

1. In each of the following groups circle the atom or ion that requires the **least** energy to remove one electron. (6 points)

S O P

 Li^+ Rb^+ N^+ Ar^- F^- Br^+

2. In each of the following groups circle the atom or ion which has the **smallest** size. (4 points)

Ca Ga Se Te

Se Br^- K^+ Se^{2-}

3. Circle the atom(s) paramagnetic in the ground state: Sr Cr Cu Cd Xe (2 points)

4. Circle the compound with the highest melting point. C_6H_6 I_2 BrF_3 BaF_2 SF_6 (2 points)

5. Electrons with $m_s = +\frac{1}{2}$ differ from electrons with $m_s = -\frac{1}{2}$ because their _____ are different: (2)
a. angular momentums b. orbitals c. energies d. spin directions e. electron affinities

6. The Pauli Exclusion Principle states that no two electrons in the same atom can have _____
_____. (2 points)

7. Write **electron configurations** AND indicate the number of **unpaired electrons** for: (20 points)

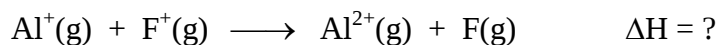
phosphorus

copper

 ${}_{65}\text{Tb}$ ${}_{46}\text{Pd}^{4+}$

8. First ionization energy: of Al 578 kJ/mol of F 1681 kJ/mol
 Second ionization energy of Al 1870 kJ/mol of F 3374 kJ/mol
 Electron affinity: of Al -42.5 kJ/mol of F -328 kJ/mol
 Sublimation energy of Al 330. kJ/mol Bond dissociation energy of F₂ 159 kJ/mol

Use these enthalpy changes to calculate ΔH for the following: **SHOW WORK** (8 points)

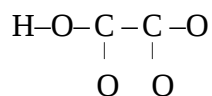


9. Use bond enthalpies C-C 348 C=C 614 C≡C 839 C-H 413 (8 points)
 (in kJ/mol) C-O 358 C=O 799 C≡O 1072 O-H 463 H-H 436

SHOW WORK

Estimate ΔH for the reaction $\text{H}_3\text{C}-\text{O}-\text{CH}=\text{CH}_2(\text{g}) + \text{C}\equiv\text{O}(\text{g}) \longrightarrow 2 \text{H}_2\text{C}=\text{O}(\text{g}) + \text{HC}\equiv\text{CH}(\text{g})$

10. A bioxalate ion, HC_2O_4^- , has skeletal structure below. (6 points)
 Draw a Lewis dot diagram for this ion (use resonance as necessary) and label the 4 CO **bonds** from shortest (1) to longest (4).



11. Draw Lewis Dot diagrams for each of the following molecules and fill in the blanks. (60 points)

a. HCNO

The formal charge on the oxygen is:

CNO bond angle is:

The molecule is polar or nonpolar?

The number of pi bonds (in the molecule) is:

The strongest bond is:

b. HSiCl₃

The hybridization on the silicon is:

The electronic shape is:

The molecule is polar or nonpolar?

c. H₂CCHNH₂

The CC bond order is:

The CCN bond angle is:

The HNH bond angle is:

The number of sigma bonds (in the molecule) is:

d. XeF₃⁺

The electronic shape is:

The molecular shape is:

F–Xe–F bond angles (3) are: , and

e. TeF₄

The hybridization on the tellurium is:

The electronic shape is:

The molecular shape is:

The formal charge on the tellurium is:

Polar or nonpolar?

f. KN_3

The NNN bond angle is:

The NN bond orders are: and

g. NO_2^-

Show resonance

The bond angle is:

The formal charge on the oxygens are: and

h. KrF_2

The hybridization on the krypton is:

The electronic shape is:

The molecular shape is:

The bond angle is:

Polar or Nonpolar?

Formal charge on the krypton:

i. PCl_3

The Cl–P–Cl bond angles are: , and

The electronic shape is:

The molecular shape is:

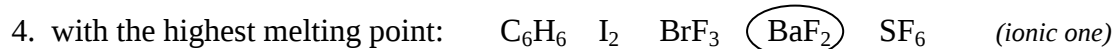
j. OF_2

The electronic shape is:

The molecular shape is:

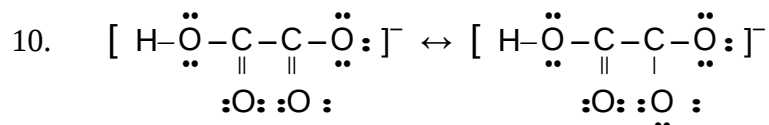
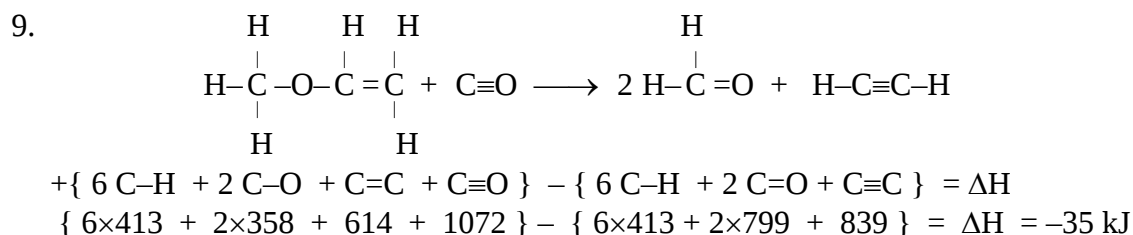
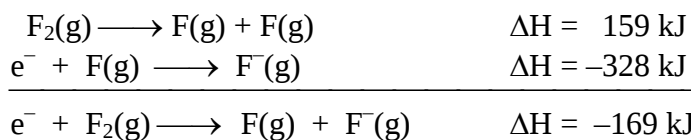
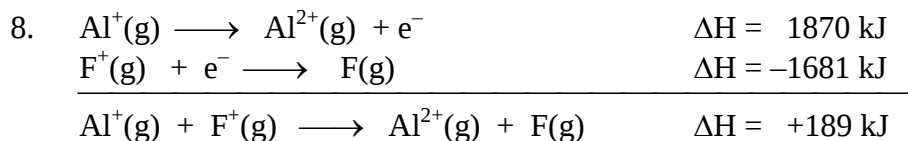
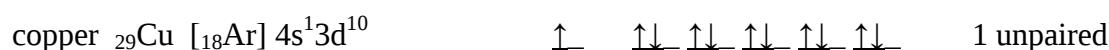
k. H_3PO_4 (oxyacid)

Formal charge on the phosphorus:



5. Electrons with $m_s = +\frac{1}{2}$ differ from electrons with $m_s = -\frac{1}{2}$ because their spin **directions** are different.

6. Pauli Exclusion Principle: no two electrons in the same atom can have **the same 4 quantum numbers**.



1 2 1.5 1.5

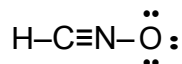
CO bond orders

(4) (1) (2)=(3)

shortest CO bond (1) to longest (4)

11. Draw Lewis Dot diagrams for each of the following molecules and fill in the blanks. (60 points)

a. HCNO



The formal charge on the oxygen is: -1

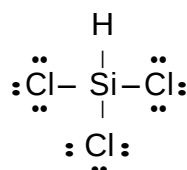
CNO bond angle is: 180°

The molecule is polar or nonpolar? polar

The number of pi bonds (in the molecule) is: 2

The hybridization on the carbon atom is: sp

b. HSiCl₃

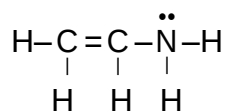


The hybridization on the silicon is: sp³

The electronic shape is: tetrahedral

The molecule is polar or nonpolar? Polar

c. H₂CCHNH₂



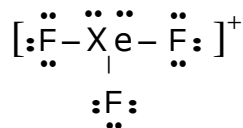
The CC bond angle is: 1

The CCN bond angle is: 120°

The HNH bond angle is: 109.5°

The number of sigma bonds (in the molecule) is: 7

d. XeF₃⁺

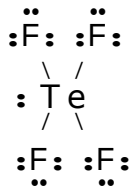


The electronic shape is: trigonal bipyramid

The molecular shape is: T-shape

F-Te-F bond angles (3) are: 90°, 90°, and 180°

e. TeF₆



The hybridization on the tellurium is: sp³d

The electronic shape is: trigonal bipyramid

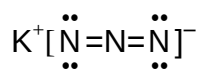
The molecular shape is: seesaw

The formal charge on the tellurium is: 0

Polar or nonpolar? Polar

f. KN_3

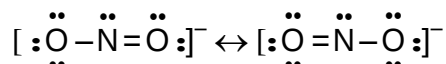
NNN bond angle is: 180°



The NN bond orders are: 2 and 2

g. O_3

Show resonance



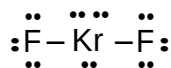
The bond angle is: 120°

The formal charge on oxygen are: $-1/2$, $-1/2$

h. KrF_2

The hybridization on the krypton is: sp^3d

The electronic shape is: trigonal bipyramid



The molecular shape is: linear

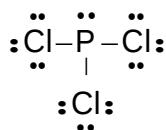
The bond angle is: 180°

Polar or Nonpolar? Non-polar

Formal charge on the krypton: 0

i. PCl_3

The Cl-P-Cl bond angles are: all 109.5°

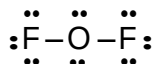


The electronic shape is: tetrahedral

The molecular shape is: trigonal pyramid

j. BrF_4^-

The electronic shape is: tetrahedral



The molecular shape is: bent

k. H_3PO_4 (oxyacid)

Formal charge on the phosphorus: +1

