

Redox reactions – galvanic cells

Lesson 4

Oxidation = anode(-), reduction = cathode(+), electrons flow from anode to cathode.

Two half cells were set up. One half cell contained the reductant Cu metal and its conjugate oxidant Cu^{2+} ions in solution while the other contained the reductant Pb metal and its conjugate oxidant Pb^{2+} ions in solution.

Will a reaction occur?

What is the voltage of the cell

Reaction	Standard electrode potential (E^\ominus) in volts at 25 °C
$\text{F}_2(\text{g}) + 2\text{e}^- \rightleftharpoons 2\text{F}^-(\text{aq})$	+2.87
$\text{H}_2\text{O}_2(\text{aq}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons 2\text{H}_2\text{O}(\text{l})$	+1.77
$\text{Au}^+(\text{aq}) + \text{e}^- \rightleftharpoons \text{Au}(\text{s})$	+1.68
$\text{Cl}_2(\text{g}) + 2\text{e}^- \rightleftharpoons 2\text{Cl}^-(\text{aq})$	+1.36
$\text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^- \rightleftharpoons 2\text{H}_2\text{O}(\text{l})$	+1.23
$\text{Br}_2(\text{l}) + 2\text{e}^- \rightleftharpoons 2\text{Br}^-(\text{aq})$	+1.09
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightleftharpoons \text{Ag}(\text{s})$	+0.80
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightleftharpoons \text{Fe}^{2+}(\text{aq})$	+0.77
$\text{O}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}_2(\text{aq})$	+0.68
$\text{I}_2(\text{s}) + 2\text{e}^- \rightleftharpoons 2\text{I}^-(\text{aq})$	+0.54
$\text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 4\text{e}^- \rightleftharpoons 4\text{OH}^-(\text{aq})$	+0.40
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Cu}(\text{s})$	+0.34
$\text{Sn}^{4+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Sn}^{2+}(\text{aq})$	+0.15
$\text{S}(\text{s}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2\text{S}(\text{g})$	+0.14
$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2(\text{g})$	0.00
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Pb}(\text{s})$	-0.13
$\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Sn}(\text{s})$	-0.14
$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Ni}(\text{s})$	-0.23

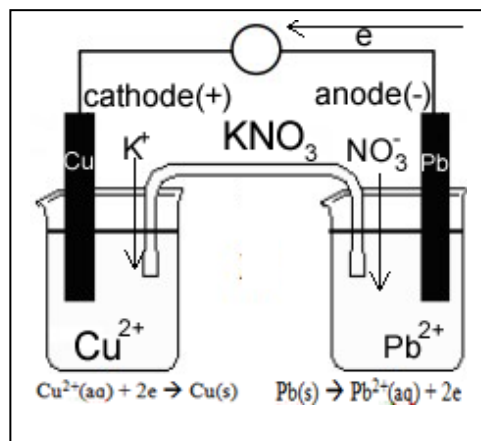
- Indicate on the diagram the Anode and its polarity
- Cathode and its polarity
- Direction of electron flow
- Direction of negative ion flow
- Direction of positive ion flow

Write the

Oxidation half equation _____

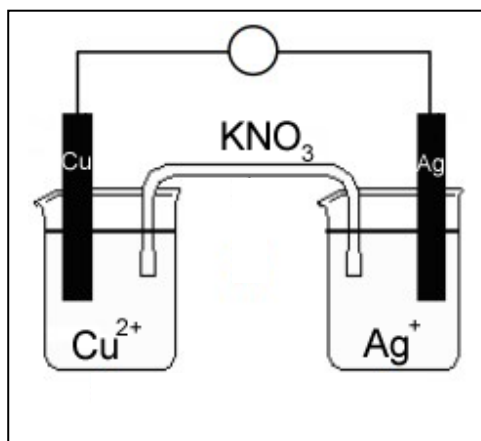
Reduction half equation _____

Overall equation $\text{Cu}^{2+}(\text{aq}) + \text{Pb}(\text{s}) \rightarrow \text{Pb}^{2+}(\text{aq}) + \text{Cu}(\text{s})$



Steps to follow when analysing a galvanic cell

- Consider the following galvanic cells
- Will a reaction occur?
- What is the theoretical cell voltage (EMF)?
- Indicate on the diagram the Anode and its polarity
- Cathode and its polarity
- Direction of electron flow
- Direction of negative ion flow

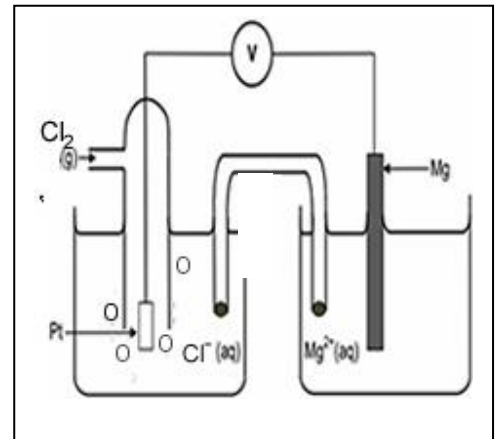


Direction of positive ion flow
 Write the
 Oxidation half equation _____

Reduction half equation _____

Overall equation _____

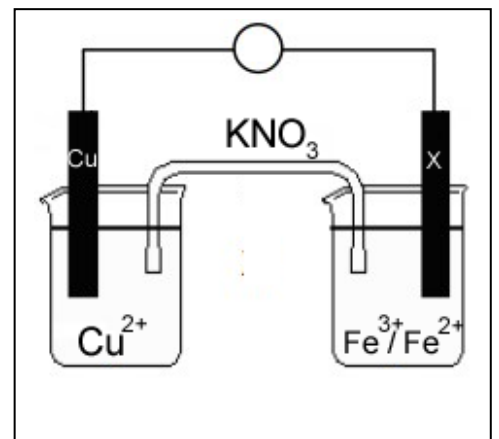
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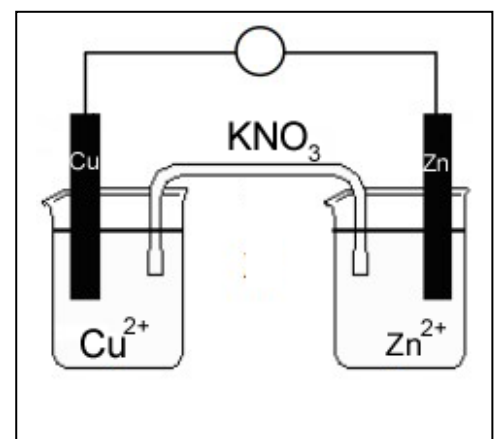
Reduction half equation _____

Overall equation _____

What is electrode "X" made of.

What properties should the material that electrode "X" is made of have?

Will a reaction occur?
 What is the theoretical cell voltage (EMF)?
 Indicate on the diagram the
 Anode and its polarity
 Cathode and its polarity



Direction of electron flow

Direction of negative ion flow

Direction of positive ion flow

Write the

Oxidation half equation _____

Reduction half equation _____

Overall equation _____

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What is the theoretical cell voltage (EMF)?

Indicate on the diagram the

Anode and its polarity

Cathode and its polarity

Direction of electron flow

Direction of negative ion flow

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Write the

Oxidation half equation _____

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