Multiple Choice Questions: Circle the single best answer. No penalty for guessing.

1. How many valence electrons does N have? (8 points)
   A) 3  B) 4  C) 5  D) 8  E) 14

2. Which of the following atoms has the smallest first ionization energy? (8 points)
   A) Na  B) K  C) Rb  D) Mg  E) Al

3. What is the highest energy occupied atomic orbital in the ground state electron configuration of iron (Fe)? (8 points)
   A) 1s  B) 2s  C) 3d  D) 4f  E) 5p

4. What is the mass percentage of oxygen in HNO₃? (8 points)
   A) 20.0 %  B) 25.3 %  C) 50.0 %  D) 60.0 %  E) 76.2 %

5. The heat of combustion of methane is –721 kJ/mol. What is the temperature change in 100.0 g of water if 0.0200 mol of methane are burned to heat the water (C₇H₈O = 4.184 J / g K)? (8 points)
   A) 3.44 K  B) 14.4 K  C) 34.5 K  D) 86.2 K  E) 141.2 K

6. What is the hybridization of the O atom in H₂CO? (8 points)
   A) sp  B) sp²  C) sp³  D) sp³d  E) 2p

7. Draw the Lewis dot structures for CH₄ and PF₅O. Remember to include formal charges (12 points)
8. Write the formula or name of the following ionic compounds and indicate the solubility. (24 points)

\[ \text{Na}_2\text{SO}_4 \]

\[ \text{CaCO}_3 \]

\[ \text{perchloric acid} \]

\[ \text{ammonium permanganate} \]

9. Draw the Lewis dot structure for \( \text{SO}_2^{2-} \). Describe the molecular and electron pair geometry as well as formal charge and oxidation state for each atom of this molecule. (16 points)

10. Arrange the following atoms in order of electronegativity from highest to lowest: K, Cl, B, Fe, Ba. (15 points)

11. Calculate the mass of AlCl\(_3\) produced when 5.00 g of Al is reacted with 5.00 g of Cl\(_2\). (15 points)