

選擇題，共 25 題，每題 4 分，共 100 分，答錯不倒扣。

1. Which of the following atomic symbols (原子符號) is incorrect?

(a) ${}^{14}_6\text{C}$, (b) ${}^{37}_{17}\text{Cl}$, (c) ${}^{32}_{15}\text{P}$, (d) ${}^{39}_{19}\text{K}$, (e) ${}^{14}_8\text{N}$.

2. One molecule of a compound weighs 2.03×10^{-22} g. Its molar mass (分子量) is:

(a) 48.0 g/mol, (b) 92.1 g/mol, (c) 114 g/mol, (d) 122 g/mol, (e) none of these.

3. A 2.00-g sample of an oxide of bromine is converted to 2.936 g of AgBr. Calculate the empirical formula (實驗式) of the oxide. (AgBr = 187.78 and Br = 79.90)

(a) BrO_3 , (b) BrO_2 , (c) BrO , (d) Br_2O , (e) none of these.

4. What mass of calcium chloride, CaCl_2 ($\text{CaCl}_2 = 110.98$) is needed to prepare 2.850 L of a 1.56 M solution?

(a) 25.9 g, (b) 60.8 g, (c) 111 g, (d) 203 g, (e) 493 g.

5. A balloon (汽球) has a volume of 1.20 liters at 24.0°C . The balloon is heated to 48.0°C . Calculate the new volume of the balloon.

(a) 1.20 L, (b) 1.30 L, (c) 1.70 L, (d) 2.10 L, (e) 2.40 L.

6. A sample of helium gas (氦氣) occupies 12.4 L at 23°C and 0.956 atm. What volume will it occupy at 40°C and 1.20 atm?

(a) 0.488 L, (b) 6.28 L, (c) 12.4 L, (d) 10.4 L, (e) 17.2 L.

7. Hydrogen (氫氣) and chlorine (氯氣) gases react to form HCl. You and a friend are on opposite sides of a long hallway, you with H_2 and your friend with Cl_2 . You both want to form HCl in the middle of the room. Which of the following is true?

(a) You should release the H_2 first.

(b) Your friend should release the Cl_2 first.

(c) You both should release the gases at the same time.

(d) You need to know the length of the room to answer this question.

(e) You need to know the temperature to answer this question.

8. A 40.2 g sample of a metal is heated to 99.3°C and then placed in a calorimeter (卡計) containing 120.0 g of water ($c = 4.18\text{J/g}^\circ\text{C}$) at 21.8°C . The final temperature of the water is 24.5°C . Which metal was used?

(a) Aluminum ($c = 0.89\text{J/g}^\circ\text{C}$), (b) Iron ($c = 0.45\text{J/g}^\circ\text{C}$), (c) Copper ($c = 0.20\text{J/g}^\circ\text{C}$), (d) Lead ($c = 0.14\text{J/g}^\circ\text{C}$), (e) none of these.

9. When 0.157 mol NH_3 is reacted with excess HCl, 6.91 kJ of energy is released as heat. What is ΔH for this reaction per mole of NH_3 consumed?

(a) -22.7 J, (b) -1.08 kJ, (c) -44.0 kJ, (d) $+22.7$ J, (e) $+44.0$ kJ.

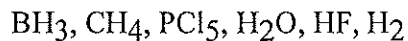
10. How many electrons in an atom can have the quantum numbers (量子數) $n = 3, l = 2$?

(a) 2, (b) 5, (c) 10, (d) 18, (e) 6.

11. Which of the following atoms or ions has 3 unpaired electrons (未成對電子)?

(a) N, (b) O, (c) C, (d) B, (e) F.

12. How many of the following molecules possess dipole moments (偶極距)?



(a) 1, (b) 2, (c) 3, (d) 4, (e) 5.

13. Which of the following has a Lewis structure (路易士結構) most like that of CO_3^{2-} ?

(a) CO_2 , (b) SO_3^{2-} , (c) NO_3^- , (d) O_3 , (e) NO_2 .

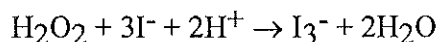
14. The hybridization (混成) of Cl in ClF_2^+ is

(a) sp, (b) sp^2 , (c) sp^3 , (d) dsp³, (e) d^2sp^3 .

15. Which of the following species has the largest dissociation energy (解離能)?

(a) O_2 , (b) O_2^- , (c) O_2^{2-} , (d) O_2^+ , (e) O_2^{2+} .

16-17. Consider the following data concerning the equation:



	$[\text{H}_2\text{O}_2]$	$[\text{I}^-]$	$[\text{H}^+]$	rate
I.	0.100 M	5.00×10^{-4} M	1.00×10^{-2} M	0.137 M/sec
II.	0.100 M	1.00×10^{-3} M	1.00×10^{-2} M	0.268 M/sec
III.	0.200 M	1.00×10^{-3} M	1.00×10^{-2} M	0.542 M/sec
IV.	0.400 M	1.00×10^{-3} M	2.00×10^{-2} M	1.084 M/sec

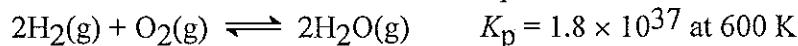
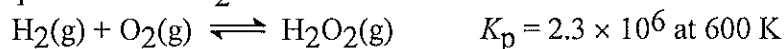
16. The rate law (反應速率定律式) for this reaction is

(a) $\text{rate} = k[\text{H}_2\text{O}_2][\text{I}^-][\text{H}^+]$, (b) $\text{rate} = k[\text{H}_2\text{O}_2]^2[\text{I}^-]^2[\text{H}^+]^2$, (c) $\text{rate} = k[\text{I}^-][\text{H}^+]$, (d) $\text{rate} = k[\text{H}_2\text{O}_2][\text{H}^+]$, (e) $\text{rate} = k[\text{H}_2\text{O}_2][\text{I}^-]$.

17. The average value for the rate constant k (速率常數) is

(a) 2710, (b) 2.74×10^4 , (c) 137, (d) 108, (e) none of these.

18. Calculate K_p for $\text{H}_2\text{O}(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}_2(\text{g})$ at 600 K, using the following data:



(a) 4.4×10^{43} , (b) 9.8×10^{24} , (c) 1.2×10^{-4} , (d) 5.4×10^{-13} , (e) 2.6×10^{-31} .

19. A solution of 8.0 M formic acid (HCOOH) is 0.47 % ionized. What is the K_a of formic acid?

(a) 3.4×10^{-8} , (b) 1.8×10^{-4} , (c) 6.9×10^{-6} , (d) 3.8×10^{-2} , (e) need more data.

20. Which of the following solutions will be the best buffer (緩衝溶液) at a pH of 9.26? (K_a for $\text{HC}_2\text{H}_3\text{O}_2$ is 1.8×10^{-5} , K_b for NH_3 is 1.8×10^{-5}).

(a) 0.10 M $\text{HC}_2\text{H}_3\text{O}_2$ and 0.10 M $\text{Na C}_2\text{H}_3\text{O}_2$

- (b) 5.0 M HC₂H₃O₂ and 5.0 M Na C₂H₃O₂
- (c) 0.10 M NH₃ and 0.10 M NH₄Cl
- (d) 5.0 M NH₃ and 5.0 M NH₄Cl
- (e) 5.0 M HC₂H₃O₂ and 5.0 M NH₃

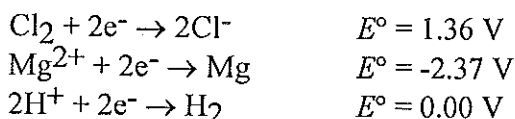
21. The heat of vaporization (汽化熱) for 1.0 mole of water at 100°C and 1.0 atm is 40.6 kJ/mol. Calculate ΔS for the process H₂O(l) → H₂O(g) at 100°C.

- (a) 109 J/K mol, (b) -109 J/K mol, (c) 406 J/K mol, (d) -406 J/K mol, (e) none of these.

22. In which case must a reaction be spontaneous (自發的) at all temperatures?

- (a) ΔH is positive, ΔS is positive.
- (b) $\Delta H = 0$, ΔS is negative.
- (c) $\Delta S = 0$, ΔH is positive.
- (d) ΔH is negative, ΔS is positive.
- (e) none of these

23. Which of the following is the best reducing agent (還原劑)?



- (a) Cl₂, (b) H₂, (c) Mg, (d) Mg²⁺, (e) Cl⁻.

24. Which metal ion has a d⁵ electron configuration (電子組態)?

- (a) Pd²⁺, (b) Ag⁺, (c) Fe³⁺, (d) Os²⁺, (e) Co²⁺.

25. Which of the following coordination compounds (配位化合物) will form a precipitate (沉澱物) when treated with an aqueous solution (水溶液) of AgNO₃?

- (a) [Cr(NH₃)₃Cl₃], (b) [Cr(NH₃)₆]Cl₃, (c) [Cr(NH₃)Cl]SO₄, (d) Na₃[Cr(CN)₆], (e) Na₃[CrCl₆].