DC Circuits: e.m.f., Kirchhoff's Laws and Potential Dividers

Electricity · 4 questions · step-by-step answers at the end

Name: Date: Score: / 4

USEFUL EQUATIONS

$E = I(R + r)$ $V = E - Ir$ $1/R = 1/R_1 + 1/R_2$ $V_{out} = V_{in} \times R_2 / (R_1 + R_2)$

Questions

Show your working in the space under each question.

1. A 12 V supply is across a 2.0 kΩ and a 4.0 kΩ resistor in series. What is the p.d. across the 4.0 kΩ resistor?

2. A cell of e.m.f. 6.0 V and internal resistance 0.50 Ω is connected to a 5.5 Ω resistor. Find the current, the terminal p.d. and the power wasted in the cell.

3. Two 6 Ω resistors in parallel are connected in series with a third 6 Ω resistor. Find the total resistance.

4. A 9 V cell and a 3 V cell are connected in opposition in a loop of total resistance 4 Ω. Find the current.

Step-by-step answers

DC Circuits: e.m.f., Kirchhoff's Laws and Potential Dividers

1. $12 \times 4.0/6.0 = \mathbf{8.0\ V}$.

2. 1. $I = E/(R + r) = 6.0/6.0 = \mathbf{1.0\ A}$.
2. $V = E - Ir = 6.0 - 0.50 = \mathbf{5.5\ V}$.
3. Wasted power $= I^2r = \mathbf{0.50\ W}$.
Answer: 1.0 A; 5.5 V; 0.50 W

3. $3 + 6 = \mathbf{9\ \Omega}$.

4. Net e.m.f. = 6 V, so $I = 6/4 = \mathbf{1.5\ A}$.