1. Balance the following reaction in acidic conditions (4 pt)

\[ \text{NO}_3^- (aq) + Cu(s) \rightarrow NO(g) + Cu^{2+} (aq) \]

2. An electron in a hydrogen atom drops from the n = 6 to the n = 3 level.
   a. What is the **wavelength** of light emitted? (4 pt)
   b. What is the **energy** of this light in kJ/mol? (6 pt)
3. What is the deBroglie **wavelength** of a 300-g object moving at a velocity of 50 m/s (about 100 mph)? (4 pt)

4. What are the **four quantum numbers**, and give their names or what they indicate. (8 pt)
   a. 
   b. 
   c. 
   d.

5. How many **orbitals** are in the following **subshells**: (6 pt)
   a. 5p
   b. 4f
   c. 3d

6. Give the electron configurations for the following (9 pt)
   a. As
   b. Pb
   c. Cr

7. What is an atomic orbital? (3 pt)
8. Give the value of \( l \) and the letter used to designate the orbital. (6 pt.)

\[ \begin{array}{c}
\text{l value:} \\
\text{designated letter:}
\end{array} \]

9. Complete the following orbital diagram for carbon. (4 pt)

\[ \begin{array}{ccc}
1s & & 2p \\
\ & \ & \ \\
\ & \ & \\
\end{array} \]

10. Indicate which is smaller in the following sets: (6 pt)
   a. \( \text{Cr}^{3+} \) or \( \text{Cr} \)
   b. \( \text{Se}^{2-} \) or \( \text{Se} \)
   c. \( \text{N}^{3-} \) or \( \text{O}^{2-} \)

11. Indicate which element has the higher first ionization energy (4 pt)
   a. \( \text{Si} \) or \( \text{S} \)
   b. \( \text{O} \) or \( \text{S} \)

12. Which element would have the higher (more negative) electron affinity (4 pt)
   a. \( \text{Mg} \ \text{Na} \ \text{Ne} \ \text{O} \)
   b. \( \text{B} \ \text{C} \ \text{Li} \ \text{Be} \)

13. Which compound will have the higher lattice energy (6 pt)
   a. \( \text{LiCl} \) or \( \text{NaCl} \)
   b. \( \text{NaCl} \) or \( \text{MgCl}_2 \)
   c. \( \text{AlCl}_3 \) or \( \text{MgCl}_2 \)

14. Give products for and balance the following reactions (8 pt)

\[ \text{Na(s)} + \ H_2O(l) \rightarrow \]

\[ \text{Na(s)} + \ O_2(g) \rightarrow \]
\[ Li(s) + O_2(g) \rightarrow \]

\[ Be(s) + Br_2(l) \rightarrow \]

15. What is the **generic** valence electron configuration of: (4 pt)
   a. halogen
   b. group 3A metal

16. Draw the Lewis structures for the following. Also, draw resonance structures where you can. (8 pt)
   a. SF\(_4\)
   b. PH\(_3\)
   c. NO\(_2^-\)

17. For the following Lewis structure, *calculate* the formal charges on all atoms. (6 pt)

\[
\begin{array}{c}
\text{O} \equiv \text{C} \equiv \text{N} \\
\text{O} \equiv \text{C} \equiv \text{N}
\end{array}
\]

For extra credit, can you draw a better resonance structure for the above compound? If so, why is yours better? (2 pt)