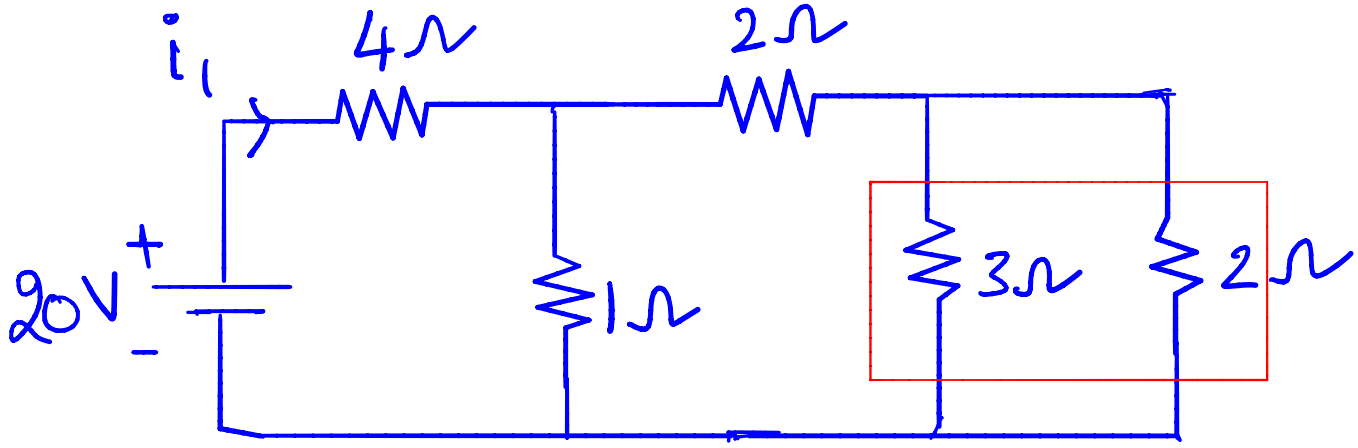
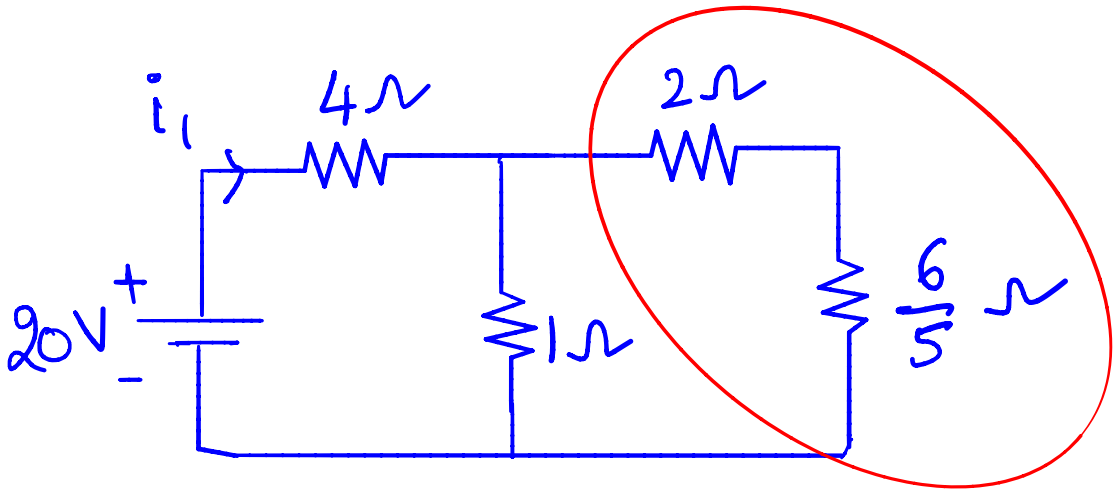
①



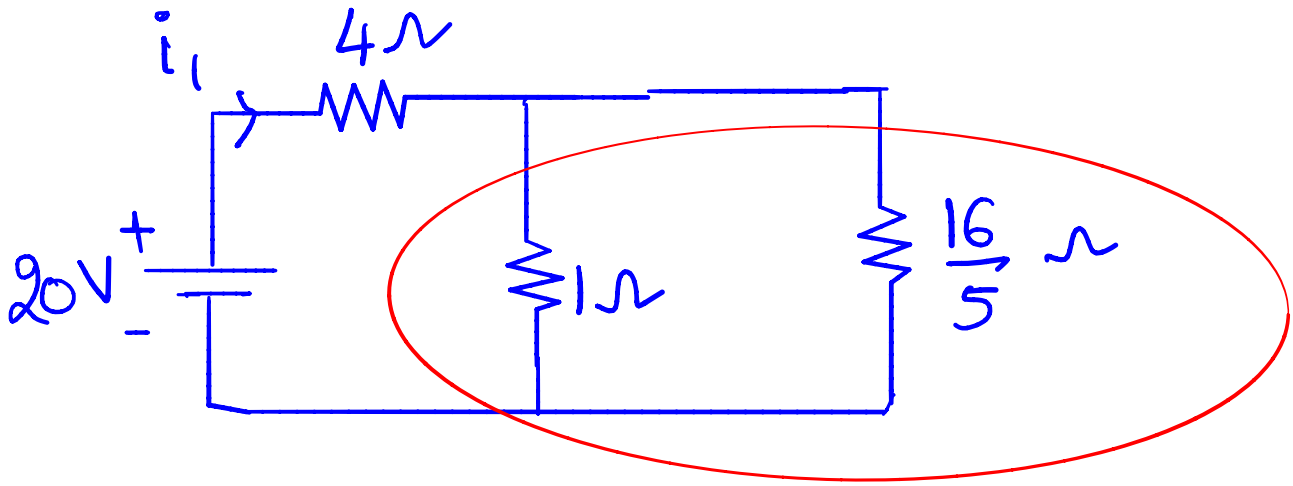
If R_1 & R_2 are in parallel then Equivalent resistance $R_{equi} = \frac{R_1 R_2}{R_1 + R_2}$

$$R_{equivalent} = \frac{3 \times 2}{3+2} = \frac{6}{5}\,\Omega$$

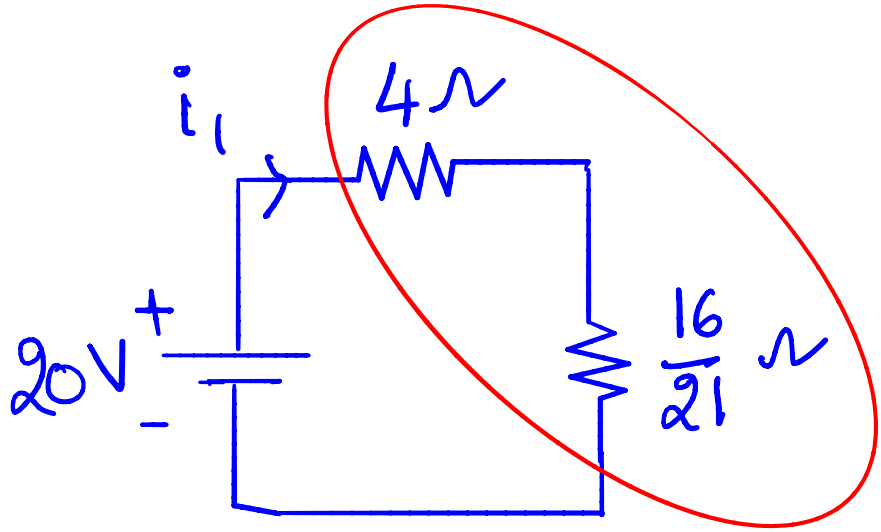


If R_1 & R_2 are in series then equivalent resistance $R_{equ} = R_1 + R_2$

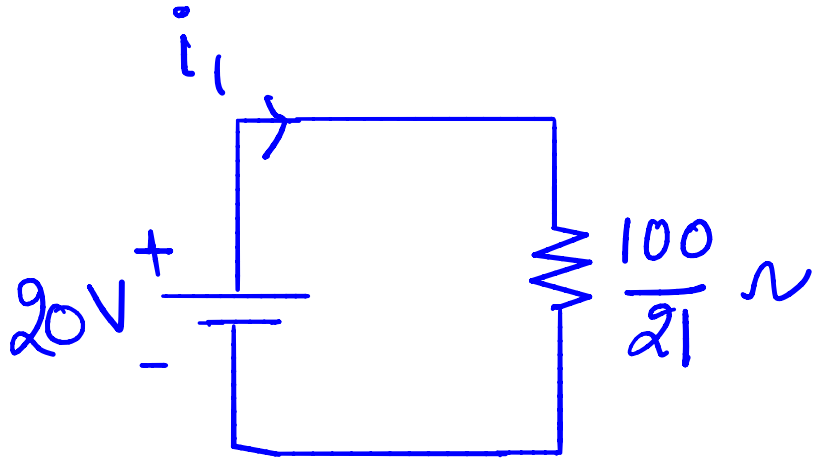
$$R_{eq} = 2 + \frac{6}{5} = \frac{16}{5}\ \Omega$$



$$R_{eq} = \frac{1 \times \frac{16}{5}}{1 + \frac{16}{5}} = \frac{16}{21}\ \Omega$$



$$R_{eq} = 4 + \frac{16}{21} = \frac{100}{21}$$

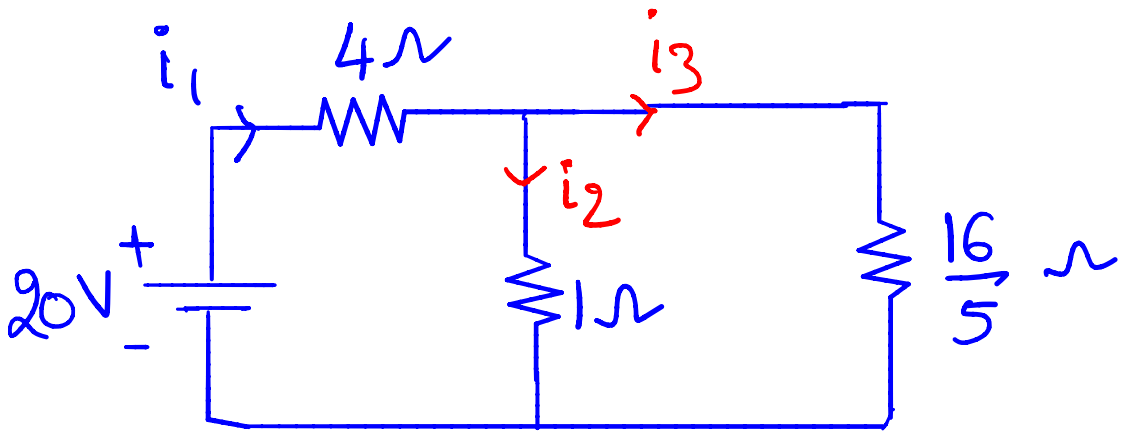


By Ohm's Law,

$$i_1 = \frac{V}{R} = \frac{20}{\frac{100}{21}} = \frac{20 \times 21}{100}$$

$$\therefore i_1 = 4.2\,A$$

(2) Lets draw the intermediate circuit in (1) solution i.e



Lets denote i_2 as current through 1Ω resistor

and i_3 as current through $\frac{16}{5}\Omega$ resistor.

$$\therefore \text{Current } i_2 = \frac{\frac{16}{5} \times i_1}{1 + \frac{16}{5}} \quad (i_1 = 4.2A)$$

$$\therefore i_2 = \frac{16 \times 4.2}{21} = 3.2\,A$$

According KCL,

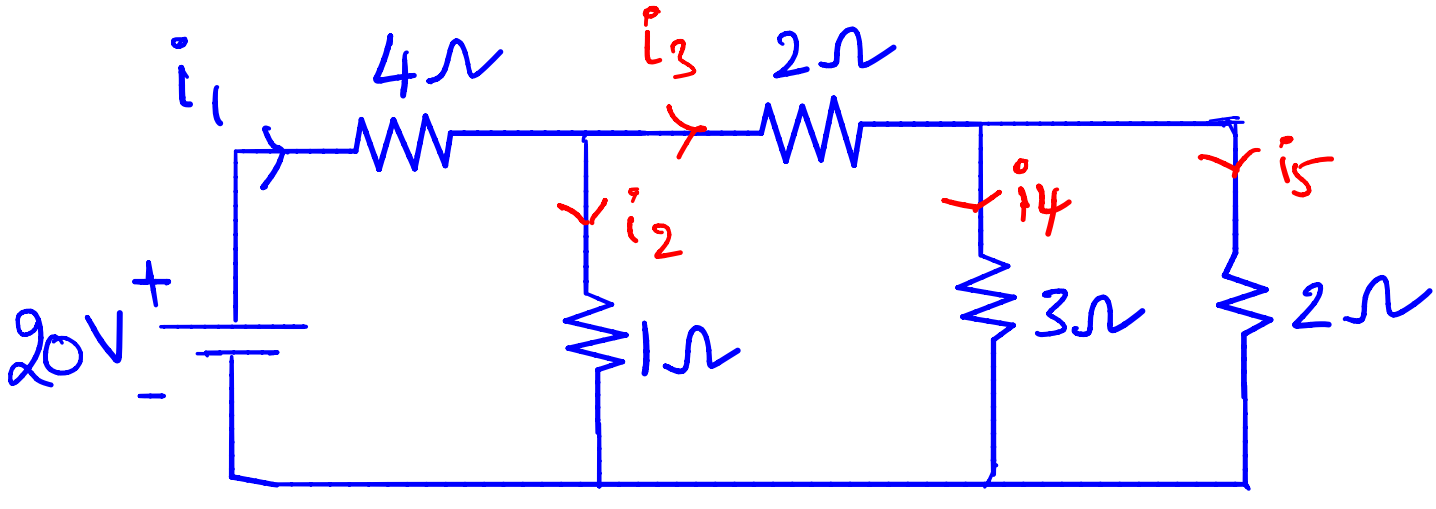
$$i_1 = i_2 + i_3$$

$$\therefore i_3 = i_1 - i_2$$

$$= 4.2 - 3.2$$

$$\boxed{i_3 = 1\,A}$$

Let's take circuit as and denote current as



Current i_4 can be calculated as

$$i_4 = \frac{2 \times i_3}{3+2} = \frac{2 \times 1}{5} = \frac{2}{5}$$

Current through 3Ω resistor $= 0.4\,A$

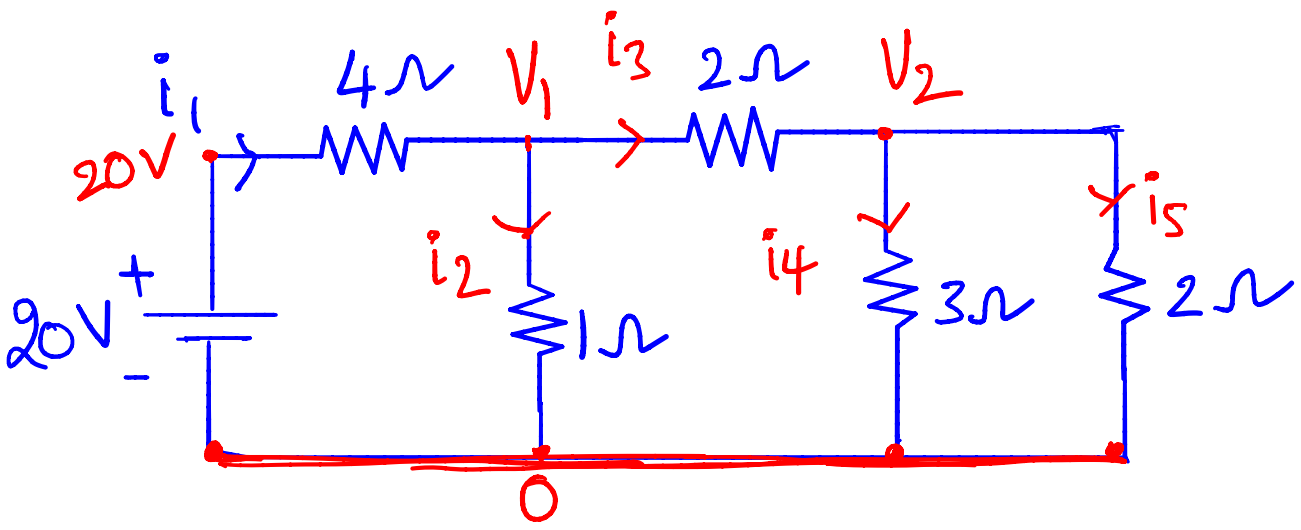
Power dissipated in the resistor

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

$\therefore$ Power dissipated in 3Ω Resistor

$$P_{3\Omega} = (0.4)^2 \times 3 = 0.48\,W$$

(3)



In the above circuit 3 loops and 2 junctions are there.

$i_1 = 4.2A$ $\quad i_2 = 3.2A$

$i_3 = 1A$ $\quad i_4 = 0.4A$

$i_5 = 0.6A$

KVL at loop 1:

$$20 - i_1 \times 4 - i_2 \times 1 = 0$$

$$\Rightarrow 20 - 4.2 \times 4 - 3.2 = 0$$

$$\Rightarrow 20 - 20 = 0$$ ✓

KVL satisfied.

KVL at loop 2:

$$i_3 \times 2 + i_4 \times 3 - i_2 \times 1 = 0$$

$$1 \times 2 + 0.4 \times 3 - 3.2 = 0$$

$$2 + 1.2 - 3.2 = 0$$

$$0 = 0$$ ✓

KVL satisfied

KVL at loop 3 :

$$i_5 \times 2 - i_4 \times 3 = 0$$

$$0.6 \times 2 - 0.4 \times 3 = 0$$

$$1.2 - 1.2 = 0$$

$$0 = 0$$ ✓

KVL satisfied

KCL

at V_1 :

$$i_1 = i_2 + i_3$$

$$4.2 = 3.2 + 1 \Rightarrow 4.2 = 4.2$$ ✓

at V_2 :

$$i_3 = i_4 + i_5$$

$$1 = 0.4 + 0.6$$

$$1 = 1$$ ✓

KCL, KVL are satisfied.