

Chemistry 30
Introductory Redox Lab
Teacher notes and answers

Name _____ Date _____ Score _____

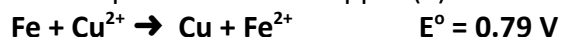
Purpose:

- To predict whether redox reactions are spontaneous or not
- To compare the relative tendency of metals and their metallic ions to react with each other.

Prelab:

1. Copper strip in solution of iron (III) nitrate
 $2\text{Fe}^{3+} + \text{Cu} \rightarrow 2\text{Fe}^{2+} + \text{Cu}^{2+}$ $E^\circ = 0.43 \text{ V}$
2. Copper strip in solution of nickel (II) nitrate
 $\text{Ni}^{2+} + \text{Cu} \rightarrow \text{Ni} + \text{Cu}^{2+}$ $E^\circ = -0.60 \text{ V}$
3. Copper strip in solution of zinc sulfate
 $\text{Zn}^{2+} + \text{Cu} \rightarrow \text{Zn} + \text{Cu}^{2+}$ $E^\circ = -1.10 \text{ V}$
4. Copper strip in solution of copper (II) sulfate
 $\text{Cu} + \text{Cu}^{2+} \rightarrow \text{Cu} + \text{Cu}^{2+}$ $E^\circ = 0.00 \text{ V}$
5. Zinc strip in solution of copper (II) nitrate
 $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$ $E^\circ = 1.10 \text{ V}$
6. Zinc strip in solution of nickel (II) nitrate
 $\text{Zn} + \text{Ni}^{2+} \rightarrow \text{Ni} + \text{Zn}^{2+}$ $E^\circ = 0.50 \text{ V}$
7. Zinc strip in solution of iron (III) nitrate
 $\text{Zn} + 2\text{Fe}^{3+} \rightarrow 2\text{Fe}^{2+} + \text{Zn}^{2+}$ $E^\circ = 1.53 \text{ V}$
8. Zinc strip in solution of zinc sulfate
 $\text{Zn} + \text{Zn}^{2+} \rightarrow \text{Zn} + \text{Zn}^{2+}$ $E^\circ = 0.00 \text{ V}$
9. Nickel strip in solution of copper (II) nitrate
 $\text{Ni} + \text{Cu}^{2+} \rightarrow \text{Ni}^{2+} + \text{Cu}$ $E^\circ = 0.43 \text{ V}$
10. Nickel strip in solution of iron (III) nitrate
 $\text{Ni} + 2\text{Fe}^{3+} \rightarrow \text{Ni}^{2+} + 2\text{Fe}^{2+}$ $E^\circ = 1.03 \text{ V}$
11. Nickel strip in solution of zinc sulfate
 $\text{Ni} + \text{Zn}^{2+} \rightarrow \text{Zn} + \text{Ni}^{2+}$ $E^\circ = -0.50 \text{ V}$
12. Nickel strip in solution of nickel (II) nitrate
 $\text{Ni} + \text{Ni}^{2+} \rightarrow \text{Ni} + \text{Ni}^{2+}$ $E^\circ = 0.00 \text{ V}$

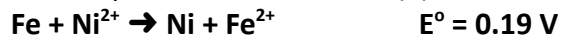
13. Iron strip in solution of copper (II) nitrate



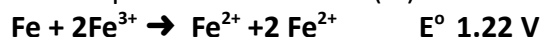
14. Iron strip in solution of zinc sulfate



15. Iron strip in solution of nickel (II) nitrate



16. Iron strip in solution of iron (III) nitrate



Metal / solution	Cu^{2+}	Zn^{2+}	Ni^{2+}	Fe^{3+}
$\text{Cu}_{(s)}$	Nothing	Nothing	Nothing	Colour change
$\text{Zn}_{(s)}$	Colour change	Nothing	Colour change	Colour change
$\text{Ni}_{(s)}$	Colour change	Nothing	Nothing	Colour change
$\text{Fe}_{(s)}$	Colour change	Nothing	Colour change	Colour change

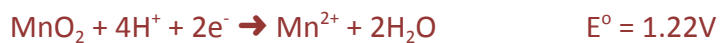
Questions:

- Write a generalization about the likelihood of a reaction between a metal and its own aqueous ion?
Generally a metal and its ion will have NO reaction
- Is the answer to question one dependent upon whether the metal has more than one ion charge? Why or why not? (Hint → you have three 'two charge' metals Ni, Fe, Cu. Explore your data booklet for some help!
Multi charge ions like iron will have a reaction when you have the metal and the larger of the ion charges.
- When metallic ions want to form metals, they are undergoing Reduction. List the metallic ions in order of their tendency to form metals. Start with the most likely one!
 Fe^{3+} , Cu^{2+} , Ni^{2+} , Zn^{2+}
- When metals want to form their metallic ions, they are undergoing oxidation. List the metals in order of their tendency to form metallic ions. Start with the most likely one.
Zn, Fe, Ni, Cu

5. For the mixtures below, write the expected redox reaction. Be sure to give voltage and expected colours for reactants and products. Identify the oxidizing agent (OA) and the reducing agent (RA)

Hydrochloric acid, potassium bromide solution, manganese (IV) oxide crystals and copper strips

Reduction half reaction



Oxidation half reaction



Redox reaction

