

## Free Response Practice #3 (6 points)

3. Answer the following questions related to aluminum and one of its compounds.

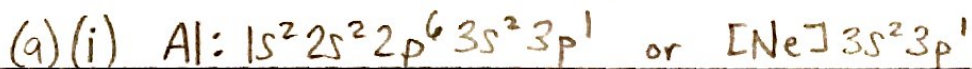
a. Consider the two chemical species Al and  $\text{Al}^{3+}$ .

i. Write the electron configuration of each species. (2 points)

ii. Explain why the radius of the Al atom is larger than the radius of the  $\text{Al}^{3+}$  ion. (2 points)

(Justify using principles of atomic structure.)

b. The  $\text{Al}^{3+}$  ion is isoelectronic with the Ne atom. From which species,  $\text{Al}^{3+}$  or Ne, is it easier to remove an electron? Explain. (2 points) (Justify w/ Coulomb's law.)



(ii) The valence  $e^-$  of Al are found at the 3<sup>rd</sup> principal energy level, farther from the nucleus than the outermost  $e^-$  in  $\text{Al}^{3+}$ , which are found at  $n=2$ .

(b) It is easier to remove an  $e^-$  from Ne than  $\text{Al}^{3+}$ , b/c an atom of Ne has fewer  $p^+$  than an ion of  $\text{Al}^{3+}$ . Coulomb's law states that the energy of attraction between valence  $e^-$  and the nucleus is directly proportional to the magnitude of the charges, so fewer  $p^+$  means Ne's valence  $e^-$  are less attracted to the nucleus than those of  $\text{Al}^{3+}$ , making them easier to remove.