Revision Gravimetric Analysis
Name: ……

1) A solution of accurately known ammonium phosphate concentration was made up using a 250 mL volumetric flask and 2.98 g of ammonium phosphate ($(NH_4)_3PO_4$).

   i) Calculate the concentration of ammonium ions in the flask.

Step 1 Find the mol of $(NH_4)_3PO_4$ => 2.98 / 149.1 = 0.0200 mol

Step 2 find the mol of NH_4^+ ions => 3 X 0.0200 = 0.0600 mol

Step 3 Find the concentration of NH_4^+ ions => 0.0600 / 0.250 = 0.240M

   ii) Calculate the concentration of phosphate ions present in the flask.

Mol of phosphate ions = 0.0200
Concentration = 0.0200 / 0.250 = 0.0800M

   iii) A 10.43 g sample of impure calcium carbonate was dissolved in 100.0 mL of 0.132 M HCl. To this solution excess ammonium phosphate solution was added to precipitate out all the calcium as calcium phosphate ($Ca_3(PO_4)_2$, molar mass 310.2 g mol^-). Before the precipitate was filtered a few drops of ammonium phosphate solution were added as a test. As a result of this test, the precipitate was filtered.
   The precipitate was then, washed with distilled water and only after the filtrate was tested with a drop of silver nitrate was the precipitate dried and weighed. The mass of the precipitate was 10.11 g. Calculate the percentage by mass of calcium carbonate in the sample.

Step 1 Write an equation for the reaction between Ca^{2+} and PO_4^{3-}.

$$3Ca^{2+}(aq) + 2PO_4^{3-}(aq) = Ca_3(PO_4)_2(s)$$

Step 2 find the mol of $Ca_3(PO_4)_2$ precipitated.

=>10.11 / 310.2 = 0.0326 mol

Step 3 find the mol of Ca^{2+}

=>according to the stoichiometric ratio mol of Ca^{2+} = 3 X 0.0326 = 0.0978 mol
Step 4 find the mol of $CaCO_3$
=>0.0978

Step 5 find the mass of $CaCO_3$ = 0.0978 X 100.1 = 9.79

Step 6 find the percent by mass of $CaCO_3$ in the sample
=> (9.79 / 10.43) X 100 = 93.9%

iv) What was the purpose of the test and what result would not have allowed for the filtration of the precipitate?

The test was to see if all the calcium had precipitated. By adding a drop of ammonium phosphate solution two things could happen:
- A precipitate forms, in which case we should precipitate out the remaining calcium ions before filtering the precipitate.

- *No precipitate forms, in which case all the calcium ions have precipitated and filtration can proceed.*
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v) What was the purpose of the test with silver nitrate and what result would not have allowed for the filtration of the precipitate?

The test was to see if all the spectator ions, such as the chloride ions, were washed off the precipitate. By adding a drop of silver nitrate solution two things could happen:
- A precipitate forms, in which case we should continue to wash the precipitate.

- *No precipitate forms, in which case all the spectator ions have been washed off the precipitate and drying can commence.*
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