Ms. Pall's Solution Chemistry MEGA Review Problem

This problem covers most aspects of Solution Chemistry, as well as a notable portion of stoichiometry.

3.75 g of Potassium Carbonate Decahydrate ($K_2CO_3 \cdot 10H_2O$) is to be made into a solution of volume 200.00 mL.

a) Describe, (experimentally), including any calculation] how you would prepare the solution using a step-by-step process.

b) Calculate the concentration of the solution?

c) Deduce the dissociation equation for the solution.

d) What is the concentration of the **ions** in the solution?

e) 25.00 mL of the Potassium Carbonate Decahydrate solution is withdrawn. What is the concentration of this solution? **Justify** your answer using knowledge of the properties of solutions.

f) What is the **total number of ions** in 25.00 mL of the Potassium Carbonate Decahydrate solution?

There exists also some Sulfuric Acid (H_2SO_4).

g) If the stock solution (*the stuff that you buy from the supplier*) of $H_2SO_{4\,(aq)}$, has a concentration of 18.00 M, describe, (both experimentally and with some calculation), how you would use the stock solution of $H_2SO_{4\,(aq)}$ to prepare a 20.00 mL of 3.00 M Sulfuric Acid.

h) Determine the concentration of the ions in:

   a. The stock H_2SO_4
   b. The diluted (3.00M) H_2SO_4

The two solutions prepared above are now mixed.

i) 25.00 mL of the Potassium Carbonate Decahydrate solution is withdrawn, and COMBINED with 20.00 mL of 3.00 M Sulfuric Acid. Write a balanced equation of the reaction, and include states!

j) Write the TIE (Total Dissociated Ionic Equation).

k) Write the NIE (Net Ionic Equation).

l) Given the equations above:

   a. Name the "spectator" ions
   b. Name the reacting ions
   c. Determine the pH of the resultant product to be either below 7, equal to 7, or greater than 7. **Justify** your answer.

m) The resultant solution from the above reaction is evaporated to dryness and the solid salt is collected. Calculate the mass of the salt produced from the reaction.

n) In an experiment, 0.22 g of the salt was obtained from the evaporation of the reaction above, (the same chemicals in the same quantities as above). Determine the % Yield of this experiment. (i.e. Experimental Yield = 0.22g).

o) l) Explain what is meant by an electrolyte and state if sulphuric acid is a strong or weak electrolyte

p) Explain if sulphuric acid is a monoprotic or diprotic acid.

q) What is the pH of a 0.0123 M sulphuric acid?

r) What is the pH of a 0.0123 M hydrochloric acid?

s) Compare and explain the relative strength of a 0.10 M hydrochloric acid, 0.10 M sulphuric acid and 0.10 M acetic acid.

[Please note that the sections (o - s) in the above question require the acid-base unit to be reviewed)