

中山醫學大學 101 學年度碩士班入學招生考試試題

應用化學系碩士班

考試科目：普通化學

時間：80 分鐘

※請注意本試題共(4)張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第 (1) 頁

本試題共 二大題，總分 100 分。請按題號順序作答!!

一、選擇題：(每題 3 分) (60%)

1. Normal body temperature is 98.6°F . Convert this temperature to the Kelvin scales.
(A) 371.75°K (B) 37.0°K (C) 310.2°K (D) 450.6°K
2. How would you separate a mixture of salt, sand, and water? (A) by filtration, followed by evaporation (B) freezing, followed by melting (C) separating with tweezers, followed by evaporation (D) by filtration, followed by burning
3. What information is not provided by the formula, C_4H_{10} , for butane? (A) butane is an organic compound (B) the molecular formula (C) the relative number of atoms of each kind (D) the shape of the molecule
4. Which state of matter is composed of charged particles which are dramatically affected by electric and magnetic fields? (A) solids (B) liquids (C) gases (D) plasma
5. The modern periodic table is based on arranging elements in the order of their (A) atomic weight (B) atomic number (C) mass number (D) isotope number
6. Liquids have a (A) fixed volume and no definite shape (B) fixed shape and no volume (C) no definite shape and no volume (D) fixed shape and fixed volume
7. When a spoonful of sugar is added to a glass of iced tea, it quickly dissolves. If no solid settles to the bottom, the resulting solution is (A) saturated (B) unsaturated (C) ionic (D) normal
8. Which of the following matches the meaning of the term condensation in terms of changes in states of matter? (A) solid \rightarrow liquid (B) liquid \rightarrow gas (C) gas \rightarrow liquid (D) gas \rightarrow liquid
9. When H_2SO_3 dissolves in water, what are the solute particles in the solution? (A) H, S, O (B) H^{1+} , S^{1+} and O^{2-} (C) H^{1+} , HSO_3^{-} and SO_3^{2-} (D) H_2^{1+} and SO_3^{2-}

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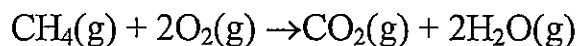
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agents (C) grab another electron from a neighboring molecule (D) all of the above

11. Which of the batteries listed below is a reusable battery? (A) dry cell battery
(B) mercury battery (C) alkaline battery (D) lead storage battery

12. Identify the reduced species in the following equation



(A) C (B) $\text{O}_2(\text{g})$ (C) H (D) H_2O

13. A p-type semiconductor is one that (A) contains more electrons than silicon
(B) is deficient electrons (C) has no electrons (D) has the same number of electrons as silicon

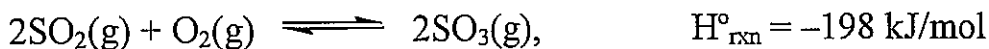
14. The reaction $2\text{NO}_2(\text{g}) \leftrightarrow 2\text{NO}(\text{g}) + \text{O}_2(\text{g})$ is suspected to be second order in NO_2 . Which of the following kinetic plots would be the most useful to confirm whether or not the reaction is second order? (A) a plot of $[\text{NO}_2]^{-1}$ vs. t (B) a plot of $\ln [\text{NO}_2]$ vs. t (C) a plot of $[\text{NO}_2]^2$ vs. t (D) a plot of $[\text{NO}_2]$ vs. t

15. An increase in the temperature of the reactants causes an increase in the rate of reaction.

The **best** explanation for this behavior is that as the temperature increases,

- (A) The activation energy decreases. (B) The collision frequency increases.
(C) The fraction of collisions with total kinetic energy greater than E_a increases.
(D) The activation energy increases.

16. Consider this reaction at equilibrium:



If the volume of the system is compressed at constant temperature, what change will occur in the position of the equilibrium?

- (A) A shift to produce more SO_2 (B) No change
(C) A shift to produce more O_2 (D) A shift to produce more SO_3

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A) Provide a means for electrons to travel from the anode to the cathode.

B) Maintain electrical neutrality in the half-cells via migration of ions.

C) Provide oxygen to facilitate oxidation at the anode.

D) Provide a means for electrons to travel from the cathode to the anode.

18. A 25.0 mL sample of an acetic acid solution is titrated with a 0.100 M NaOH solution. The equivalence point is reached when 37.5 mL of the base is added. The concentration of acetic acid is _____ M. (A) 0.067 (B) 0.075 (C) 0.150 (D) 0.375

19. Mixture of helium and oxygen can be used in scuba diving tanks to help prevent “the bends.” For a particular diving, 48 L He at 27 °C and 1.0 atm and 12 L O₂ at 27 °C and 1.0 atm were pump into a tank with a volume of 5.0 L. Please determine the total pressure in the tank at 5 °C (gas constant R=0.08206 L-atm/K-mol) (A) 9.6 atm (B) 2.4 atm (C) 11.1 atm (D) 12 atm

20. The enthalpy of combustion CH₄ (g) when H₂O (l) is formed is -891 kJ/mol and the enthalpy of combustion CH₄ (g) when H₂O (g) is formed is -803 kJ/mol. Use these data and Hess’s law to determine the enthalpy of vaporization for water. (A) 44 kJ/mol (B) - 88 kJ/mol (C) -44 kJ/mol (D) 88 kJ/mol

二、計算題：共 40% (需詳列計算式)

1. To analyze the alcohol content of a certain wine, a chemist needs 1.00 L of an aqueous 0.200 M K₂Cr₂O₇ (potassium dichromate, *f.w.* =294.20 g/mol) solution.

(1) How much solid K₂Cr₂O₇ must be weighed out to make this solution? (5%)

(2) please describe the steps involved in the preparation of this standard aqueous solution.(5%)

2. Please use **half-reaction method** to balance the following oxidation-reduction reaction in **basic solution**. Is this spontaneous reaction under standard conditions?(10%)

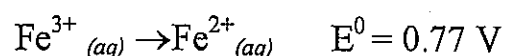
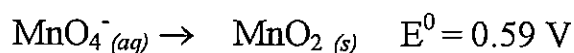
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3. Write Lewis structures and predict the molecular structures for XeF_4 and NF_3 . Are these molecule polar?(10%)
4. Calculate the pH of a solution made by mixing 50.0 mL of 0.300 M CH_3COONa (K_a for $\text{CH}_3\text{COOH} = 1.00 \times 10^{-5}$) with 50.0 mL of 0.100 M HCl . ($\log 2=0.301$, $\log 3=0.477$, $\log 7=0.845$) (5%)
5. How many Na^+ and Cl^- ions are in each NaCl unit cell? (5%)