

Unit 4 Study Guide

Problem 1

A 25.0 mL solution contains a mixture of $\text{Li}^+(\text{aq})$, $\text{K}^+(\text{aq})$, and $\text{Mg}^{2+}(\text{aq})$ ions. Excess $\text{NaOH}(\text{aq})$ is added to the mixture and a precipitate forms. The precipitate is then filtered and dried. The results of the reaction are shown in the data table below.

Mass of thoroughly dried filter paper	1.281 g
Mass of filter paper + precipitate after first drying	1.592 g
Mass of filter paper + precipitate after second drying	1.418 g
Mass of filter paper + precipitate after third drying	1.418 g

- Calculate the mass of precipitate that is formed.
- What is the chemical formula of the precipitate? (Hint: solubility rules)
- Write the balanced net ionic equation of the reaction that takes place when $\text{NaOH}(\text{aq})$ is added to the mixture of ions.
- Calculate the moles of the cation in the precipitate.
- Calculate the mass percent of the hydroxide in the precipitate.

Problem 2

30.0 mL of $\text{Na}_3\text{PO}_4(\text{aq})$ is reacted with excess 2.00 M $\text{Ba}(\text{NO}_3)_2(\text{aq})$. A precipitate of $\text{Ba}_3(\text{PO}_4)_2(\text{s})$ is formed. The precipitate is filtered and dried to constant mass. The mass of precipitate produced is 4.10 g.

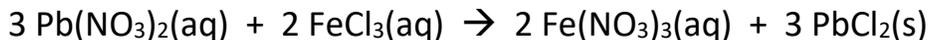
- Write the balanced net ionic equation of the reaction.
- How many moles of Na_3PO_4 reacted?
- Calculate the molarity of $\text{Na}_3\text{PO}_4(\text{aq})$.
- Identify the chemical formulas of the species in the filtrate solution.

Problem 3

15.0 mL of 0.284 M HCl is reacted with 1.37 M $\text{Ca}(\text{OH})_2(\text{aq})$. How many milliliters of $\text{Ca}(\text{OH})_2(\text{aq})$ should be added to react completely with the HCl ?

Problem 4

38.5 mL of 1.3 M $\text{Pb}(\text{NO}_3)_2(\text{aq})$ is added to 23.7 mL 2.4 M $\text{FeCl}_3(\text{aq})$. The reaction below occurs.



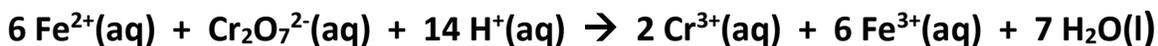
- Write the balanced net ionic equation for the reaction.
- Calculate the grams of $\text{PbCl}_2(\text{s})$ produced.
- Calculate the concentration of Fe^{3+} ions present in solution at the completion of the reaction.

Problem 5

How many milliliters of 3.00 M AgNO_3 need to be added to 10.0 mL of 2.55 M CuI_2 in order to precipitate all I^- ions out of solution?

Problem 6

A 5.34 g sample containing FeCl_2 and an inert impurity is dissolved in sufficient water to produce 50.0 mL of solution. The 50.0 mL solution was then reacted with 0.335 M $\text{K}_2\text{Cr}_2\text{O}_7$. 13.27 mL of 0.335 M $\text{K}_2\text{Cr}_2\text{O}_7$ were needed to complete the reaction.



- Calculate the number of moles of $\text{Cr}_2\text{O}_7^{2-}$ that reacted.
- Calculate the number of moles of FeCl_2 that were present in the sample.
- Calculate the mass percent of FeCl_2 in the impure sample.
- Describe how to prepare 20.0 mL of 0.335 M $\text{K}_2\text{Cr}_2\text{O}_7$ solution.

Unit 4 Practice MC (No Calculators)

1. A 0.10 mol sample of $\text{Na}_2\text{CO}_3(\text{s})$ and a 0.30 mol sample of $\text{NaCl}(\text{s})$ are dissolved in water and diluted to 250. mL. What is the concentration of Na^+ in the solution?

(A) 0.50 M
(B) 0.500 M
(C) 2.0 M
(D) 2.00 M

2. What is the molarity of $\text{K}^+(\text{aq})$ in a solution that contains 26 g K_3N (molar mass 131 g) in 2.0 L of the solution?

(A) 0.10 M
(B) 0.20 M
(C) 0.30 M
(D) 0.60 M

3. In a qualitative analysis for the presence of Pb^{2+} , Fe^{2+} , and Cu^{2+} ions in an aqueous solution, which of the following will allow the separation of Pb^{2+} from the other ions at room temperature?
(A) Adding Na_2S solution
(B) Adding HCl solution
(C) Adding NaOH solution
(D) Adding HNO_3 solution

Questions 4-5 refer to the following equation.



4. How many moles of $\text{NO}_3^-(\text{aq})$ are needed to react completely with 6.355 g of Cu?
- (A) 0.03333 mol
(B) 0.05555 mol
(C) 0.06666 mol
(D) 0.1000 mol
5. How many moles of NO(g) will be produced when 63.55 g of Cu is mixed with 50.0 mL of acidified 2.00 M NaNO_3 solution?
- (A) 0.100 mol
(B) 0.200 mol
(C) 0.400 mol
(D) 0.500 mol