Revision Gravimetric Analysis
Name: …….

1) The percentage, by mass, of NaCl, in a sample of baby food is determined by a gravimetric procedure.
   Some of the steps are outlined below in no particular order.
   i) Place the steps in their correct order as you would if conducting the gravimetric procedure.
      a) Wash the precipitate with distilled water.
      b) Weigh filter paper
      c) Weigh the sample of baby food
      d) Dissolve sample of baby food in distilled water
      e) Filter and wash the insoluble residue left in the filter paper with distilled water.
      f) Collect the filtrate and add excess $AgNO_3$.
      g) Dry and weigh the precipitate and filter paper.
      h) Filter the precipitate.

      c=>d=>e=>f=>b=>h=>a=>g

There are two steps in which washing with distilled water is specified.

ii) What is the impact on the final result if the first washing is not done? Explain

At step "e" washing the residue with distilled water only serves to wash through the filter paper all the Cl^- ions present on the residue. If this is not done the final result will be a lower percentage of salt in the food.

iii) What is the impact on the final result if the second washing is not done? Explain

At step "a" washing the precipitate with distilled water only serves to wash through the filter paper all the NO_3^- ions present on the precipitate. If this is not done the final result will be a higher percentage of salt in the food.

iv) Write an ionic equation for the formation of the precipitate.

$Ag^+(aq) + Cl^-(aq) => AgCl(s)$

v) A 5.502g sample of one particular brand of baby food was analysed for its salt content by precipitation of chloride ions as AgCl(s). If 0.270g of AgCl(s) find the percentage by mass of NaCl in the baby food.

Step 1 find the mol of AgCl => $0.270 / 143.4 = 1.88 \times 10^{-3}$
Step 2 find the mol of Cl^- and hence the mol of NaCl = 1.88×10^{-3}
Step 3 find the mass of NaCl => $mass_{NaCl} = 1.88 \times 10^{-3} \times 58.5 = 0.110g$
Step 4 find the percentage by mass of NaCl in the food
=> $(0.110 / 5.502) \times 100 = 2.00\%$

2) Phosphorus is added to fertilisers in the form of P_2O_5 (molar mass 142.0 g mol^-). A 2.563 g sample of fertiliser is mixed with 40.0 mL of distilled water and the insoluble residue removed using vacuum filtration. 50.0 mL of 10% $MgSO_4.7H_2O$ solution was added to the filtrate followed by 150.0 mL of 2 M NH_3 solution. A white precipitate forms which is later filtered and washed with 10 mL of distilled water.
The precipitate is dried to constant mass and weighed. A final mass of 3.941 g of precipitate was obtained. The known formula of the precipitate is $MgNH_4PO_4.6H_2O$ (molar mass = 245.3 $gmol^-$)

a) Calculate the percentage by mass of P_2O_5 in the fertiliser.

$n(MgNH_4PO_4.6H_2O) = 3.941 / 245.3$ g $mol^- = 1.606 \times 10^{-2}$
$n(P_2O_5) = ½\ n(MgNH_4PO_4.6H_2O) = 8.03 \times 10^{-3}$
$mass(P_2O_5) = 8.03 \times 10^{-3} \times 142.0$ g $mol^- = 1.14$g
$\%P_2O_5 = (1.14 \times 2.563) \times 100 = 44.5\%$

b) When $MgNH_4PO_4.6H_2O$ is heated above the boiling point of water it converts completely into $MgNH_4PO_4$. Would the calculated result, in a) above, be higher, lower or the same if the precipitate had been deliberately heated in a boiling solution for several minutes before drying and weighing? Explain your answer.
The same.
The key word here is "deliberately". Since it was known that the precipitate was heated to 100 ^oC and hence had a formula of $MgNH_4PO_4$ it would be expected that the mass of precipitate be divided by the right molecular formula to obtain the number of mols.
$n(MgNH_4PO_4.6H_2O)$ will be the same as n $n(MgNH_4PO_4)$ if we divide by the appropriate molar mass.