

# 11.5 Compound DC Circuits

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

**Total: 11 marks****KEY WORDS** parallel 并联 • series 串联 • internal resistance 内阻 • resistance 电阻

## Objective

Build the skills to answer exam questions on **compound DC circuits**.

**You must be able to:**

- combine resistors in **series** 串联 ( $R_s = R_1 + R_2 + \dots$ ) and in **parallel** 并联 ( $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$ )
- account for the **internal resistance** 内阻 of a real battery and its terminal voltage
- analyse a circuit with mixed series and parallel sections

## 1 Worked examples

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

### ■ Series and parallel

- **Series:** same current,  $R_s = R_1 + R_2 + \dots$  (resistance adds up).
- **Parallel:** same voltage,  $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$  (total is **less** than the smallest).

### ■ Internal resistance

A real cell has internal resistance  $r$ , so the terminal voltage is  $V = \varepsilon - Ir$ .

### ■ Example

Two  $4.0\ \Omega$  resistors in parallel:  $\frac{1}{R_p} = \frac{1}{4} + \frac{1}{4} \Rightarrow R_p = 2.0\ \Omega$ .

## 2 Practice

**2.1** Two  $6.0\ \Omega$  resistors are connected in series. Find the total resistance.

[1]

**2.2** The same two  $6.0\ \Omega$  resistors are connected in parallel. Find the total resistance. [2]

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**2.3** A battery of emf  $12\ \text{V}$  and internal resistance  $0.50\ \Omega$  drives a current of  $2.0\ \text{A}$ . Find the terminal voltage. [2]

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### 3 Exam-style questions

**3.1** Resistors in series have a total resistance equal to [1]

|   |   |
|---|---|
| A | B |
| C | D |

- A less than the smallest
- B the sum of the individual resistances
- C their average
- D their product

**3.2** Adding another resistor in parallel makes the total resistance [1]

|   |   |
|---|---|
| A | B |
| C | D |

- A larger
- B smaller
- C unchanged
- D infinite

**3.3** A  $3.0\ \Omega$  and a  $6.0\ \Omega$  resistor are in parallel across a  $12\ \text{V}$  supply.

(a) Find the combined resistance. [2]

(b) Find the total current drawn from the supply. [2]