

1. Qualitative analysis:

A. Multiple choice:

_____ 1. Which of the following gives a strong yellow color to the flame in a flame test?

- a. Li^+ b. Na^{++} c. Na^+ d. Cr^{+++}

_____ 2. Which of the following ions can be precipitated by adding $\text{NH}_3_{(\text{aq})}$?

- a. Li^+ b. NH_4^+ c. Fe^{+++} d. K^+

_____ 3. Which of the following ions will not produce a red color in a flame test?

- a. Li^+ b. K^+ c. Ca^{++} d. None of the above

_____ 4. A red precipitate is a positive confirmation test for which of the following ions?

- a. Li^+ b. Cr^{+++} c. Fe^{+++} d. Cu^{++}

_____ 5. What substance is added to Cr^{+++} ions to produce a yellow solution?

- a. $\text{K}_4\text{Fe}(\text{CN})_6$ b. KSCN c. H_2O_2 d. NH_3

B. General knowledge test.

Below are two pairs of ions. Give one test (and only ONE test, more than one test will result in no points) that will separate the two ions. Give one test for each ion in the pair that will confirm the presence of that ion.

i. Fe^{+++} and Cu^{++}

Separation test:

Confirmation of Fe^{+++} :

Confirmation of Cu^{++} :

ii. Cr^{+++} and Cu^{++}

Separation test:

Confirmation of Cr^{+++} :

Confirmation of Cu^{++} :

2. A solution is 1.6 M in $[\text{Ag}(\text{NH}_3)_2^+]$ and 1.25 M in free NH_3 . What is the **maximum $[\text{Cl}^-]$** that can be maintained in the solution without forming a precipitate of $\text{AgCl}_{(s)}$?

3. A student mixes 78.43 mL of 0.1204 M Nitric acid with 44.54 mL of 0.4240 M Calcium Hydroxide solution. What is the pH of the resulting solution?

4. A particular water sample has 131 ppm of CaSO_4 (131 g CaSO_4 per 10^6 g water). If this water is boiled in a teakettle, approximately what ***fraction of water must be evaporated*** before $\text{CaSO}_{4(s)}$ begins to precipitate? Assume that the solubility of $\text{CaSO}_{4(s)}$ does not change much in the temperature range 0 to 100°C .

5. How many grams of sodium nitrite must be added to 150.0 mL of 0.1115 M Nitrous acid to make a solution that has a pH of 3.50?

6. A 0.0536 M solution of a weak base has a pH of 10.05. Calculate K_b for the base.

7. A 1.0-L solution that is 4.2 M in ammonia is mixed with 26.7 g of ammonium chloride.

a. What is the hydroxide ion concentration of this solution?

b. 0.075 mol of $MgCl_2$ is added to the above solution. Assume that there is no volume change. After $Mg(OH)_2$ has precipitated, what is the molar concentration of magnesium ion? What percent of the Mg^{2+} is removed from the solution?