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We use 9,0 ml of HF (48% m/m, ρ 1,14 g/ml) and 1,8 ml of HNO_3 (60% m/m, ρ 1,40 g/ml) for bomb digestion of sample.

HF (F):

The concentration of HF in acid mixture at bomb digestion is possibly calculated by 2 means:

1. Concentration in water solution is calculated using water content and HF content:
   9 ml of HF contains 4.925 g of HF and 5.335 g of H_2O:
   9 ml x 1.14=10.26 g – 100%
   X g - 48% - 4.925 g of HF
   10.26-4.925=5.335 g of H_2O;
   1.8 ml of HNO_3 contains 1.512 g of HNO_3 and 1.008 g of H_2O:
   1.8 ml x 1.40=2.52 g – 100%
   X g - 60% - 1.512 g of HNO_3
   2.52 -1.512 =1.008 g of H_2O;
   So, the final solution contains 4.925 g of HF, 1.512 g of HNO_3 and 5.335 + 1.008 =6.343 g of H_2O; total mass of water solution of HF is 4.925 g of HF + 6.343 g of H_2O = 11.268 g.
   11.268 g of water solution of HF – 100%
   4.925 g of HF – 43.7% of HF or 41,515% of F or **24,8 Mol/l of F**.

2. Concentration in acid mixture is calculated using water content, HNO_3 and HF content:
   9 ml of HF contains 4.925 g of HF and 5.335 g of H_2O (as above);
   1.8 ml of HNO_3 contains 1.512 g of HNO_3 and 1.008 g of H_2O (as above);

   So, the final solution of the acid mixture contains 4.925 g of HF, 1.512 g of HNO_3 and 5.335 + 1.008 =6.343 g of H_2O; total mass of acid mixture is 4.925 g of HF + 6.343 g of H_2O + 1.512 g of HNO_3 = 12.78 g.
   12.78 g of acid mixture– 100%
   4.925 g of HF – 38.5% of HF or 36,575% of F or **21,9 Mol/l of F**.

BaF_2, solubility product is 1,84*10^{-7} [1]

Spike of 50 mg of the nephelinite NKT-1 contains 37050 ng of Ba or 37,05*10^{-6} g or 2,68*10^{-7} mol.

The concentration of Ba in water solution:

(mean 1, using 6.343 g of H_2O, ρ 1,0 g/ml) is calculated as **4,2*10^{-5} Mol/l:**

2,68*10^{-7} mol of Ba is in 6,343 ml

X mol - 1000 ml;

(mean 2, using 12.78 g of acid mixture, ρ about 1,2 g/ml) is calculated as **2,5*10^{-5} Mol/l**;

So, **real ($Ba*F^2$)** are **5 orders above** solubility product of BaF_2 at least:

in water solution is calculated as $4,2*10^{-5} * 24,8^2 =$ **$2,6*10^{-2}$**

in acid mixture is calculated as $2,5*10^{-5} * 21,9^2 =$ **$1,2*10^{-2}$**

FeF_2, solubility product is $2,36*10^{-6}$ [1]

300 mg of the dunite DTS-1 contains 18228000 ng of Fe or $18,2*10^{-3}$ g or $3,25*10^{-4}$ mol.

The concentration of Fe in water solution:

(mean 1, using 6.343 g of H_2O, ρ 1,0 g/ml) is calculated as **$5,1*10^{-5}$ Mol/l;**

(mean 2, using 12.78 g of acid mixture, ρ about 1,2 g/ml) is calculated as **$3,1*10^{-5}$ Mol/l**;

So, **real ($Fe*F^2$)** are **4 orders above** solubility product of FeF_2 at least:

in water solution is calculated as $5,1*10^{-5} * 24,8^2 =$ **$3,1*10^{-2}$**

in acid mixture is calculated as $2,5*10^{-5} * 21,9^2 =$ **$1,2*10^{-2}$**

LiF, solubility product is $1,84*10^{-3}$ [1]

300 mg of the dunite DTS-1 contains 597 ng of Li or $5,97*10^{-7}$ g or $8,5*10^{-8}$ mol.

The concentration of Li in water solution:

(mean 1, using 6.343 g of H_2O, ρ 1,0 g/ml) is calculated as **$1,3*10^{-5}$ Mol/l;**

(mean 2, using 12.78 g of acid mixture, ρ about 1,2 g/ml) is calculated as **$8*10^{-6}$ Mol/l**;

So, **real (Li*F)** are ***1 order under*** solubility product of LiF at least:

in water solution is calculated as $1,3*10^{-5} * 24,8 =$ **$3,2*10^{-4}$**

in acid mixture is calculated as $8*10^{-6} * 21,9 = 528*10^{-5} =$ **$1,8*10^{-4}$**

MgF_2, solubility product is $5,16*10^{-11}$ [1]

300 mg of the dunite DTS-1 contains 89100000 ng of Mg or $89,1*10^{-3}$ g or $3,71*10^{-3}$ mol.

The concentration of Sr in water solution:

(mean 1, using 6.343 g of H_2O, ρ 1,0 g/ml) is calculated as **0,49 Mol/l:**

(mean 2, using 12.78 g of acid mixture, ρ about 1,2 g/ml) is calculated as **0,35 Mol/l**;

So, **real ($Mg*F^2$)** are **13 orders above** solubility product of MgF_2 at least:

in water solution is calculated as $0,49 * 24,8^2 =$ **301** in acid mixture is calculated as 0,35 * $21,9^2$ = **168**

PbF_2, solubility product is 3,3*10^{-8} [1]

Spike of "100 ng of the elements" contains 100 ng of Pb or 100*10^{-9} g or 4,81*10^{-10} mol.

The concentration of Pb in water solution:

(mean 1, using 6.343 g of H_2O, ρ 1,0 g/ml) is calculated as **7,6*10^{-8} Mol/l:**

(mean 2, using 12.78 g of acid mixture, ρ about 1,2 g/ml) is calculated as **4,5*10^{-8} Mol/l**;

So, **real (Pb*F^2)** are **3 orders above** solubility product of PbF_2 at least:

in water solution is calculated as 7,6*10^{-8} * $24,8^2$ = **4,7*10^{-5}**

in acid mixture is calculated as 4,5*10^{-8} * $21,9^2$ = **2,2*10^{-5}**

SrF_2, solubility product is 4,33*10^{-9} [1]

Spike of "100 ng of the elements" contains 100 ng of Sr or 100*10^{-9} g or 1,14*10^{-9} mol.

The concentration of Sr in water solution:

(mean 1, using 6.343 g of H_2O, ρ 1,0 g/ml) is calculated as **1,8*10^{-7} Mol/l:**

1,14*10^{-9} mol of Sr is in 6,343 ml

X mol - 1000 ml**;**

(mean 2, using 12.78 g of acid mixture, ρ about 1,2 g/ml) is calculated as **1,1*10^{-7} Mol/l**;

So, **real (Sr*F^2)** are **5 orders above** solubility product of SrF_2 at least:

in water solution is calculated as 1,8*10^{-7} * $24,8^2$ = 1107*10^{-7} = **1,1*10^{-4}**

in acid mixture is calculated as 1,1*10^{-5} * $21,9^2$ = 528*10^{-5} = **5,3*10^{-3}**

ScF_3, solubility product is 5,81*10^{-24} [1]

Spike of "100 ng of the elements" contains 100 ng of Sc or 100*10^{-9} g or 2,22*10^{-9} mol.

The concentration of Sc in water solution:

(mean 1, using 6.343 g of H_2O, ρ 1,0 g/ml) is calculated as **3,5*10^{-7} Mol/l;**

(mean 2, using 12.78 g of acid mixture, ρ about 1,2 g/ml) is calculated as **2,1*10^{-7} Mol/l**;

So, **real (Sc*F^3)** are **21 orders above** solubility product of ScF_3 at least:

in water solution is calculated as $3,5*10^{-7} * 24,8^3$ = $\mathbf{5,3*10^{-3}}$

in acid mixture is calculated as $2,1*10^{-7} * 21,9^3 = 528*10^{-5}$ = $\mathbf{2,2*10^{-3}}$

1. A.I. Volkov, I.M. Zharskiy. Large chemical guide. Modern school, Minsk, 2005 (in Russian).