

IB Chemistry: Batteries & Electrochemical Cells

Curated questions-only collection

Includes rechargeable batteries, fuel cells, voltaic/galvanic cells, electrolytic cells, standard electrode potentials and related electrochemistry.

In mixed-topic questions, clearly unrelated subparts were removed where possible while keeping context needed for the electrochemistry parts.

Markschemes and examiner reports are excluded.

Section 1 - Rechargeable Batteries & Fuel Cells

Dedicated C.6 questions plus direct rechargeable-battery questions from other units

Problems included: 19

Questions are extracted from the uploaded IB Chemistry problem collection.

Markschemes and examiner reports are not included in this questions-only edition.

Fuel cells may be twice as efficient as the internal combustion engine. Although fuel cells are not yet in widespread use, NASA has used a basic hydrogen-oxygen fuel cell as the energy source for space vehicles.

State the half-equations occurring at each electrode in the hydrogen-oxygen fuel cell in an alkaline medium.

(+) Cathode:

(−) Anode:

[2]

a.

Describe the composition of the electrodes and state the overall cell equation of the nickel-cadmium battery.

(+) Cathode:

(−) Anode:

Cell equation:

[3]

b.

Compare a fuel cell and a lead-acid battery, with respect to possible concerns about pollution of the environment.

[2]

c.

The high activity of lithium metal leads to the formation of an oxide layer on the metal which decreases the contact with the electrolyte in a battery.

Describe how this is overcome in the lithium-ion battery.

[2]

a.

Describe the migration of ions taking place at the two electrodes in the lithium-ion battery when it produces electricity.

Anode (–):

Cathode (+):

[2]

b.

Discuss **one** similarity and **one** difference between fuel cells and rechargeable batteries.

Similarity:

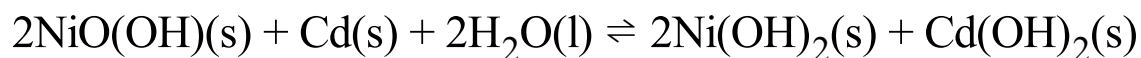
Difference:

[2]

c.

Rechargeable nickel-cadmium batteries are used in portable electrical equipment and emergency lighting.

The **discharge** process can be summarized by the equation below.



State the change in oxidation number of the cadmium and deduce if it is acting as the positive or negative electrode during the discharge process.

[2]

a.

Identify a physical property of $\text{Cd}(\text{OH})_2$ which allows this process to be reversed and the battery recharged.

[1]

b.

State the half-equations for the reactions taking place at the negative electrode (anode) and the positive electrode (cathode) in an alkaline hydrogen-oxygen fuel cell.

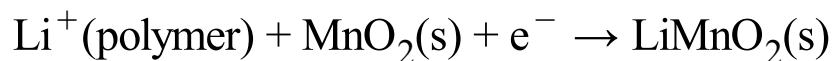
Negative electrode (anode):

Positive electrode (cathode):

[2]

a.

A different type of cell has the half-equation below.



Identify this type of cell.

[1]

b.

Both fuel cells and rechargeable batteries offer great potential for the future. Compare these two power sources.

[2]

c.

Suggest **two** problems associated with using hydrogen gas in a fuel cell.

[2]

d.

Fuel cells convert chemical energy directly into electrical energy that can be used in applications ranging from spacecraft to remote weather stations.

Describe the composition of the electrodes in a hydrogen-oxygen fuel cell.

[1]

a.

State the half-equation at each electrode in the hydrogen-oxygen **alkaline** cell.

Positive electrode (cathode):

Negative electrode (anode):

[2]

b.