Worksheet: Ohm's Law Calculations (V = I R)

PhysicsSheets

Specification: GCSE Physics (AQA 4.2.1.3 / Edexcel SP10)

Ohm's Law: The potential difference (V) across a component is directly proportional to the current (I) through it, provided its temperature remains constant.

Core Equation: $V = I \times R$

Rearranged Forms: $I = \frac{V}{R}$ | $R = \frac{V}{I}$

Units: V (Potential difference, Volts) | I (Current, Amperes) | R (Resistance, Ohms, Ω)

Section A: Recall, Rearranging & Unit Conversions

1. Complete the table below with the correct SI unit and symbol for each variable in Ohm's Law:

Variable	Unit Name	Unit Symbol
Potential difference (V)	**Volts**	**V**
Current (I)	**Amperes**	**A**
Resistance (R)	**Ohms**	**Ω**

2. Rearrange the formula $V = I \times R$ to make I and R the subject:

a) $I =$ **V/R**

b) $R =$ **V/I**

3. Convert the following values into their standard SI units:

a) 250 mA = **0.25** A

b) 4.7 kΩ = **4700** Ω

c) 120 mV = **0.12** V

d) 0.005 A = **5** mA

Section B: Practice Calculations

4. Calculate the missing values in the following scenarios. Show your working clearly and state the correct units.

a) A current of 0.5 A flows through a resistor with a resistance of 12 Ω. Calculate the potential difference across the resistor.

Model Answer:
$V = I \times R = 0.5 \text{ A} \times 12 \text{ Ω} = 6 \text{ V}$

b) A 9 V battery is connected across a component with a resistance of 30 Ω. Calculate the current flowing through the component.

Model Answer:
$I = \frac{V}{R} = \frac{9 \text{ V}}{30 \text{ Ω}} = 0.3 \text{ A}$

c) A 12 V power supply drives a current of 200 mA through a circuit. Calculate the total resistance of the circuit.

Model Answer:
First, convert current: $I = 200 \text{ mA} = 0.2 \text{ A}$
Then, $R = \frac{V}{I} = \frac{12 \text{ V}}{0.2 \text{ A}} = 60 \text{ Ω}$

d) A component has a resistance of 1.5 kΩ. If a current of 0.04 A flows through it, what is the potential difference across the component?

Model Answer:
First, convert resistance: $R = 1.5\ \text{k}\Omega = 1500\ \Omega$
Then, $V = I \times R = 0.04\ \text{A} \times 1500\ \Omega = 60\ \text{V}$

Section C: Challenge Context

5. Figure 1 shows a simple circuit containing a 6 V cell, a fixed resistor, and an ammeter. The ammeter reads 150 mA.

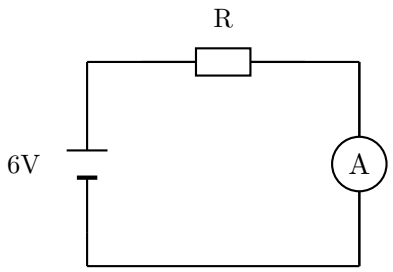

Figure 1: Simple Series Circuit

a) Calculate the resistance of the fixed resistor, R. Give your answer to an appropriate number of significant figures.

Model Answer:
First, convert current: $I = 150\ \text{mA} = 0.150\ \text{A}$
Using Ohm's Law, $R = \dfrac{V}{I} = \dfrac{6\ \text{V}}{0.150\ \text{A}} = 40\ \Omega$
(Answer given to 2 significant figures, consistent with input values like 6 V and 150 mA)

b) Explain what would happen to the current flowing through the circuit if the potential difference of the cell was halved AND the resistance of the fixed resistor was doubled.

Model Answer:
1. Ohm's Law states $I = V/R$.
2. If the potential difference (V) is halved, the current would halve (as $I \propto V$).
3. If the resistance (R) is doubled, the current would halve again (as $I \propto 1/R$).
4. Therefore, the current would become a quarter of its original value. For example, if $I = V/R$, then new current $I' = (V/2)/(2R) = V/(4R) = \frac{1}{4}I$.