} with R_{eq}

$$R_{eq} = R_7 + R_{11} = 2.00\Omega + 2.67\Omega = \boxed{4.67\Omega}$$

$\boxed{20.60}$



$$R_5 = R_1 + R_2 = 16\,\Omega + 8\,\Omega = 24\,\Omega$$

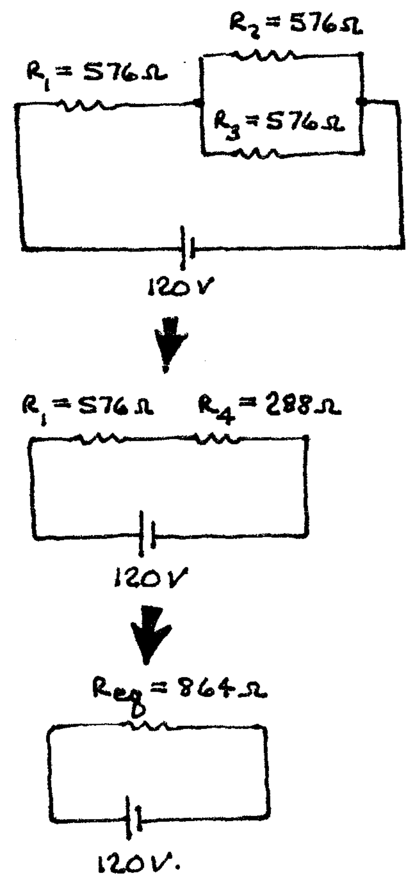
$$\frac{1}{R_6} = \frac{1}{R_3} + \frac{1}{R_5} = \frac{1}{48\,\Omega} + \frac{1}{24\,\Omega} = \frac{3}{48\,\Omega}$$

$$\therefore\ R_6 = \frac{48\,\Omega}{3} = 16\,\Omega$$

$$R_{eq} = R_6 + R_4 = 16\,\Omega + 26\,\Omega = \boxed{42\,\Omega}$$

$\boxed{20.64}$

Since $P = V^2/R = I^2R$, to determine the power dissipated in each of the resistors shown below, we need only determine the current or the voltage associated with each resistor.



$$P_3 = V_3^2/R_3 = \frac{(40V)^2}{576\Omega} = \boxed{2.777\cdots W}$$

$$\therefore P_2 = V_2^2/R_2 = \frac{(40V)^2}{576\Omega} = \boxed{2.777\cdots W}$$

$$V_2 = V_3 = V_4 = 40V$$

$$\therefore V_4 = 40V.$$

$$\therefore V_4 = I_4R_4 = (0.13888\cdots A)(288\Omega)$$

Also, $I_4 = I_{total} = 0.13888\cdots A$

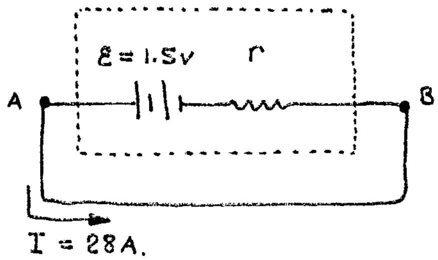
$$\therefore P_1 = \boxed{11.1111\cdots W}$$

$$\therefore P_1 = I_1^2R_1 = (0.13888\cdots A)^2(576\Omega)$$

$$I_1 = I_{total} = 0.13888\cdots A$$

$$I_{total} = \frac{120V}{864\Omega} = 0.13888\cdots A.$$

$\boxed{20.69}$



The electromotive force (emf), ℰ, and the internal resistance, r, form the equivalent of a real battery. The terminals of the "real" battery are at A and B. When a "wire of negligible resistance" is placed between A & B, the current that flows in the circuit is limited by the internal resistance. According to Ohm's law,

$$r = \frac{\mathcal{E}}{I} = \frac{1.5\text{ V.}}{28\text{ A.}} = \boxed{0.054\,\Omega}$$

$\boxed{20.100}$

$V = 12\ V.$

$P = 33\ W.$

$R = ?$

$I = ?$

Since $P = V^2/R \longrightarrow R = \frac{V^2}{P} = \frac{(12\ V)^2}{33\ W} = 4.363636\cdots\ \Omega = \boxed{4.4\ \Omega}$

Since $P = IV \longrightarrow I = P/V = \frac{33\ W}{12\ V.} = \boxed{2.8\ A.}$