

Oxidation–Reduction Basics

Data Table 1. Reactivity of the Metals

Tube	Metal	0.1 M Solution	Observations
1	Mg	CuSO ₄	
2	Mg	ZnSO ₄	
3	Cu	MgSO ₄	
4	Cu	ZnSO ₄	
5	Zn	MgSO ₄	
6	Zn	CuSO ₄	

NR = No Reaction

Data Table 2. Halogens in Aqueous and Organic Solutions

Tubes	Halogen	Observations
1 & 2	Bromine water (Br ₂)	
3 & 4	Chlorine water (Cl ₂)	
5 & 6	Iodine solutions (I ₂)	
1 & 2	Br ₂ + hexanes	
3 & 4	Cl ₂ + hexanes	
5 & 6	I ₂ + hexanes	

Data Table 3. Reactivity of the Halogens

Tube	Free Halogen	0.1 M Halide Solution	Observations
1	Br ₂	NaCl	
2	Br ₂	NaI	
3	Cl ₂	NaBr	
4	Cl ₂	NaI	
5	I ₂	NaBr	
6	I ₂	NaCl	

Post-Lab Questions *(Answer the following questions on a separate sheet of paper.)*

Part 1. Reactivity of the Metals

1. Based on laboratory results, which metal is most active? How do you know this?
2. Which metal is least active? How do you know this?
3. Using lab data, rank the metals in order of reactivity, from most active to least active. What evidence do you have for this activity order?
4. Write a balanced equation for each reaction that occurred in Part 1. Write net ionic equations, omitting any spectator ions.
5. Look specifically at the reaction between magnesium metal and copper(II) ions.
 - a. Write the half-reaction for magnesium metal. Is this an oxidation or a reduction reaction?
 - b. Write the half-reaction for the copper(II) ions. Is this an oxidation or a reduction reaction?
 - c. Which material is being oxidized and which is the oxidizing agent? Which material is being reduced and which is the reducing agent?
6. Which metal is most likely to retain electrons—magnesium, copper, or zinc? Why?
7. Which metal has the greatest tendency to lose electrons? Why?

Part 2. Reactivity of the Halogens

8. Based on laboratory observations, how can each of the free halogens— Br_2 , Cl_2 , and I_2 —be detected in the aqueous layer and in the organic (hexanes) layer?
9. Look at results from tubes 1 and 2. Did bromine react with the chloride ion solution? the iodide ion solution? What evidence do you have for any reaction that occurred?
10. Look at results from tubes 3 and 4. Did chlorine react with the bromide ion solution? the iodide ion solution? What evidence do you have for any reaction that occurred?
11. Look at results from tubes 5 and 6. Did iodine react with the bromide ion solution? the chloride ion solution? What evidence do you have for any reaction that occurred?
12. Write a balanced equation for each reaction that occurred in Part 2. Write net ionic equations, omitting any spectator ions.
13. Based on laboratory results, which halogen is the most active? Which is the least active? Provide evidence.
14. Using lab data, rank the halogens in order of their relative oxidizing ability, from highest to lowest. What evidence do you have for this activity order?
15. Look specifically at the reaction between elemental bromine and iodide ions.
 - a. Write the half-reaction for the elemental bromine. Is this an oxidation or a reduction reaction?
 - b. Write the half-reaction for the iodide ions. Is this an oxidation or a reduction reaction?
 - c. Which material is being oxidized and which is the oxidizing agent? Which material is being reduced and which is the reducing agent?