1.5 Resistance

Physics KS3 NC link:

- resistance, measured in ohms, as the ratio of potential difference (p.d.) to current
- differences in resistance between conducting and insulating components (quantitative).

Working Scientifically NC link:

- select, plan, and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent, and control variables, where appropriate.

Band	Outcome	Checkpoint	
		Question	Activity
Developing	State the unit of resistance (Level 4).	B	Main
	Compare simply the resistance of conductors and insulators (Level 4).	1	Main
	List examples of conductors and insulators (Level 3).		Main
	Identify some of the variables in the investigation (Level 4).		Main
Secure	Describe what is meant by resistance (Level 5).	1	Main
	Calculate resistance of a component and of a circuit (Level 6).	2	Maths, Plenary 1, Homework
	Describe the difference between conductors and insulators in terms of resistance (Level 5).	1, 3	Main
	Identify independent, dependent, and control variables (Level 5).		Main
Extending	Explain the causes of resistance (Level 7).	1	Main
	Explain what factors affect the resistance of a resistor (Level 7).		Starter 2, Main
	Compare the effect of resistance in different materials (Level 7).	3	Starter 2, Main
	Independently select and control all the variables in the investigation, considering accuracy and precision (Level 7).		Main

Maths
Students calculate resistance using simple equations, giving units for their answers. Higher-ability students will be required to rearrange this equation.
They plot a graph of resistance against length of wire using experimental results.

Literacy
Students use key words correctly when suggesting a conclusion for their experiment, and when discussing aspects of working scientifically.

APP
Students identify key variables in their experiment (AF4), present experimental results using appropriate tables and graphs (AF3), and suggest reasons for the trends observed between variables (AF5).

Key Words
resistance, ohms, conductor, insulator

Answers from the student book

In-text questions	**A** How easy or difficult it is for the charges to pass through a component in a circuit. **B** ohms
Activity	**What's the resistance?** $\text{resistance} = \frac{\text{voltage}}{\text{current}} = \frac{12\text{ V}}{0.6\text{ A}} = 20\ \Omega$

Summary Questions	**1** potential difference, resistance, resistance, electrons, energy, conductors, insulators (7 marks) **2** lamp resistance $= \frac{\text{voltage}}{\text{current}} = \frac{3\text{ V}}{0.4\text{ A}} = 7.5\ \Omega$ motor resistance $= \frac{\text{voltage}}{\text{current}} = \frac{3\text{ V}}{0.1\text{ A}} = 30\ \Omega$ (4 marks) **3** 6 mark question. Example answers: Both conductors and insulators have resistance. Conductors have many charges that can move readily. Conductors have low resistance. Insulators do not contain many charges that are free to move. Insulators have high resistance. Most conductors are metals that have electrons that are free to move. Current in an insulator would be smaller than the current through a conductor (for the same potential difference).

kerboodle

Starter	Support/Extension	Resources
What do you know already? (5 min) This interactive resource asks students to match circuit components to their functions. This can be used as a consolidation task, before introducing students to the more abstract concept of resistance. **What affects resistance?** (10 min) Explain what resistance is in general, for example, resistance makes it harder for something to happen. Remind students that current is the flow of charge, so electrical resistance makes it harder for charge to flow. Discuss changes you could make in a circuit to increase resistance. This is a useful activity to highlight student misconceptions.	**Extension**: Students draw circuit symbols or diagrams to illustrate each key word or phrase. **Support**: Use the analogy of water flowing in a hosepipe. How can water flow be reduced? For example, it is harder for water to flow if the hosepipe is narrower.	**Interactive**: What do you know already?
Main	**Support/Extension**	**Resources**
Investigating the resistance of a wire (40 min) Introduce the idea of electrical resistance, including the equation to calculate resistance, and the difference in resistance between conductors and insulators. Students will investigate how changes in a wire affect its resistance. They should list the factors they can change, for example, length, diameter, material, and temperature. It is important at this point to remind students of independent, dependent, and control variables. Students will then carry out an experiment to investigate the relationship between resistance and the length of a wire. The practical sheets provided can easily be adapted to investigate other independent variables as described above.	**Support**: The support sheet contains a partially filled results table. **Extension**: Students can use ammeters and voltmeters instead of a multimeter, in order to use their readings to calculate resistance for each length of wire.	**Practical**: Investigating the resistance of a wire **Skill sheet**: Recording results **Skill sheet**: Choosing scales
Plenary	**Support/Extension**	**Resources**
Calculating resistance (5 min) Draw a circuit diagram including an ammeter and voltmeter. Add sample readings for students to calculate the correct value of resistance. This can be a quiz dividing the class into three teams, and giving marks for correct calculations. **Evaluating my experiment** (10 min) Students individually list two things that went well, and two things they would change if they repeated their experiment. They then compare these choices in their practical groups, and decide overall which factors had the greatest effect on the experiment.	**Support**: Provide a multiple-choice selection of resistance values. **Extension**: Provide circuit diagrams with resistance values but current or potential difference readings missing. Students should calculate the missing information.	**Skill sheet**: Evaluation
Homework	**Support/Extension**	
Provide students with further examples of resistance calculations, for them to complete at home.	**Support**: Provide multiple-choice answers. **Extension**: Include calculations involving rearrangements.	