

Name: _____

Period: _____

Seat#: _____

Directions: These questions require a bit more thought and “puzzling” to figure out. They are all doable with the knowledge base you have (if you have been paying attention I suppose...ha!). You may need to really talk through the questions and work through the answers with your classmates. Make sure you think about the key words, terms, phrases, ideas that you have learned so far. Quality answers should include references to things like number of sub atomic particles, atomic radius, electron configurations, shielding, effective nuclear charge, ions, stability in orbital filling, connecting multiple trends together, etc.

- 1) Atomic radii cannot be measured directly because the electron cloud surrounding the nucleus does not have a clearly defined what?

- 2) The general trend in the radius of an atom moving down a group is partially accounted for by which of the following:
- a) Decrease in the mass of the nucleus
 - b) Increase in the charge of the nucleus
 - c) Fewer number of filled orbitals
 - d) Shielding of the outer electrons by the inner electrons

Explain: _____

- 3) Draw a diagram that represents the relative sizes of a sodium atom to the diameter of the Na^+ ion. Just use simple circles.

- 4) Rank in order of decreasing radii – explain briefly.

a) Br^- , Cl^- , F^-

b) Be^{2+} , Ca^{2+} , Mg^{2+}

c) Ca^{2+} , Rb^+ , Sr^{2+} , K^+

- 5) Rank the following in order of decreasing radii

a) I , I^-

b) K , K^+

c) Al , Al^{3+}

- 6) Based on electron configurations, what group of elements would the alkali metals like to react with in a 1:1 ratio? Give an example using electron configurations to justify your answer.

- 7) Explain why the radius of the chlorine atom is smaller than the radius of the chloride ion, Cl^- . Use orbital diagrams to justify your answer.
(Radii: Cl atom = 0.99\AA ; Cl^- ion = 1.81\AA)

- 8) Explain why the first ionization energy of aluminum is lower than the first ionization energy of magnesium.
(First ionization energies: Mg = 7.6 eV ; Al = 6.0 eV)

- 9) Explain why the difference between the 2nd and 3rd ionization energies is much larger in Magnesium than the difference between the 1st and 2nd ionization energies for Magnesium.
(IEs: 1st = 7.6 eV ; 2nd = 14 eV ; 3rd = 80 eV)

- 10) Explain why the first ionization energy of B is lower than that of Be. Use orbital diagrams to justify your answer.

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Periodic Trends – Beyond Simple Ranking

11) Explain why the first ionization energy of O is lower than that of N. Use orbital diagrams to justify your answer.

12) Predict how the first ionization energy of Na compares to those of Li and Ne. Explain.

13) Explain why the second ionization energy of sodium is about three times greater than the second ionization energy of magnesium.

14) Explain why the radius of the Ca atom is 0.197nm and the radius of Ca^{2+} ion is 0.099nm.

15) The first and second ionization energies of K are 419 kJ/mol and 3052 kJ/mol, and those of Ca are 590 kJ/mol and 1145 kJ/mol. Account for the observed differences in their

a) First ionization energies

b) Second ionization energies

16) Explain why potassium has a lower first ionization energy than lithium.

17) Explain why the ionic radius of N^{3-} is larger than that of O^{2-} .

18) Explain why a Ca atom is larger than a Zn atom.

19) Explain why the first ionization energy of S is less than that of P. Use orbital diagrams to justify your answer.

20) The electron affinities of five elements are given below. Explain the observed trend as atomic number increases. Also make sure to account for the break in this trend at N. Use orbital diagrams to justify your answer.

Boron 26.7 kJ/mol
Carbon 153.9 kJ/mol
Nitrogen 7 kJ/mol
Oxygen 141 kJ/mol
Fluorine 328 kJ/mol