

Grade 9 Natural Sciences Worksheet

Adding cells to a circuit

Investigative question

If we add more cells in series in a circuit, how will the current strength and potential difference in the circuit change? In other words, what is the relationship between current strength and potential difference?

Aim

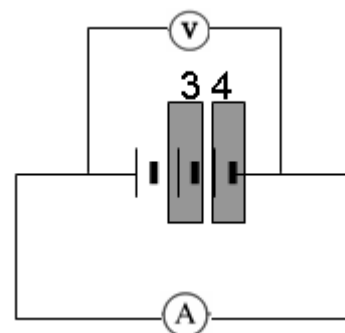
To investigate the relationship between current strength and potential difference in a circuit.

Apparatus

Circuit board and components, 5 torch cells, ammeter and voltmeter.

Method

1. Set up a circuit containing one cell and an ammeter in series. Connect the voltmeter in parallel over the cell.
2. Take down the readings on the ammeter and voltmeter.
3. Add a second cell in series and record the readings on the ammeter and voltmeter.
4. Add a third cell in series and record the readings on the ammeter and voltmeter.
5. Continue until all 5 cells have been added and complete the table below.



Results

Number of cells in series	Ammeter reading (A)	Voltmeter reading (V)	Resistance: $\frac{\text{Voltmeter reading (V)}}{\text{Ammeter reading (A)}}$
One			
Two			
Three			
Four			
Five			

[5]

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Use the results in the table to draw a graph showing the relationship between potential difference and currents strength.

[8]

Discussion

Select the most appropriate word or term to make each statement correct:

1. Potential difference is the (dependent/independent) variable.
2. Current strength is the (dependent/independent) variable.
3. The shape of the graph is a (curved/straight) line and represents resistance.
4. The ammeter reading (increases/stays the same/decreases) as more cells are added in series.
5. The voltmeter reading (increases/stays the same/decreases) as more cells are added in series.

[10]

Conclusion

1. Adding cells in series (increases/does not affect/decreases) the current in the circuit.
2. Adding cells in series (increases/does not affect/decreases) the potential difference in the circuit.

[4]

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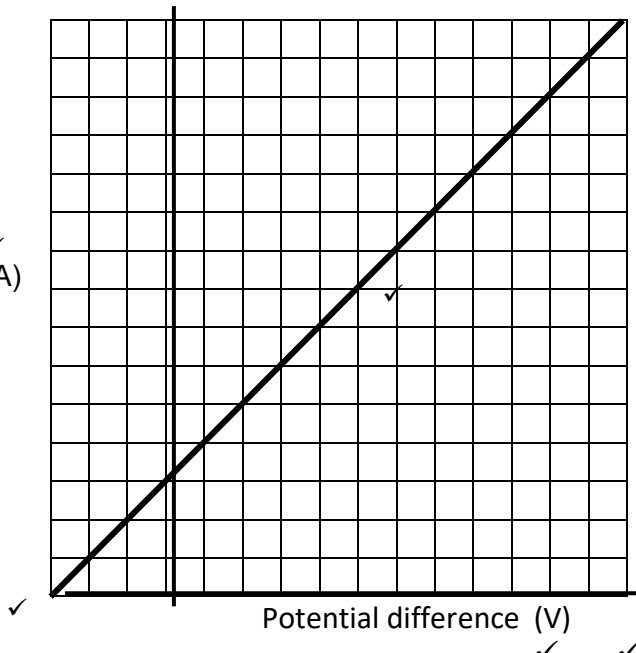
Rubric to assess practical work and graph

Category	Levels of Achievement			
	4	3	2	1
Handling apparatus	Learner can manipulate apparatus and helps others in the group/sets up apparatus entirely unassisted. [4 marks]	Learner is confident and can set up the circuit with minimal assistance. [3 marks]	Learner is unsure of what to do but attempts to set up the circuit with prompting. [2 marks]	Clumsy, not confident, little basic understanding of circuits. [1 mark]
Drawing of graph	All seven requirements met: heading, correct axes labelled with units, correct plotting and straight line drawn through. [7 marks]	One or two errors. [6 – 5 marks]	Three or four errors. [4 – 3 marks]	Five or more errors. [2 – 0 marks]

[Total: 30 marks]

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Suggested Solutions

Question number	Possible marks	Solution												
Results	5	<table border="1"> <thead> <tr> <th>Number of cells in series</th> <th>Ammeter reading (A)</th> <th>Voltmeter reading (V)</th> <th>Resistance: $\frac{\text{Voltmeter reading (V)}}{\text{Ammeter reading (A)}}$</th> </tr> </thead> <tbody> <tr> <td>One</td> <td rowspan="5">Increases</td> <td rowspan="5">Increases</td> <td rowspan="5">Constant</td> </tr> <tr> <td>Two</td> </tr> <tr> <td>Three</td> </tr> <tr> <td>Four</td> </tr> <tr> <td>Five</td> </tr> </tbody> </table>	Number of cells in series	Ammeter reading (A)	Voltmeter reading (V)	Resistance: $\frac{\text{Voltmeter reading (V)}}{\text{Ammeter reading (A)}}$	One	Increases	Increases	Constant	Two	Three	Four	Five
Number of cells in series	Ammeter reading (A)	Voltmeter reading (V)	Resistance: $\frac{\text{Voltmeter reading (V)}}{\text{Ammeter reading (A)}}$											
One	Increases	Increases	Constant											
Two														
Three														
Four														
Five														
Graph	7	<p>See rubric in Appendix of Assessment Tools.</p> <p>Line graph showing relationship between potential difference and current strength. ✓</p>  <p style="text-align: right;">(7)</p>												
Discussion	10	<ol style="list-style-type: none"> Potential difference is the independent variable. Current strength is the dependent variable. The shape of the graph is a straight line and represents resistance. The ammeter reading increases as more cells are added in series. The voltmeter reading increases as more cells are added in series. 												

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Conclusion	4	1. Adding cells in series increases the current in the circuit. 2. Adding cells in series increases the potential difference in the circuit.
Practical work	4	See rubric in Appendix of Assessment Tools.

Rubric to assess practical work and graph

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