# PRACTICE #6 Titration/Miscellaneous AQ Chemistry Practice Problems

1.
50.10 mL of 0.0123 M sodium hydroxide was used to titrate 35.15 mL of an HCl solution of unknown molarity. What is the molarity of the HCl?

2.
Baking soda can be used to neutralize an acid spill in chem lab according to the following equation:

$NaHCO_3\ (s) + HNO_3\ (aq) \rightarrow NaNO_3\ (aq) + CO_2\ (g) + H_2O\ (l)$

If 30.00 mL of 5.00 M Nitric acid were spilled, how many grams of baking soda would it take to neutralize the acid?

3.
If it took 130.50 mL of 3.50 M HCl to completely neutralize 250 mL of an unknown NaOH solution.
A) What is the molarity of the NaOH solution?
B) How would you physically make this solution (the base)?

4.
A 100.0 mL sample of acidified dichromate ions of unknown molarity were titrated with a 0.100M solution of iron(II)chloride. If 43.2 mL of iron(II)chloride were used to fully react the dichromate:
A) What is the balanced net ionic equation for this reaction?
B) What is the molarity of the dichromate ions?
C) What is the concentration of the dichromate ions in ppm (parts per million)? Hint: 1 ppm = 0.001g/1 Liter of volume . . . Or, one milligram/L

5.
A 100.0 mL sample of $Pb^{2+}$ ions of unknown concentration were titrated with 0.100M HCl.
A) What is the concentration of the $Pb^{2+}$ in parts per million (see #4) if 0.0124g of $PbCl_2$ (s) were collected after filtering and drying?
B) What volume of HCl was used to produce this solid?

## ANSWERS:

1. $NaOH + HCl \rightarrow NaCl + H_2O$

50.10 mL X 1L/1000 mL X 0.0123mol NaOH/L = $6.16 \times 10^{-4}$ mol $OH^-$

$6.16 \times 10^{-4}$ mol OH- = mol $H^+$ = x mol $H^+$/L X 35.15 mL X 1L/1000 mL

= 0.0175 M HCl

2. $NaHCO_3$ (s) + $HNO_3$ (aq) → $NaNO_3$ (aq) + $CO_2$ (g) + $H_2O$ (l)

30.00 mL X 1L/1000 mL X 5.00 mol $HNO_3$/L = 0.150 mol $HNO_3$

1:1 rxn, so 0.150 mol $NaHCO_3$ X 84.01 g $NaHCO_3$/mol = 12.6 grams

3. A) nNaOH + HCl → NaCl + $H_2O$

130.50 mL X 1L/1000 mL X 3.50 mol HCl/L = 0.457 mol HCl =

mol $OH^-$ (1:1 ratio). So, 0.457 mol $OH^-$ = 250 mL X 1L/1000mL

X x mol $OH^-$/L = 1.83 M NaOH

B) take 0.457 mol NaOH X 40.00 g NaOH/mol = 18.28 g NaOH

Place NaOH in a 250.00 mL volumetric flask, dissolve and top up to the mark when cooling is complete.

4.
A) Reduction:
$14 H^+ + 6e' + Cr_2O_7^{2-} \rightarrow 2Cr^{3+} + 7H_2O$

Oxidation:
$6(Fe^{2+} \rightarrow Fe^{3+} + 1e')$

$14H^+ + 6Fe^{2+} + Cr_2O_7^{2-} \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

B) 0.100 mol $Fe^{2+}$/L X 43.2 mL X 1L/1000 mL X 1 mol $Cr_2O_7^{2-}$/6 mol $Fe^{2+}$

X 1/100.0 mL X 1000 mL/1L = 0.00720 M $Cr_2O_7^{2-}$

C) 1 liter has 0.00720 moles $Cr_2O_7^{2-}$ so, .00720 moles $Cr_2O_7^{2-}$/L X

216 g $Cr_2O_7^{2-}$/mol X 1000 mg/g X 1ppm/1 mg/L = 1510 ppm $Cr_2O_7^{2-}$

5. A) 0.0124 g $PbCl_2$/100 mL X 1000 mL/L X 1 mol $PbCl_2$/278.1 g $PbCl_2$

X 1 mol $Pb^{2+}$/1 mol $PbCl_2$ X 207.2 g $Pb^{2+}$/ 1 mol $Pb^{2+}$ X 1000 mg/g X

1 ppm/1 mg/L = 92.4 ppm $Pb^{2+}$

B) 0.124 g $PbCl_2$ X 1 mol $PbCl_2$/278.1 g $PbCl_2$ X 2 mol HCl/1 mol $PbCl_2$ X

1L/0.100 mol HCl = $8.92 \times 10^{-4}$ liters or 0.892 mL