

Multiple Choice (5 points each, Put answers in CAPS in the left margin.)

- Which of the following would have the highest boiling point? (Homework 11.24)
A) 0.12 *m* C₂H₅OH C) 0.30 *m* CaF₂ E) pure H₂O
B) 0.35 *m* NH₃ D) 0.19 *m* KI
- A solution of H₂SO₄ (aq) with a molal concentration of 4.48 *m* has a density of 1.135 g/mL. What is the molar concentration of this solution?
A) 2.74 *M* B) 3.53 *M* C) 4.16 *M* D) 4.39 *M* E) 4.48 *M*
- What is the value of *K*_C for the reaction: N₂ (g) + 3 H₂ (g) ⇌ 2 NH₃ (g) at 249 °C. *K*_P = 0.216
A) 1.18 x 10⁻⁴ B) 2.52 x 10⁻³ C) 0.216 D) 90.2 E) 396
- Which of the following is the correct equilibrium expression (*K*_C) for the reaction:
SnO₂ (s) + 2 CO (g) ⇌ Sn (s) + 2 CO₂ (g)
A) $\frac{[\text{CO}_2]^2}{[\text{CO}]^2}$ C) $\frac{[\text{Sn}][\text{CO}_2]}{[\text{SnO}_2][\text{CO}]}$ E) $\frac{[\text{Sn}][\text{CO}_2]^2}{[\text{SnO}_2][\text{CO}]^2}$
B) $\frac{[\text{CO}]^2}{[\text{CO}_2]^2}$ D) $\frac{[\text{SnO}_2][\text{CO}]^2}{[\text{Sn}][\text{CO}_2]^2}$
- In the previous equilibrium which of the following will cause no change in the position of the equilibrium?
A) Adding SnO₂. C) Adding HCl. E) (A) and (D)
B) Adding CO. D) Reducing the container volume.
- Which of the following would you expect to be **most** acidic? (See Discussion Question #4.)
A) HIO₃ B) HBrO₂ C) HBrO D) HIO E) HClO₄
- Which of the following is false?
A) The stronger an acid or base, the weaker is its conjugate.
B) H₃O⁺ is the strongest acid that can exist in water.
C) Group IA oxides form basic solutions.
D) The majority of acids are weak acids.
E) A Lewis base is an electron pair acceptor.
- When a weak acid neutralizes a strong base, the final solution will be _____.
A) acidic B) basic C) neutral (pH = 7)
D) unable to determine with the given information

Discussion questions (You must show your work to receive credit!)

1. For the reaction $A + B \longrightarrow C$ the following data were collected:

<u>[A] (M)</u>	<u>[B] (M)</u>	<u>rate (Ms⁻¹)</u>
0.35	0.35	12.1
0.35	0.70	24.2
0.70	0.35	48.4

- What is the rate law for this reaction?
- What is the value of the rate constant for this reaction? (8 points)

2. Provide a physical explanation of why solids are not included in equilibrium expressions. (6 points)

3. The equilibrium constant for the reaction $H_2 + I_2 \rightleftharpoons 2 HI$ is 55.6 at 425 °C (all are gases). If 1.00 mol of hydrogen and 1.00 mol of iodine are allowed to equilibrate in a 5.00 L vessel, how many moles of hydrogen iodide are produced? What percentage of iodine is converted to hydrogen iodide? (10 points)

4. For the reaction: $NaHCO_3(aq) + NaOH(aq) \rightarrow Na_2CO_3(aq) + H_2O(l)$, identify the acid, base, and their respective conjugates.

5. Provide a physical explanation for your answer to multiple choice question 6. (6 points)

5. What is the pH of a _____ (12 points)

a) 0.37 M aniline (C_6H_5N) solution? ($K_b = 3.9 \times 10^{-10}$)

b) 0.76 M NaOAc ($K_a(\text{HOAc}) = 1.8 \times 10^{-5}$) solution?

6. If a buffer solution is 0.230 M in a weak acid (HA , $K_a = 4.1 \times 10^{-5}$) and 0.580 M in its conjugate base, what is its pH? What is its pH if 0.050 mol of NaOH is added to 1.00 L of this solution? (10 points)