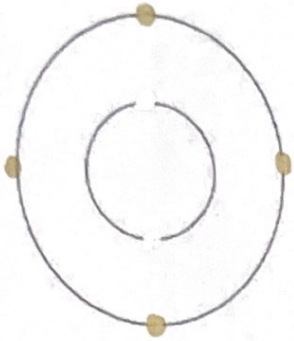
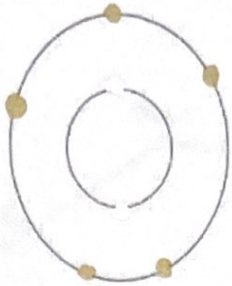
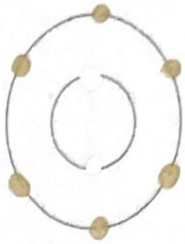
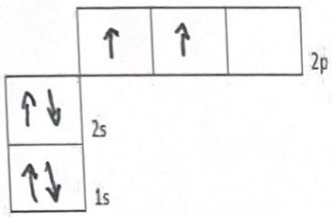
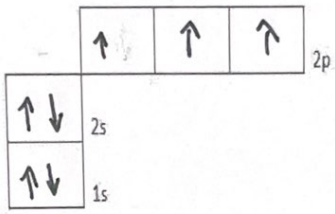
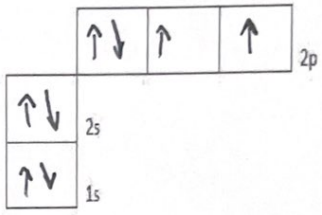
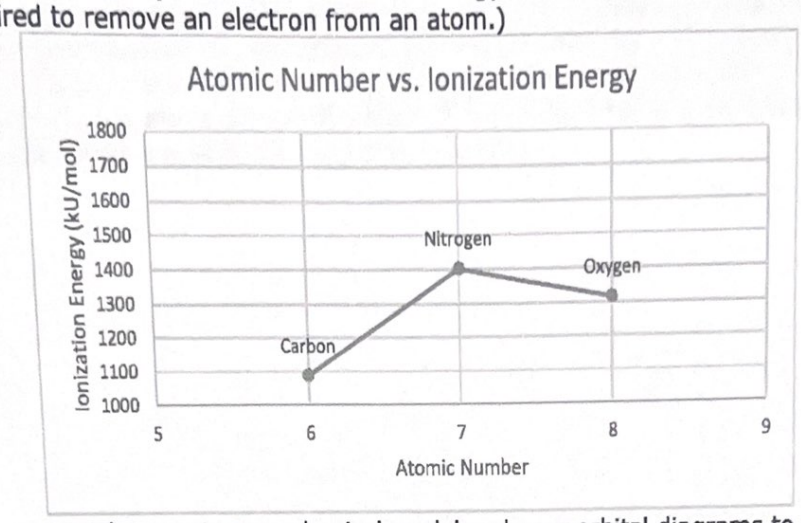
Compare

Complete the table and answer the questions below comparing the following elements.

Carbon	Nitrogen	Oxygen
		
Z_{eff} =	Z_{eff} =	Z_{eff} =
		

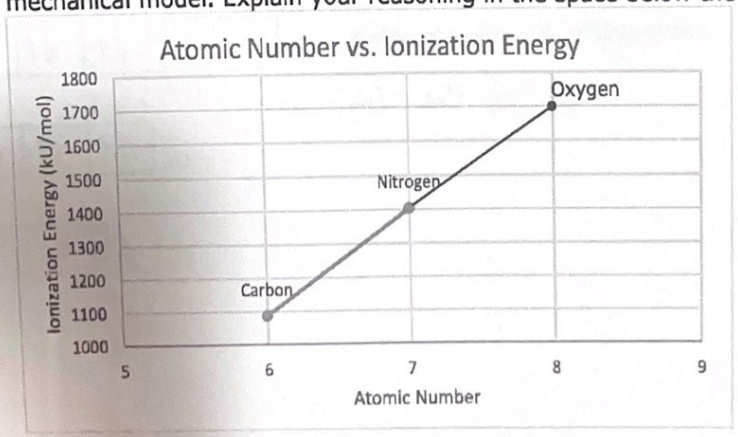
1. Using the examples in the table above, explain why the trend for atomic radius decreases from left to right across the periodic table.

2. Look at the graph of ionization energy of these three elements, then answer the questions below. (Recall that ionization energy is the amount of energy that is required to remove an electron from an atom.)



a. Use the quantum mechanical model and your orbital diagrams to explain the drop in ionization energy from nitrogen to oxygen, despite oxygen having more protons and a higher effective nuclear charge.

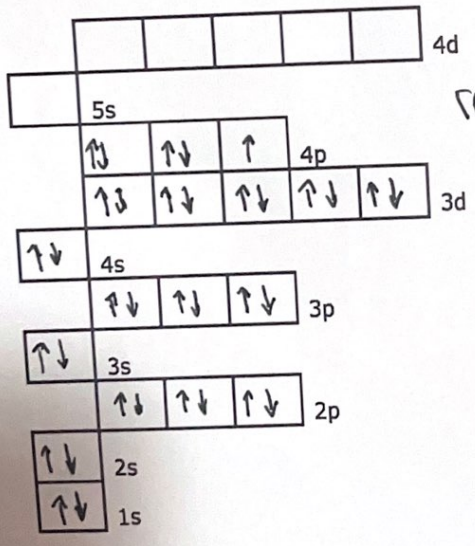
b. On the graph below, draw where you might predict oxygen's ionization energy to be using the Bohr model as your guide, rather than the quantum mechanical model. Explain your reasoning in the space below the graph.



3. The slight drop in ionization energy from nitrogen to oxygen can be seen in subsequent periods as well between other atoms that end with electron configurations of np^3 and np^4 (ex: phosphorus and sulfur). Are there other electron configurations where you might expect to see similar drops in ionization energy as you go across a period? Explain your reasoning.

Extension

The following expanded orbital diagram can be used to practice larger atoms. Use it to write the electron configuration and orbital diagram for Br.



Electron configuration:

$[Br]\ 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^5$

Noble gas electron configuration:

$[Ar]\ 4s^2\ 3d^{10}\ 4p^5$.