

考試時間：八十分鐘

答題須知：請詳細閱讀下列試題，並請標明題號依試題順序將答案書寫於答案卷上。

本份試題共計 1 頁、7 題，配分如各題說明，共 100 分。

1. (20%) Name the following compounds:

- |                                     |                     |                       |                                     |                                    |
|-------------------------------------|---------------------|-----------------------|-------------------------------------|------------------------------------|
| (1) CuI                             | (2) NaOH            | (3) CaSO <sub>4</sub> | (4) NH <sub>4</sub> NO <sub>3</sub> | (5) H <sub>2</sub> SO <sub>4</sub> |
| (6) Na <sub>2</sub> CO <sub>3</sub> | (7) CH <sub>4</sub> | (8) HCN               | (9) HClO <sub>4</sub>               | (10) HClO <sub>3</sub>             |

2. (12%) Cyanide ion is often used to extract the silver by the following reaction:  $Ag_{(s)} + CN^{-}_{(aq)} + O_{2(g)} \xrightarrow{Basic} Ag(CN)_{2(aq)}^{-}$

Balancing this oxidation-reduction reaction occurring in *Basic* solution by the following steps:

- (1) (4%) identify and write the equations for the two half-reactions:
- (2) (4%) balance each half reaction:
- (3) (4%) equalize the electron transfer in the two half-reactions and show the balanced equation:

3. (16%) Consider 2.00 mol of a monatomic ideal gas that is taken from state A ( $P_A = 2.00$  atm,  $V_A = 10.0$  L) to state B ( $P_B = 1.00$  atm,  $V_B = 30.0$  L) through the pathway: state A  $\rightarrow$  state C ( $P_C = 2.00$  atm,  $V_C = 30.0$  L)  $\rightarrow$  state B. Calculate the heat required  $q$ , the PV work required  $w$ , and the average translational energy change per mole of gas  $\Delta E$ , the enthalpy change per mole of gas  $\Delta H$  for this pathway. .

4. (12%) Calculate the energy required to excite the hydrogen electron from level  $n = 1$  to level  $n = 2$ . Also calculate the wavelength of light that must be absorbed by a hydrogen atom in its ground state to reach this excited state.

5. (10%) Give the Lewis structure for each of the following.

- |                     |                    |                     |                      |                      |
|---------------------|--------------------|---------------------|----------------------|----------------------|
| (1) CF <sub>4</sub> | (2) N <sub>2</sub> | (3) NO <sup>+</sup> | (4) ClF <sub>3</sub> | (5) H <sub>2</sub> O |
|---------------------|--------------------|---------------------|----------------------|----------------------|

6. (10%) Give possible Lewis structures for SO<sub>4</sub><sup>2-</sup>. Determine the formal charges of each atom in the various Lewis structures.

7. (10%) A silver concentration cell is set up at 25°C with 1.0 M AgNO<sub>3</sub> in the left compartment and 1.0 M NaCl along with excess AgCl(s) in the right compartment. The measured cell potential is 0.58 V. Calculate the  $K_{sp}$  value for AgCl at 25 °C

8. (10%) Show that the root mean square velocity of an ideal gas is  $\sqrt{\frac{3RT}{M}}$