Given battery has *emf* \( \mathcal{E} = 10 \text{ V} \) and the internal resistance \( r = 1 \Omega \), as shown in the figure below. An external resistance \( R = 0.01 \Omega \) is connected to the battery.

\[
\begin{array}{c}
\begin{array}{c}
\mathcal{E} \\
A
\end{array}
\begin{array}{c}
\begin{array}{c}
r \\
B
\end{array}
\end{array}
\begin{array}{c}
R
\end{array}
\end{array}
\]

Compare \( V_{AB} \) with \( \mathcal{E} \).

A) \( V_{AB} \ll \mathcal{E} \).

B) \( V_{AB} \approx \mathcal{E} \).

C) \( V_{AB} \gg \mathcal{E} \).
\[ R_{\text{total}} = R + r \]

\[ I = \frac{\mathcal{E}}{R + r} \]

\[ V_{AB} = \frac{R}{R + r} \mathcal{E} = \frac{0.01}{0.01 + 1} \text{ 10 V} = 0.099 \text{ V} \]

This simple calculation shows \( V_{AB} = 0.099 \text{ V} \ll \mathcal{E} \). In other words, when \( r \gg R \), most of the potential drop is across the internal resistance \( r \).

Answer A.

28.02-01a `EMF` and `internal resistance` 2004-3-24