Q. 02

(a) Three resistors 2 Ω, 4 Ω and 5 Ω are combined in parallel. What is the total resistance of the combination?

(b) If the combination is connected to a battery of emf 20 V and negligible internal resistance, determine the current through each resistor, and the total current drawn from the battery.

Answer

(a) There are three resistors of resistances,

$R_1 = 2\ \Omega$, $R_2 = 4\ \Omega$, and $R_3 = 5\ \Omega$

They are connected in parallel. Hence, total resistance (R) of the combination is given by,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{2} + \frac{1}{4} + \frac{1}{5} = \frac{10+5+4}{20} = \frac{19}{20}$$

$$\therefore R = \frac{20}{19}\ \Omega$$

Therefore, total resistance of the combination is $\frac{20}{19}\ \Omega$.

(b) Emf of the battery, V = 20 V

Current (I_1) flowing through resistor R_1 is given by,

$$I_1 = \frac{V}{R_1}$$

$$= \frac{20}{2} = 10\,\text{A}$$

Current (I_2) flowing through resistor R_2 is given by,

$$I_2 = \frac{V}{R_2}$$

$$= \frac{20}{4} = 5\,\text{A}$$

Current (I_3) flowing through resistor R_3 is given by,

$$I_3 = \frac{V}{R_3}$$

$$= \frac{20}{5} = 4\,\text{A}$$

Total current, $I = I_1 + I_2 + I_3 = 10 + 5 + 4 = 19$ A

Therefore, the current through each resister is 10 A, 5 A, and 4 A respectively and the total current is 19 A.