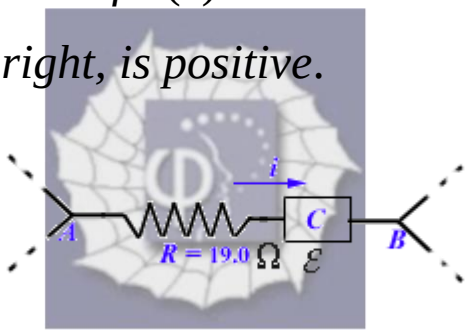
404.

Problem 33.9 (RHK)

A section of the circuit AB (see figure) *absorbs 53 W of power when a current* $i = 1.20$ A *passes through it in the indicated direction.* (a) *We have to find the potential difference between A and B.* (b) *Assuming that the element C does not have any internal resistance, we have to find the emf.* (c) *We have to answer which terminal, left or right, is positive.*



Solution:

(a)

The section of the circuit *AB* shown in the figure absorbs 53.0 W of power when a current $i = 1.20$ A passes through it. We have to find the potential difference between *A* and *B*.

Joule heat in the resistance $R = 19\ \Omega$ will be

$P_1 = i^2 R = 1.20^2 \times 19$ W $= 27.36$ W.

Therefore, the power absorbed in the element *C* will be

$$P_2 = P - P_1 = (53.0 - 27.36)\ \text{W} = 25.60\ \text{W}.$$

(b) and (c)

As the device C is without internal resistance, it has to be a source of emf. The energy that is being absorbed by *C* is getting converted into chemical energy through the charging process. Therefore, the left terminal of C will be positive. The emf of *C* can be found from the relation

$P_2 = \text{E}i$,

and

$$\text{E} = \frac{P_2}{i} = \frac{25.60}{1.20}\ \text{V} = 21.37\ \text{V}.$$

The potential difference *A* and *B* will, therefore, be

$$-19.0 \times 1.2\ (\Omega\ \text{A}) - 21.37\ \text{V} = -44.17\ \text{V}.$$

That is *B* is at -44.17 V, if *A* is at 0.0 V.