

國立高雄師範大學 105 學年度學士班轉學生招生考試試題

系所別：化學系、生物科技系二年級

科 目：普通化學

※注意：1.不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上，於本試題上作答者，不予計分。

2.限用藍色或黑色之鋼筆、原子筆作答，以鉛筆或其他顏色作答者不予計分。

一、簡答題：

1. 請解釋以下化學專有名詞。(每題 5%，共 20%)

(a) 八隅體規則 (Octet rule)

(b) 赫斯定律 (Hess's Law)

(c) 熱力學第一定律 (The first law of thermodynamics)

(d) 價殼層電子互斥理論 (Valence Shell Electron Pair Repulsion, VSEPR)

2. 請寫出以下分子的鍵級 (bond order)。(每題 2%，共 10%)

(a) H_2

(b) H_2^+

(c) H_2^-

(d) CN^-

(e) CN

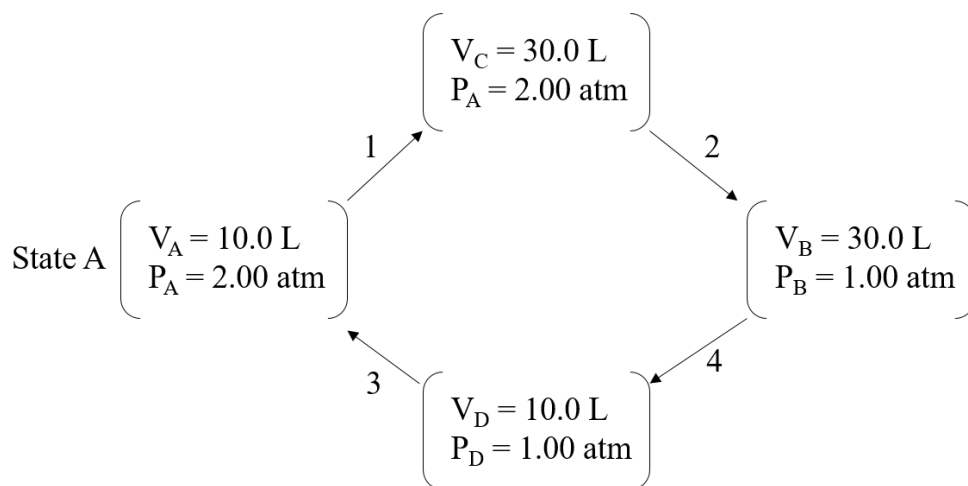
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二、計算題：(請務必寫出計算過程)

1. 2 莫耳的理想氣體 (ideal gas)，從狀態 A (state A, $P_A = 2.00 \text{ atm}$, $V_A = 10.0 \text{ L}$) 到狀態 B (state B, $P_B = 1.00 \text{ atm}$, $V_B = 30.0 \text{ L}$)，可透過以下兩種途徑。請回答以下問題 (每題 5%，共 10%)



(a) 請依照上圖兩種途徑，分別計算此理想氣體所作的功 (單位為焦耳 (J))。

(b) 請根據 (a) 說明功是否為狀態函數 (state function)。

2. 請計算分別每一甲烷(CH_4)分子在溫度 546K 的均方根速率 (root mean square velocities) 和平均動能 (average kinetic energies) [$R = 8.3145 \text{ JK}^{-1}\text{mol}^{-1}$]。(10%)

三、Suppose a sealed flask contains 1.0 L of oxygen gas that is completely converted to ozone (O_3) at the same temperature. Calculate the ratio of the new pressure to the original pressure and the ratio of the number of impacts of ozone molecules with the walls of the container to the number of impacts of oxygen molecules with the walls of the container. (10%)

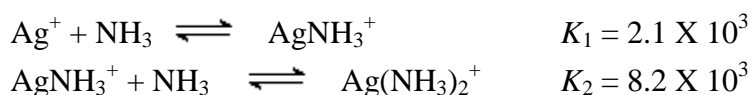
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四、 At 25°C a sample of $\text{N}_2\text{O}_4(\text{g})$ is placed in an empty cylinder. After equilibrium is reached, the total pressure is 1.5 atm, and 16% (by moles) of the original N_2O_4 has dissociated to $\text{NO}_2(\text{g})$. If the volume of the cylinder is increased until the total pressure is 1.0 atm, what percent (by moles) of the original $\text{N}_2\text{O}_4(\text{g})$ has dissociated at the new equilibrium position? (10%)

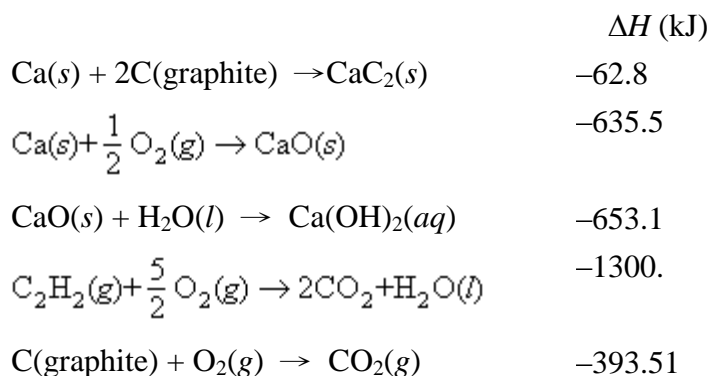
五、 A solution is made by mixing equal volumes of 0.20 M HCN ($K_a = 6.2 \times 10^{-10}$) and 0.20 M NH_3 ($K_b = 1.8 \times 10^{-5}$). Determine the pH of the solution. (10%)

六、 The Ag^+ ion reacts with NH_3 to form the following complex ions:



AgCl ($K_{sp} = 1.6 \times 10^{-10}$) is dissolved to its solubility limit in 10.0 M NH_3 . Calculate the equilibrium concentrations of Ag^+ , Cl^- , $\text{Ag}(\text{NH}_3)_2^+$, and NH_3 . (10%)

七、 Consider the following data:



Use Hess's law to find the change in enthalpy at 25°C for the following equation:

