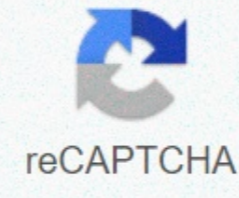I'm not robot

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Chemistry 1 periodicity worksheet answer key

Name: __ Section: __ You should try to answer the question without speaking to your tutorial. If you're stuck, try asking another group for help. Development skills Understand the link between effective nuclear charge and ionization energy, electron affinity, and observable electronic configuration The ability to calculate an effective nuclear charge using Slater's Able Rules to draw conclusions between effective nuclear charge and atomic radiuses, energy of ionization and affinity of electrons Use an effective nuclear charge to predict and explain the trends associated with atomic radiuses, the energy of ionization and the affinity of electrons Although quantum mechanics help us understand the likelihood of finding electrons in an atom, they do not fully explain the observed reactivity of these electrons. For example, why does the 4s shell fill up before 3d? Why is Lee's ionization energy much smaller than that of Cl? To understand this, we need to look more closely at nuclear/electronic relations. The question is, what impact if any electrons between the core and electron interest have on its reactivity and placement? Slater1, Clementi and Raimondi2 detailed this problem and found that an effective nuclear charge (\(Z_{eff}\)) could be used to assess atomic radium, ionization energy, electron affinity, and to explain the observed configuration of electrons. Clementi and Raymondi use self-positioned field theory to get fairly accurate ratings \(Z_{eff}\). Slater, however, has developed a set of rules that allows for a quick and messy assessment of the nuclear charge. A basic understanding of these Slater Rules will help us better understand the frequency and nuclear/electronic relationships. The following model asserts Slater's rules and shows an example of how they can be used. $$Z_{eff} = Z-S \label{1}$$ de \(Z\) = nuclear charge (atomic number) and \(S\) = screening (protection) of permanent Slater rules For calculation \(S\): Write out the electronic configuration of the item in the following order and grouping: (1s) (2s 2p) (3s, 3p) (3d) (4s, 4p) (4d), (4f), (5s, 5p).... etc... Electrons higher than one of the interests do not contribute to anything \(S\). Calculation \(S\) for a particular electron in ns or np orbital electrons in the same (ns,np) grouping contributes 0.35 to \(S\) Each of the electrons in (n - 1) energy levels contribute 0.85 to \(S\) Each of the electrons in (n - 2 or below) energy levels contribute 1.00 to \(S\) calculation \(S\) for a specific electron in ND or NF orbital electrons in the same (nd, nf) group to make 0.35 to \(S\) Electrons in all lower groups to make 1.00 to \(S\) Example \(\PageIndex{1}\): What is \(Z_{eff}\) for 2pn electron in F? Solution 1: Write down the electronic configuration element Electron Configuration for F: 1s22s22p5 Slater's Groupings: (1s)2 (2s 2p)7 Step 2: Calculation \(S\) for a specific electron in ns or np orbital $$S = (6*0.35) + (((1 5)2 * 0.85) = 3.8 onumber$$ Use Equation \ref{1} $$Z_{eff} = 9 – 3.8 = 5.2 onumber$$ (a) How do you progress forward from the electron in question, does protection (contribution to S) affect electrons from nuclear charge greater or less? (b) Is that what you expected? Why not? When calculating \(Z_{eff}\) do you include the electron you are investigating in your protective constant calculation (S)? Using Slater rules, calculate \(Z_{eff}\) for the 2p electron for the Cl atom Z_. What conclusions can you draw between atomic radiuses and \(Z_{eff}\) (use your previous knowledge of atomic radiuses here). Distribute the second period atoms equally between your group and calculate \(Z_{eff}\) for the highest valence electron for each. Using these and your arguments from 3b, anticipate the trend you expect on the atomic radius as you progress from left to right (Li to Ne). Does this agree with your previous knowledge of atomic radiuses? Using \(Z_{eff}\), calculated for all atoms in the second period of #4, explain the following ionization energy graph as an atomic number function. Does \(Z_{eff}\) explain the deviation from the expected increase in electron affinity between elements 14 and 15 illustrated in the graph above? What else could be related? Explain. Exercise \(\PageIndex{1}\) How does the energy of atomic orbital NS depend on increasing n? Calculate \(Z_{eff}\) for 4s electron and 3d electron for Vanadium. Based on these numbers, explain why the electron configuration for V+ ion is likely to be 3d34s1 rather than 3d24s2. Place the total energy of the Aln+ ionization as a function n from n=1 to n=8. Explain the source of the gap (if any) in your curve. (Be sure to use a reliable source for ionization energies and links to it.) Calculate \(Z_{eff}\) with Aln+ and construct them as function n. Are there any conclusions that can be drawn by comparing two curves? For ns electrons in group 1, which is stronger, electron-electron repulsion or nuclear-electronic gravity? For np electrons in group 7, which is stronger, electron-electron repulsion or nuclear-electronic gravity? Link Contributors to Kelly J. Wilson Participation!

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