Solutions

1. **In lab, you found a jar of ammonium chloride solid. Describe how to make 1.8 L of 3.25 M NH_4Cl solution.**

Strategy: 1. Determine how many moles of NH_4Cl you need. 2. Convert to mass.

2. **If 2.65 grams of magnesium nitrite is added to 1.8 L of water, what is the concentration of $Mg(NO_2)_2$?**

What is the concentration of Mg^{2+}?

Strategy: use formula subscripts to convert.

What is the concentration of NO_2^{-1}?

What is the concentration of NO_2^{-1} if another 1.8 L of water is added?

Strategy: Since moles of nitrite remain constant, the change in [NO_2^{-1}] is due to the change in volume. 1. Determine the new volume. 2. Calculate molarity (moles per liter).

3. **If 354 mL of water is added to 550 mL of 1.5 M NaCl, what is the new concentratio**n?

4. **In lab, you find a bottle labelled 1.8 M $Mg(OH)_2$. You determine that the volume of this solution is exactly 375 mL. Starting with this solution, how much water do you need to add to have exactly 1.00 M OH^-?**

Strategy: 1. Determine how many moles of OH^{-1} you have. 2. From moles of OH^{-1} and desired concentration, determine the volume that is needed. 3. Calculate the volume of water that you need to add

5. **Describe how to make a solution that contains 2.5 M chloride from 1.50 L of 2.5 M $FeCl_3$.**

6. 900 mL of 0.250 M $FeCl_2$ is mixed with 350 mL of 302 mM NaOH. Determine the mass of any solid that forms and determine the concentration of all ions left in solution after the reaction.

Step 1: Write a balanced double displacement reaction.

Step 2: Identify spectator ions.

Step 3. Using a limiting reactant approach, determine the mass of the solid that can be produced. You will need to use the volume and concentration of each solution to find moles of reactants that are available.

Step 4. You should have found that NaOH is the limiting reactant. This means that ALL of the OH- was used to make $Fe(OH)_2$. What is the concentration of OH^- after the reaction?

Step 5. Determine the concentration of the spectator ions (Na^+ and Cl^-). The steps for this are the same as you saw in problem 2.

Step 6. Determine the concentration of Fe^{2+}. Some iron was incorporate into the solid, so we need to figure out how much you started with and how much was used.

Started with: use volume, molarity, and formula subscript.

Used: Start with the mass of $Fe(OH)_2$ that was produced and determine the moles of Fe^{2+} that was used.

The moles of Fe left is the difference of the two values above. Take this divide by the total volume to get M.

7. 600 mL of 0.850 M $MgCl_2$ is mixed with 750 mL of 802 mM $Pb(NO_3)_2$. Determine the mass of any solid that forms and determine the concentration of all ions left in solution after the reaction.