

元智大學 103 學年度研究所 碩士班 招生試題卷

系(所)別： 生物科技與工程
研究所碩士班

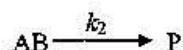
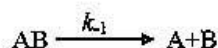
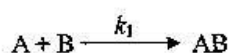
組別： 不分組

科目： 普通化學

用紙第 1 頁共 1 頁

●不可使用電子計算機

1. Penicillin, the first antibiotics, was discovered by Alexander Fleming in 1928, but he was never able to isolate it as pure compound. This is similar antibiotics have saved millions of lives that might have been lost to infections. Penicillin F has formula $C_{14}H_{20}N_2SO_4$. Compute the mass percent (%) of each element. (10 points)
(Mw of each element: C: 12, H: 1, N: 14, S: 32, O: 16)
2. Caffeine, a stimulant found in coffee, tea, and chocolate, contains 49.48% carbon, 5.15% hydrogen, 28.87% nitrogen, and 16.49% oxygen, by mass and has a molar mass of 194.2. Determine the molecular formula of caffeine. (10 points)
3. Arrange the following bonds according to increasing polarity: H-H, O-H, Cl-H, S-H, and F-H (electronegativity values : H: 2.1, O: 3.5, S: 2.5, Cl: 3, F: 4) (10 points)
4. Describe the electron arrangement in the nitrite anion (NO_2^-), Using the localized electron model. (5 points)
5. What is the Lewis structure for each of following?
 - a. HF (2 points)
 - b. N_2 (2 points)
 - c. NH_3 (2 points)
 - d. CH_4 (2 points)
 - e. CF_4 (2 points)
6. Draw the isomers of pentane (C_5H_{12}) (5 points)
7. A typical reaction mechanism is show in the following:



Based on rate law, write the reaction rate of disappearance for A ($-r_A$) and the reaction rate of formation for AB (r_{AB}) and P (r_P).

(12 points)

8. For each of the following pairs of substances, which substance has the greater value of S^0 .
 - a. $C_2H_5OH(l)$ or $C_2H_5OH(g)$ (4 points)
 - b. $CO_2(s)$ or $CO_2(g)$ (4 points)
9. (A) What volume of 16 M sulfuric acid must be used to prepare 1.5 L of a 0.5 M H_2SO_4 ? (5 points)
(B) How many grams of potassium permanganate, $KMnO_4$, are needed to prepare 500 mL of 0.5 M solution? (5 points)
(Mw of each element: H: 1, S: 32, O: 16, K: 39, Mn: 55)

10. In a study of the equilibrium.



2 mole of H_2 and 6 mole of I_2 gave rise at equilibrium to X mole of HI. Addition of a further 4 mole of H_2 gave an additional X mole of HI. What is X? (10 points) What is K at the temperature of the experiment? (10 points)