

國立高雄師範大學九十三年度碩士班招生考試試題

系所別：科學教育研究所

科目：化學（共 2 頁）

1~20 題為選擇題，每小題 3 分

1. Which answer has the correct number of significant figure? (a) $(10.46 + 1.7394)/12.2 = 1.000$; (b) $(14.234 + 0.005169) / 0.1243 = 115$; (c) $(0.723 + 9.746) / 15.493 = 0.6757$; (d) $(300.4 + 0.00216) / 9.18745 = 32.697$; (e) none of these.
2. $^{35}\text{Cl}^-$, ^{40}Ar , and $^{39}\text{K}^+$ all have the same (a) mass number; (b) atomic number; (c) number of electrons; (d) number of neutrons; (e) none of these.
3. A compound contains 46.7% N and 53.3% O. What is the empirical formula of this compound? (a) NO; (b) NO₂; (c) N₂O₃; (d) N₂O (e) none of these.
4. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ has an 85% yield. What mass of NH₃(g) is produced from 12.0 g N₂(g)? (a) $(12.0/28.0)(2)(17.0)(0.85)$; (b) $(12.0/14.0)(2)(17.0/0.85)$; (c) $(12.0/28.0)(2)(17.0/0.85)$; (d) $(12.0/14.0)(2)(17.0)(0.85)$; (e) none of these.
5. $\text{Cr}_2\text{O}_7^{2-} + \text{I}^- + \text{H}^+ \rightarrow \text{Cr}^{3+} + \text{I}_2 + \text{H}_2\text{O}$ When the smallest whole number coefficients are used, the correct coefficient for I⁻ in the balanced equation is (a) 2; (b) 3; (c) 6; (d) 14; (e) none of these.
6. The ideal gas constant has the value of 0.08206. The unit of this number is (a) L atm mol⁻¹ K⁻¹; (b) L mmHg mol⁻¹ K⁻¹; (c) mL mmHg mol⁻¹ K⁻¹; (d) mL atm mol⁻¹ K⁻¹; (e) none of these.
7. $\Delta H_f^0(\text{NH}_3(\text{g})) = -46.0 \text{ kJ/mol}$; $\Delta H_f^0(\text{O}_2(\text{g})) = 0.00 \text{ kJ/mol}$; $\Delta H_f^0(\text{N}_2(\text{g})) = 0.00 \text{ kJ/mol}$; $\Delta H_f^0(\text{H}_2\text{O}(\text{g})) = -241.8 \text{ kJ/mol}$.
 ΔH_{rex}^0 of $\text{NH}_3(\text{g}) + 3/4 \text{ O}_2(\text{g}) \rightarrow 1/2 \text{ N}_2(\text{g}) + 3/2 \text{ H}_2\text{O}(\text{g})$ in kJ/mol is (a) -195.8; (b) +408.8; (c) -408.8; (d) -316.7; (e) none of these.
8. NH₃ form a fertilizer by reacting with all EXCEPT (a) H₂SO₄; (b) H₃PO₄; (c) CO₂; (d) HCl; (e) HNO₃.
9. Radiation with a frequency of $3 \times 10^{15} \text{ Hz}$ has a wavelength of (a) 10 nm; (b) 100 nm; (c) 1000 nm; (d) 10000 nm; (e) none of these.
10. In general, the ionization potentials of elements decrease as one proceeds in the periodic table (a) bottom → top and right → left; (b) top → bottom and right → left; (c) bottom → top and left → right; (d) top → bottom and left → right; (e) none of these.
11. Which molecule has no polar bond? (a) H₂CO; (b) CCl₄; (c) OF₂; (d) N₂O; (e) none of these.
12. The hybridization of Br in BrF₃ is (a) not hybridized; (b) sp³d²; (c) sp³d; (d) sp³; (e) none of these.
13. A face-centered cubic cell of a metallic element contain all or part of how many different atom? (a) 2; (b) 6; (c) 8; (d) 14; (e) none of these.
14. What volume (in liters) of 0.0325 M solution can be produced from 41.6 mL of 0.742 M solution? (a) $41.6(0.742/0.0325)$; (b) $41.6(0.0325/0.742)$; (c) $(41.6/1000)(0.0325/0.742)$; (d) $(1000/41.6)(0.742/0.0325)$; (e) none of these.
15. The unit of a first-order rate constant could be (a) s⁻¹; (b) M⁻¹; (c) M⁻¹ s⁻¹; (d) M s; (e) none of these.
16. For the reaction $2\text{N}_2\text{O}(\text{g}) + \text{N}_2\text{H}_4(\text{g}) \rightarrow 3\text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$, K_p equals (a) K_c; (b) RT/K_c; (c) K_c(RT)²; (d) K_c/RT; (e) none of these.
17. A 2.4 M solution of a weak base has [OH⁻] = 0.0034 M. What is K_b of this base? (a) 0.0034; (b) $0.0034/2.4$; (c) $(2.4)^2/0.0034$; (d) $(0.0034/2.4)^2$; (e) none of these.
18. A weak acid HA has K_a = 1.4×10^{-3} . In order to produce a solution with [H⁺] = 5.6×10^{-3} , the ratio [A⁻]/[HA] must equal (a) 4.0; (b) 0.25; (c) 2.0; (d) 1.0; (e) none of these.
19. A solution has [F⁻] = $1.4 \times 10^{-5} \text{ M}$. What is the maximum [Ca²⁺] that can be present before CaF₂ (K_{sp} = 2.7×10^{-11}) will precipitate? (a) 1.4×10^{-5} ; (b) 7×10^{-6} ; (c) 3.5×10^{-6} ; (d) 5.6×10^{-5} ; (e) none of these.
20. For $\text{Cl}_2(\text{g}) + \text{F}_2(\text{g}) \rightarrow 2\text{ClF}(\text{g})$, $\Delta H^0 = -11.3 \text{ kJ/mol}$, and $\Delta S^0 = 9.25 \text{ J mol}^{-1} \text{ K}^{-1}$. As temperature decrease for this

reaction, (a) it eventually becomes nonspontaneous; (b) ΔG^0 decreases; (c) it reach equilibrium; (d) it shifts left; (e) none of these.

21. 解釋下列之名詞: (30%)

- 甲、paramagnetism
- 乙、Aufbau procedure
- 丙、stereoisomerism
- 丁、disproportionation
- 戊、solvation
- 己、solvent-system definition of acids and bases
- 庚、Jahn-Teller effect
- 辛、Zero-order reaction
- 壬、Uncertainty principle
- 癸、Three-center two-electron bond

22. 用 VSEPR 理論來預測下列分子的形狀: (10%)

- 甲、 SCl_2
- 乙、 SOCl_2
- 丙、 SF_4
- 丁、 SF_6
- 戊、 ClF_3