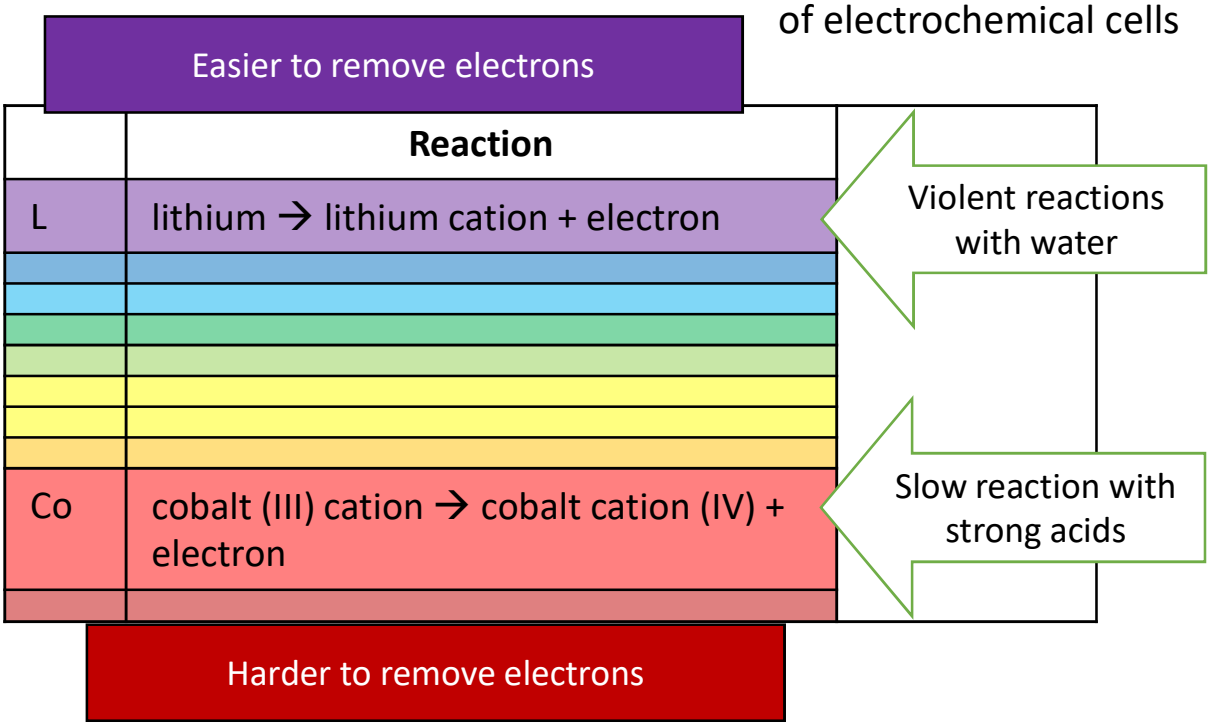
Lithium cells

AQA syllabus point:
3.1.11.2 Commercial applications of electrochemical cells



From the electrochemical series, we know lithium sits nearly at the top. It's nearly the most keen metal to lose electrons. In the negative electrode of a lithium ion battery, the following reaction takes place:

$Li \rightarrow Li^+ + e^-$

In the positive electrode, the lithium ions are incorporated into a material that accepts that electron:

$Li^+ + CoO_2 + e^- \rightarrow Li^+[CoO_2]^-$

The electron is now at a more positive potential.

The lithium ion that gets incorporated into the structure has come from the solution. It gets replaced by a lithium ion from the metal. The electron passes around the **external** circuit, where the electron does work.

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Questions on Lithium Cells

Reaction	Standard Electrode Potential (V)
lithium cation + electron ⇌ lithium $Li^+ + e^- \rightarrow Li$	-3.04
Lithium + cobalt oxide + electron ⇌ Lithium cobalt oxide $Li^+ + CoO_2 + e^- \rightleftharpoons Li^+[CoO_2]^-$	+0.90

1) Why are lithium ion batteries a source of electrical energy?

2) From the values above, what is the EMF of the cell?

3) What happens when the cell is recharging?

4) We have used the terms “positive” and “negative” electrode when describing lithium cells. Which is which? Why haven’t we use the terms “anode” and “cathode”? (Hint, anode is where oxidation occurs, is the negative electrode *always* being oxidised? When might it be reduced instead?)

5) What is the oxidation state of cobalt in CoO_2 and $Li^+[CoO_2]^-$?

6) What are the benefits to society of Lithium cells? What about the risks?

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3.1.11.2 Commercial applications of electrochemical cells
3.1.11.1 Electrode potentials and cells

Alkaline batteries

Easier to remove electrons

Reaction	Standard Electrode Potential (V)
$2MnO_{2(s)} + H_2O_{(l)} + 2e^- \rightarrow Mn_xO_Y + 2OH^-_{(aq)}$	+0.15
$Zn_{(s)} + 2OH^-_{(aq)} \rightarrow ZnO_{(s)} + ? + 2e^-$	+ 1.28

Harder to remove electrons

1) What are x and y in Mn_xO_Y ?
2) What is the EMF of the cell?
3) What is being oxidised and what is being reduced?
4) What is used up in the cell?
5) Why is it called an alkaline battery?

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