Worksheet 2.3: Charge & Current (Q = I t)

PhysicsSheets

Specification: GCSE Physics (AQA 4.2.1.2 / Edexcel SP10)

Core Equation: $Q = I \times t$

Rearranged Forms: $I = \frac{Q}{t}$ | $t = \frac{Q}{I}$

Units: Charge flow (Q) in Coulombs (C) — Current (I) in Amperes (A) — Time (t) in seconds (s)

Section A: Units, Rearranging & Conversions

1. Complete the sentences below with the correct SI unit and its symbol for each variable in the equation $Q = I \times t$:

a) Charge flow (Q) is measured in _____ (_____).

b) Current (I) is measured in _____ (_____).

c) Time (t) is measured in _____ (_____).

2. Rearrange the equation $Q = I \times t$ to make:

a) Current (I) the subject: $I =$ _____

b) Time (t) the subject: $t =$ _____

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

a) 250 mA = _____ A

b) 15 minutes = _____ s

c) 2.5 hours = _____ s

d) 0.003 kC = _____ C

e) 5000 µA = _____ A

f) 1.2 ms = _____ s

Section B: Practice Calculations

Answer the following questions, showing your working clearly and stating the correct units. Remember to convert all values to standard SI units before calculation.

a) A current of 0.5 A flows through a wire for 30 s. Calculate the total charge that passes through the wire.

b) 120 C of charge passes through a component in 60 s. Calculate the current flowing through the component.

c) A current of 0.2 A flows through a bulb, and a total charge of 360 C passes through it. For how long was the bulb switched on?

d) A charge of 450 C flows through a circuit in 5 minutes. Calculate the current in Amperes.

Section C: Challenge & Contextual Problems

Figure 2 shows a simple circuit with a 6 V cell and a resistor.

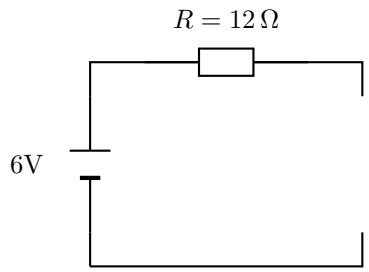

Figure 2: Simple Resistor Circuit

1. Answer the following questions, showing your working clearly and stating the correct units.

a) Using Figure 2, calculate the current flowing through the $12\,\Omega$ resistor. Then, calculate the total charge that passes through the resistor in 1.5 hours. Give your final answer in Coulombs.

b) A large battery has a charge capacity of 150 kC. It is used to power a device that draws a constant current of 250 mA.

i) Calculate the maximum time, in hours, that the battery can power the device. (Give your answer to 2 significant figures).

ii) Explain why, in reality, the device might not operate for this full calculated time, referring to factors that affect battery performance.