

所別： 材料工程研究所 組別： 不分組 科目： 普通化學

注意： ☐ 一般計算器 ☒ 工程用計算器，考試時間總計：100 分鐘。試題共 1 頁，第 1 頁

1. For the exothermic reaction $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{SO}_{3(g)}$ predict the equilibrium shift caused by each of the following changes. (10 %)
(a) SO_2 is added ; (b) SO_3 is removed; (c) The volume is decreased. (d) The temperature is decreased.
2. Suppose 25.0 kg of nitrogen gas and 5.00 kg of hydrogen gas are mixed reacted to form ammonia. Calculate the mass of ammonia produced when this reaction is run to completion. (10 %)
$$\text{N}_{2(g)} + \text{H}_{2(g)} \rightarrow \text{NH}_{3(g)} \quad (\text{molar mass: 1 mole N} = 14.01\text{g})$$
3. A 2.0-L flask contains a mixture of nitrogen gas and oxygen gas at 25°C . The total pressure of the gaseous mixture is 0.91 atm, and the mixture is known to contain 0.050 mole of N_2 . Calculate the partial pressure of oxygen and the moles of oxygen present. (10 %)
4. Calculate the energy (in kJ) required to heat 25 g of ice from 25°C to 100°C and change it to steam at 100°C . (10 %)
(Molar heat of fusion and vaporization of water are 6.02 and 40.6 kJ/mole, respectively; the specific heat capacity of water is 4.18 J/g $^\circ\text{C}$)
5. Which substance in each pair would be expected to show the largest vapor pressure at a given temperature? Explain your reasoning. (10 %)
(a) H_2O (l) or H_2S (l) ; (b) H_2O (l) or CH_3OH (l); (c) CH_3OH (l) or $\text{CH}_3\text{CH}_2\text{OH}$ (l)
6. Name each of the following compounds. (15%)
(a) AlCl_3 ; (b) MgI_2 ; (c) CuCl ; (d) HgO (e) NO
(Al: aluminum; Cl: chlorine; Mg: magnesium; I: iodine; Cu: copper; Hg: mercury; N: nitrogen; O: oxygen)
7. For each of the following reactions, complete and balance the equation, indicating clearly which product is the precipitate. (15%)
(a) $\text{Ba}(\text{NO}_3)_2(\text{aq}) + (\text{NH}_4)_2\text{SO}_4(\text{aq}) \rightarrow$
(b) $\text{NiCl}_2(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow$
(c) $\text{HCl}(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \rightarrow$
8. The K_{sp} value for lead chromate, PbCrO_4 , is 2.0×10^{-16} at 25°C . Calculate its solubility at 25°C . (10%)
9. What volume of 16M H_2SO_4 must be used to prepare 1.5L of a 0.10M H_2SO_4 solution. (10%)