

Experiment 12

Advance Study Assignment: The Alkaline Earths and the Halogens

1. All of the common noble gases are monatomic and low-boiling. Their boiling points in °C are: Ne, -245; Ar, -186; Kr, -152; Xe, -107. Using the Periodic Table, predict as best you can the ~~molecular~~ formula and boiling point of radon, Rn, the only radioactive element in this family.

?
Trend is that $T_b \uparrow$ as you go down the group. Unnecessarily rigorous plot attached.

Rn -60.5 °C

2. Substances A, B, and C can all act as oxidizing agents. In solution, A is green, B is yellow, and C is red. In the reactions in which they participate, they are reduced to A^- , B^- , and C^- ions, all of which are colorless. When a solution of C is mixed with one containing A^- ions, the color changes from red to green.

before reaction: C + A^-
red colorless

Which species is oxidized? A^-

after reaction: C^- + A
colorless green

Which is reduced? C

When a solution of C is mixed with one containing B^- ions, the color remains red.

$C + B^- \rightarrow$ no reaction

Is C a better oxidizing agent than A? yes

because C changed A^- to A

Is C a better oxidizing agent than B? no,

because C could not remove an e^- from B^-

Arrange A, B, and C in order of increasing strengths as oxidizing agents.

$A < C < B$

Think about which substances end up as the anion. C is able to take an e^- from A^- , so C is a stronger oxidizing agent than A. But C could not do so from B^- , so B must

3. You are given an unknown, colorless, solution that may contain only one salt from the following set: NaA, NaB, NaC. In solution each salt dissociates completely into the Na^+ ion and the anion A^- , B^- , or C^- , whose properties are given in Problem 2. The Na^+ ion is effectively inert. Given the availability of solutions of A, B, and C, develop a simple procedure for identifying the salt that is present in your unknown. be the strongest oxidizing agent.

Add B. If no color change, then B^- is present \Rightarrow unknown is NaB
 If color turns green, A^- " " \Rightarrow NaA
 " " " red, C^- " " \Rightarrow NaC