2018 Ph H1 Q15

Section: Electricity

Topic: Current, PD, Power, Resistance

Question Summary
A 12 V battery with negligible internal resistance is connected to a 10 Ω resistor in series with two 10 Ω resistors in parallel. A switch S controls the bottom branch of the parallel pair. A voltmeter V measures the p.d. across the lone 10 Ω resistor. A1 measures total current from the battery. A2 measures current in the top branch of the parallel pair. Which of the student's statements about voltmeter and ammeter readings are correct?

Worked Solution
<u>Case 1 – Switch S open</u>
Only the top 10 Ω resistor remains in the parallel section, so total resistance = 10 + 10 = 20 Ω.
Total current = 12/20 = 0.60 A.
Voltmeter across lone 10 Ω resistor: V = IR = 0.60 × 10 = 6.0 V. □ (Statement I correct)
A2 measures branch current = 0.60 A. □ (Statement II correct)

<u>Case 2 – Switch S closed</u>
Two 10 Ω resistors in parallel → Req = (10 × 10) / (10 + 10) = 5.0 Ω.
Total circuit resistance = 10 + 5 = 15 Ω.
Total current = 12/15 = 0.80 A. □ (Statement III correct)

Final Answer: E (I, II and III are correct)

Revision Tips

- For parallel resistors: 1/Req = 1/R1 + 1/R2.
- When switch changes state, redraw the circuit to simplify.
- Series resistors share current; parallel resistors share voltage.
- Always calculate total resistance first, then use I = V/R.
- Voltmeter across a resistor shows V = IR for that component only.