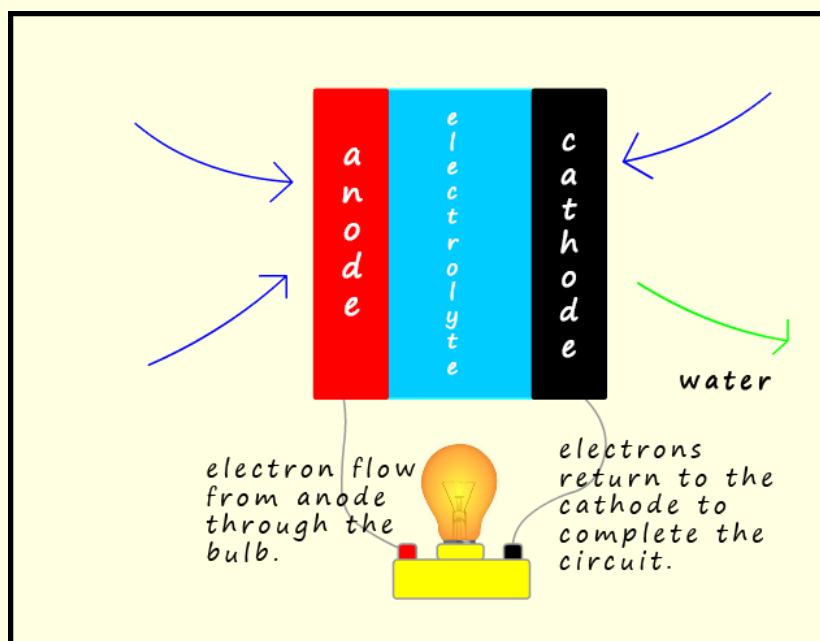


# Fuel Cells

Answer all the questions below then check your answers

1. How are fuel cells similar to and different from traditional batteries and cells?
2. What fuels are commonly used in fuel cells? Name 3 fuels.
3. In cells what charge is on the anode and cathode? How is this different from the anode and cathode used in electrolysis?
4. The chemical reactions that take place inside fuel cells happen on the anodes and cathodes. The reactions use catalysts. What catalysts are used on the anode and cathode in fuel cells.
5. The diagram below shows an outline of a hydrogen fuel cell.

- a. Where does the hydrogen enter the fuel cell?
- b. What happens to the hydrogen when it gets to the anode?
- c. Write an ion-electron half equation to show what happens to the hydrogen at the anode.



- d. the anode half-reaction produces electrons and hydrogen ions. Where do these two products go now in the cell?
- e. Which gas is fed into the fuel cell at the cathode?
- f. What happens to the oxygen gas at the cathode?
- g. Write an ion-electron half equation to show what happens to the oxygen gas at the cathode.
- h. Where in the cell does oxidation and reduction take place?
- i. What waste products does the fuel cell produce?
- j. What are the advantages and disadvantages of using hydrogen fuel cells?

# Fuel cells

## Answers

1. How are fuel cells similar to and different from traditional batteries and cells?

Cells and batteries have chemicals inside them that react to produce an electrical current, a fuel cell has chemicals continually supplied to it that react to produce an electrical current.

2. What fuels are commonly used in fuel cells? Name 3 fuels.

Hydrogen, methane and alcohol are the most common fuels used in fuel cells.

3. In cells what charge is on the anode and cathode? How is this different from the anode and cathode used in electrolysis?

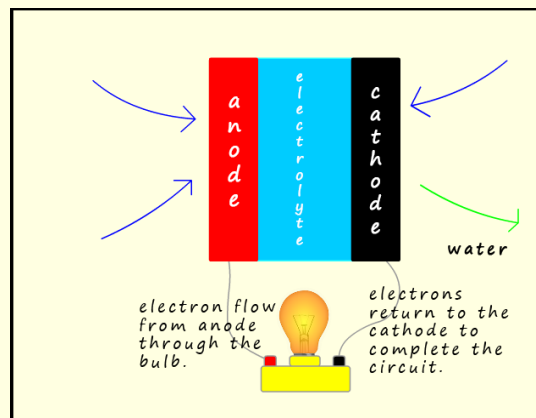
Anode has a negative charge, cathode has a positive charge, this is the other way round in electrolysis.

4. The chemical reactions that take place inside fuel cells happen on the anodes and cathodes. The reactions use catalysts. What catalysts are used on the anode and cathode in fuel cells. Platinum and nickel are often used in fuel cells. These catalysts coat the anode and cathode.

- 5 The diagram below shows an outline of a hydrogen fuel cell.

- a. Where does the hydrogen enter the fuel cell?

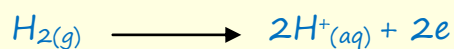
At the anode



b. What happens to the hydrogen when it gets to the anode?

The hydrogen is oxidised. It loses electrons and forms hydrogen ions,  $H^+$  and releases electrons

c. Write an ion-electron half equation to show what happens to the hydrogen at the anode.



d. the anode half-reaction produces electrons and hydrogen ions. Where do these two products go now in the cell?

The electrons form an electrical current and travel through whatever the fuel cell is being used to power. The hydrogen ions pass through the semi-permeable membrane and enter the electrolyte and then start moving towards the cathode.

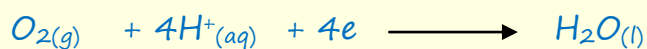
e. Which gas is fed into the fuel cell at the cathode?

Oxygen gas

f. What happens to the oxygen gas at the cathode?

The oxygen gas is reduced, it gains electrons and reacts with the hydrogen ions from the electrolyte to form water.

g. Write an ion-electron half equation to show what happens to the oxygen gas at the cathode.



h. Where in the cell does oxidation and reduction take place?

Oxidation takes place at the anode and reduction at the cathode. Overall this is a redox reaction.

i. What waste products does the fuel cell produce?

*Water is the only waste product*

j. What are the advantages and disadvantages of using hydrogen fuel cells?

*Some of the advantages include:*

- *Long lasting and reliable with no moving parts, so break downs are very rare.*
- *Water is the only waste produce, so environmentally friendly.*
- *Very efficient. Little energy is waste.*
- *Can be scaled to produce either large amounts of energy or small amounts.*

*Some of the disadvantages include:*

- *Hydrogen is not readily available.*
- *Hydrogen gas is very explosive, so safety issues.*
- *Hydrogen would need to be stored under pressure as it is a gas at room temperature. This would incur more expense and possible dangers in using compressed gases in the general population.*