

選擇題，每題 2.5 分

- What hybridization exists on P in PH_3 ?
a. sp b. sp^3 c. p^3 d. sp^2 e. d^2sp^3
- What hybridization change occurs on the P atom when PCl_5 reacts with Cl^- to form the $[\text{PCl}_6]^-$?
a. sp^4 to sp^5 b. s^2p^2 to s^2p^3 c. sp^3d to sp^3d^2
d. d^5 to d^3s e. sp^3 to sp^3d^2
- The carbon compounds that have triple bonds are said to belong to the class of compounds called
a. alkanes b. alkenes c. benzenoids
d. graphitic compounds e. alkynes
- What class of compounds are not hydrocarbons?
a. alkanes b. silanes c. alkenes
d. alkynes e. benzenes
- Let the rate of the reaction
$$2 \text{SO}_3(\text{g}) \rightleftharpoons 2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g})$$
be expressed as $-\Delta[\text{SO}_3]/\Delta t$. Express the rate of the reaction in terms of $\Delta[\text{O}_2]/\Delta t$
a. rate = $-2\Delta[\text{SO}_3]/\Delta t = \Delta[\text{O}_2]/\Delta t$
b. rate = $-\Delta[\text{SO}_3]/\Delta t = 2\Delta[\text{O}_2]/\Delta t$
c. rate = $-\Delta[\text{SO}_3]/\Delta t = 1/2\Delta[\text{O}_2]/\Delta t$
d. rate = $-\Delta[\text{SO}_3]/\Delta t = \Delta[\text{O}_2]/\Delta t$
e. rate = $-1/2\Delta[\text{SO}_3]/\Delta t = 2\Delta[\text{O}_2]/\Delta t$
- Calculate the order of the following rate expression. Rate = $k(\text{A})^2(\text{B})^1(\text{C})^0$
a. 2 b. 3 c. 0 d. 4 e. 5
- Calculate the pH of a solution prepared by mixing 20.0 mL of 0.55 M NaOH with 20.0 mL of 0.65 M HCl.
a. 0.18 b. 0.26 c. 0.090 d. 0.13 e. 1.3
- One of the following changes will not affect the equilibrium position in the following equation.
$$\text{A}(\text{g}) + 3 \text{B}(\text{g}) \leftrightarrow \text{C}(\text{g}) + \text{D}(\text{g}) + 2 \text{E}(\text{g})$$
a. removal of A b. addition of A c. increase in volume
d. addition of E e. removal of B
- Calculate the pH of a 0.550 M methylamine (CH_3NH_2) solution.
 $K_b = 4.30 \times 10^{-5}$
a. 2.31 b. 4.62 c. 9.60 d. 11.7 e. 13.7
- 20.0 g of NaF and 20.0 g of HF are mixed in 450 mL of solution. What is the pH of this buffer pair? $K_a = 7.2 \times 10^{-4}$
a. 3.14 b. 3.36 c. 1.57 d. 2.82 e. 4.86

11. What is the oxidation number of the underlined element in the following compound, $K_2\underline{S}_4O_6$?
a. 2- b. 2+ c. 3+ d. 2.5+ e. 1+
12. In complex ions, the metal ions act as
a. Lewis bases b. Lewis acids c. Arrhenius acids
d. Arrhenius bases e. Bronsted-Lowry bases
13. How long, in years, will it take for the ^{208}Po activity to be reduced by 99.99% ?
The half-life of ^{208}Po is 2.83 y.
a. 2.82 b. 283 c. 37.6 d. 376 e. 18.8
14. Acetic acid (CH_3COOH) is known to react with many compounds. Which one of the following compounds will not react with acetic acid ?
a. CH_3OH b. NH_3 c. CH_4 d. CH_3NH_2 e. NaOH
15. X and Y have solubilities of 4.04 and 6.06 g, respectively, in 80.0 g of water. If X and Y are added to 100.0 g of water to make a saturated solution, what is the total mass of the solution ?
a. 100.0 g b. 112.6 g c. 90.1 g d. 110.1 g e. 190.1 g
16. 0.00100 mol of CaCO_3 is dissolved in 4200.0 mL. What is the concentration in parts per million (ppm) ?
a. 23.8 b. 2.38 c. 0.00420 d. 0.420 e. 0.238
17. A gas sample is heated with 1020 J. The gas is in a cylinder and it expands doing 820 J of work. What is the change in internal energy (E), in J, of the system ?
a. 1840 b. -200 c. 1.24 d. 8.36×10^{-5} e. 200
18. Calculate the standard entropy change, in J/K, for the following chemical change.
 $2 \text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{HNO}_2(\text{aq}) + \text{HNO}_3(\text{aq}) \quad \Delta S^\circ = ?$
 $S^\circ = 240.4 \text{ J/mol-K}$ (NO_2), $S^\circ = 69.91 \text{ J/mol-K}$ (H_2O)
 $S^\circ = 32.40 \text{ J/mol-K}$ (HNO_2), $S^\circ = 146.0 \text{ J/mol-K}$ (HNO_3)
 HNO_2 and HNO_3 are at unit molality (1.00 m)
a. -131.5 b. 131.5 c. 371.5 d. -371.5 e. 185.8
19. Calculate ΔG° for the following reaction.
 $3 \text{Cl}_2(\text{g}) + 2 \text{CH}_4(\text{g}) \rightarrow \text{CH}_3\text{Cl}(\text{g}) + \text{CH}_2\text{Cl}_2(\text{g}) + 3 \text{HCl}(\text{g})$
- | Molecule | $\Delta H^\circ(\text{kJ/mol})$ | $S^\circ(\text{J/mol-K})$ |
|--------------------------|---------------------------------|---------------------------|
| Cl_2 | 0.00 | 223.1 |
| CH_4 | -74.81 | 186.3 |
| CH_3Cl | -80.83 | 234.6 |
| CH_2Cl_2 | -92.47 | 270.2 |
| HCl | -92.31 | 186.9 |
- a. 307.6 b. -307.6 c. 300.6 d. -300.6 e. 7.0
20. Hydrogen bromide decomposes at 700 K.
 $2 \text{HBr}(\text{g}) \leftrightarrow \text{H}_2(\text{g}) + \text{Br}_2(\text{g})$
The initial concentration of $[\text{HBr}] = 0.460 \text{ M}$. Calculate the equilibrium concentration of HBr, given that $K_c = 0.00450$.
a. 0.00450 b. 0.0671 c. 0.259 d. 0.406 e. 0.208