Preparing and mixing acid solutions for the use in the Cosmoegnic RadioNuclide (CRN) Target Preparation Facility –
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Standard Concentrations and Normality of Acids:

Hydrochloric Acid, HCl conc. (36%): 12N (ρ = 1.19 g/mL)

Nitric Acid, HNO_3 conc. (69%): 15.8N (ρ = 1.42 g/mL)

Sulfuric Acid, H_2SO_4 (95.8%): 36N (ρ = 1.84 g/mL)

Ammonium Hydroxide, NH_4OH (29%): 14.8N (ρ = 0.90 g/mL)

Acetic Acid, CH_3CO_2H (99.8%): 17.4N (ρ = 1.05 g/mL)

You use the following relation to calculate the volumes of acid mixtures with a given normality (N):

$$N_1 \times V_1 = N_2 \times V_2$$
$$V_1 = V_2 \times N_2/N_1$$

Example: Preparation of 6N Hydrochloric Acid (1:1 HCl)

N_1 = 12N (conc. HCl)

N_2 = 6N

V_2 = 2000mL

V_1 = 2000mL x 6N / 12N

V_1 = 1000mL

To prepare a 2L 6N HCl solution, you mix 1L of conc. HCl with 1L of milliQ water.

Acid	Normality	Mixture to make a 2000mL solution
HCl	0.5N	83mL of conc. HCl (36%) + 1917mL of milliQ water
HCl	1N	167mL of conc. HCl (36%) + 1833mL of milliQ water
HCl	6N	1000mL of conc. HCl (36%) + 1000mL of milliQ water
HCl	8N	1333mL of conc. HCl (36%) + 667mL of milliQ water

Making a 1% Hydrofluoric and 1% Nitric acid mixture

For a 20 L solution, you use 49% HF: 0.2 / 0.49 = 0.41L

and 69% HNO3: 0.2 / 0.69 = 0.29L and 19.3L milliQ water.

Making a 5% Hydrofluoric and 5% Nitric acid mixture

For a 20 L solution, you use 49% HF: 1 / 0.49 = 2.04L

and 69% HNO3: 1 / 0.69 = 1.45L and 16.5L milliQ water.

Mixing of 0.4M Oxalic acid $(COOH)_2$

Molar weight of Oxalic acid, M = 126.07 g/mol

Mixing a 2 liter 0.4M oxalic acid solution:

126.07 g/mol x 0.4 mol/l x 2 = 100.9 g

Mixing a 1 liter 0.4M oxalic acid solution:

126.07 g/mol x 0.4 mol/l = 50.5 g

Put the weight of 100.9 g into the 2L LDPE bottle and add 2L of water.

Close lid, shake well – it may take up to several hours until all crystals are dissolved.