Answer on Question #45819– Physics – Electric Circuits

Question: a battery has emf $13.2\ V$ and internal resistance $24\ m\Omega$. If the load current is $20\ A$, find the terminal voltage of the battery.

a) $12.7\ V$;
b) $14.5\ V$;
c) $16.8\ V$;
d) $17.7\ V$.

Solution: the load current in the circle can be determined using the Ohm's law

$$I = \frac{\epsilon}{R + r},$$

where R is resistance of the load, r is inner resistance and ϵ is emf. From last equation we get

$$IR + Ir = \epsilon\ .$$

The terminal voltage of the battery is the voltage output measured across its terminals. Thus it is the same as the voltage on the load. Using the Ohm's law again, we obtain

$$U_{terminal} = IR = \epsilon - Ir$$

After calculations we get

$$U_{terminal} = 13.2 - 24 \cdot 10^{-3} \cdot 20 \cong 12.7\ V$$

Answer:

$$a)\ 12.7\ V.$$