

Final Exam Review Problems

1. The following data are known for the element X :

number of photoelectron spectroscopy peaks: 5
covalent radius of neutral atom: 0.099 nm
first ionization energy: 1.251 MJ/mol
average valence electron energy: 1.59
core charge: +7

Identify the element and explain your reasoning.

How many valence electrons does the element have?

Element Y has one more proton than X . Is the AVEE for Y larger than, smaller than, or the same as the AVEE for X ?

Element Z has the same core charge as X , but its first ionization energy is larger. What can you conclude about the identity of Z ?

2. The elements X , Y , and Z have the following electron configurations:

X : $1s^2 2s^2 2p^6 3s^2 3p^6$

Y : $1s^2 2s^2 2p^6 3s^2$

Z : $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

The first ionization energies of the elements (in MJ/mol and in no particular order) are 0.4188, 0.4958, and 1.5205. The covalent radii of the elements (in nm and in no particular order) are 0.157, 0.094, and 0.202.

Identify each element and match it to the appropriate ionization energy and covalent radius.

Which, if any, of the elements is (are) paramagnetic?

3. The first four ionization energies for an element are (in MJ/mol):

0.899 1.757 14.848 21.006

How many valence electrons does this element have?

4. The compound XO_2 has a bent geometry, a double bond to one oxygen and a single bond to the other oxygen, and a single lone-pair of electrons on X . Limiting yourself to the first 18 elements, identify the possible choices for X .

5. Suggest a possible element for X in the compound XF_4^- if there are two lone-pairs of electrons on X .

6. Consider the polyatomic anion OCN^- .

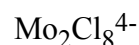
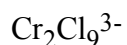
Draw all possible Lewis structures for this anion and give the formal charge on each atom in each structure.

Rank the structures from best to worst and explain your reasoning?

7. Draw the best Lewis structure for each of the following compounds and circle the compound that will have the larger dipole moment.



8. An area of active research in inorganic chemistry is the synthesis of compounds containing metal-metal bonds. For example, the ions



each contain a metal-metal bond. What are oxidation states of the metals in each?

9. Consider the following compounds: HgO, ZrO, SrO, and SeO₂. Which of these compounds is likely to have the highest melting point? Explain your reasoning.

10. Consider the reaction



Is this an oxidation-reduction reaction and, if so, what is being oxidized and what is being reduced?

Is this an acid-base reaction and, if so, what is the acid and what is the base?