

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

1. (20%) Define the following terms or symbols and give one example for each.
 - a. *hydrogen bonding*
 - b. *colligative properties*
 - c. ΔH_f°
 - d. *mean free path*

2. (20%) Answer the following questions
 - a. Explain what *Henry's Law* is. (7%)
 - b. Explain *Pauli Exclusion Principle* (7%)
 - c. Not all gases can be considered ideal gases under some conditions. What property or properties cause a gas to deviate (偏離) from ideal behavior? (6%)

3. (20%) A 16.42 mL volume of 0.1327 M KMnO_4 is required to oxidize 20.00 mL of an acidic aqueous FeSO_4 solution.
 - a. Write the half reactions (in ionic forms) for the above reaction, then obtain an overall balanced equation.
 - b. Calculate the concentration of the FeSO_4 solution.

4. (20%) The following reaction is in equilibrium ($K_{\text{eq}} = 1.0 \times 10^5$) and it takes place in a closed but heat conductive (會導熱的) cylinder (活塞).

$$3 \text{A} (\text{g}) + \text{B} (\text{s}) \rightleftharpoons 2 \text{C} (\text{g}) + 2 \text{H}_2\text{O} (\text{g}) + 320 \text{ kJ/mol}$$
 - a. Is the reaction endothermic or exothermic? Why?
 - b. How to obtain more gas C?
 - c. What will happen to the equilibrium if compress the cylinder?
 - d. What will happen to the equilibrium if you put the cylinder on a block of ice?
 - e. Can you calculate the reaction rate from the given information? Why?

5. (20%) Titanium is prepared by the reduction of titanium (IV) chloride with molten magnesium:

$$\text{TiCl}_4 (\text{g}) + 2 \text{Mg} (\text{l}) \rightarrow \text{Ti} (\text{s}) + 2 \text{MgCl}_2 (\text{l})$$
 If 3.54×10^4 kg of TiCl_4 is reacted with 1.13×10^4 kg of mg.
 - a. Calculate the theoretical yield of TiCl_4 . (8%)
 - b. Which compound or metal is the limiting reagent? (4%)
 - c. Calculate the percent yield if 7.91×10^3 kg of Ti is actually obtained. (8%)