

## 7.1 Current, potential difference and resistance

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 10 marks

**KEY WORDS** current • potential difference

### Objective

Current, potential difference and resistance. Supported SL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

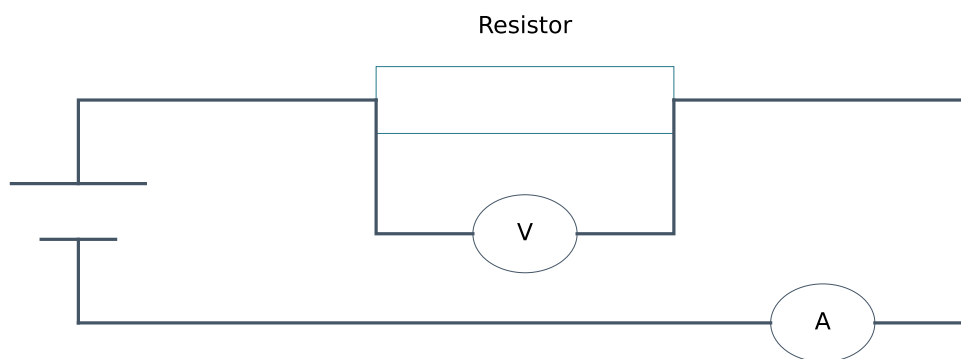
### 1 Key knowledge and worked examples

#### ■ What would explain this observation?

- A lamp becomes dimmer when another is added in series. **Current** and energy transfer depend on the whole circuit, not only one lamp.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

#### ■ Build the model

- Current is charge passing per time. **Potential difference** is energy transferred per charge. Resistance is potential difference divided by current for a stated operating point.
- current: Rate of flow of charge; potential difference: Energy transferred per unit charge.



DC supply in series

Ammeter in series; voltmeter across resistor

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■ **Choose evidence that can test it**

- Current is the same through components in series. Potential differences add around the series path. In parallel, branches share the same potential difference, while branch currents sum at a junction.
- Place an ammeter in series and a voltmeter in parallel. For an I-V investigation, change voltage in steps, reverse polarity when appropriate and limit current to reduce heating.

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■ **Work from known quantities**

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: a resistor has 6.0 V across it and carries 0.30 A. Use  $R = V/I$ .  $R = 6.0/0.30 = 20$  ohms. Power = VI. Power =  $6.0 \times 0.30 = 1.8$  W. These quantities describe the same operating point.

**Example:**

A component has 12 V across it and carries 0.40 A. Find resistance. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

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■ **Check the conclusion and its limits**

- Current is not used up by a lamp. A filament heats up, so its resistance need not remain constant as voltage changes.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

**Warn:**

A lamp uses up electric current as charge passes through it. This claim is false: Current is not used up by a lamp. A filament heats up, so its resistance need not remain constant as voltage changes.

**Key:**

Current, potential difference and resistance: Current is the same through components in series. Potential differences add around the series path. In parallel, branches share the same potential difference, while branch currents sum at a junction.

## 2 Practice

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**2.1** How is a voltmeter connected to measure voltage across a resistor? Choose one answer.

- **A** In parallel with the resistor
- **B** In series only
- **C** Across the ammeter only

[1]

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**2.2** A component has 12 V across it and carries 0.40 A. Find resistance. Show the relation, substitution and units.

[2]

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**2.3** Decide whether this claim is true and justify: A lamp uses up electric current as charge passes through it.

[2]

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**2.4** Rate of flow of charge: write the technical term.

[1]

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### 3 Exam-style questions

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**3.1** Connect two  $30\ \Omega$  resistors in parallel across  $12\ \text{V}$ . Find total resistance, total current and power; compare one resistor alone. [4]

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