PhET Name	Circuit Construction Kit: AC
PhET Simulation Link	https://phet.colorado.edu/en/simulations/circuit-construction-kit-ac
Topic Covered using the Simulation	Electricity
Class	10
Learning Focus	Electric current Potential difference Resistance Relationship between voltage, current and resistance Ohm's Law Series and parallel circuits Ammeter and voltmeter Effect of resistance on current Electrical power and energy Behaviour of components in an electric circuit

Task 1: Explore the Circuit Components

Look at the components available in the simulation.

- Identify the battery/AC source, wires, resistors, switches, bulbs and meters.
- Identify the component used to measure current.
- Identify the component used to measure potential difference.
- Explore how the different components can be connected.
- Construct a simple closed circuit.
- Observe what happens when the switch is opened and closed.

Task 2: Explore Electric Current

Construct a simple circuit containing a source, resistor, switch and ammeter.

- Close the switch.

Observe the current shown by the ammeter.

Increase the voltage of the source.

Observe the change in current.

Record at least five sets of readings.

Voltage (V)	Current (A)

Observe

What happens to current when the voltage is increased while resistance is kept constant?

Think

Does increasing voltage always produce the same change in current? What evidence does the simulation provide?

Task 3: Explore Resistance

Construct a circuit with a fixed voltage.

Select a resistor.

Record the current.

Change the resistance.

Observe the current.

Repeat for different resistance values.

Resistance (Ω)	Voltage (V)	Current (A)

Compare

What happens to the current when resistance increases?

What happens when resistance decreases?

Predict

Before changing the resistance again, predict what will happen to the current. Test your prediction using the simulation.

Task 4: Investigate Ohm's Law

Construct a circuit containing a source and resistor.

Keep the resistance constant.

Change the voltage systematically.

Measure the current for each voltage.

Calculate **V/I** for each observation.

Voltage (V)	Current (A)	V/I (Ω)

Investigate

1. What pattern do you observe between V and I?
2. What does the value of V/I represent?
3. Does V/I remain approximately constant?
4. How can your observations be represented mathematically?

Relationship identified:
V = _____ × _____

Challenge

Can you explain Ohm's Law using your simulation observations rather than simply stating the formula?

Task 5: Explore Ammeter and Voltmeter

Construct a simple circuit containing a resistor.

Part A — Ammeter

Connect the ammeter to measure the current.

Observe where it is connected.

Change its position in the circuit.

Compare the readings.

Question:
Why is an ammeter connected in series?

Part B — Voltmeter

Connect the voltmeter across the resistor.

Observe the voltage reading.

Change its position to different points across the same resistor.

Question:
Why is a voltmeter connected in parallel?

Complete the Table

Instrument	Measures	Connection
Ammeter	_____	_____
Voltmeter	_____	_____

Task 6: Explore Series Circuits

Construct a circuit with two resistors connected in series.

Record the resistance of each resistor.

Measure the current at different points in the circuit.

Measure the potential difference across each resistor.

Calculate the total resistance.

Quantity	Observation
R_1	
R_2	
Total resistance	
Current before R_1	
Current between R_1 and R_2	
Current after R_2	
Voltage across R_1	
Voltage across R_2	
Total voltage	

Observe

Is the current the same at different points in a series circuit?

How is the total resistance related to the individual resistances?

How is the total potential difference related to the potential differences across the resistors?

Challenge

Predict the total resistance of three resistors connected in series before constructing the circuit. Test your prediction.

Task 7: Explore Parallel Circuits

Construct a circuit with two resistors connected in parallel.

Measure the total current.

Measure the current through each branch.

Measure the potential difference across each resistor.

Compare the branch currents.

Quantity	Observation
R_1	
R_2	
Total current	
Current through R_1	
Current through R_2	
Voltage across R_1	
Voltage across R_2	

Investigate

1. Is the potential difference across the parallel branches the same?
2. How is the total current related to the branch currents?
3. What happens to the total resistance when another branch is added?

Predict

What will happen to the total current if another resistor is connected in parallel? Test your prediction.

Task 8: Compare Series and Parallel Circuits

Construct equivalent series and parallel circuits using the same resistors and source.

Feature	Series	Parallel
Current		
Potential difference		
Total resistance		
Number of paths		
Effect of adding another resistor		

Think

Why are household electrical appliances generally connected in parallel rather than in series?

Use evidence from the simulation to support your answer.

Task 9: Investigate Electrical Power

Construct a circuit containing a resistor.

Record the voltage and current.

Use:

P = VI

Calculate the electrical power.

Voltage (V) Current (A) Power P = VI (W)

Explore

What happens to power when voltage increases?

What happens when resistance is increased?

Can two circuits have the same current but different power?

Challenge

Construct two circuits in which the electrical power is different. Explain why.

Task to be Completed and Shared

1. Construct a circuit and demonstrate the relationship between **voltage, current and resistance**.
2. Collect at least five sets of data and use them to explain **Ohm's Law**.
3. Construct both **series and parallel circuits** and compare current, voltage and resistance.
4. Demonstrate the correct placement of an **ammeter and voltmeter**.
5. Create a circuit that shows what happens to current when resistance is increased.
6. Create two different circuits having the same voltage but different currents. Explain why.
7. Construct a parallel circuit and demonstrate what happens to total current when another branch is added.
8. Take screenshots of your circuits and observations and share them.

Challenge

Challenge 1

Can you construct two different circuits that have:

the same voltage,

different resistance,

and different current?

Explain the relationship among the three quantities.

Challenge 2

Can you design a circuit in which adding another resistor **increases the total current**? Explain why this happens.

Challenge 3

Can you construct a circuit in which removing one component does not stop the other branch from working?

What type of circuit does this demonstrate?

Challenge 4

Design a circuit that helps a student discover **V = IR** without giving them the formula beforehand.

Inquiry-Based Classroom Questions

1. Electric Current

What conditions are necessary for current to flow in a circuit?

What happens to current when the circuit is opened?

Does current get consumed as it passes through a resistor? How can the simulation help you investigate this?

2. Potential Difference

What does the voltmeter reading tell us about a component?

Why does the voltmeter need to be connected across a component?

What happens to the potential difference when different resistors are used?

3. Resistance

What happens to current when resistance increases while voltage remains constant?

Can you predict the current before changing the resistance?

Why does changing resistance affect current?

4. Ohm’s Law

If voltage is doubled while resistance remains constant, what happens to current?

Does the simulation provide evidence that V and I are directly proportional?

How can you use your data to determine resistance?

Why should students discover the relationship before being given the formula V = IR?

5. Series Circuits

Why is the current the same at different points in a series circuit?

What happens to total resistance when another resistor is added in series?

What happens to the voltage across individual resistors?

6. Parallel Circuits

Why is the potential difference the same across parallel branches?

What happens to total current when another branch is added?

Why does adding another parallel path affect the total resistance?

7. Ammeter and Voltmeter

What would happen if an ammeter were connected in parallel?

What would happen if a voltmeter were connected in series?

Why are the two instruments connected differently?

8. Circuit Design

Can two circuits have the same voltage but different currents? Why?

Can two circuits have the same current but different resistance?

How can the simulation be used to test your prediction before constructing the actual circuit?

9. Misconception Investigation

Does current get “used up” by a bulb or resistor?

Does increasing voltage always increase current by the same amount?

Does a larger resistance always mean a larger current?

Is current necessarily different at different points in a series circuit?

Does adding a resistor in parallel always decrease the total current?

10. Challenge Question

How can a simulation help students move from memorising circuit formulas to reasoning from evidence?

Use at least **two observations from your simulation** to support your answer.