

# 淡江大學 103 學年度碩士班招生考試試題

42

系別：化學工程與材料工程學系

科目：物理化學

考試日期：3月2日(星期日) 第2節

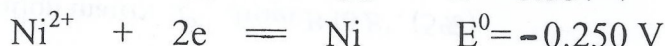
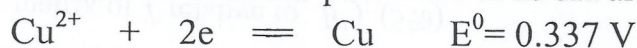
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20 points 1. Use appropriate state functions and relevant notions to explain the following terms.

- (1) the first law of thermodynamics
- (2) the third law of thermodynamics
- (3) Clausius inequality
- (4) Clausius-Clapeyron equation

20 points 2. Determine the net cell reaction and calculate the cell potential of the cell composed of Ni<sup>2+</sup>/Ni and Cu<sup>2+</sup>/Cu electrodes at 298K, if  $a_{\text{Ni}^{2+}}=0.85$  and  $a_{\text{Cu}^{2+}}=0.22$ .

Data: The standard electrode potentials at 298K are as follows:



20 points 3. One mole of an ideal gas, initially occupying 10.0 liters at 300K, expands adiabatically and reversibly to 20.0 liters. Calculate the final temperature and pressure.

Data: Given  $C_{v,m} = 2.5 R$ .

20 points 4. If  $K_p$  at 723K is 0.02 for the reaction  $2\text{HI}_{(g)} \rightleftharpoons \text{H}_{2(g)} + \text{I}_{2(g)}$ . Calculate  $\Delta G^0$  for this reaction. Also, estimate  $K_p$  at 500K, assuming that  $\Delta H^0$  is constant.

Data:  $\Delta H_f^0 (\text{HI},g) = 26.48 \text{ KJmol}^{-1}$

$$\Delta H_f^0 (\text{I}_2,g) = 62.44 \text{ KJmol}^{-1}$$

20 points 5. A second-order reaction of the type  $A + B \rightarrow C$  was carried out in a solution that initially was  $0.4 \text{ moldm}^{-3}$  in A and  $0.4 \text{ moldm}^{-3}$  in B. After one hour, the concentration of A was  $0.15 \text{ moldm}^{-3}$ . Calculate the rate constant and determine the half-life of this reaction.