

國立臺北教育大學 105 學年度碩士班招生入學考試

自然科學教育學系碩士班 化學 科試題

共十題，每題 10 分

1. A gaseous binary compound (which is known to contain nitrogen) has a density 1.94 times that of oxygen gas (at the same temperature and pressure). When 1.31 g of the compound is completely burned in excess oxygen, 1.21 g of water is formed. Determine the formula of the compound.
2. At a particular temperature, a 3.0L flask contains 2.4 moles of Cl_2 , 1.0 mole of NOCl , and 4.5×10^{-3} mole of NO . Calculate K at this temperature for the following reaction:
$$2\text{NOCl}(g) \rightleftharpoons 2\text{NO}(g) + \text{Cl}_2$$
3. Gold (atomic mass = 197 g/mol) is plated from a solution of chlorauric acid, HAuCl_4 ; it deposits on the cathode. Calculate the time it takes to deposit 0.65 g of gold, passing a current of 0.14 amperes. (1 faraday = 96,485 coulombs)
4. Calculate the pH of 5.0×10^{-4} M HCN . ($K_a = 6.2 \times 10^{-10}$)
5. A 140.0-g sample of water at 25.0°C is mixed with 100.0 g of a certain metal at 100.0°C . After thermal equilibrium is established, the (final) temperature of the mixture is 29.6°C . What is the heat capacity of the metal, assuming it is constant over the temperature range concerned?
6. On the basis of molecular orbitals, predict the bond order of NO^- , NO and NO^+ , and provide a brief explanation.
7. Using the Slater's rules, determine effective nuclear charge Z^* for a 3p electron in P and Cl.
8. Name each of the following compounds:
a. CsF b. NaNO_2 c. MnO_2 d. P_2S_5 e. NH_4NO_3

9. A sample of a monatomic ideal gas at 1.00 atm and 25°C expands adiabatically and reversibly from 5.00 L to 12.5 L. Calculate the final temperature and pressure of the gas, the work associated with this process, and the change in internal energy.
10. A first-order reaction is 75.0% complete in 320 second. How long does it take for 90.0% completion?