

# Activity Description

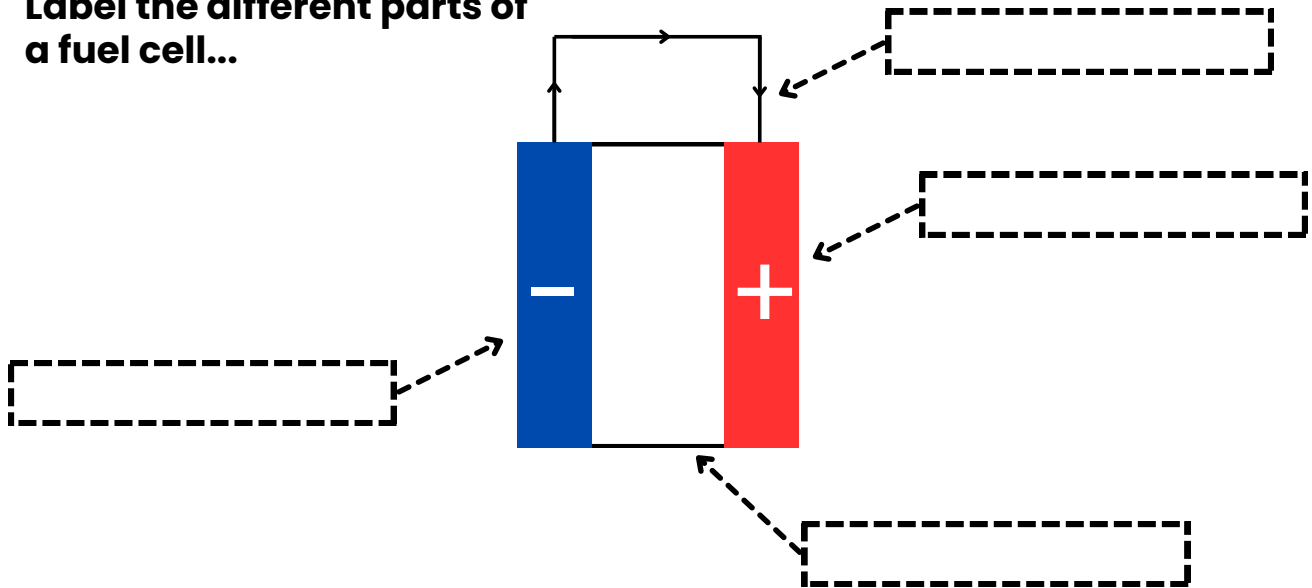
This is a worksheet containing a variety of activities to reinforce the content delivered in the 'Simplified Fuel Cells' presentation. The content is aimed for student aged 15–18.

It consists of:

- Activities aimed at consolidating knowledge on fuel cells
- An answer sheet for the activities

# Simplified Fuel Cells - Worksheet

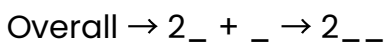
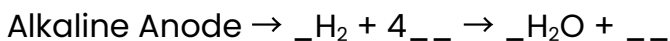
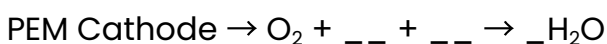
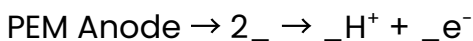
Label the different parts of a fuel cell...



Order these statements about the processes in a PEM fuel cell...

	Oxygen enters the fuel cell at the cathode (positive electrode) and reacts with the hydrogen ions/water that passed through the electrolyte and electrons from the external circuit
	Hydrogen enters the fuel cell at the anode (negative electrode) and is oxidised to form electrons and hydrogen ions/water
	Oxygen is reduced to form water, which exits the fuel cell
	The hydrogen ions/water passes through the electrolyte; electrons pass through an external circuit to produce electricity

Complete these equations for PEM and alkaline fuel cells...



## Define these fuel cell components...

- Anode →

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- Cathode →

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- Electrolyte →

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- External Circuit →

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- Reactants →

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- Products →

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## What are the 2 main uses of fuel cells? Can you give some general advantages and disadvantages of fuel cells too?

- Uses →

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- Advantages →

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- Disadvantages →

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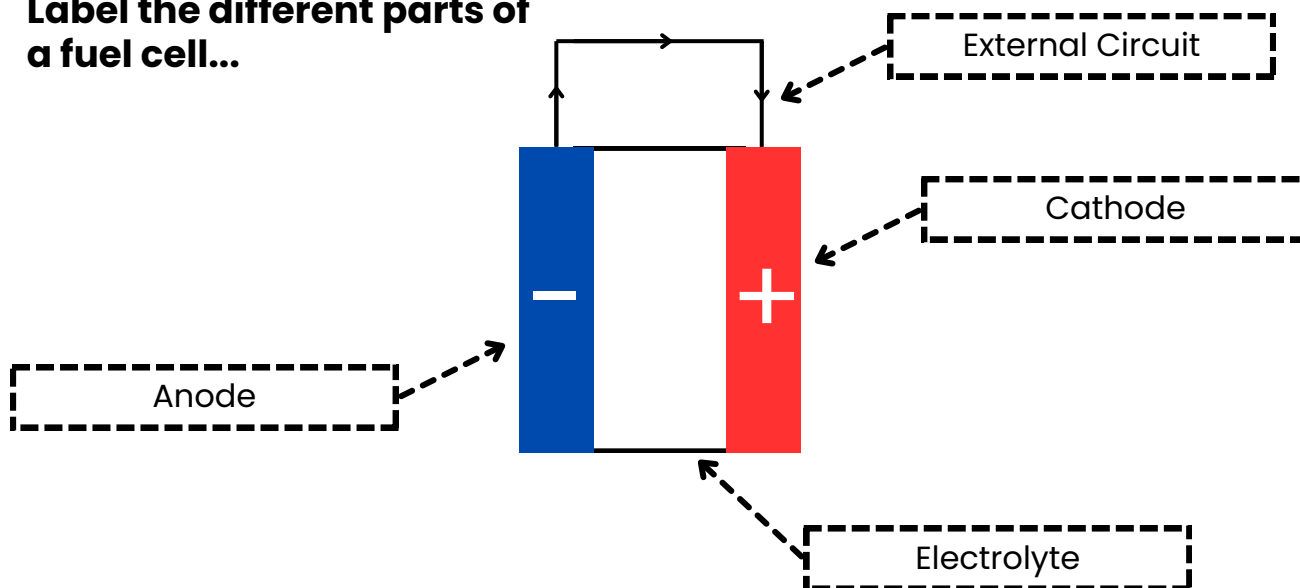
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# Simplified Fuel Cells - Worksheet Answers

Label the different parts of a fuel cell...

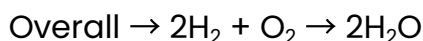
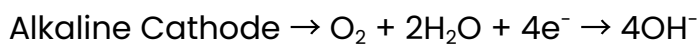
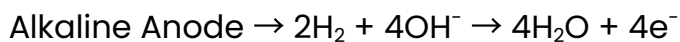
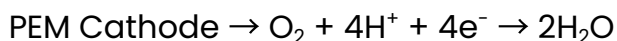
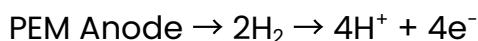


Order these statements about the processes in a PEM fuel cell...

3	Oxygen enters the fuel cell at the cathode (positive electrode) and reacts with the hydrogen ions/water that passed through the electrolyte and electrons from the external circuit
1	Hydrogen enters the fuel cell at the anode (negative electrode) and is oxidised to form electrons and hydrogen ions/water
4	Oxygen is reduced to form water, which exits the fuel cell
2	The hydrogen ions/water passes through the electrolyte; electrons pass through an external circuit to produce electricity

**Note:** these processes actually occur simultaneously in continuous operation

Complete these equations for PEM and alkaline fuel cells...



## Define these fuel cell components...

- Anode → negative electrode
  - Cathode → positive electrode
  - Electrolyte → a medium that conducts electricity through the movement of ions
  - External Circuit → an electrical circuit that does not include the power source (fuel cell)
  - Reactants → hydrogen and oxygen, but alternatives to hydrogen can be used
  - Products → water, electricity and heat
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## What are the 2 main uses of fuel cells? Can you give some general advantages and disadvantages of fuel cells too?

- Uses → Transport; producing electricity for the National Grid

### Advantages

- No harmful emissions that cause climate change or impact local health
- Hydrogen fuel cells produce clean energy which benefits the drive for net zero energy
- Fast vehicle refuelling times
- Continuous power for stationary electricity production

### Disadvantages

- High cost to build fuel cells
- The infrastructure for hydrogen refuelling stations needs improving before fuel cell vehicles are commercial
- Sources of hydrogen are not always environmentally friendly
- Hydrogen is flammable so must be stored safely