1. Today is the 14th day of the month; in celebration of today, please complete the following table showing, in the order that they are filled (beginning with the lowest energy level), the quantum numbers for each of the 14 electrons in an silicon atom that is in the ground electronic state. ***Remember, no two electrons in an atom can have the same set of four quantum numbers!!!***

Electron number	***n***	***l***	m_l	m_s
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

2. Using the core shell inert gas format, write the electronic configuration for:

   a. V^{2+}

   b. Cu

   c. W

3. Compare the second ionization energy of magnesium with the second ionization energy of sodium and fully explain, using fundamental scientific principles, the reason for the difference.

4. Compare the relative sizes of Cl^-, Ar, and P^{3-}. Fully explain, using fundamental scientific principles, the reason for the differences.

5. Strontium-90 is a radioactive isotope formed during nuclear bomb explosions and present in the radioactive fallout. Its half-life is 28.1 years.

   a. Calculate what percentage of strontium-90 remains after 12.2 years.

   b. Conduct an analysis that clearly demonstrates whether your answer to part a makes sense.

   c. Predict how strontium-90 would be expected to radioactively decay; fully support your answer, and write a balanced equation for this nuclear reaction.

   d. Outline the specific source of energy that is released from the radioactive decay of strontium-90.

6. Calculate:

   a. The energy, in joules, that is created when a single positron is annihilated. The mass of one positron is 9.109×10^{-28} g.

   b. The wavelength of light, in nm, that corresponds to this energy.

7. Complete the following table; clearly show all work.

Molecule	NO_3^-	$AsCl_3$	ICl_5	XeF_4	C_2H_2
Number of Valence Electrons					
Lewis Structure (include all nonzero formal charges)					
Electron Arrangement					
Molecular Geometry					
Bond Angle(s)					
Hybridization					
Polar or Nonpolar Molecule					
Number of sigma (σ) bonds					
Number of pi (π) bonds					
Bond Order					

8. Draw the electron configuration, determine the bond orders, and compare the relative bond lengths of $\mathbf{N_2^+}$, $\mathbf{N_2}$, and $\mathbf{N_2^-}$.

9. For a very small particle in a one dimensional box, compare the relative probabilities that the particle is in the left quarter of the box when the particle is in the n=1 level, the n=2 level, and the n=4 level. Draw a diagram to clearly support your answer.

10. Draw the band energy diagram for arsenic doped semiconductors and clearly explain why arsenic is being used for these types of materials.

11. If a 1.0 kg book were dropped from the 3rd floor of Sims to the ground which is 10.0 meters below, calculate the book's downward velocity just before it hits the ground. Neglect air friction in your calculation.