

國立臺北科技大學

九十七學年度四年制二、三年級轉學生招生考試

系所組別：四技二年級化學工程與生物科技系

第三節 專業科目 (二) 普通化學 試題

第一頁 共二頁

注意事項：

1. 本試題之選擇題共 30 題，皆為單選題，分成兩部分：Part I (1~20)，每題 4 分；Part II (21~30)，每 2 分題。
2. 請依各編號作答，合計共 100 分。僅准用工程型計算機，餘者均不得使用，計算之答案選取最接近者。
3. 作答之全部答案，須依序寫在答案卷之答案欄內，否則不予計分；欄外空白區可供計算用。

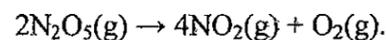
Part I. (1~20, each 4 points)

1. The value of ΔG^0 at 373K for the oxidation of solid elemental sulfur to gaseous sulfur dioxide, $S(s) + O_2(g) \rightarrow SO_2(g)$, is x kJ/mol. At 298K, ΔH^0 of this reaction is -269.9 kJ/mol and ΔS^0 is +11.6 J/K. Which is the correct value of x ?
(A) +300.4 (B) -3,597 (C) -300.4 (D) -274.2
2. How many kilowatt-hours (kWh) of electricity are used to produce 1.00 kg of magnesium in the electrolysis of molten $MgCl_2$ with an applied emf of 4.50 V? ($Mg = 24.31$)
(A) 0.0336 (B) 14.92 (C) 9.93 (D) 7.45
3. When the following equation is balanced, what is the coefficient of permanganate ion?
 $MnO_4^- + Br^- \rightarrow Mn^{2+} + Br_2$ (in acid solution)
(A) 1 (B) 2 (C) 3 (D) 4
4. Applying with thermodynamics, which one that is we cannot determine?
(A) The direction of a spontaneous reaction.
(B) The extent of a reaction.
(C) The value of the equilibrium constant.
(D) The speed of a reaction.
5. Which process below will produce a decrease in the entropy for a system?
(A) Dissolving sodium chloride in water.
(B) Sublimation of naphthalene.
(C) Freezing water to form ice.
(D) Boiling water to form steam.

6. It is based on molecular orbital theory to find the bond order, what bond order of N—N bond is in the N_2^{2+} ion?
(A) 0 (B) 1 (C) 2 (D) 3
7. If we want to prepare a buffer solution, by mixing with hydrofluoric acid, water. And which one should also be added?
(A) NaF (B) NaCl (C) KBr (D) NaBr
8. The K_{sp} of $PbCl_2$ is 1.6×10^{-5} . What is the solubility (in M) of $PbCl_2$ in a 1.0 L, 0.25 M solution of HCl?
(A) 3.32×10^{-3} (B) 2.56×10^{-4} (C) 1.84×10^{-5} (D) 1.64×10^{-6}
9. Which ion below will act as a weak base in water?
(A) Cl^- (B) NO_3^- (C) OH^- (D) ClO^-
10. The reaction is exothermic and at equilibrium: $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$. Applying Le Chatelier's principle, which operation below will increase the number of moles of $SO_3(g)$?
(A) By decreasing the temperature.
(B) By removing some oxygen.
(C) By increasing the volume of the container.
(D) By decreasing the pressure.
11. When the system is at equilibrium for the gas phase reaction at 300°C:
 $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, and the equilibrium constant (K_{eq}) is 4.34×10^{-3} . Which description below for the reaction is correct?
(A) Only products are present.
(B) Only reactants are present.
(C) Reactants predominate.
(D) Roughly equal amounts of products and reactants are present.
12. Hydrogen iodide at 425°C is decomposed in a vessel into molecular hydrogen and iodine:
 $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$.
When the system comes to equilibrium, the pressures of HI, H_2 , and I_2 are 0.708 atm, 0.0960 atm, and 0.0960 atm, respectively. What is the value of the equilibrium constant (K_p)?
(A) 54.3 (B) 1.30 (C) 1.84×10^{-2} (D) 6.8×10^{-3}
13. A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and 23.5% O by mass. The molecular weight of the compound is 136 amu. What is the molecular formula? ($C = 12.01$; $H = 1.008$; $O = 16.00$)
(A) C_8H_8O (B) $C_8H_4O_2$ (C) C_4H_6O (D) $C_7H_{12}O_2$
14. The following reaction is second order in [A] and the rate constant is $0.039 M^{-1}s^{-1}$:
 $A \rightarrow B$. When the concentration of A was 0.30 M at 23s, and what was the initial concentration of A in M ?
(A) 4.7 (B) 1.2 (C) 0.41 (D) 0.27

注意：背面尚有試題

15. At elevated temperatures, dinitrogen pentoxide decomposes to nitrogen dioxide and oxygen:



If the rate of formation of NO_2 is $5.5 \times 10^{-4} \text{ M/s}$, and what is the rate of decomposition of N_2O_5 in M/s ?

- (A) 2.2×10^{-2} (B) 1.4×10^{-3} (C) 5.5×10^{-4} (D) 2.8×10^{-4}

16. At 20°C , a 2.32 M concentration of 1.0 L aqueous solution of ammonium chloride has a density of 1.0344 g/mL . The formula weight of NH_4Cl is 53.50 g/mol . What is the molality (m) of ammonium chloride in this solution?

- (A) 2.55 (B) 2.23 (C) 0.446 (D) 0.0449

17. The freezing point of the ethanol ($\text{C}_2\text{H}_5\text{OH}$) is -114.6°C . The molal freezing point depression constant for ethanol is 2.00°C/m . As a solution prepared by dissolving 50.0 g of glycerin ($\text{C}_3\text{H}_8\text{O}_3$, a nonelectrolyte) in 200 g of ethanol, and what is the freezing point ($^\circ\text{C}$)?

- (A) -135.14 (B) -123.32 (C) -120.03 (D) -114.61

18. The value of ΔH° for the reaction below is $+128.1 \text{ kJ}$:



When 15.5 g of $\text{CH}_3\text{OH}(\text{l})$ decomposes as shown in the equation, how many kJ of heat are consumed?

- (A) 62.05 (B) 48.24 (C) 32.13 (D) 28.16

19. The specific heat capacity of liquid water is $4.18 \text{ J/g}\cdot\text{K}$. To raise the temperature of 5.00 g of water from 25.1°C to 65.3°C , how many joules of heat are needed?

- (A) 261.23 (B) 532.61 (C) 840.18 (D) 1690.14

20. Given the equation:



When 24.0 grams of C_2H_6 is burned in excess oxygen gas and how many liters of CO_2 are formed at STP?

- (A) 17.92 (B) 35.84 (C) 52.16 (D) 63.27

Part II. (21~30, each 2 points)

21. Which is the correct formula for perchloric acid?

- (A) HClO (B) HClO_2 (C) HClO_3 (D) HClO_4

22. Using the VSEPR model, what is the molecular geometry for the central atom in PF_5 ?

- (A) tetrahedral (B) square planar (C) trigonal bipyramidal (D) seesaw

23. Which of the elements below has the largest electronegativity?

- (A) Si (B) Na (C) P (D) S

24. Natural rubber is too soft and chemically reactive for practical applications. Describing about the vulcanization of natural rubber entails, which one is correct?

- (A) It is a conversion of an addition polymer to a condensation polymer
 (B) It is a conversion of a condensation polymer to an addition polymer
 (C) It is a decrease in the average molecular weight of an addition polymer
 (D) It is a cross-linking reactive polymer chains with sulfur atoms

25. Natural, unpolluted is typically acidic. Which one is the source of this acidity?

- (A) HCl (B) CO_2 (C) SO_3 (D) NO_2

26. Owing to which below that a catalyst could increase the rate of a reaction?

- (A) Through increasing the activation energy of the reaction
 (B) By changing the value of the frequency factor
 (C) By providing an alternative pathway with a lower activation energy
 (D) By lowering the activation energy of reverse reaction

27. Comparing following atomic radii, which gives correct order in decreasing for Mg, Na, P, Si, and Ar?

- (A) $\text{Mg} > \text{P} > \text{Si} > \text{Ar} > \text{Na}$
 (B) $\text{Ar} > \text{Si} > \text{Na} > \text{Mg} > \text{P}$
 (C) $\text{Si} > \text{Ar} > \text{P} > \text{Na} > \text{Mg}$
 (D) $\text{Na} > \text{Mg} > \text{Si} > \text{P} > \text{Ar}$

28. Which electron configuration is the S^{2-} ion?

- (A) $[\text{Ar}]3s^23p^2$ (B) $[\text{Ar}]3s^23p^3$ (C) $[\text{Ne}]3s^23p^4$ (D) $[\text{Ne}]3s^23p^6$

29. Which is the correct relationship of volatility between vapor pressure?

- (A) They are inversely proportional to one another.
 (B) They are directly proportional to one another.
 (C) They are not related.
 (D) They are the same thing.

30. Given the electronegativities below, which covalent single bond is most polar?

Element:	H	C	N	O
Electronegativity:	2.1	2.5	3.0	3.5
(A) C—H	(B) N—H	(C) O—H	(D) O—C	