

1. If you mix equal molar quantities of the following substances, how many will produce an acidic solution?

Set 1: NaOH + HCl Set 2: NaOH + HNO₃
Set 3: NH₃ + HCl Set 4: NaOH + CH₃CO₂H

d. one

2. We mix 100. mL of 0.20 M HBr and 50.0 mL of 0.40 M NaClO. What is the pH of the resulting solution? $K_a(\text{HClO}) = 3.5 \cdot 10^{-8}$

c. 4.17

3. We have a solution of acetic acid. What effect will the addition of sodium acetate have on this solution?

1. increase the pH
2. decrease the H₃O⁺
3. decrease the OH⁻

d. 1 and 2 only

4. If you mix 50.0 mL of 0.34 M HCN with 100. mL of 0.17 M KOH, what is the pH of the resulting solution? $K_a(\text{HCN}) = 4.0 \cdot 10^{-10}$

a. 11.23

5. If you add 1.0 mL of 10.0 M HCl to 500. mL of a 0.10 M NH₃ solution, what is the pH of the resulting solution? For NH₃, $K_b = 1.8 \cdot 10^{-5}$

e. 9.86

6. What is the pH at the equivalence point in the titration of 10.0 mL of 0.16 M NH₃ with 25.0 mL of 0.064 M HCl? For NH₄⁺, $K_a = 5.6 \cdot 10^{-10}$

b. 5.30

7. The solubility of HgS is $5.5 \cdot 10^{-27}$ mol/L. What is K_{sp} for HgS?

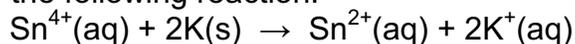
e. $3.0 \cdot 10^{-53}$

8. A student measures the molar solubility of silver chromate (Ag₂CrO₄) in a water solution to be $1.34 \cdot 10^{-4}$ M. Based on her data, the solubility product constant for this compound is

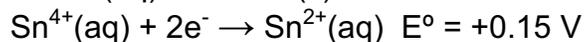
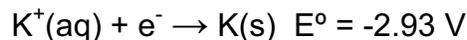
e. $K_{sp} = 9.62 \cdot 10^{-12}$

9. Which of the following compounds has the highest molar solubility?
- c. PbSO_4 ; $K_{\text{sp}} = 1.8 \cdot 10^{-8}$
10. Calculate the molar solubility of PbI_2 in a 0.40 M solution of NaI. (K_{sp} of PbI_2 is $8.7 \cdot 10^{-8}$)
- d. $5.4 \cdot 10^{-7}$ M
11. Calculate the change in entropy for the condensation of butane, the fuel in hand-held, disposable lighters at its boiling point of -0.5°C given $\Delta H_{\text{vap}} = 24.3$ kJ/mol.
- a. -89.2 J/K•mol
12. Calculate the standard molar entropy of urea $[\text{CO}(\text{NH}_2)_2(\text{s})]$ if the standard entropy change for the formation is -456.3 J/K•mol and given $S^\circ[\text{C}(\text{s})] = 5.74$ J/K•mol, $S^\circ[\text{O}_2(\text{g})] = 205.1$ J/K•mol, $S^\circ[\text{N}_2(\text{g})] = 191.6$ J/K•mol, and $S^\circ[\text{H}_2(\text{g})] = 130.7$ J/K•mol.
- d. $+105.0$ J/K•mol
13. Which of the following do you expect to have the largest entropy at 25°C ?
- b. $\text{Xe}(\text{g})$
14. If ΔG is positive at all temperatures, then ΔS is _____ and ΔH is _____.
- b. negative, positive
15. A student determines the value of the equilibrium constant to be $2.34 \cdot 10^{14}$ for the following reaction:
- $$2\text{HBr}(\text{g}) + \text{Cl}_2(\text{g}) \longrightarrow 2\text{HCl}(\text{g}) + \text{Br}_2(\text{g})$$
- Based on this value of K_{eq} , calculate the free energy change for the reaction of 2.37 moles of $\text{HBr}(\text{g})$ at standard conditions at 298K. ($R = 8.314$ J/K•mol)
- d. $\Delta G^\circ = -97.1$ kJ
16. Calculate ΔG for the following reaction:
- $$2\text{Ag}^+(\text{aq}) + \text{Sn}(\text{s}) \rightarrow 2\text{Ag}(\text{s}) + \text{Sn}^{2+}(\text{aq})$$
- using the following half-reactions:
- $$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s}) \quad E^\circ = +0.80 \text{ V}$$
- $$\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}(\text{s}) \quad E^\circ = -0.14 \text{ V}$$
- e. -181 kJ

17. Calculate E° for the following reaction:

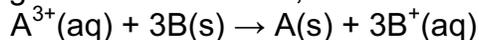


using the following half-reactions:



c. +3.08 V

18. If ΔG of the following reaction is -144 kJ, what is E° ?

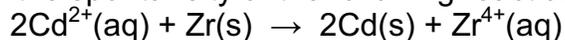


None of the choices is correct. The correct value is 0.498 V. Every student receives credit. Students who report the correct answer receive 1 point extra credit.

19. Given the following two half-reactions



determine E° and the spontaneity of the following reaction:



b. +1.13 V and spontaneous

20. How long would it take to deposit 1.36 g of copper from an aqueous solution of copper(II) sulfate by passing a current of two amperes through the solution?

a. 2070 sec