

Exercise 04

Name: _____ Key

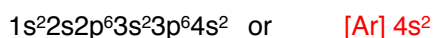
Consider the element calcium (Ca).

- (a) Write the electron configuration of Ca using noble gas shorthand.

 - (b) Is the ionization energy of Ca^+ greater than or less than neutral Ca?
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- (a) Calcium is in the fourth row ($n = 4$) and second column of the periodic table with an atomic number $Z = 20$.

Therefore, its electron configuration is:



- (b) Neutral Ca would have 20 protons and 20 electrons. The cation Ca^+ would have an electron configuration of $[\text{Ar}] 4s^1$ with 20 protons and 19 electrons. Both Ca^+ and Ca have the same number of protons; i.e., the same positive charge in the nucleus.

However, the (ionization) energy required to remove the 4s electron from Ca^+ is greater than the energy required to remove the 4s electron from Ca. Ca^+ has a greater effective nuclear charge (Z_{eff}) than Ca because its 4s electron is *less* shielded from the nucleus' charge since there are fewer electrons between the nucleus and the outermost (the ionized) electron.