

單選題 每題四分

1. Consider three 1.0 L flasks at STP. Flask A contains He gas, flask B contains O₂ gas, and flask C contains H₂ gas. Which of the following is correct?
 - a) Gas particles in flask A have the lowest average kinetic energy
 - b) Gas particles in flask B have the lowest average kinetic energy
 - c) Gas particles in flask C have the highest average velocity
 - d) Gas particles in flask B have the highest average velocity
2. Given the equation $2A(g) \rightleftharpoons 2B(g) + C(g)$. At a particular temperature, $K = 1.6 \times 10^4$. Decrease the temperature will
 - a) cause concentration [A] to increase
 - b) cause concentration [B] to increase
 - c) cause concentration [C] to decrease
 - d) have no effect
3. Which of the following species is not amphoteric?
 - a) HSO₄⁻
 - b) H₂PO₄⁻
 - c) HPO₄²⁻
 - d) H₂O
4. For nitrous acid, HNO₂, $K_a = 4.0 \times 10^{-4}$. Calculate the pH of 0.25 M HNO₂.
 - a) 2.00
 - b) 2.30
 - c) 2.70
 - d) 3.70
5. Which of the following will not produce a buffered solution?
 - a) 100 mL of 0.1 M Na₂CO₃ and 50 mL of 0.1 M HCl
 - b) 100 mL of 0.1 M NaHCO₃ and 25 mL of 0.2 M HCl
 - c) 100 mL of 0.1 M Na₂CO₃ and 75 mL of 0.2 M HCl
 - d) 50 mL of 0.2 M Na₂CO₃ and 5 mL of 1.0 M HCl
 - e) 100 mL of 0.1 M Na₂CO₃ and 50 mL of 0.1 M NaOH
6. Which of the following compounds has the lowest solubility in mol/L in water?
 - a) Al(OH)₃ $K_{sp} = 2 \times 10^{-32}$
 - b) CdS $K_{sp} = 1.0 \times 10^{-28}$
 - c) PbSO₄ $K_{sp} = 1.3 \times 10^{-8}$
 - d) Sn(OH)₂ $K_{sp} = 3 \times 10^{-27}$
7. Which of the following properties is an intensive property?
 - a) mass
 - b) energy
 - c) volume
 - d) concentration
8. For which process is ΔS negative?
 - a) evaporation of 1 mol of CCl_{4(l)}
 - b) mixing 5 mL ethanol with 25 mL water
 - c) compressing 1 mol Ne at constant temperature from 1.5 atm to 0.5 atm
 - d) raising the temperature of 100 g Cu from 275 K to 295 K.

(背面仍有題目,請繼續作答)

9. Which of the following is the strongest oxidizing agent?
 $\text{MnO}_4^- + 4\text{H}^+ + 3\text{e}^- \rightarrow \text{MnO}_2 + 2\text{H}_2\text{O} \quad E^\circ = 1.68 \text{ V}$
 $\text{I}_2 + 2\text{e}^- \rightarrow 2\text{I}^- \quad E^\circ = 0.54 \text{ V}$
 $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn} \quad E^\circ = -0.76 \text{ V}$
a) MnO_4^- b) I_2 c) Zn^{2+} d) Zn e) MnO_2
10. The electron configuration for the chromium atom is:
a) $[\text{Ar}]4s^23d^4$ b) $[\text{Ar}]4s^13d^5$ c) $[\text{Kr}]4s^13d^5$ d) $[\text{Kr}]4s^23d^4$
11. For the elements Cs, F, and Cl, the order of increasing electronegativity is:
a) $\text{F} < \text{Cl} < \text{Cs}$ b) $\text{Cs} < \text{Cl} < \text{F}$ c) $\text{Cl} < \text{Cs} < \text{F}$ d) $\text{F} < \text{Cs} < \text{Cl}$
12. The hybridization of the central atom in SeF_4 is:
a) sp b) sp^2 c) sp^3 d) dsp^3 e) d^2sp^3
13. If four atomic orbitals on one atom overlap four atomic orbitals on a second atom to form a molecule, how many molecular orbitals will form?
a) 1 b) 4 c) 8 d) 16
14. For the reaction $\text{A} + \text{B} \rightarrow \text{Products}$, the following rate data were obtained with different $[\text{A}]_0$ and $[\text{B}]_0$ concentrations:
- | | | | | | |
|------------------------|------|-------|-------|-------|-------|
| Initial rate (mol/L s) | 0.3 | 0.059 | 0.060 | 0.090 | 0.090 |
| $[\text{A}]_0$ (mol/L) | 0.10 | 0.20 | 0.20 | 0.30 | 0.30 |
| $[\text{B}]_0$ (mol/L) | 0.20 | 0.20 | 0.30 | 0.30 | 0.50 |
- What is the experimental rate law?
a) $\text{Rate} = k[\text{A}]$ b) $\text{Rate} = k[\text{B}]$ c) $\text{Rate} = k[\text{A}][\text{B}]$ d) $\text{Rate} = [\text{A}]^2[\text{B}]$
15. The reaction $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ has the following mechanism
 $\text{H}_2\text{O}_2 + \text{I}^- \rightarrow \text{H}_2\text{O} + \text{IO}^-$
 $\text{H}_2\text{O}_2 + \text{IO}^- \rightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$
The catalyst in the reaction is?
a) H_2O b) I^- c) H_2O_2 d) IO^-
16. Identify the major attractive force in the CH_4 molecules
a) London dispersion b) Dipole-dipole c) Hydrogen bonding d) Ionic

17. The unit cell in a certain lattice consists of a cube formed by an anion at each corner, an anion in the center, and a cation at the center of each face. The unit cell contains a net:
- a) 5 anions and 6 cations, b) 5 anions and 3 cations c) 2 anions and 2 cations
d) 2 anions and 3 cations e) 3 anions and 4 cations
18. Which of the following compounds is an example of a network solid?
a) S_8 b) SiO_2 c) MgO d) $C_{25}H_{52}$
19. Which of the following complexes shows geometric isomerism?
a) $[Co(NH_3)_5Cl]SO_4$ b) $[Co(NH_3)_6]Cl_3$ c) $[Co(NH_3)_5Cl]Cl_2$
d) $K[Co(NH_3)_2Cl_4]$
20. The color of a transition metal complex results from:
a) bending vibrations b) stretching vibrations c) transition of an electron between d orbitals d) transition of an electron between an s and a p orbital.
21. The half-life of ^{90}Sr is 28 years. How long will it take for a given sample of ^{90}Sr to be 90% decomposed?
a) 9 half-lives b) 56 years c) 93 years d) 140 years
22. Oxidation of a primary alcohol results in a?
a) carboxylic acid b) aldehyde c) ester d) ketone
23. Which of the following has the highest boiling point?
a) methane b) ethane c) propane d) butane
24. The molar solubility of $AgCl$ ($K_{sp} = 1.6 \times 10^{-10}$) in 0.0020 M $NaCl$ solution at is?
a) 1.6×10^{-10} b) 4×10^{-6} c) 8.0×10^{-8} d) 1.27×10^{-5}
25. Why is aluminum protected from corrosion?
a) Aluminum has a high standard potential that it cannot be oxidized easily.
b) Aluminum forms a protective oxide coating.
c) Aluminum forms a protective $AlH_{3(s)}$ coating.
d) Actually, aluminum is not protected from corrosion.