2023 Ph H1 Q21

Section: Electricity

Topic: Sources, Internal Resistance

Question Summary
An experiment is performed to determine the EMF and internal resistance of a battery. The circuit includes a variable resistor and a voltmeter across the battery. Readings of terminal voltage V against current I are plotted on a graph, and the EMF and internal resistance are deduced from the intercept and gradient.

Worked Solution
The relationship is $V = E - Ir$, where E is the EMF and r is the internal resistance.
From the graph, the vertical intercept ($I = 0$) is $V = 6.0$ V, so EMF = 6.0 V.
The slope of the line gives $-r$. From the graph, when $V = 0$, $I = 3.0$ A, so $r = E / I = 6.0 / 3.0 = 2.0\ \Omega$.

Final Answer: E

Revision Tips

- Terminal voltage V decreases linearly with current I due to internal resistance.
- The y-intercept of a V–I graph gives the EMF.
- The gradient ($-r$) gives the internal resistance.