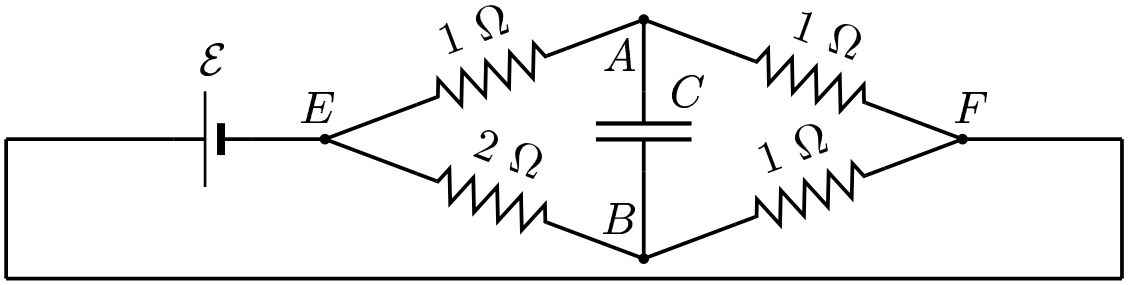
Given: The circuit is in a steady state.



Determine $\Delta V = V_{AB} = V_B - V_A$.

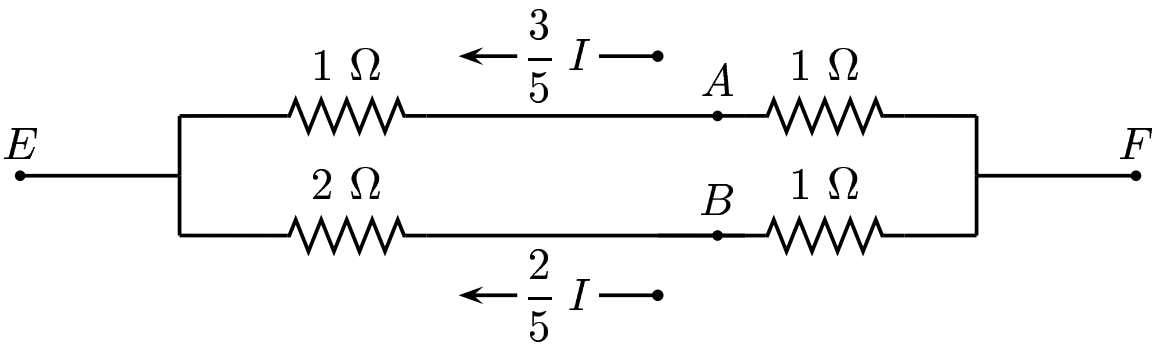
A) $V_B - V_A = +\frac{1}{6}\,\mathcal{E}$

B) $V_B - V_A = +\frac{1}{3}\,\mathcal{E}$

C) $V_B - V_A = +\frac{1}{2}\,\mathcal{E}$

D) $V_B - V_A = +\frac{2}{3}\,\mathcal{E}$

E) $V_B - V_A = +\frac{5}{6}\,\mathcal{E}$



Given: I is the total current, $R_{top} = 2\ \Omega$, $R_{bottom} = 3\ \Omega$.
Since $\mathcal{E} = V_{FE} = R_{top}\, I_{top} = R_{bottom}\, I_{bottom}$, we have

$$\frac{I_{bottom}}{I_{top}} = \frac{R_{top}}{R_{bottom}} = \frac{2\ \Omega}{3\ \Omega} = \frac{2}{3}\,, \qquad \text{and} \qquad \frac{\mathcal{E}}{2} = I\,(1\ \Omega)\,.$$

Then, $V_{AF} = I_{top}\,(1\ \Omega)$ and $V_{BF} = I_{bottom}\,(1\ \Omega) = \dfrac{2}{3}\, I_{top}\,(1\ \Omega)$, so

$$V_{BA} = V_{AF} - V_{BF} = I\,(1\ \Omega) - \frac{2}{3}\, I\ (1\ \Omega) = \frac{\mathcal{E}}{2} - \frac{2}{3}\,\frac{\mathcal{E}}{2} = \frac{1}{6}\,\mathcal{E}\,.$$

Answer **A**.

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