注意：考試開始鈴響前，不可以翻閱試題

台灣聯合大學系統 111 學年度學士班轉學考試題

考試科目：普通化學

組別：A6

參考用

—作答注意事項—

1. 作答中如發現試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
2. 請核對答案卷（卡）上之准考證號、考試科目是否正確。
3. 本考科禁止使用計算器。
4. 選擇題請在答案卡上作答。
5. **考生限在作答區內作答，不可書寫姓名、准考證號或與作答無關之其他文字或符號。**
6. 答案卷用盡不得要求增加。
7. 答案卷限用藍筆或黑色鋼筆、原子筆或鉛筆書寫；答案卡限用 2B 軟心鉛筆畫記，如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果考生自行負責。
8. 因字跡潦草或作答未標明題號等情事，致評閱人員無法辨識答案者，該部分不予計分。

Multiple choice questions: (答錯不倒扣)

1. How many types of Bravais lattices do we have? (5%)
(A) 7, (B) 10, (C) 12, (D) 14, (E) 16

2. Select the liquid-liquid solution that reveals a negative deviation from Raoult's law. (5%)
(A) benzene-toluene, (B) ethanol-hexane, (C) acetone-water, (D) heptane-water, (E) heptane-hexane.

3. Which of the following combinations has the same number of electrons? (5%)
(A) Ne & S^{2-}, (B) Cu^{+} & K^{+}, (C) Mg^{2+} & Be^{2+}, (D) Al^{3+} & F^{-}, (E) Si & Ca^{2+}.

4. For a reversible reaction A + B ⇌ C + D, the enthalpy change and activation energy of the forward reaction are -20.0 kJ/mol and 85.0 kJ/mol, respectively. What is the activation energy of the reverse reaction? (5%)
(A) 65.0 kJ/mol, (B) -105.0 kJ/mol, (C) -65.0 kJ/mol, (D) 105.0 kJ/mol, (E) 130.0 kJ/mol.

5. Which of the following acids and its sodium salt are the best combination for buffering a solution at pH 4.30? (5%)
(A) benzoic acid ($K_a = 6.4\times10^{-5}$), (B) propanoic acid ($K_a = 1.3\times10^{-5}$), (C) chloroacetic acid ($K_a = 1.35\times10^{-3}$), (D) hypochlorous acid ($K_a = 3.5\times10^{-8}$), (E) all of the above are similar

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6. Which of the following substances are likely to be soluble in water? (5%)
(A) aluminum nitrate, (B) lead(II) sulfide, (C) nickel(II) hydroxide, (D) silver chloride, (E) barium chromate.

7. For the synthesis of ammonia at 500°C, the equilibrium constant is 6.0×10^{-2}. Determine which system in the following cases will shift toward the product? (5%)

i. $[NH_3]_0 = 1.0 \times 10^{-3}\ M$; $[N_2]_0 = 1.0 \times 10^{-5}\ M$; $[H_2]_0 = 2.0 \times 10^{-3}\ M$

ii. $[NH_3]_0 = 2.0 \times 10^{-4}\ M$; $[N_2]_0 = 1.50 \times 10^{-5}\ M$; $[H_2]_0 = 2.0 \times 10^{-1}\ M$

iii. $[NH_3]_0 = 1.0 \times 10^{-4}\ M$; $[N_2]_0 = 5.0\ M$; $[H_2]_0 = 1.0 \times 10^{-2}\ M$

(A) only i, (B) only ii, (C) only iii, (D) i & ii, (E) i & iii.

8. Which has the largest ion size? (5%)
(A) Li^+, (B) F^-, (C) Br^-, (D) Mg^{2+}, (E) Ga^{3+}.

9. Which of the following electrolytes has the biggest difference between its expected and observed values of the van't Hoff factor? Assume the concentrations for all the electrolyte solutions are 0.05 *m*. (5%)
(A) NaCl, (B) $MgCl_2$, (C) HCl, (D) $MgSO_4$, (E) Glucose.

10. How is the central atom in XeF_4 hybridized? (5%)
(A) sp, (B) sp^2, (C) sp^3, (D) dsp^3, (E) d^2sp^3.

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11. Select the reaction order of the following reaction for which the half-life of reactant A is independent of its initial concentration. (5%)

aA → products

(A) zero order, (B) first order, (C) second order, (D) both zero and first orders, (E) both zero and second orders.

12. What kind of orbitals of carbon atoms are used to form π molecular orbitals in a benzene molecule? (5%)

(A) *s* orbitals, (B) *p* orbitals, (C) *sp* orbitals, (D) sp^2 orbitals, (E) sp^3 orbitals.

13. Calculate the formal charge for the central atom of a sulfate ion with the most stable Lewis structure. (5%)

(A) -2, (B) -1, (C) 0, (D) 1, (E) 2.

14. Determine the pH at the second equivalent point for the titration of a H_3PO_4 solution with NaOH. (5%)

(A) pH = pK_{a1}, (B) pH = pK_{a2}, (C) pH = pK_{a3}, (D) pH = $(pK_{a1}+pK_{a2})/2$, (E) pH = $(pK_{a2}+pK_{a3})/2$.

15. Which of the following sets of quantum numbers is allowed in the hydrogen atom? (5%)

(A) $n = 3$, $\ell = 2$, $m_\ell = 2$, (B) $n = 4$, $\ell = 3$, $m_\ell = 4$, (C) $n = 0$, $\ell = 0$, $m_\ell = 0$, (D) $n = 2$, $\ell = -1$, $m_\ell = 1$, (E) $n = 1$, $\ell = 1$, $m_\ell = 0$.

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16. What is the bond order for a B_2 molecule? (5%)
(A) 0, (B) 1, (C) 2, (D) 3, (E) 4.

17. The maximum possible useful work obtainable from a process at constant pressure and temperature is equal to the change of which of the following thermodynamic properties? (5%)
(A) internal energy, (B) enthalpy, (C) entropy, (D) free energy, (E) none of the above.

18. As you move from top to bottom on the periodic table, what generally happens to the ionization energy? (5%)
(A) it increases, (B) it remains constant, (C) it cannot be determined, (D) it decreases, (E) it increases then decreases.

19. Which of the following electromagnetic radiations has the largest wavelength? (5%)
(A) X ray, (B) Infrared, (C) γ ray, (D) Visible light, (E) Ultraviolet.

20. Which of the following molecules does not totally obey the octet rule? (5%)
(A) SF_6, (B) Ne, (C) CO_2, (D) CCl_4, (E) N_2.