

一、申論題 (50%)

1. 何謂有性生殖、無性生殖 (5 分)，比較有性生殖與無性生殖的優勢與劣勢 (20 分)。
2. 詳述細胞間如何傳遞訊息 (25 分)

二、選擇題 (50%)

下列各題為單選題，每題 2 分，答錯者每題倒扣 0.5 分

1. 在化磷酸化反應中促使 ATP 合成的直接能量來源是：
  - a. 葡萄糖以及其它有機化合物的氧
  - b. 釋能反應的電子流向電子傳遞鏈
  - c. 電子對氧的親和
  - d. 粒線體內膜的兩端  $H^+$  濃度的不同
  - e. 磷酸鹽由克氏循環的中間產物移轉到 ADP 上
2. 雨使某個特定湖泊的 pH 降低為 4.0. 該湖泊的氫氧離子濃度為
  - a.  $10^{-7}M$
  - b.  $10^{-4}M$
  - c.  $10^{-10}M$
  - d.  $10^{-14}M$
  - e.  $10M$
3. 多數細胞無法利用熱來做功是因為
  - a. 熱不屬於能量的型式
  - b. 細胞沒有多少熱；它們相當冷
  - c. 細胞內通常溫度均衡
  - d. 自然界沒有用熱來做功的機轉
  - e. 熱會使酵素變性
4. 下列構造和功能的配對何者是錯誤的
  - a. 核仁——製造核糖體
  - b. 溶體——細胞內消化
  - c. 核糖體——合成蛋白質
  - d. 高基氏體——細胞產物的分泌
  - e. 微管——肌肉收縮
5. 下列何者可能是第一個原核生物？
  - a. 藍菌
  - b. 可以非生命性程序來產生有機物質的化學自營菌
  - c. 厭氧光合自營菌
  - d. 黴漿菌
  - e. 寄生性細菌
6. 在分類系統上，有色界(kingdom Chromista)的界部份是因其具有
  - a. 來自真核性內共生的葉綠體
  - b. 來自藍菌的葉綠體
  - c. 粒線體
  - d. 葉綠素 a
  - e. 異營性的營養型式
7. 動物界的兩側對稱體制和下列那項特性最有關連性？
  - a. 對於各個方向具相同感應力
  - b. 骨骼的存在
  - c. 運動、主動獵食和逃逸
  - d. 真體腔的發生
  - e. 陸生環境的適應
8. 在直立菌絲頂端產生無性孢子的孢子囊是何者的特徵？
  - a. 子囊菌
  - b. 擔子菌
  - c. 不完全菌
  - d. 接合菌
  - e. 地衣



9. 只有在下列何種情況下，不同原生體(protobionts)的競爭才會產生演化上的改良？  
a.它們具有催化化學反應的能力    b.發展出某種遺傳的能力    c.可以生長和繁殖  
d.原生體獲得選擇性通透膜    e. DNA 第一次出現時
10. 哺乳類及鳥類胚胎的鰓囊為  
a.殘遺構造    b.支持“個體發生歷史重演種系發生歷史”    c.同源構造    d. 胚胎利用它來呼吸    e.身體不用構造退化的證據
11. 下列那項特徵，為具有橫膈的動物所特有？  
a.毛髮    b.羽毛    c.鱗片    d.肺臟    e.潮濕的皮膚
12. 下列那一項不屬於組織的分類層級  
a.軟骨    b.胃的黏膜內襯    c.血液    d.腦    e.心肌
13. 下列那一種酵素，具有最低的 pH 值最適度  
a.唾液澱粉    b.胰蛋白酶    c.胃蛋白酶    d.胰澱粉酶    e.胰脂肪酶
14. 下列那種動物缺乏消化管(完全消化系統)  
a.蚯蚓    b.水母    c.昆蟲    d.魚類    e.鳥類
15. 脈搏是直接在測量什麼？  
a.血壓    b.心搏出量    c.心輸出量    d.心跳速率    e.呼吸速率
16. 在負壓呼吸中，吸氣主要因為  
a 用力將室氣由胸腔壓入肺臟    b.橫隔收縮    c.肋間肌舒張    d.利用肺部肌肉，使肺泡擴張    e.腹肌收縮
17. 下列那一項非局部發炎反應的早期特徵  
a.微血管之通透性增加    b..細胞毒性 T 細胞的攻擊    c.凝血蛋白的釋出  
d.組織胺的釋出    e.血管擴張
18. 腎元中那一步驟，最不具選擇性  
a.分泌作用    b.再吸收作用    c.通過集尿管的運輸作用    d.過濾作用    e. 亨氏環中，鹽分的主動唧出
19. 下列那一項有關心肌的敘述為正確的  
a.它們的肌動蛋白與肌凝蛋白缺乏規則的排列    b.它們的肌漿膜較不發達，故而其收縮較平滑肌細胞緩慢  
c.細胞間以心間盤相連，透過此構造，動作電位可快



- 速傳給心臟的每個細胞 d.其靜止膜電位較動作電位的閾電位，來得更正值 e. 僅在受到神經元刺激時，才會收縮
20. 神傳遞物質之受器，座落  
a.軸突前端      b.位於朗氏結的軸突胞膜上      c.突觸後神經膜      d.突觸小泡的單位膜  
e.突觸前神經膜
21. 一般來說，沙漠出現的緯度是在  
a.乾燥氣流下降      b.潮濕氣流下之降      c.乾燥氣流上升      d.上升氣流產生無風帶  
e.氣團靜止不移動處
22. 一個族群均勻散佈的形式可能代表著  
a.此族群向外擴展及擴張範圍      b.資源的分佈是不均質的(heterogeneous)  
c.群中的個體在競爭一些資源，如植物競爭水與礦物養分、動物競爭巢位等  
d.在個體間沒有強烈的吸引或排斥現象      e.族群的密度相當低
23. 根據島嶼生物地理學的理论，島上的種量豐度將在何時達到最高  
a.小而遙遠者      b.大而遙遠者      c.大而靠近大陸      d.小而靠近大陸      e. 環境均質化
24. 分解者在氮循環中的角色是  
a.將氮固定為銨      b.將有機化物中的氮釋出，並隨後回到土壤中      c.將氮去氮並將氮回歸大氣  
d.將氮轉變為植物可吸收的硝酸鹽      e.將氮併入胺基酸以及有機化物中
25. 先天對後天爭論的中心點是：  
a.行為的最終與直接原因的區別      b.學習行為中基因的角色      c.動物是否具有意識感覺或是思想  
d.動物行為的程度是為本能或是學習而來的      e.良好親代照顧的重要性



# 國立中山大學 97 學年度轉學生招生考試試題

科目：普通化學【海資系二年級、海工系二年級】

共 3 頁 第 1 頁

選擇題 (均為單選，每題 4 分，答錯倒扣 1 分，未作答則不計分亦不倒扣。)

1. ( ) Which of the following elements is diamagnetic ?  
(A) H (B) Li (C) Be (D) B (E) C
2. ( ) Which of the following rules states that no two electrons in an atom can have the same set of quantum numbers ?  
(A) Hund's rule (B) The Heisenberg Uncertainty principle (C) The Pauli Exclusion principle (D) The de Broglie hypothesis (E) The Bohr model
3. ( ) Which of the following is true of the alkali metal elements ?  
(A) They usually take the +2 oxidation state. (B) They have oxides that act as acid anhydrides.  
(C) They form covalent bonds with oxygen. (D) They are generally found in nature in compounds. (E) They have relatively large first ionization energies.
4. ( ) Which of the following ions has the smallest ionic radius ?  
(A)  $O^{2-}$  (B)  $F^-$  (C)  $Na^+$  (D)  $Mg^{2+}$  (E)  $Al^{3+}$
5. ( ) Which of the following is an impossible set of quantum numbers ( $n, l, m_l, m_s$ ) ?  
(A) 4, 0, 0,  $\frac{1}{2}$  (B) 4, 0, 1,  $\frac{1}{2}$  (C) 4, 1, 0,  $\frac{1}{2}$  (D) 4, 1, 1,  $\frac{1}{2}$   
(E) 4, 2, 1,  $\frac{1}{2}$
6. ( ) Which of the following species does NOT have a tetrahedral structure ?  
(A)  $CH_4$  (B)  $NH_4^+$  (C)  $SF_4$  (D)  $AlCl_4^-$  (E)  $CBr_4$
7. ( ) In which of the following species does the central atom NOT form  $sp^2$  hybrid orbitals ?  
(A)  $SO_2$  (B)  $BF_3$  (C)  $NO_3^-$  (D)  $SO_3$  (E)  $PCl_3$
8. ( ) Which of the molecules listed below has the largest dipole moment ?  
(A)  $Cl_2$  (B)  $HCl$  (C)  $SO_3$  (D)  $NO$  (E)  $N_2$
9. ( ) A gaseous mixture at  $25^\circ C$  contained 1 mole of  $CH_4$  and 2 moles of  $O_2$  and the pressure was measured at 2 atm. The gases then underwent the reaction shown below.  
$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$
  
What was the pressure in the container after the reaction had gone to completion and the temperature was allowed to return to  $25^\circ C$  ?  
(A) 1 atm (B) 2 atm (C) 3 atm (D) 4 atm (E) 5 atm
10. ( ) A 22.0 gram sample of an unknown gas occupies 11.2 liters at standard temperature and pressure. Which of the following could be the identity of the gas ?  
(A)  $CO_2$  (B)  $SO_3$  (C)  $O_2$  (D)  $N_2$  (E) He
11. ( ) Which of the following conditions would be most likely to cause the ideal gas laws to fail ?  
I. High pressure  
II. High temperature  
III. Large volume  
(A) I only (B) II only (C) I and II only (D) I and III only (E) II and III only

【背面還有試題】



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科目：普通化學【海資系二年級、海工系二年級】

共 3 頁 第 2 頁

12. ( ) Which of the following gases would be expected to have a rate of effusion that is three times as large as that of  $H_2$  ?  
 (A)  $O_2$  (B)  $N_2$  (C) He (D)  $H_2O$  (E)  $CO_2$
13. ( ) Which of the following is true of a substance in equilibrium in the liquid phase ?  
 (A) Its temperature must be less than  $100^\circ C$ . (B) Its temperature must be greater than  $0^\circ C$ . (C) Its temperature must be lower than that of the surrounding atmosphere. (D) Its vapor pressure must be greater than the pressure of the surrounding atmosphere. (E) Its vapor pressure must be lower than the pressure of the surrounding atmosphere.
14. ( )  $2Al(s) + 3Cl_2(g) \rightarrow 2AlCl_3(s)$   
 The reaction above is not spontaneous under standard conditions but becomes spontaneous as the temperature decreases towards absolute zero. Which of the following is true at standard conditions ?  
 (A)  $\Delta S$  and  $\Delta H$  are both negative. (B)  $\Delta S$  and  $\Delta H$  are both positive.  
 (C)  $\Delta S$  is negative and  $\Delta H$  is positive. (D)  $\Delta S$  is positive and  $\Delta H$  is negative.  
 (E)  $\Delta S$  and  $\Delta H$  are both equal to zero.
15. ( ) If an endothermic reaction is spontaneous at 298K, which of the following must be true for the reaction ?  
 I.  $\Delta G$  is greater than zero.  
 II.  $\Delta H$  is greater than zero.  
 III.  $\Delta S$  is greater than zero.  
 (A) I only (B) II only (C) I and II only (D) II and III only (E) I, II, and III
16. ( )  $H_2(g) + F_2(g) \rightarrow 2HF(g)$   
 Gaseous hydrogen and fluorine combine in the reaction above to form hydrogen fluoride with an enthalpy change of  $-540 kJ$ . What is the value of the heat of formation of  $HF(g)$  ?  
 (A)  $-1080 kJ/mol$ . (B)  $-540 kJ/mol$ . (C)  $-270 kJ/mol$ . (D)  $270 kJ/mol$ . (E)  $540 kJ/mol$ .
17. ( ) Which of the following aqueous solutions has the highest boiling point ?  
 (A)  $0.5m NaCl$  (B)  $0.5m KBr$  (C)  $0.5m CaCl_2$  (D)  $0.5m C_6H_{12}O_6$  (E)  $0.5m NaNO_3$
18. ( ) A student added 1 liter of a  $1.0 M KCl$  solution to 1 liter of a  $1.0 M Pb(NO_3)_2$  solution. A lead chloride precipitate formed and nearly all of the lead ions disappeared from the solution. Which of the following lists the ions remaining in the solution in order of decreasing concentration ?  
 (A)  $[NO_3^-] > [K^+] > [Pb^{2+}]$  (B)  $[NO_3^-] > [Pb^{2+}] > [K^+]$  (C)  $[K^+] > [Pb^{2+}] > [NO_3^-]$   
 (D)  $[K^+] > [NO_3^-] > [Pb^{2+}]$  (E)  $[Pb^{2+}] > [NO_3^-] > [K^+]$
19. ( ) The solubility of  $PbS$  in water is  $3 \times 10^{-14}$  molar. What is the solubility product constant,  $K_{sp}$ , for  $PbS$  ?  
 (A)  $2 \times 10^{-7}$  (B)  $9 \times 10^{-7}$  (C)  $3 \times 10^{-14}$  (D)  $3 \times 10^{-28}$  (E)  $9 \times 10^{-28}$
20. ( ) For a particular salt, the solution process is endothermic. As the temperature at which the salt is dissolved increases, which of the following will occur ?  
 (A)  $K_{sp}$  will increase and the salt will become more soluble. (B)  $K_{sp}$  will decrease and the salt will become more soluble. (C)  $K_{sp}$  will increase and the salt will become less soluble. (D)  $K_{sp}$  will decrease and the salt will become less soluble. (E)  $K_{sp}$  will not change and the salt will become more soluble.



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共 3 頁 第 3 頁

21. ( ) Which of the following expressions is equal to the hydrogen ion concentration of a 1-molar solution of a very weak monoprotic acid, HA, with an ionization constant  $K_a$  ?  
(A)  $K_a$  (B)  $K_a^2$  (C)  $2K_a$  (D)  $2K_a^2$  (E)  $\sqrt{K_a}$

22. ( ) A multistep reaction takes place by the following mechanism ?



Which of the species shown above is an intermediate in the reaction ?

(A) A (B) B (C) C (D) D (E) E

23. ( )  $A+B \rightarrow C+D$

The rate law for the hypothetical reaction shown above is as follows:

$$\text{Rate} = k [A]$$

Which of the following changes to the system will increase the rate of the reaction ?

- I. An increase in the concentration of A.
- II. An increase in the concentration of B.
- III. An increase in the temperature.

(A) I only (B) I and II only (C) I and III only (D) II and III only (E) I, II, and III

24. ( ) Which of the following is true of the oxidation-reaction that takes place in a galvanic cell under standard conditions ?

- (A)  $G^\circ$  and  $E^\circ$  are positive and  $K_{eq}$  is greater than 1.
- (B)  $G^\circ$  is negative,  $E^\circ$  is positive, and  $K_{eq}$  is greater than 1.
- (C)  $G^\circ$  is positive,  $E^\circ$  is negative, and  $K_{eq}$  is less than 1.
- (D)  $G^\circ$  and  $E^\circ$  are negative and  $K_{eq}$  is greater than 1.
- (E)  $G^\circ$  and  $E^\circ$  are negative and  $K_{eq}$  is less than 1.

25. ( ) A sample of radioactive material undergoing nuclear decay is found to contain only potassium and calcium. The sample could be undergoing which of the following decay processes ?

- I. Beta ( $\beta^-$ ) decay .
- II. Alpha decay .
- III. Electron capture .

(A) I only (B) II only (C) I and III only (D) II and III only  
(E) I, II, and III