編號： 470　系所：環境醫學研究所甲組　　科目：化學

本試題是否可以使用計算機：☑可使用，☐不可使用　（請命題老師勾選）

1. Before generating a periodic chart from our knowledge of the hydrogen wave function, please define the following rules for multi-electron atoms:
   a. Pauli Exclusion Principle (5%).
   b. Hund's rule (5%).

2. The energy required to remove an electron from a hydrogen atom is 13.3eV. Please compute the difference in mass between a hydrogen atom and a separated proton plus an electron. (1eV=1.6022×10^{-12} erg) (10%)

3. Give Lewis diagrams for the two molecules with the empirical formula C_2H_6O (9%).

4. Please define the following terms (20%, 5% for each).
   a. Boyle's Law
   b. Charles' Law
   c. Dalton's Law
   d. Van Der Waals Equation

5. Consider the following hypothetical chemical reaction: (25%, 5% for each).
   $XY_2(s)+ZW3(g) \rightarrow Z_3Y_2\ (l) + X(s) + W_2\ (g)$
   The atomic weights of the hypothetical elements are:
   X = 10.0; Y = 15.0; Z = 20.0; and W = 30.0.
   a. Balance the equation.
   b. How many moles of ZW_3 (g) are required to produce 3/5 mole of W_2 (g)?
   c. How many moles of X(s) can be produced from the reaction of 5.00 g of XY_2 (s) with 10.0 g of ZW_3 (g)?
   d. How many cm^3 of Z_3Y_2 (*l*) (density =2.30 g/ cm^3 can be formed in the reaction of 0.50 mole of XY_2 (s) with excess ZW_3 (g)?
   e. How many liters of W_2 (g) at 235℃ and 2.00 atm can be produced from the reaction of 3.0 moles of XY_2 (s) with excess ZW_3(g)?

6. A 26.802 g sample of $Na_2C_2O_4$ was dissolved in water and diluted to exactly 1 liter. A 25.00 ml aliquot of acidified $KMnO_4$ (aq) was then titrated with the sodium oxalate solution to give Mn^{2+} (aq) and CO_2 (g). This titration required 35.50 ml of the oxalate solution. Calculate the molarity and normality of the permanganate solution (12%).

7. Consider the following chemical reaction: (14%, 2% for each).
   $PbI_2(s) + 4OH^-(aq) \rightarrow Pb(OH)_4^{2-}(aq) + 2I^-(aq)$
   Will the concentration of $Pb(OH)_4^{2-}$ (aq) be increased, decreased or unaffected by :
   a. increasing the concentration of OH^-(aq)
   b. addition of HNO_3(aq)
   c. decreasing the amount of PbI_2(s)
   d. decreasing the temperature ($\Delta H^o<0$)
   e. increasing the total pressure ($\Delta V^o>0$)
   f. addition of $NaClO_4$(aq)
   g. decreasing the PbI_2(s) particle size