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| **Redox Reactions and Voltaic Cells** | Name: |  |
| Hand-In, Chem 210L | Partner: |  |

See the attached rubric for more detailed information about grading.

1. (3 points) Rank the activity/reactivity of the four metals you used in the first part of this experiment. Then rank the activity/reactivity of the four metal cations. Explain any relationship between these two rankings. {Be sure to explain why the relationship occurs, not just stating the relationship. Hint: This is a lab on oxidation and reduction}

{Type answer here.}

2. (5 points) Write a balanced net ionic equation for each of the ten voltaic cells you measured in Part IIB. To the right of each balanced equation write the cell potential value, *E*˚, for that cell based on your measurements. Be sure that you write the equations and the potentials for the **spontaneous** process that is occurring in each cell.

{Type reactions here. Here is an arrow for your use “→”}

3. (5 points) Compare the magnitude of the potentials you **measured** for metals that are not next to each other in your ranking (from Question #1) to the potentials you **calculate** for these cells based on the potentials of adjacent metals in your ranking (from Question #1). Explain how you calculated the non-adjacent potentials. **Calculate** and **show the calculation** of a percent difference between the calculated potential and the measured potential for each non-adjacent pair of metals. As always, start with the general equation and explain your steps.

{Insert calculations of cell potentials and percent differences here.}

{Type discussion/explanation here.}

4. (4 points) Based on your measured cell potentials in Part II, where would nickel metal and Ni2+(aq) ions fit in your rankings from question #1? **Explain carefully** how you determined this placement, and include calculations and/or numerical values to show your **data** supported this placement.

{Type answer here.}

5. (3 points) Include both of your graphs from Part III relating concentration to measured cell voltage. Describe the relationship between measured cell potential and concentration for each graph**. Include a linear trendline, equation and R2 on each of the graphs.** Are the graphs different? Is one of them more helpful in interpreting the relationship between concentration and cell voltage? {Hint: Does one of them give a better linear trendline and why is that one more helpful in interpreting the relationship? }

{Attach graphs here.}

{Type discussion here.}

See the attached rubric on the next page for more detailed information about grading.

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|  | **Unsatisfactory** | **Borderline** | **Satisfactory** | **Excellent** | **Score** |
| **Q #1**  **Rank-ings** | Rankings are both incorrect and the relationship between the rankings is not explained.  **0 points** | **1 point** | -1 for each incorrect ranking. -1 for noting relationship between rankings but not explaining it.  **2 points** | Each ranking is correct and the relationship between the two ranks is explained well.  **3 points** | 3 pts. |
| **Q #2**  **Eqn’s.** | No equations balanced properly.  **0-1 points** | **2 points** | -0.5 pt. for any reaction not balanced.  -0.5 pt. for any reaction not written as a spontaneous reaction with the correct sign of *E*˚.  **3-4 points** | Net-ionic equations are all properly balanced and written as spontaneous reactions.  **5 points** | 5 pts. |
| **Q #3**  **Non-adja-cent *E*˚s** | No *E*˚ calculations or no explanation given.  **0-1 points** | Mistakes in *E*˚ calculations and explanation not clear.  **2-3 points** | Correct calculation of *E*˚ values but no percent difference calculation or explanation not clear.  **4 points** | Clear, correct calculations of *E*˚ values with clear explanation and percent difference determined correctly and example shown.  **5 points** | 5 pts. |
| **Q #4**  **Ni place-ment** | Ni not placed properly in the activity series and no supporting explanation or data.  **0-1 points** | Ni placed properly in the activity series but no data provided in support of placement.  **2 points** | Ni placed properly in the activity series but not supported clearly with student’s data.  **3 points** | Ni placed properly in the activity series and placement supported with student’s data and explanation.  **4 points** | 4 pts. |
| **Q #5**  **Conc. effect** | No graphs included.  **0 points** | Only 1 point if graphs are not **scatter** graphs.  **1 point** | Good graphs but unclear or missing discussion.  **2 points** | Clear, well labeled graphs and discussion of graphs. Trendlines, equations and R2 values included on both graphs.  **3 points** | 3 pts. |
| **Total** |  |  |  |  | 20 pts |