國立中山大學114學年度
碩士班考試入學招生考試試題

科目名稱：普通化學【海資系碩士班選考】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答。
- 答案卡請以2B鉛筆劃記，不可使用修正液（帶）塗改，未使用2B鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶書籍、紙張（應考證不得做計算紙書寫）、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**
- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

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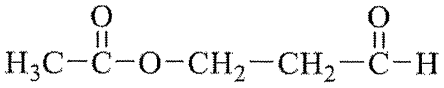
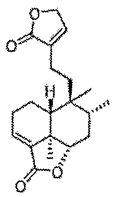
※本科目依簡章規定「不可以」使用計算機(混合題)　　

單選題(每題4分) **Single Choice Questions (4 points each, 20 questions in total)**

1. Which of the following species is a weak acid in aqueous solution?
   (A) HCl (B) HNO_3 (C) CH_3COOH (D) H_2SO_4
2. Identify all the functional groups present in the following organic compound: 1) ketone, 2) aldehyde, 3) acid, 4) alcohol, 5) ether, 6) ester, 7) amine.



   (A) 2, 5 (B) 1, 2 (C) 1, 2, 5 (D) 2, 6 (E) none of these
3. For an exothermic reaction to be nonspontaneous at high temperature, which of the following conditions must be met?
   (A) $\Delta H < 0, \Delta S < 0, \Delta G > 0$ (B) $H < 0, \Delta S > 0, \Delta G > 0$ (C) $H < 0, \Delta S < 0, \Delta G < 0$
   (D) $\Delta H > 0, \Delta S > 0, \Delta G > 0$ (E) none of these
4. What is the molarity of a solution prepared by dissolving 1 mole of NaCl in 2 liters of water?
   (A) 0.25 M (B) 0.50 M (C) 1.00 M (D) 2.00 M
5. The rate law for a reaction is given as **Rate = k[A][B]²**. What is the overall order of the reaction?
   (A) 1 (B) 2 (C) 3 (D) 4
6. Give the number of protons (p), neutrons (n), and electrons (e) in one atom of ^{137}Ba
   (A) 137 p, 81 n, 56 e (B) 81 p, 56 n, 81 e (C) 56 p, 81 n, 56 e (D) 56 p, 137 n, 56 e
   (E) none of these
7. How many chiral centers of following compound? (A)8 (B)7 (C)6 (D)5 (E)4



8. The dominant intermolecular forces in pentane (C_5H_{12}) molecules are
   (A) covalent bonds (B) polar covalent bonds (C) dipole-dipole forces
   (D) hydrogen bonding (E) London dispersion forces
9. What is the oxidation number of phosphorus in H_3PO_4?
   (A) +1 (B) +3 (C) +5 (D) +7
10. What is the shape of the molecule XeF_4?
    (A) Tetrahedral (B) Square planar (C) Trigonal bipyramidal (D) See-saw
11. Which of the following orbitals can hold a maximum of 10 electrons?
    (A) s orbital (B) p orbital (C) d orbital (D) f orbital
12. Among the following statements regarding buffer solutions, which one is incorrect?
    (A) Buffer solutions also exhibit a common ion effect.
    (B) The pH value of a buffer solution will not undergo significant changes upon the addition of an acid or base.
    (C) Buffer solutions are composed of a weak acid and its salt or a weak base and its salt.
    (D) Blood is also a type of buffer solution.
13. According to ideal gas law, what happen to the pressure of a gas when its volume is halved while keeping temperature constant?
    (A) pressure is halved (B) pressure remains the same (C) pressure is double (D) pressure is quadruple
14. The number of carbon atoms in 0.080 mol of $C_6H_{12}O_6$ is
    (A) 2.89×10^{23} C atoms (B) 5.78×10^{23} C atoms (C) 8.20×10^{23} C atoms
    (D) 1.45×10^{23} C atoms (E) none of these
15. The electron configuration of a nitrogen atom?

(A) $1S^2 2S^2 2P^2$ (B) $1S^2 2S^2 2P^1$ (C) $1S^2 2S^2 2P^3$ (D) $1S^2 2S^2 2P^4$ (E) $1S^2 2S^2 2P^6$

16. Among the following compounds, which one, when added to litmus solution, turns it blue?
(A) Cl_2 (B) CO_2 (C) CaO (D) SO_2

17. Which of the following is a state function?
(A) Work (B) Heat (C) Enthalpy (D) Time (E) None

18. A change of state that occurs in a system is accompanied by 5.8 kJ of heat, which is transferred to the surroundings at a constant pressure and a constant temperature of 290 K. For this process ΔS_{surr} (J/k) is:
(A) +5800 (B) -5.8 (C) +20 (D) 0 (E) none of these

19. Which one of the following statements about ion exchange resins is incorrect?
(A) They can be classified into cation exchange resins and anion exchange resins.
(B) The exchangeable functional groups of cation exchange resins carry a negative charge.
(C) The exchangeable functional groups of anion exchange resins are anions.
(D) Ion exchange resins can be used to soften hard water.

20. Select the correct name for the compound with the formula $CH_3CH_2CH_2CH_2OH$.
(A) ethanol (B) butanol (C) pentanol (D) propanol (E) none of these

問答題 **Essay Question**

1. Write down the structure of the following functional group or organic compound (A)aldehydes (B) amide (C) ethanol (D) hexane (E) ethers (各 2 分)

2. Balance the following equation using oxidation states. (5 分)

$$MnO_4^-(aq) + Fe^{2+}(aq) \xrightarrow{\text{acidic}} Mn^{2+}(aq) + Fe^{3+}(aq)$$

3. Describe in detail how to prepare 50 mL of 0.150 M NaCl aqueous solution from the solid. (molar mass for Na = 22.99 g/mol, Cl = 35.45 g/mol) (5 分)