

1. a. (2 pts.) According to current theories on nucleogenesis, shortly after what event were most of the subatomic particles, hydrogen nuclei, and helium nuclei formed? 1. _____
2. _____
 - b. (4 pts.) Where, and by what process, are hydrogen and helium nuclei converted to larger nuclei. 3. _____
4. _____
 - c. (4 pts.) Nuclei heavier than the iron nucleus are not made by the process used in part b. How and where are nuclei heavier than iron formed. 5. _____
6. _____
7. _____
8. _____
2. (6 pts) a. Write the atomic symbols for hydrogen-3 (tritium) and helium-4. 9. _____
10. _____
 - b. When hydrogen-3 reacts with helium-4, what nucleus forms? Write the symbol for the atom. 11. _____
 - c. Using the information from a and b, write the nuclear reaction where hydrogen-3 and helium-4 are combined to form the new element.
3. (10 pts.) Rutherford's famous gold foil experiment established what fact about atomic structure, explain.

4. a. (5 pts.) Millikan's oil drop experiment determined what about atomic structure?

b. (5 pts.) Briefly describe how Millikan's experiment was accomplished.

5. a. (6 pts.) Match the definition with the correct term.

siderophile	"Copper loving" combines with sulfur, selenium and arsenic
chalcophile	"Iron loving" combines with metals like iron
lithophile	"Rock loving" combines with oxygen and halogens.

b. (6 pts.) If you were looking for "rock-loving" elements, would you expect to find them in the Earth's core? Explain, briefly.

6. (10 pts.) List the l , m_l , and n values for an electron in each of the following orbitals. If more than one set of quantum number can be used to describe the electron, list them all.

a. an electron in a 4p orbital

b. an electron in a 3s orbital

7. (16 pts.) Draw Lewis structures for the following molecules.

a. Cl_2SO

b. NO_2^-

8. When an e^- is added to a C atom, energy is released; on the other hand, energy is not released when one attempts to add an electron to a N atom.

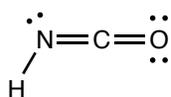
a. (6 pts.) Draw energy level diagrams for the C and N atoms.

b. (6 pts.) Explain why more energy is not released when an electron is added to a N atom even though a N atom has a more positively charged nucleus than a C atom.

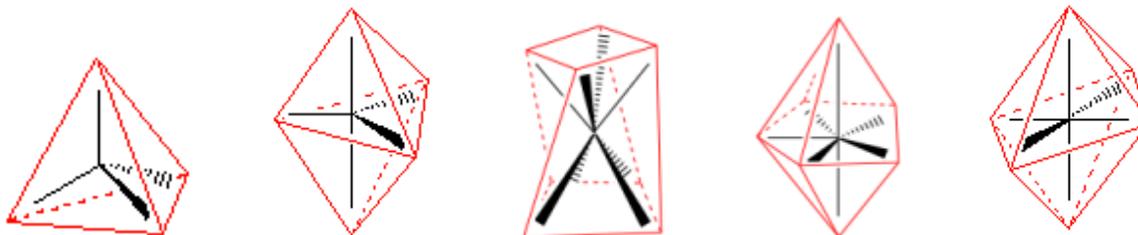
9. a. (4 pts.) Draw resonance structures for the molecule that is drawn below.

b. (4 pts.) Calculate the formal charges for the atoms (label all atoms, even those with a 0 formal charge).

c. (2 pts.) Rank the structures from lowest (#1) to highest (#2, #3, etc.) energy.



10. (12 pts.) Some possible arrangements for bonds around a central atom are drawn below. Label each drawing with the appropriate name: tetrahedral, square antiprismatic, pyramidal, bent, v-shaped, trigonal bipyramidal, trigonal planar, pentagonal bipyramidal, octahedral, see-saw, T-shaped.



11. (12 pts.) In comparison to the repulsion between pairs of electrons in nonpolar σ bonds, explain how the following features affect the bond angles in a molecule.

a. lone pair electrons

b. π bonds

c. bonds to electronegative atoms