

Chem 40S – Exam Review

- 1) Predict the net ionic equation for the following:
 - a) $\text{HF} + \text{LiOH}$
 - b) Calcium metal is placed in water
 - c) Nitric acid is mixed with barium hydroxide

- 2) A 25.00 mL sample of a 0.5250 M HBr solution is titrated with a $\text{Mg}(\text{OH})_2$ solution using phenolphthalein as the indicator. It is found that 22.07 mL of the $\text{Mg}(\text{OH})_2$ solution is needed to reach the endpoint of the titration. What is the molarity of the $\text{Mg}(\text{OH})_2$ solution?

- 3) Determine if the following qualify as redox reactions:
 - a) $2\text{Al}_{(s)} + 3\text{H}_2\text{O}_{(g)} \rightarrow \text{Al}_2\text{O}_{3(s)} + 3\text{H}_{2(g)}$
 - b) $\text{Ca}_{(s)} + \text{F}_{2(g)} \rightarrow \text{CaF}_{2(s)}$

- 4) Balance the following using the oxidation number method:
 - a) $\text{SnCl}_4 + \text{Fe} \rightarrow \text{SnCl}_2 + \text{FeCl}_3$
 - b) $\text{H}_2\text{SeO}_3 + \text{HClO}_3 \rightarrow \text{H}_2\text{SeO}_4 + \text{Cl}_2 + \text{H}_2\text{O}$

- 5) Balance the following using the acidic method:
 - a) $\text{I}_{2(s)} + \text{OCl}^-_{(aq)} \rightarrow \text{IO}_3^-_{(aq)} + \text{Cl}^-_{(aq)}$
 - b) $\text{Cr}_2\text{O}_7^{2-}_{(aq)} + \text{C}_2\text{O}_4^{2-}_{(aq)} \rightarrow \text{Cr}^{3+}_{(aq)} + \text{CO}_{2(g)}$

- 6) Balance the following using the basic method:
 - a) $\text{MnO}_4^-_{(aq)} + \text{I}^-_{(aq)} \rightarrow \text{MnO}_{2(s)} + \text{IO}_3^-_{(aq)}$
 - b) $\text{S}^{2-}_{(aq)} + \text{I}_{2(s)} \rightarrow \text{SO}_4^{2-}_{(aq)} + \text{I}^-_{(aq)}$

- 7) Which element is represented in the following?
 - a) $[\text{Kr}]5s^24d^1$
 - b) $[\text{He}]2s^22p^6$

- 8) Na^+ and Mg^{2+} ions each have ten electrons surrounding their nuclei. Which ion would you expect to have the larger radius? Why?

- 9) Which element in each pair is more electronegative?
 - a) K, As
 - b) N, Sb

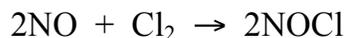
- 10) Draw and state the electron configurations for the following elements:
 - a) cesium
 - b) manganese
 - c) fluorine
 - d) bromine

- 11) What is the difference between frequency and wavelength?

- 12) Explain why atomic radii decrease as you move left to right across a period.

- 13) Given $3\text{A} \rightarrow 2\text{B}$, and $[\text{A}]$ drops from 0.545M to 0.475M in 1.65 minutes. Write the relative stoichiometric reaction rate and find the average rate of formation of B during this time interval in M/s.

14) Propose a reaction mechanism for the following reaction. Identify the intermediate:



15) Given a reaction in which the reactants have 20 kJ more energy than the products which exist at 33 kJ. The activation energy for this reaction is 27 kJ. Upon addition of a catalyst, the activation energy is decreased to 17 kJ. Draw the energy diagram for both the forward catalyzed and non-catalyzed reactions.

16) Use the collision theory to explain why increasing the concentration of a reactant usually increases the reaction rate.

17) Explain why a crushed solid reacts with a gas more quickly than a large chunk of the same solid.

18) How can you use the idea of activation energy to explain why a catalyst increases the rate of a chemical reaction?

19) Use the collision theory to explain why increasing the temperature usually increases the reaction rate.

20) For the above reaction, the following data were taken:

Exp	[NO]	[Cl ₂]	Rate (M/s)
1	0.01M	0.01M	1.2×10^{-4}
2	0.01M	0.02M	9.6×10^{-4}
3	0.02M	0.02M	2.3×10^{-4}

a) What's the rate law?

b) What's the value of the constant?

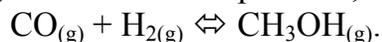
c) If [NO] = 0.016M and [Cl₂] = 0.023M, what's the new rate?

21) What is the rate determining step? How can you identify it in a reaction mechanism?

22) What is the difference between heterogenous and homogenous equilibria?

23) What is the difference between chemical and physical equilibria?

24) At a certain temperature, $k_{\text{eq}} = 7.5\text{M}^{-2}$ for the equilibrium:



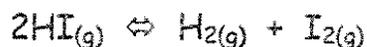
Find the [H₂] when there are 2.01 mol/L of CO and 0.498 mol/L of CH₃OH

25) The equilibrium equation at a certain temperature is:

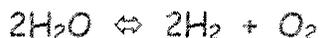


If 4.2mol of each reactant is placed in a 6.0L container initially and at equilibrium there is 3.6mol of C, find the equilibrium constant and the number of moles of each reacting species at equilibrium

- 26) Initially, only HI exists in a sealed container. The $[HI] = 3.5M$ and the $k_{eq}=49$. Using the balanced equation below, find $[H_2]$ and $[I_2]$ at equilibrium.



- 27) Find the k_{eq} and the number of moles at equilibrium in a 2L container for all reacting species if the initial $[H_2O] = 2.5M$ and $k_{eq} = 4.3 \times 10^{-4}M$.



- 28) $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$ $\Delta H = 56.5kJ$

- increase heat
- increase pressure
- add inert He to the system
- increase volume

- 29) Silver chromate, Ag_2CrO_4 , has a k_{sp} of 1.1×10^{-12}

- What is the molar solubility of the salt?
- What are the ion concentrations in solution?

- 30) To determine the k_{sp} of magnesium carbonate, $MgCO_3$, a student prepared a saturated solution of the substance. She then took 25.0ml for this solution and evaporated it to dryness to recover the solute. She got 0.018g of solid. What is the k_{sp} of magnesium carbonate based on this data?

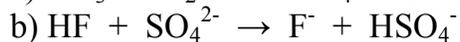
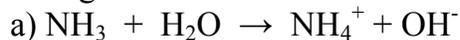
- 31) Predict if a precipitate will form when 15ml of $1 \times 10^{-5} M BaCl_2$ and 10ml of $1.75 \times 10^{-5} M H_2SO_4$ are mixed (k_{sp} for $BaSO_4 = 1.5 \times 10^{-9}$)

- 32) Differentiate between Arrhenius' and Bronsted-Lowry's definition of acids and bases.

- 33) What is a salt?

- 34) What are some properties of acids? What are some properties of bases?

- 35) Label the conjugate pairs, give their relative strengths and state the favored direction of the following reactions:



- 36) A mass of 4g of NaOH is dissolved in water to make a solution with a volume of 1L. What is the molar concentration of the hydrogen ions in this solution?

- 37) The concentration of hydrogen ions in a solution is $5.21 \times 10^{-2}M$. What is the pH of this solution?

- 38) Find the $[OH^-]$ for a solution with a pH of 10.32.

- 39) Find the $[H^+]$, $[OH^-]$, pH and pOH of a 8.345g CH_3COOH solution.

- 40) Briefly describe the three types of indicators we discussed.