

STEM SMART Phase One, 2022

**Physics Week 3 – Resistors & Resistivity**

[https://isaacphysics.org/gameboards#smart\\_p\\_1\\_3](https://isaacphysics.org/gameboards#smart_p_1_3)



## Essential Pre-Uni Physics C1.1

A Level - Practice (P1)

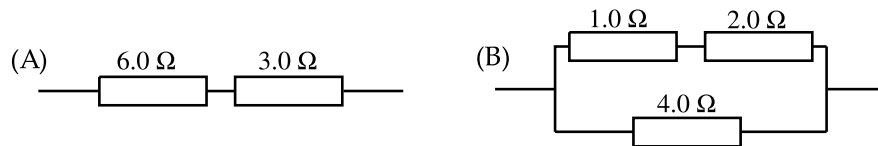


Figure 1: Two different resistor arrangements

### Part A Combination (A)

What is the resistance of combination (A)? Answer to 2 significant figures.

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### Part B Combination (B)

What is the resistance of combination (B)? Answer to 2 significant figures.

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## Essential Pre-Uni Physics C1.2

A Level - Practice (P1)

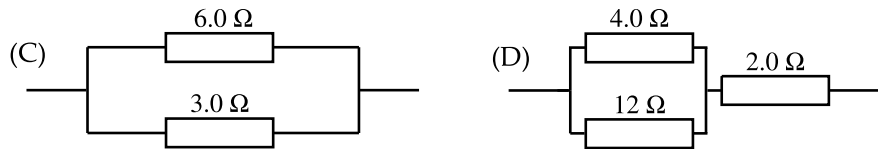


Figure 1: Two different resistor arrangements

### Part A Combination (C)

What is the resistance of combination (C)? Answer to 2 significant figures.

### Part B Combination (D)

What is the resistance of combination (D)? Answer to 2 significant figures.



## Essential Pre-Uni Physics C1.3

A Level - Practice (P1)

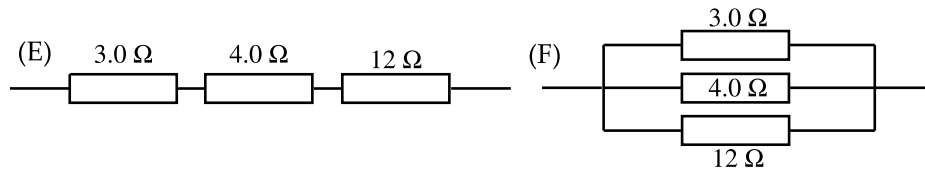


Figure 1: Two different resistor arrangements

### Part A Combination (E)

What is the resistance of combination (E)? Answer to 2 significant figures.

### Part B Combination (F)

What is the resistance of combination (F)? Answer to 2 significant figures.



## Essential Pre-Uni Physics C1.4

A Level - Practice (P1)

Complete the questions in the table.

Length / m	Wire thickness	Resistivity / $\Omega \text{ m}$	Resistance / $\Omega$
68	cross sectional area: $2.1 \times 10^{-6} \text{ m}^2$	$1.5 \times 10^{-8}$	C1.4

What is the resistance?



## Essential Pre-Uni Physics C1.8

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A Level - Practice (P1)

Conventional domestic 13 A sockets are connected with copper cables with a cross sectional area of  $2.5 \text{ mm}^2$ . Copper has a resistivity of  $1.5 \times 10^{-8} \Omega \text{ m}$ . What is the resistance of 20 m of cable to 2 significant figures?

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## Essential Pre-Uni Physics C1.9

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A Level - Challenge (C2)

A high voltage wire for transmission of electricity across the country is made of 10 aluminium wires (resistivity of  $2.5 \times 10^{-8} \Omega \text{ m}$ ) wound together with 15 copper wires (resistivity of  $1.5 \times 10^{-8} \Omega \text{ m}$ ). If all of the wires have a radius of 2.0 mm, calculate the overall resistance of 20 km of cable to two significant figures. (The aluminium is there to give strength to the cable.)

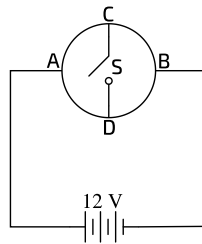
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## Resistance Loop

A Level - Challenge (C2)

A circular loop of radius 15 cm is made of wire with a uniform circular cross-section of diameter 3.0 mm and resistivity  $1.5 \times 10^{-4} \Omega \text{ m}$ . A 12 V battery of negligible internal resistance is connected to two diametrically opposite points A and B on the loop. The same type of wire and a switch S are used to connect points C and D, such that the lengths AC, CB, BD, DA are equal. Assume that the switch is small and ideal such that when the switch is closed the resistance between C and D is solely due to wire between C and D.



**Figure 1:** Circuit diagram showing the loop of resistive wire and how it is connected using the switch and the cell.

### Part A Open switch current

What is the current  $I$  through the battery when S is open?

### Part B Closed switch current

What is the current  $I$  through the battery when S is closed?

Adapted with permission from UCLES, A Level Physical Science, 1980, Paper 1, Question 10





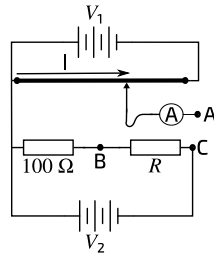
## Measuring Resistances

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The unknown resistance  $R$  of a resistor can be measured by comparing with a  $100\ \Omega$  standard. A potentiometer slide-wire, which consists of a bare wire with constant resistivity, so that contact can be made at any point along its length, is used to find two balance points where the current through the ammeter is zero, when A is connected to B or C.

When A is connected to B, the balance point was found to be when  $l = 400\text{ mm}$ .

When A is connected to C, the balance point was found to be when  $l = 588\text{ mm}$ .



**Figure 1:** Circuit diagram showing the points A, B and C, the length  $l$ , and the resistances of the two resistors.

What is the value of  $R$ ?