1.Explained the follow terms:　45% (必須詳述其物理意義及相關公式) (各3分)

(1)molar mass　(2) Polymer　(3) Solutions　(4) second law of thermodynamics (5) Hess's law

(6) Charles' law (7) Hard water　(8) Henry's law　(9) free energy　(10) rate law

(11) Bond energy (12) Unit cell (13) The Ideal Gas Law (14) Work (15) Clausius-Clapeyron equation

2. The gas phase reaction $A + B + C \rightarrow D$ has a reaction rate which is experimentally observed to follow the relationship rate = $k[A]^2[C]$. The reaction is _____ order in A, _____ order in B, and _____ order in C. (5%)

3. Given the following potential energy diagram for the one-step reaction $X + Y \rightarrow Z + R$ The point "b" represents? (5%)
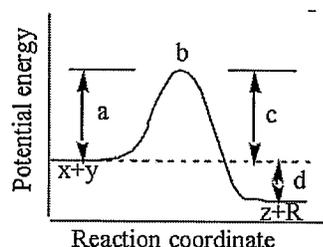


(a) the energy of the mixture when half of the reactants have been converted to products
(b) the energy of the transition state
(c) the number of moles of transition state that must be formed
(d) the energy of the forward reaction

4. Translation the follow sentence:　　(25%)
 (a) First Law of Thermodynamics: The total amount of energy in the universe is constant (also known as the Law of Conservation of Energy); energy is neither created nor destroyed in ordinary chemical reactions and physical changes.
 (b) Standard entropy change, $\Delta S0$: The entropy change in which the number of moles of reactants specified in the balanced chemical equation, all at standard states, is converted completely to the specified number of moles of products, all standard states.
 (c) Boiling Point: The temperature at which the vapor pressure of a liquid is equal to the external pressure; also the condensation point.
 (d) Triple point: The point on a phase diagram that corresponds to the only pressure and temperature at which three phases (usually solid, liquid, and gas) of a substance can coexist at equilibrium.
 (e) Gibbs free energy, $\Delta G$: The indicator of spontaneity of a process at constant T and P. $\Delta G = \Delta H - T\Delta S$. If $\Delta G$ is negative, the process is product-favored (spontaneous); also called free energy change.

5. Which of these liquids would have the highest surface tension at 25°C? (5%)
 (a)$Br_2$(b)$H_2O$(c)$CCl_4$(d)$C_5H_{12}$(e)$CH_3OCH_3$

6. Which of the following interactions are the strongest? (5%)
 (a) Hydrogen bonding (b) London forces (c) covalent bonds (d) ion-ion interactions (e) dispersion forces

7. The mole fraction of oxygen in the atmosphere is 0.2094.Calculate the partial pressure of $O_2$ in air when the atmosphere pressure is 760.torr. (5%)

8. One mole of a gas occupies 36.5 L and its density is 1.36 g/L at a given temperature and pressure.
 (a) What is its molar mass? (b) What is its density at STP? (5%)