

國立臺北教育大學 107 學年度碩士班考試入學招生考試  
自然科學教育學系碩士班 化學 科試題

共 10 題，每題 10 分

1. Please use the frontier orbital theory to define acid and base concept.
2. Hydrochloric acid (150.0 mL of 0.125 M) is added to 225.0 mL of 0.0550 M  $\text{Ba}(\text{OH})_2$  solution. What is the concentration of the excess  $\text{H}^+$  or  $\text{OH}^-$  left in this solution?
3. Briefly write the principle of Gas Chromatography-Mass Spectrometer.
4. Place the  $\text{Te}^{2-}$ ,  $\text{I}^-$ ,  $\text{Cs}^+$ ,  $\text{Ba}^{2+}$ , and  $\text{La}^{3+}$  ions in order of decreasing size and explain.
5. Nickel has a face-centered cubic unit cell. Calculate a value for the atomic radius of nickel. (The density of nickel is  $6.84 \text{ g/cm}^3$  and atomic mass is  $58.69 \text{ g/mole}$ )
6. The standard free energy of formation of  $\text{AgBr}(s)$  is  $-97 \text{ kJ/mol}$ . Calculate  $\Delta G^\circ$  for the reaction  
$$2\text{AgBr}(s) \rightarrow 2\text{Ag}(s) + \text{Br}_2(g)$$
7. The reaction  $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$  has the following mechanism:  
$$\text{H}_2\text{O}_2 + \text{I}^- \rightarrow \text{H}_2\text{O} + \text{IO}^-$$
$$\text{H}_2\text{O}_2 + \text{IO}^- \rightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$$
What is the catalyst in the reaction?
8. The oxidation of secondary alcohols results in
  - a. secondary alcohols.
  - b. aldehydes.
  - c. ketones.
  - d. esters.
  - e. ethers.

9. Consider the equation  $2A(g) \rightleftharpoons 2B(g) + C(g)$ . At a particular temperature,  $K = 1.6 \times 10^4$ .

If you start with 2.0 M of chemical A, calculate the equilibrium concentration of chemical C.

10. A 5.22-g sample of a compound is dissolved in 200.0 g of benzene. The freezing point of this solution is  $1.08^\circ\text{C}$  below that of pure benzene. What is the molar mass of this compound? (Note:  $K_f$  for benzene =  $5.12^\circ\text{C}/m$ .)