Exercise walk-through

Electric Current ▪ 11.1

eXercise

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

Method — Current

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

Method — Drift of carriers

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

Method — Conventional current

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

Method — Example

6.0 C passing in 2.0 s: $I = 3.0$ A.

Practice 2.1 ▪ 2 marks

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

Solution 2.1

Worked steps

$$I = \frac{\Delta q}{\Delta t} = \frac{12}{4.0} = 3.0 \text{ A}$$ M1 A1.

Practice 2.2 ▪ 1 mark

State the direction of conventional current relative to the electron flow.

Solution 2.2

Method: Conventional current

Worked steps

opposite to the electron flow B1.

Practice 2.3 ▪ 2 marks

A current of 0.50 A flows for 10 s. Find the charge that passes.

Solution 2.3

Worked steps

$\Delta q = I\,\Delta t = 0.50 \times 10 = 5.0$ C (M1)(A1).

Exam-style 3.1 ▪ 1 mark

Electric current is the rate of flow of

A energy

B charge

C mass

D voltage

Solution 3.1

Method: Conventional current

A energy

B charge ✓

C mass

D voltage

Worked steps

B.

Exam-style 3.2 ▪ 1 mark

Conventional current is defined as the direction of flow of

A electrons

B positive charge

C neutrons

D photons

Solution 3.2

Method: Conventional current

A electrons

B positive charge ✓

C neutrons

D photons

Worked steps

B.

Exam-style 3.3 ▪ 2 marks

A wire carries a current of 2.0 A.
(a) Find the charge that passes in 30 s.
(b) Find the number of electrons this represents ($e = 1.6 \times 10^{-19}$ C).

Solution 3.3

Worked steps

(a) $\Delta q = I\Delta t = 2.0 \times 30 = 60$ C M1 A1. (b) $N = \dfrac{60}{1.6 \times 10^{-19}} = 3.75 \times 10^{20}$ electrons M1 A1.