

11.1 Electric Current

Name: _____ Class: _____ Date: _____

Total: 11 marks

Objective

Build the skills to answer exam questions on **electric current**.

You must be able to:

- define **electric current** 电流 as the rate of flow of charge, $I = \frac{\Delta q}{\Delta t}$
- describe current as the drift of charge carriers through a conductor
- distinguish **conventional current** 常规电流 from electron flow

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Current

$I = \frac{\Delta q}{\Delta t}$, measured in amperes ($1 \text{ A} = 1 \text{ C s}^{-1}$).

■ Drift of carriers

In a metal, current is the slow drift of free electrons pushed by the field.

■ Conventional current

Conventional current is the direction **positive** charge would flow —opposite to the actual electron flow.

■ Example

6.0 C passing in 2.0 s: $I = 3.0 \text{ A}$.

2 Practice

2.1 A charge of 12 C flows past a point in 4.0 s. Find the current.

[2]

2.2 State the direction of conventional current relative to the electron flow. [1]

2.3 A current of 0.50 A flows for 10 s. Find the charge that passes. [2]

3 Exam-style questions

3.1 Electric current is the rate of flow of [1]

- **A** energy
- **B** charge
- **C** mass
- **D** voltage

3.2 Conventional current is defined as the direction of flow of [1]

- **A** electrons
- **B** positive charge
- **C** neutrons
- **D** photons

3.3 A wire carries a current of 2.0 A.

(a) Find the charge that passes in 30 s. [2]

(b) Find the number of electrons this represents ($e = 1.6 \times 10^{-19}$ C). [2]

4 Go further

- work through the **11.1 Electric Current** lesson on the **Learn** page;

- read the **Electric Circuits** section of the AP Physics 2 handout on the **Know** page.

Solutions

2.1 $I = \frac{\Delta q}{\Delta t} = \frac{12}{4.0} = 3.0 \text{ A}.$

2.2 opposite to the electron flow.

2.3 $\Delta q = I \Delta t = 0.50 \times 10 = 5.0 \text{ C}.$

3.1 B.

3.2 B.

3.3 (a) $\Delta q = I \Delta t = 2.0 \times 30 = 60 \text{ C}.$ (b) $N = \frac{60}{1.6 \times 10^{-19}} = 3.75 \times 10^{20} \text{ electrons}.$