

國立臺北科技大學九十四學年度學士班轉學考試

化工系 普通化學試題

填 准 考 證 號 碼

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注意事項：

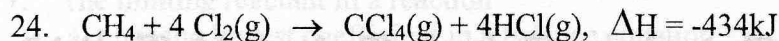
1. 本試題共 40 題，共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

Please choose a correct answer for each question (2.5 points each)

1. Which of the following represents a pair of isotopes?
a) $^{14}_6\text{C}$, $^{14}_7\text{N}$ b) ^1_1H , ^2_1H c) $^{13}_6\text{C}$, $^{14}_7\text{N}$ d) O_2 , O_3
2. Which is not the correct chemical formula for the compound named?
a) potassium phosphate K_3PO_4 b) iron (II) oxide FeO c) calcium carbonate CaCO_3
d) sodium sulfide NaS e) lithium nitrate LiNO_3
3. Indium has atomic number 49 and atomic mass 114.8g. Naturally occurring indium contain a mixture of indium-112 and indium-115, respectively, in an atomic ratio of approximately
a) 6/94 b) 25/75 c) 50/50 d) 75/75 e) 94/6
4. What is the molar mass of ethanol ($\text{C}_2\text{H}_5\text{OH}$)?
a) 45.07 b) 38.90 c) 46.07 d) 34.17 e) 62.07
5. How many molecules of ammonia are present in 4.0g of ammonia?
a) 0.23 b) 2.6×10^{24} c) 3.9×10^{25} d) 1.4×10^{23} e) 6.0×10^{23}
6. Consider the following unbalance equation:
 $\text{KO}_2 + \text{H}_2\text{O} \rightarrow \text{KOH} + \text{O}_2 + \text{H}_2\text{O}_2$
For every 3.0 mol of KO_2 , _____ mol of H_2O is need for a complete reaction.
a) 1.0 b) 2.0 c) 3.0 d) 6.0 e) none of these

7. The limiting reactant in a reaction
- has the lowest coefficient in a balance equation.
 - Is the reactant for which you have the fewest number of moles
 - has the lowest ratio of moles available/ coefficient in the balanced equation.
 - has the lowest ratio of coefficient in the balanced equation / moles available.
 - None of these
8. Which of the following solution contains the greatest total ion concentration?
- One mole of potassium chloride dissolved in 1.0 L of solution.
 - One mole of iron (II) nitrate dissolved in 1.0 L of solution.
 - One mole of potassium hydroxide dissolved in 1.0 L of solution.
 - One mole of sodium phosphate dissolved in 1.0 L of solution.
9. What volume of 10.0M potassium hydroxide is required to prepare 75.0 mL of 0.5 M KOH?
- 3.75 mL
 - 4.18 mL
 - 9.43 mL
 - 1.50 L
 - none of these
10. What is the oxidation state of chromium in $K_3Cr_2O_7$?
- +2
 - +3
 - +6
 - 2
 - 3
11. Body temperature is about 308 K. On a cold day, what volume of air at 273K Must a person with a lung capacity of 2.0 L breath in to fill the lungs?
- 2.26 L
 - 1.77 L
 - 1.13 L
 - 3.45 L
 - none of these
12. Which of the following relationship is not true?
- $PV = \text{constant}$ when temperature and moles of gas are held constant.
 - $V/T = \text{constant}$ when pressure and moles of gas are held constant.
 - $nT = \text{constant}$ when pressure and volume are held constant.
 - $P/n = \text{Constant}$ when volume and temperature are held constant.
 - All of the above are true.
13. An excess of sodium hydroxide is treated with 1.1 L of dry hydrogen chloride gas measure at STP. What is the mass of sodium chloride formed?
- 0.50 g
 - 1.8 g
 - 2.0 g
 - 2.9 g
 - 22g
14. Which of the following statement is true concerning ideal gases?
- The temperature of the gas sample is directly related to the average velocity of the gas particle
 - At STP, 1.0 L of Ar(g) contains about twice the number of atoms as 1.0 L of Ne(g) since the molar mass of Ar is bout twice that of Ne.
 - A gas exerets pressure as a result of the collisions of the gas molecules with the walls of the container.
 - the gas particles in a sample exert attraction for one another.
 - All of the above are false.

15. Which of the following statement is true?
- When two opposing process are proceeding at identical rates, the system is at equilibrium.
 - Catalysts are an effective means of changing the position of an equilibrium.
 - The concentration of the products equals that of reactants and is constant at equilibrium.
 - An endothermic reaction shifts toward reactants when heat is added to the reaction.
 - None of the above statement is true.
16. Given the equation $A(aq) + 2B(aq) \rightleftharpoons 3C(aq) + 2D(aq)$. 45.0 mL of 0.05M A is mixed with 25.0 mL 0.100 M B. At equilibrium the concentration of C is 0.0410 M. Calculate K.
- a) 7.3 b) 0.34 c) 0.040 d) 0.14 e) none of these
17. According to the Bronsted-Lowry definition, an acid is
- a substance that increases the hydroxide concentration ion concentration in a solution.
 - A substance that increase the hydrogen ion concentration ion concentration in a solution
 - A substance that can accept a proton from another species in solution
 - A substance that can donate a proton to another species.
 - An electron pair acceptor
18. The strong acid HA is added to water. Which of the following is the strongest base in the system?
- a) HA b) H_2O c) H_3O^+ d) A^- e) H_2A^-
19. Which of the following is a conjugate acid/base pair?
- a) HCl / OCl^- b) H_2SO_4 / SO_4^{2-} c) NH_4^+ / NH_3 d) H_3O^+ / OH^- e) none of these
20. A solution contains 0.45 M HA ($K_a = 2.0 \times 10^{-7}$) and 0.25 M NaA. Calculate the pH after 0.05 mole of NaOH is added to 1.00 L of this solution.
- a) 6.3 b) 6.44 c) 6.57 d) 6.70 e) none of these
21. Which of the following will not produce a buffered solution?
- 100 mL of 0.1 M Na_2CO_3 and 50 mL of 0.1 M HCl
 - 100 mL of 0.1 M $NaHCO_3$ and 25 mL of 0.2 M HCl
 - 100 mL of 0.1 M Na_2CO_3 and 75 mL of 0.2 M HCl
 - 50 mL of 0.2 M Na_2CO_3 and 5 mL of 1.0 M HCl
 - 100 mL of 0.1 M Na_2CO_3 and 50 mL of 0.1 M NaOH
22. Which of the following are state function?
- work, heat b) work, heat, enthalpy, energy c) enthalpy, energy
 - work, heat, enthalpy e) heat, enthalpy, energy
23. Calculate ΔE for a system that release 28 J of heat while 63 J of work is done on it.
- a) 35 J b) 91 J c) -35 J d) -91 J e) none of these



Base on the above reaction, what energy change occurs when 1.2 moles of methane reacts?

- a) $5.2 \times 10^5 \text{ J}$ are released b) $5.2 \times 10^5 \text{ J}$ are absorbed c) $3.6 \times 10^5 \text{ J}$ are released
d) $3.6 \times 10^5 \text{ J}$ are absorbed e) $4.4 \times 10^5 \text{ J}$ are released
25. In which reaction is ΔS° expected to be positive?
a) $\text{I}_2(\text{g}) \rightarrow \text{I}_2(\text{s})$ b) $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{s})$ c) $\text{CH}_3\text{OH}(\text{g}) + (3/2) \text{O}_2 \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
d) $2\text{O}_2(\text{g}) + 2\text{SO}(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$ e) none of these
26. For a certain process, at 300K, $\Delta G = -10.0 \text{kJ}$ and $\Delta H = -7.0 \text{kJ}$. If the process is carried out so that no useful work is performed, ΔG is
a) $+10.0 \text{ kJ}$ b) $+7.0 \text{ kJ}$ c) 0 d) -7.0 kJ e) -10.0 kJ
27. The following reaction occurs in basic solution:
 $\text{Ag}^+ + \text{Cu} \rightarrow \text{Ag} + \text{Cu}^{2+}$
When the equation is balanced, the sum of the coefficient is:
a) 4 b) 5 c) 6 d) 7 e) none of these
28. What is the oxidation state of Mn in MnO_4^- ?
a) -1 b) +7 c) +9 d) -6 e) none of these
29. How many electrons are transferred in the following reaction?
 $\text{SO}_3^{2-}(\text{aq}) + \text{MnO}_4^-(\text{aq}) \rightarrow \text{SO}_4^{2-}(\text{aq}) + \text{Mn}^{2+}(\text{aq})$
a) 6 b) 2 c) 10 d) 4 e) 3
30. Red light has a wavelength of $6.50 \times 10^2 \text{ nm}$. The energy of photon of red light is
a) $2.18 \times 10^{-19} \text{ J}$ b) $3.06 \times 10^{-19} \text{ J}$ c) $3.28 \times 10^{-18} \text{ J}$ d) $4.57 \times 10^{-20} \text{ J}$ e) none of these
31. What is the wavelength of a photon of green light (in nm) whose frequency is $5.66 \times 10^{14} \text{ Hz}$?
a) 428 nm b) 530 nm c) 684 nm d) 762 nm e) none of these
32. Atoms having greatly differing electronegativities are expected to form:
a) no bonds b) polar covalent bonds c) nonpolar covalent bonds d) ionic bonds
e) covalent bonds
33. Which of the following bonds would be the most polar without being considered ionic?
a) Mg-O b) C-O c) O-O d) Si-O e) N-O
34. How many Lewis structures does CO_3^{2-} have?
a) 1 b) 2 c) 3 d) 4 e) 5
35. Which of the following molecules contains a nitrogen atom that is sp^2 hybridized?
a) NH_3 b) NO_3^- c) N_2 d) HCN e) none of the above

36. Which of the following statements is true?
- a) Electrons are never found in an antibonding MO.
 - b) All antibonding MOs are higher in energy than the atomic orbitals of which they are composed.
 - c) Antibonding MOs have electron density mainly outside the space between the two nuclei.
 - d) None of the above is true
 - e) Two of the above statements are true.
37. The rate constant k is dependent on
- a) the concentration of the reactant
 - b) the concentration of the product
 - c) the temperature
 - d) the order of the reaction
 - e) none of these
38. Which of the following is most likely to be a gas at room temperature?
- a) Na_2S b) C_8H_{18} c) CaF_2 d) N_2 e) H_2O
39. Which of the following compounds has the highest boiling points?
- a) CH_4 b) H_2O c) NH_3 d) N_2 e) He
40. An aqueous solution contains 45.0 g KNO_3 in 250.0 mL solution. The molarity of the solution is
- a) 0.455 M KNO_3 b) 1.78 M KNO_3 c) 2.25 M KNO_3 d) 8.99 M KNO_3 e) none of these