1. Multiple choice – Write the letter that corresponds to the correct answer in the space provided. Circling the answer will ***NOT*** count.

_____ i. A molecule has 5 groups of electrons around the central atom. 3 of the groups are lone pairs. The hybridization of the central atom is:
a. sp^2 b. sp^3 c. sp^3d d. sp^3d^2

_____ ii. An atom emits a red (689 nm) photon. A different atom emits a blue (486 nm) photon. The first photon has _____ energy than the second.
a. more b. less
c. the same d. none of the above

_____ iii. All tetrahedral molecules are
a. polar b. non-polar
c. sp^3 hybridized d. sp^2 hybridized

_____ iv. A molecule has 5 groups of electrons around the central atom. 3 of the groups are lone pairs. The molecular geometry is:
a. square planar b. tetrahedral
c. linear d. trigonal bipyramidal

_____ v. All molecules with lone pairs are:
a. polar b. non-polar
c. can't determine polarity d. none of the above

2. An electron drops from the fifth energy level to the second energy level in a Be^{3+} ion.
   a. Calculate the ***wavelength*** of the light emitted in nm.

   b. Calculate the ***frequency*** of the light in Hz.

3. a. Draw the ***molecular orbital energy level diagram*** for N_2^{2-}.

   b. Calculate the ***bond order***.

   c. Is the ion diamagnetic or paramagnetic?

4. For each compound shown, write everything you know about it.

a. CO

b. PCl_4^-

5. For each of the atoms listed, write the ***electron configuration*** (use the noble gas shorthand) and the ***orbital diagram***.

   a. Platinum

   b. Molybdenum

6. Calculate the enthalpy of reaction for

$$HCN_{(g)} \rightarrow H_{(g)} + C_{(g)} + N_{(g)}$$

   from enthalpies of formation. Given that the C—H bond energy is 411 kJ/mol, obtain a value for the C≡N bond energy. Compare your result with the value given on the back of the periodic table (i.e., find the %error).

Substance	$HCN_{(g)}$	$H_{(g)}$	$C_{(g)}$	$N_{(g)}$
ΔH_f° (kJ/mol)	135.1	218.0	716.7	472.7