

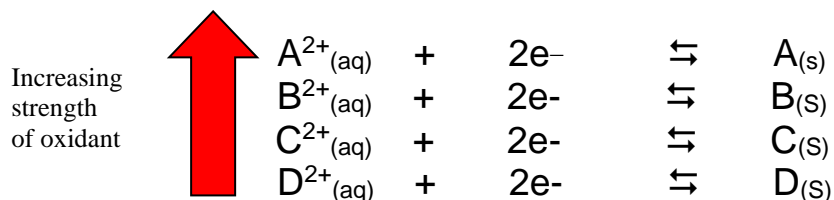
Order of Half equations in the Electrochemical Series

Before conducting this investigation complete the virtual experiment in this [link](#).

Aim

To perform an experiment to determine the order of four half equations and hence create a mini “electrochemical series”.

Each half –equation can be represented in the form:



Materials

- 4 x unidentified half cells, labelled ‘A’ to ‘D’
- 50 mL of 0.1 M potassium nitrate solution
- 100 mL beaker
- voltmeter
- 2 x wire leads with alligator clips
- filter paper for salt bridges
- safety glasses

Safety

Wear safety glasses and a laboratory coat for this experiment.

Solutions in some of the half cells are corrosive and toxic.

Handle the half cells with care.

Method

1. A number of half cells have been prepared and labelled A to D. Six stations around the room have been set up to allow you to compare all the various combinations of half-cells by creating a number of electrochemical cells.
2. At each station, use the filter paper and KNO_3 solution to connect the half cells. Then connect the cell to the voltmeter so that a positive reading is achieved. Use the voltmeter to determine the polarity of the electrodes and the voltage output of the cell. *Disconnect the cell once you have the information you require.*
3. Use this information to fill in the table in the results section. Determine the reaction (oxidation or reduction) occurring in each half cell and hence identify the stronger oxidant in each combination.



Results

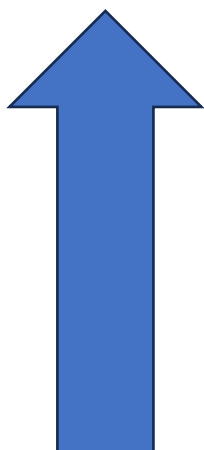
Complete a results table shown below.

Half cell setup	Half cell forming the negative electrode	Half cell forming the negative electrode	Voltage	Oxidation half equation	Reduction half equation	Oxidant	Reductant
A ⁺ /A B ²⁺ /B							
A ⁺ /A C ⁺ /C							
A ⁺ /A D ⁺ /D							
B ²⁺ /B C ⁺ /C							
B ²⁺ /B D ⁺ /D							
C ⁺ /C B ²⁺ /B							

Table 1

Use the information you gathered to develop a mini electrochemical series for the half equations for the half-cells A⁺ / A to D⁺ / D showing the strongest oxidant at the top of your series (you do not need to assign voltage values).

List the four reduction half equations, in the form $X^{2+}(\text{aq}) + e \rightarrow X^+(\text{aq})$, in order of increasing strength of oxidant in the table below



Increasing
Strength of
oxidant

Discussion

1. Include a BRIEF explanation of how you used the experimental data to establish order of oxidant strength.

2. Results of the $B^{2+}/B \parallel D^+/D$ cell from two groups conducting this experiment, under the same conditions, are given table 2.

Group	Trial 1 (V)	Trial 2(V)	Trial 3 (V)
1	0.26	0.25	0.26
2	0.20	0.19	0.20

Table 2



- a. Are the results in table 1 :
 - i. repeatable? Explain

- ii. reproducible? Explain.

b. Suggest two possible errors one with the equipment and one with the method. Explain how this contributed to results shown in table 1.

i. Equipment

ii. Method

c. Are the results obtained during this investigation valid? Explain the reasoning for your answer.

Conclusion

Write an appropriate conclusion for this experiment.
