

OCR (A) Chemistry A-level

Topic 5.2.3 - Redox and Electrode Potentials

Flashcards

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Define oxidising agent



Define oxidising agent

A species that is reduced in a reaction and causes another species to be oxidised



Define reducing agent



Define reducing agent

A species that is oxidised in a reaction and causes another species to be reduced



Define oxidation



Define oxidation

Loss of electrons

An increase in the oxidation number



Define reduction



Define reduction

Gain of electrons

Decrease in the oxidation number



What happens in a redox reaction?



What happens in a redox reaction?

Electrons are transferred from one species to another.

One element is oxidised whilst the other is reduced



Why is,
$$2\text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow \text{Cr}_2\text{O}_7^{2-} + \text{H}_2\text{O},$$

not a redox reaction?

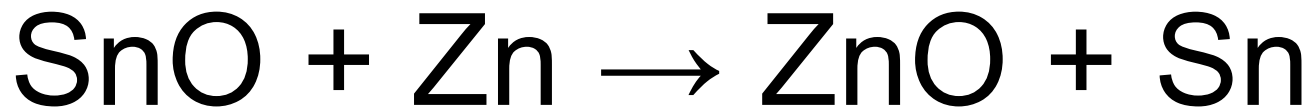


Why is, $2\text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow \text{Cr}_2\text{O}_7^{2-} + \text{H}_2\text{O}$, **not** a redox reaction?

Chromium is oxidised whereas hydrogen remains the same oxidation state (no element is reduced).



What are the half equations
and the ionic equation for:



What are the half equations and the ionic equation for: $\text{SnO} + \text{Zn} \rightarrow \text{ZnO} + \text{Sn}$

Half Equations:

- $\text{Sn}^{2+} + 2\text{e}^- \rightarrow \text{Sn}$
- $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$

Ionic Equation:

- $\text{Sn}^{2+} + \text{Zn} \rightarrow \text{Sn} + \text{Zn}^{2+}$



Define standard electrode potential



Define standard electrode potential

The e.m.f. Of a half cell compared with a standard hydrogen half cell measured at 298 K with solution concentration of 1 mol dm^{-3} and a gas pressure of 100kPa



What happens when a rod of a metal is dipped into a solution of its own ions?



What happens when a rod of a metal is dipped into a solution of its own ions?

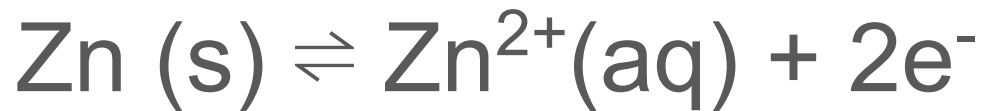
An equilibrium is set up between the solid metal and the aqueous metal ions



Write a half-equation for
zinc (s) to zinc (II)



Write a half-equation for zinc (s) to zinc (II).



Write a half-equation for
copper (II) to copper (III)



Write a half-equation for copper (II) to copper (III).



What is a standard hydrogen half cell made of? (3)



What is a standard hydrogen half cell made of? (3)

- Hydrochloric acid 1 mol dm^{-3}
- Hydrogen gas at 100 kPa
- Inert platinum electrode



Why is hydrogen half cell used as a standard half cell?



Why is hydrogen half cell used as a standard half cell?

Easy to control its purity and reproducibility



How to make a simple salt bridge?



How to make a simple salt bridge?

Soak a piece of filter paper in an aqueous solution of KNO_3 or NH_4NO_3



Why are salt bridges necessary?



Why are salt bridges necessary?

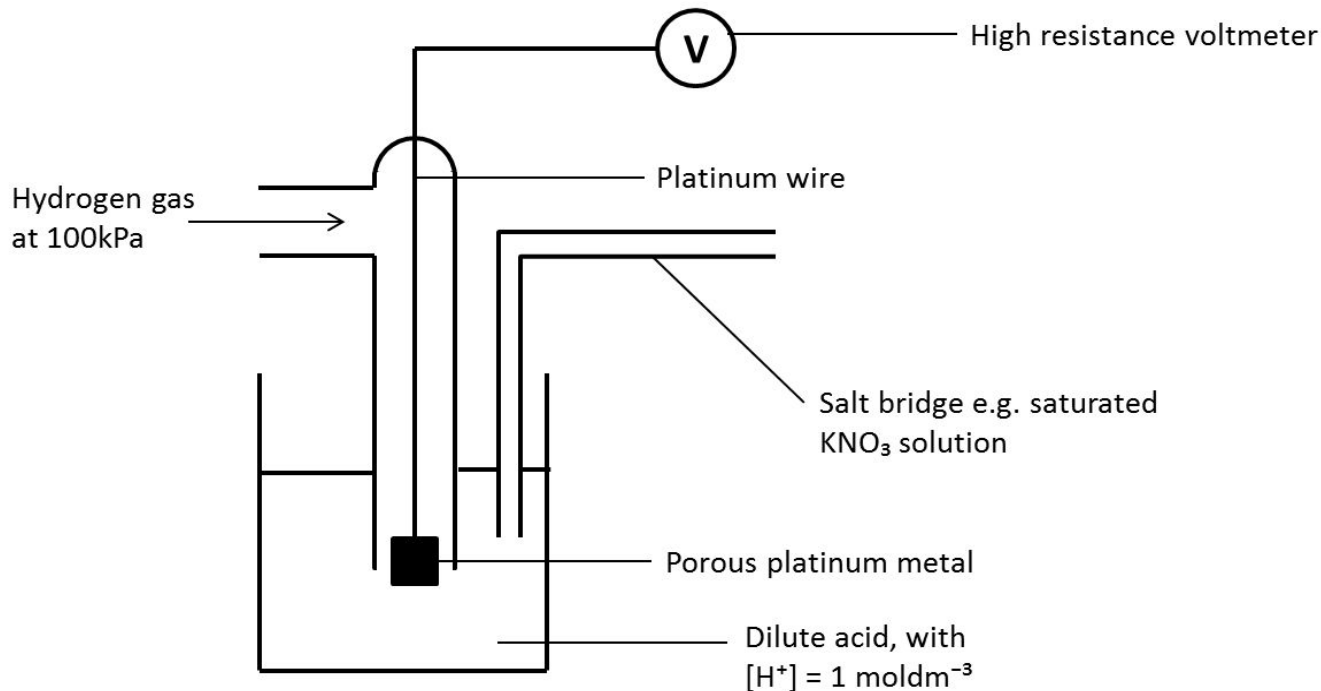
To complete the circuit by connecting the two solutions. This enables charge to be transferred between the half cells. They do not react with the electrodes



Draw the standard hydrogen half cell



Draw the standard hydrogen half cell



Why might you use other
standard electrodes
occasionally?



Why might you use other standard electrodes occasionally?

They are cheaper/easier/quicker to use and can provide just as good a reference.

Platinum is expensive



If an E° value is more negative, what does it mean in terms of oxidising/reducing power?



If an E^\ominus value is more negative, what does it mean in terms of oxidising/reducing power?

Better reducing agent (easier to oxidise)



If an E° value is more positive, what does it mean in terms of oxidising/reducing power?



If an E° value is more positive, what does it mean in terms of oxidising/reducing power?

Better oxidising agent (easier to reduce)



How do you calculate the
emf of a cell from E°
values?



How do you calculate the emf of a cell from E^\ominus values?

$$E^\ominus_{\text{cell}} = E^\ominus_{\text{positive}} - E^\ominus_{\text{negative}}$$



When would you use a Platinum electrode?



When would you use a Platinum electrode?

When both the oxidised and reduced forms of the metal are in aqueous solution



Why is Platinum chosen?



Why is Platinum chosen?

Inert and good conductor to complete circuit



How would you predict if a reaction would occur?



How would you predict if a reaction would occur?

Take the 2 half equations.

Find the species that is being reduced

Calculate its E^\ominus value minus the E^\ominus value of the species that is being oxidised

If E^\ominus overall $> 0.4V$, reaction will occur.



What are the 3 main types of electrochemical cells?



What are the 3 main types of electrochemical cells?

- Non rechargeable cells
- Rechargeable cells
- Fuel cells



Describe how non rechargeable cells work



Describe how non rechargeable cells work

They provide electrical energy until all the chemicals have reacted



Describe how rechargeable cells work



Describe how rechargeable cells work

Chemicals in the cell provide electrical energy. When recharging the reactions of the cells can be reversed



Give some examples of rechargeable cells



Give some examples of rechargeable cells

- Nickel and cadmium batteries
- Lithium ion batteries
- Lithium polymer batteries



Explain why lithium is used in laptop batteries



Explain why lithium is used in laptop batteries

Lithium has low density so the electrode is light and it is very reactive.



What are the drawbacks of using lithium batteries?



What are the drawbacks of using lithium batteries?

- They are toxic if ingested
- Rapid discharge of current can cause fire or even explosions



Describe how fuel cells work



Describe how fuel cells work

The cell uses external supplies of fuel and an oxidant. These external supplies need to be continuously supplied.



Modern fuel cells are based on
what type of fuels?



Modern fuel cells are based on what type of fuels?

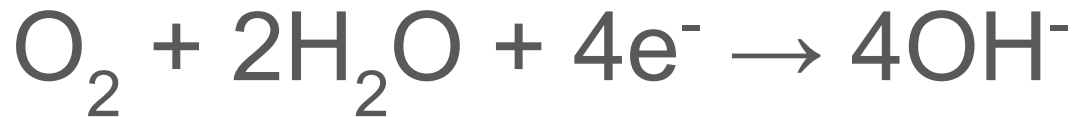
- Hydrogen
- Hydrogen rich fuels e.g methanol



What are the reactions that take place at the two electrodes in an alkaline hydrogen fuel cell?



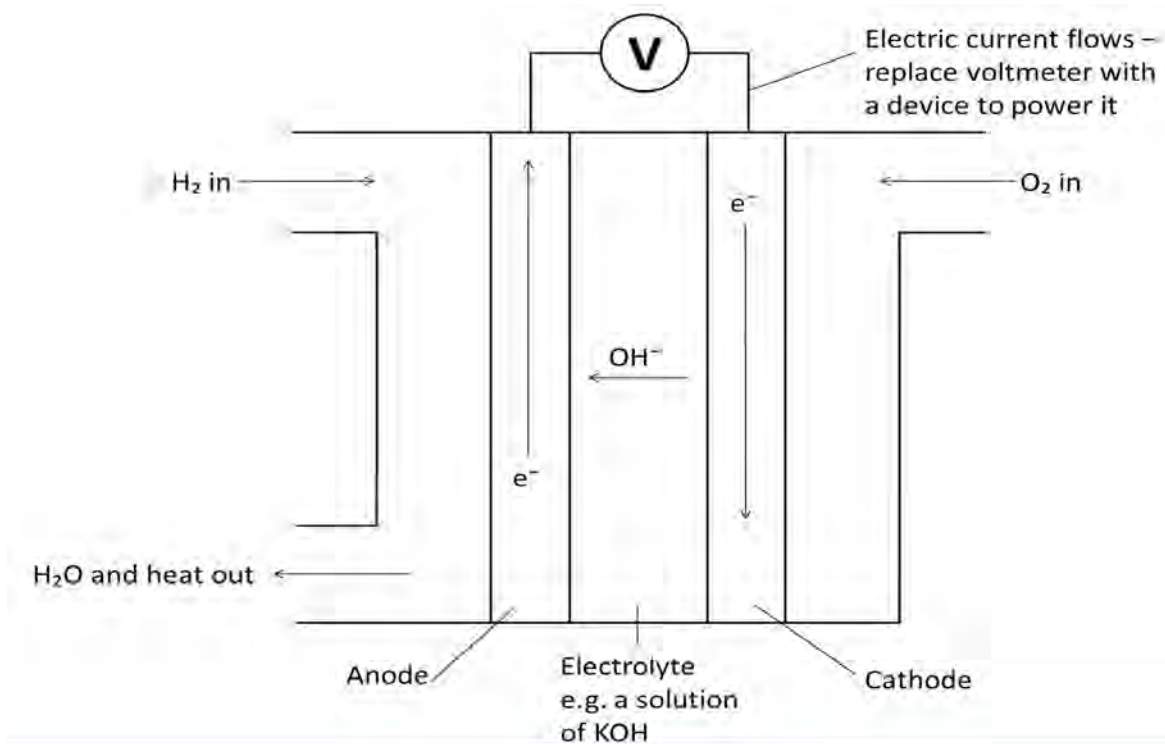
What are the reactions that take place at the two electrodes in an alkaline hydrogen fuel cell?



Draw a diagram of a hydrogen fuel cell



Draw a diagram of a hydrogen fuel cell



What are the disadvantages of fuel cells?



What are the disadvantages of fuel cells?

Hydrogen is a flammable gas with a low b.p. → hard and dangerous to store and transport → expensive to buy

Fuel cells have a limited lifetime and use toxic chemicals in their manufacture



What is the reason that some cells cannot be recharged?



What is the reason that some cells cannot be recharged?

Reaction of the cell is not reversible - a product is produced that either dissipates or cannot be converted back into the reactants



Why might the e.m.f. Of a cell change after a period of time?



Why might the e.m.f. Of a cell change after a period of time?

Concentrations of the ions change - the reagents are used up



How can the e.m.f. Of a cell
be kept constant?



How can the e.m.f. Of a cell be kept constant?

Reagents are supplied constantly, so the concentrations of the ions are constant;
 E_0 remains constant

