

國立臺北科技大學 101 學年度碩士班招生考試

系所組別：3620 生化與生醫工程研究所乙組

第一節 普通化學 試題

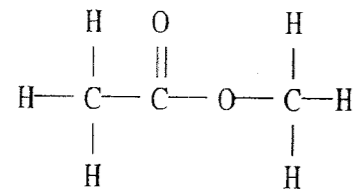
第一頁 共三頁

注意事項：

1. 本試題共四大題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、Single choice questions(Choose the best answer). (40 points, 2 points per question)

1. The compound below is a(n) _____.



- A) carboxylic acid
- B) ester
- C) ketone
- D) aldehyde
- E) amine

2. Proteins are biopolymers formed via multiple condensation coupling of which two functional groups?

- A) ester and amine
- B) alcohol and carboxylic acid
- C) alcohol and amine
- D) ester and carboxylic acid
- E) amine and carboxylic acid

3. _____ is a monosaccharide.

- A) Sucrose

- B) Maltose
- C) Glucose
- D) Lactose
- E) Starch

4. Which of the following is optically active (i.e., chiral)?

- A) $\text{HN}(\text{CH}_3)_2$
- B) CH_2Cl_2
- C) 2-Chloropropane
- D) 3-Chloropentane
- E) 2-Chlorobutane

5. Indium has atomic number 49 and atomic mass 114.8 g. Naturally occurring indium contains a mixture of indium-112 and indium-115, respectively, in an atomic ratio(indium-112 to indium-115) of approximately

- A) 6:94.
- B) 25:75.
- C) 50:50.
- D) 75:25.
- E) 94:6.

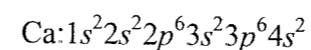
6. Consider five solutions, each of which has the same mass of solute in 100.0 mL of solution. Which has the highest concentration as measured in molarity?

- A) NaF
- B) NaCl
- C) Na_2SO_4
- D) KCl
- E) CaCl_2

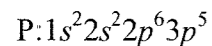
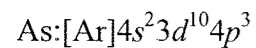
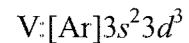
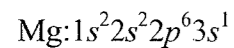
7. Which form of electromagnetic radiation has the shortest wavelengths?

- A) Microwaves
- B) Radio waves
- C) Gamma rays
- D) X-rays
- E) Infrared radiation

8. How many of the following electron configurations for the species in their ground state are correct?



注意：背面尚有試題



- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

9. Atoms that obey the octet rule and that are sp^3 hybridized form how many pi bond(s).

- A) 0
- B) 1
- C) 2
- D) 3
- E) 4

10. What metal is complexed in chlorophyll?

- A) iron
- B) chromium
- C) manganese
- D) magnesium
- E) vanadium

11. A racemic mixture is

- A) an equal mixture of both enantiomers of an optically active species.
- B) a mixture of an optically active species with an optically inactive species.
- C) an equal mixture of cis- and trans-isomers.
- D) a mixture of metal ions and ligands in equilibrium.
- E) a mixture of structural isomers.

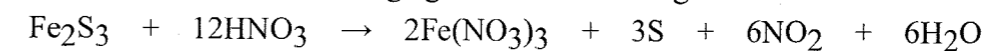
12. Isotopes of hydrogen

- A) have different atomic numbers and different mass numbers.
- B) have the same atomic number and the same mass number.
- C) have the same atomic number and different mass numbers.
- D) have different atomic numbers and the same mass number.
- E) are exactly alike.

13. Which pair of formula/name is incorrect?

- A) NO / nitrogen monoxide
- B) N_2O / dinitrogen monoxide
- C) NO_2 / nitrogen dioxide
- D) N_2O_4 / dinitrogen trioxide
- E) N_2O_5 / dinitrogen pentoxide

14. Which substance is the oxidizing agent in the following reaction?



- A) NO_2
- B) H_2O
- C) HNO_3
- D) Fe_2S_3
- E) S

15. The first law of thermodynamics can be given as _____.

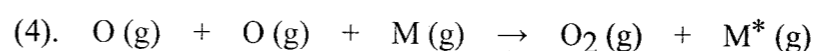
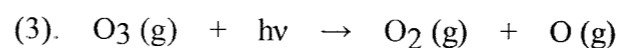
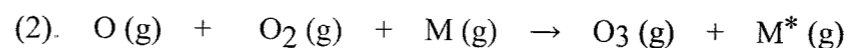
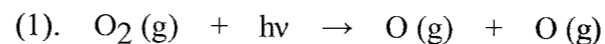
- A) $\Delta S = q_{\text{rev}}/T$ at constant temperature
- B) $\Delta H^\circ_{\text{rxn}} = \sum n\Delta H^\circ_f(\text{products}) - \sum m\Delta H^\circ_f(\text{reactants})$

C) for any spontaneous process, the entropy of the universe increases

D) the entropy of a pure crystalline substance at absolute zero is zero

E) $\Delta E = q + w$

16. Of the reactions involved in the photodecomposition of ozone (shown below), which are photochemical ?



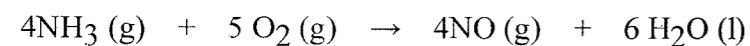
- A) (1) and (3)
- B) (1), (2), and (4)
- C) (2) and (4)
- D) (1) only
- E) all of them

17. The units of of heat capacity are _____.

- A) K/J or $^\circ\text{C}/\text{J}$
- B) J/K or $\text{J}/^\circ\text{C}$

- C) J/g-K or J/g-°C
 D) J/mol
 E) g-K/J or g-°C/J

18. Given the data in the table below, $\Delta H^\circ_{\text{rxn}}$ for the reaction



is _____ kJ.

Substance	ΔH_f° (kJ/mol)
H ₂ O (l)	-286
NO (g)	90
NO ₂ (g)	34
HNO ₃ (aq)	-207
NH ₃ (g)	-46

- A) -1172
 B) -150
 C) -1540
 D) -1892
 E) The ΔH_f° of O₂ (g) is needed for the calculation.

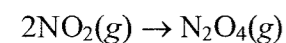
19. Aqueous solutions of a compound did not form precipitates with Cl⁻, Br⁻, I⁻, SO₄²⁻,

CO₃²⁻, PO₄³⁻, OH⁻, or S²⁻. This highly water-soluble compound produced the

foul-smelling gas H₂S when the solution was acidified. This compound is _____.

- A) Pb(NO₃)₂
 B) Li₂CO₃
 C) NaBr
 D) (NH₄)₂S
 E) AgNO₃

20. At constant pressure, the reaction



is exothermic. The reaction (as written) is

- A) always spontaneous.

- B) spontaneous at low temperatures, but not at high temperatures.
 C) spontaneous at high temperatures, but not at low temperatures.
 D) never spontaneous.
 E) ΔH is positive.

二. Explain the following terms (25 points, 5 points per question).

- Alkanes
- The Common-Ion Effect
- Brønsted-Lowry Acid and Base
- Oxidation-Reduction Reactions
- Limiting Reactants

三. Answer the following questions (20 points, 5 points per question).

- Draw and name the isomers of pentane.
- What is the secondary structure of polypeptides?
- What is the net ionic equation for the reaction between aqueous sulfuric acid and aqueous sodium hydroxide?
- Which one is the strongest intermolecular force experienced by noble gases? When a water molecule forms a hydrogen bond with another water molecule, which atoms are involved in the interaction?

四. Answer the following questions (15 points).

- A buffer is made by adding 0.300 mol acetic acid (HC₂H₃O₂) and 0.300 mol NaC₂H₃O₂ to enough water to make 1.00 L of solution. The pH of the buffer is 4.74. Calculate the pH of this solution after 0.020 mol of NaOH is added. (10%)
- For a second-order reaction
 $aA \rightarrow \text{Products}$
 the first half-life is 20 minutes. What is the second half-life? (2%) Why? (3%)

