

11.1 Electric Current

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS electric current 电流 • current density 电流密度 • drift velocity 漂移速度
• amperes 安培

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, $I = \frac{dQ}{dt}$
- distinguish **conventional current** from electron flow
- relate current to **current density** 电流密度 and **drift velocity** 漂移速度
- apply **conservation of charge** to steady current

1 Worked examples

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

■ Current

$I = \frac{dQ}{dt}$, measured in amperes. Over a steady flow, $I = \frac{\Delta Q}{\Delta t}$.

■ Conventional current

The direction that **positive** charge would flow — opposite to the actual electron drift.

■ Microscopic picture

Current is carriers **drifting** slowly through the conductor; a potential difference across the conductor drives the flow, and charge is conserved.

2 Practice

2.1 A charge of 15 C flows past a point in 3.0 s. Find the current. [2]

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

2.3 State what drives a current through a conductor. [1]

3 Exam-style questions

3.1 Electric current is defined as [1]

- A** Q/V
- B** $\frac{dQ}{dt}$
- C** It
- D** V/R

3.2 Conventional current flows in the direction of [1]

- A** electron flow
- B** positive charge flow
- C** neutron flow
- D** no charge

3.3 A wire carries a steady current of 3.0 A.

(a) Find the charge that passes in 20 s. [2]

(b) State the conservation law obeyed by a steady current. [1]

Solutions

2.1 $I = \frac{\Delta Q}{\Delta t} = \frac{15}{3.0} = 5.0 \text{ A}.$

2.2 opposite to the electron flow.

2.3 a potential difference across it.

3.1 B.

3.2 B.

3.3 (a) $\Delta Q = I \Delta t = 3.0 \times 20 = 60 \text{ C}.$ (b) conservation of charge.