

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:



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 $\text{PbCl}_2 (s)$ were collected after filtering and drying?

B) What volume of HCl was used to produce this solid?

ANSWERS:



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

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

$$= 0.0175 \text{ M HCl}$$



$$30.00 \text{ mL} \times 1\text{L}/1000 \text{ mL} \times 5.00 \text{ mol HNO}_3/\text{L} = 0.150 \text{ mol HNO}_3$$

$$1:1 \text{ rxn, so } 0.150 \text{ mol NaHCO}_3 \times 84.01 \text{ g NaHCO}_3/\text{mol} = 12.6 \text{ grams}$$



$$130.50 \text{ mL} \times 1\text{L}/1000 \text{ mL} \times 3.50 \text{ mol HCl}/\text{L} = 0.457 \text{ mol HCl} =$$

$$\text{mol OH}^- (1:1 \text{ ratio}). \text{ So, } 0.457 \text{ mol OH}^- = 250 \text{ mL} \times 1\text{L}/1000\text{mL}$$

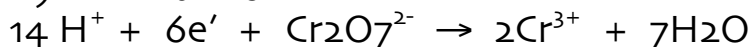
$$\times x \text{ mol OH}^-/\text{L} = 1.83 \text{ M NaOH}$$

$$\text{B) take } 0.457 \text{ mol NaOH} \times 40.00 \text{ g NaOH}/\text{mol} = 18.28 \text{ g NaOH}$$

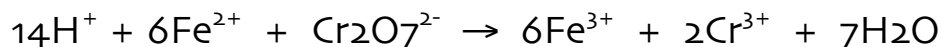
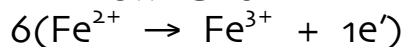
Place NaOH in a 250.00 mL volumetric flask, dissolve and top up to the mark when cooling is complete.

4.

A) Reduction:



Oxidation:



$$\text{B) } 0.100 \text{ mol Fe}^{2+}/\text{L} \times 43.2 \text{ mL} \times 1\text{L}/1000 \text{ mL} \times 1 \text{ mol Cr}_2\text{O}_7^{2-}/6 \text{ mol Fe}^{2+}$$

$$\times 1/100.0 \text{ mL} \times 1000 \text{ mL}/1\text{L} = 0.00720 \text{ M Cr}_2\text{O}_7^{2-}$$

$$\text{C) } 1 \text{ liter has } 0.00720 \text{ moles Cr}_2\text{O}_7^{2-} \text{ so, } .00720 \text{ moles Cr}_2\text{O}_7^{2-}/\text{L} \times$$

$$216 \text{ g Cr}_2\text{O}_7^{2-}/\text{mol} \times 1000 \text{ mg}/\text{g} \times 1\text{ppm}/1 \text{ mg}/\text{L} = 1510 \text{ ppm Cr}_2\text{O}_7^{2-}$$

$$5. \text{ A) } 0.0124 \text{ g PbCl}_2/100 \text{ mL} \times 1000 \text{ mL}/\text{L} \times 1 \text{ mol PbCl}_2/278.1 \text{ g PbCl}_2$$

$$\times 1 \text{ mol Pb}^{2+}/1 \text{ mol PbCl}_2 \times 207.2 \text{ g Pb}^{2+}/1 \text{ mol Pb}^{2+} \times 1000 \text{ mg}/\text{g} \times$$

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

$$\text{B) } 0.124 \text{ g PbCl}_2 \times 1 \text{ mol PbCl}_2/278.1 \text{ g PbCl}_2 \times 2 \text{ mol HCl}/1 \text{ mol PbCl}_2 \times$$

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