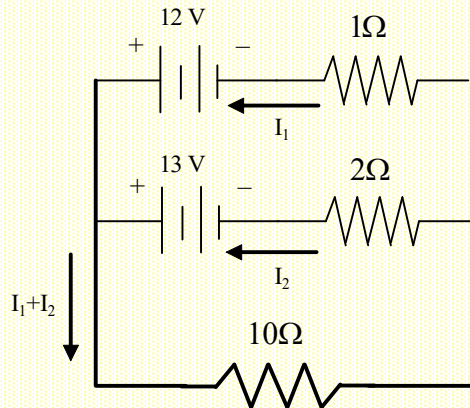


Two batteries with e.m.f. 12 V and 13 V are connected in parallel across a load resistor of 10 Ω . The internal resistances of the two batteries are 1 Ω and 2 Ω respectively. The voltage across the load lies between:

- (1) 11.6 V and 11.7 V (2) 11.5 V and 11.6 V
 (3) 11.4 V and 11.5 V (4) 11.7 V and 11.8 V

Solution-I



$$12 - I_1 \times 1 = 13 - I_2 \times 2 = 10(I_1 + I_2) \quad \text{Or, } 12 - I_1 = 13 - 2I_2 = 10I_1 + 10I_2$$

$$\therefore 2I_2 - I_1 = 1 \dots\dots(1) \quad \& \quad 10I_2 + 11I_1 = 12 \dots\dots(2)$$

$$\therefore 10I_2 + 11(2I_2 - 1) = 12$$

$$\therefore 32I_2 = 23, \text{ Or } I_2 = \frac{23}{32}$$

$$\text{Required voltage} = 13 - 2I_2 = 13 - 2 \times \frac{23}{32} = 13 - \frac{23}{16} = 11 + \frac{9}{16} \text{ V}$$

Solution-II

Three batteries in parallel (third battery here has emf = 0) can be replaced by single battery having emf,

$$= \frac{\frac{E_1}{r_1} + \frac{E_2}{r_2} + \frac{E_3}{r_3}}{\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}} = \frac{\frac{12}{1} + \frac{13}{2} + \frac{0}{10}}{\frac{1}{1} + \frac{1}{2} + \frac{1}{10}} = \frac{\frac{24+13}{2}}{\frac{10+5+1}{10}} = \frac{37 \times 5}{16} \text{ V}$$

Hence, Option (2). [Based on JEE Main 2018 - [123IITJEE](#)]