

銘傳大學八十八學年度管理科學研究所碩士班招生考試

(甲組) 第一節

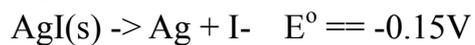
普通化學 試題

1. Explain why the electron affinity of the elements tend to increase from left to right in a given period. (10%)
2. Write the electronic configurations of  $\text{O}_2$ . Determine the bond orders and arrange the  $\text{O}_2$ ,  $\text{O}_2^+$ ,  $\text{O}_2^-$ ,  $\text{O}_2^{2-}$  in order of increasing bond energy and bond length. Indicate which of these species are paramagnetic. (10%)
3. Explain the fact that the boiling point of  $\text{H}_2\text{Te}$ ,  $\text{H}_2\text{Se}$ , and  $\text{H}_2\text{S}$  decrease from about  $-2^\circ\text{C}$  to  $-60^\circ\text{C}$  while the boiling point of  $\text{H}_2\text{O}$  is  $100^\circ\text{C}$ . (10%)
4. Write an equation to estimate the value of electron affinity of oxygen,  $\text{O} + e \rightarrow \text{O}^-$ , by application of the Born-Haber cycle to the formation of  $\text{MgO}$ . (10%)
5. The diamagnetic complex of cobalt,  $[\text{Co}(\text{NH}_3)_6]^{3+}$ , is orange-yellow while the paramagnetic complex,  $[\text{CoF}_6]^{3-}$ , is blue. Explain the difference in color. (10%)
6. Show the steps in the acid-catalyzed hydration of 2-methylpropene and indicate which product is formed. (10%)
7. The reaction
$$2 \text{HCrO}_4^- + 3 \text{HSO}_3^- + 5 \text{H}^+ \rightarrow 2 \text{Cr}^{3+} + 3 \text{SO}_4^{2-} + 5 \text{H}_2\text{O}$$
follows the rate law  $\text{Rate} = k[\text{HCrO}_4^-][\text{HSO}_3^-]^2[\text{H}^+]$ . What happens to the rate if, in separate experiments, (a) the concentration of  $\text{HSO}_3^-$  is doubled. (b) the pH is decreased by one unit (c) the solution is diluted to twice its volume. (10%)
8. Determine the solubility product of  $\text{AgI}$  at  $25^\circ\text{C}$  by its reduction by its reduction potential. (10%)
9. One mole of an ideal gas initially occupies a volume of 2.00 L at a pressure of 10.0 atm. The gas is expanded against a constant external pressure of 1.00 atm until its volume is 20.0 L, at which point it is in equilibrium with

its surroundings. The gas is then compressed reversibly and isothermally back to a volume of 2.00 L. Calculate  $\Delta E$ ,  $q$ , and  $w$  for this overall process.

10. Compare the solubility of **PbI<sub>2</sub>** in 0.10 M **NaI** with that in pure water at 25°C. (10%)

$$K_{sp} \text{ of PbI}_2 = 7.09 \times 10^{-9}$$



$$\text{gas constant } R = 0.08206 \text{ L}\cdot\text{atm/mole}\cdot\text{K} = 8.314 \text{ J/mole}\cdot\text{K}, 1 \text{ atm.} = 101.32\text{J}$$

試題完