Station 1

Write the complete balanced chemical reactions for the following:

a) Potassium hydroxide and hydrogen are produced when potassium metal reacts with water.

$$2K + 2H_2O \rightarrow 2KOH + H_2$$

b) The reaction between magnesium metal and copper(II) sulphate.

$$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$$

c) Decomposition of mercury(II) oxide to its elements.

$$2HgO \rightarrow 2Hg + O_2$$

Station 2

$2\,Al + 3\,F_2 \rightarrow 2\,AlF_3$

a) What is the molar mass of each of the compounds in the reaction above?

Al : 27.0 g/mol

F_2 : 19.0 × 2 = 38.0 g/mol

AlF_3 : 27.0 + (19.0 × 3) = 84.0 g/mol

b) Fluorine has a purity of 78%. How many grams of the product will be formed from 56.0 g of fluorine?

↳ sample

$$\%\ \text{purity} = \frac{\text{pure}}{\text{sample}} \times 100\%$$

$$\frac{78\%}{100\%} = \frac{x}{56.0} \times \frac{100\%}{100\%}$$

$$0.78 = \frac{x}{56.0}$$

$$x = 43.7\ g\ F_2\ \text{pure}$$

$$43.7\ g_{F_2} \times \frac{1\ mol}{38.0\ g_{F_2}} \times \frac{2\ mol\ AlF_3}{3\ mol\ F_2} \times \frac{84.0\ g_{AlF_3}}{1\ mol_{AlF_3}}$$

$$= 64\ g\ AlF_3$$

Station 3

$M = \frac{mol}{L}$

200.0 g of NaCl are dissolved in 100. mL of water. Calculate the molarity of the solution.

$$\frac{200.0\ g}{100.\ mL} \times \frac{1\ mol}{58.5\ g} \times \frac{1000\ mL}{1\ L}$$

$$= \frac{34.2\ mol}{L} = \boxed{34.2\ M}$$

g

How many grams of AgCl are required to prepare 150.0 mL of 0.200 M solution?

0.150 L

$$L \times \frac{mol}{L}$$

$$0.1500\ \cancel{L} \times \frac{0.200\ \cancel{mol}}{1\ \cancel{L}} \times \frac{143.4\ g}{1\ \cancel{mol}}$$

$$= \boxed{4.30\ g}$$

Station 4

Aluminum and hydrochloric acid react together to form hydrogen gas and aluminum chloride. What mass of $AlCl_3$ is produced when 24.5 g of Al reacts with 90.0 g of HCl?

g

$$2\,Al + 6\,HCl \rightarrow 3\,H_2 + 2\,AlCl_3$$

Excess

$$24.5\,g\,Al \times \frac{1\,mol\,Al}{27.0\,g\,Al} \times \frac{2\,mol\,AlCl_3}{2\,mol\,Al} \times \frac{133.5\,g\,AlCl_3}{1\,mol\,AlCl_3} = 121\,g\,AlCl_3$$

Limiting

$$90.0\,g\,HCl \times \frac{1\,mol\,HCl}{36.5\,g\,HCl} \times \frac{2\,mol\,AlCl_3}{6\,mol\,HCl} \times \frac{133.5\,g\,AlCl_3}{1\,mol\,AlCl_3} = 110.\,g\,AlCl_3$$

Station 5

standard solution

In three trials of a titration, 36.9 mL, 34.4 mL, and 34.3 mL of 0.200 M NaOH were used to neutralize a 25.0 mL sample of H_2SO_4.

a) Write a balanced chemical reaction for this neutralization.

$$2\,NaOH + H_2SO_4 \rightarrow 2\,H_2O + Na_2SO_4$$

b) What was the average volume of NaOH used?

$$\frac{36.9 + 34.4 + 34.3}{3} = 35.2\,mL_{NaOH} \rightarrow 0.0352\,L$$

c) Calculate the molarity of the acid.

start w/ standard solution

$$0.0352\,L_{NaOH} \times \frac{0.200\,mol_{NaOH}}{1\,L_{NaOH}} \times \frac{1\,mol_{H_2SO_4}}{2\,mol_{NaOH}} \times \frac{1}{0.0250\,L_{H_2SO_4}}$$

$$= \boxed{0.141\,M_{H_2SO_4}}$$

Station 6

200.0 mL of 0.150 M $AlCl_3$ is added to 200.0 mL 0.250 M $BaCl_2$. Calculate the $[Ba^{2+}]$, $[Al^{3+}]$ and the $[Cl^-]$ immediately after mixing the two solutions.

Dilution

$[AlCl_3]$

$C_1V_1 = C_2V_2$

$(0.150M)(200.0mL) = C_2(400.0mL)$

$[AlCl_3] = 0.0750M$

$[BaCl_2]$

$(0.250M)(200.0mL) = C_2(400.0mL)$

$[BaCl_2] = 0.125M$

Ionization

$AlCl_3 \rightarrow Al^{3+} + 3Cl^-$

0.0750M → 0.0750M + 0.225M

×3

$BaCl_2 \rightarrow Ba^{2+} + 2Cl^-$

0.125M → 0.125M + 0.250M

×2

$[Cl^-] = 0.475M$