



STOICHIOMETRY AND MOLARITY

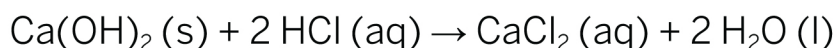


1. How many mL of 0.280 M barium nitrate are required to precipitate as barium sulfate all the sulfate ions from 25.0 mL of 0.350 M aluminum sulfate?

2. What volume of 0.496 M HCl is required to neutralize 20.0 mL of 0.809 M sodium hydroxide?

3. How many grams of calcium phosphate can be produced from the reaction of 2.50 L of 0.250 M calcium chloride with excess phosphoric acid?

4. Consider the following equation:



a. How many liters of 0.100 M HCl would be required to react completely with 5 grams of calcium hydroxide?

b. If 15 grams of calcium hydroxide combines with 75 mL of 0.500 M HCl, how many grams of calcium chloride will be formed?

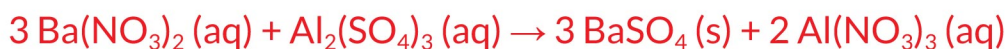


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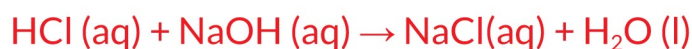
Answers

1. How many mL of 0.280 M barium nitrate are required to precipitate as barium sulfate all the sulfate ions from 25.0 mL of 0.350 M aluminum sulfate?



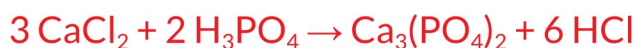
$$0.025 \text{ L Al}_2\text{(SO}_4)_3 \times (0.35 \text{ mol Al}_2\text{(SO}_4)_3 / 1 \text{ L Al}_2\text{(SO}_4)_3) \times (3 \text{ mol Ba(NO}_3)_2 / 1 \text{ mol Al}_2\text{(SO}_4)_3) \\ \times (1 \text{ L Ba(NO}_3)_2 / 0.280 \text{ mol Ba(NO}_3)_2) = 93.8 \text{ mL Ba(NO}_3)_2$$

2. What volume of 0.496 M HCl is required to neutralize 20.0 mL of 0.809 M sodium hydroxide?



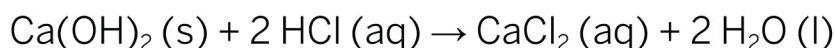
$$0.020 \text{ L NaOH} \times (0.809 \text{ mol NaOH} / 1 \text{ L NaOH}) \times (1 \text{ mol HCl} / 1 \text{ mol NaOH}) \\ \times (1 \text{ L HCl} / 0.496 \text{ mol HCl}) = 33 \text{ mL HCl}$$

3. How many grams of calcium phosphate can be produced from the reaction of 2.50 L of 0.250 M calcium chloride with excess phosphoric acid?



$$2.5 \text{ L CaCl}_2 \times (0.250 \text{ mol CaCl}_2 / 1 \text{ L CaCl}_2) \times (1 \text{ mol Ca}_3\text{(PO}_4)_2 / 3 \text{ mol CaCl}_2) \\ \times (310 \text{ g Ca}_3\text{(PO}_4)_2 / 1 \text{ mol Ca}_3\text{(PO}_4)_2) = 64.6 \text{ g Ca}_3\text{(PO}_4)_2$$

4. Consider the following equation:



a. How many liters of 0.100 M HCl would be required to react completely with 5 grams of calcium hydroxide?

$$5 \text{ g Ca(OH)}_2 \times (1 \text{ mol Ca(OH)}_2 / 74.092 \text{ g Ca(OH)}_2) \times (2 \text{ mol HCl} / 1 \text{ mol Ca(OH)}_2) \\ \times (1 \text{ L HCl} / 0.100 \text{ mol HCl}) = 1.35 \text{ L HCl}$$

b. If 15 grams of calcium hydroxide combines with 75 mL of 0.500 M HCl, how many grams of calcium chloride will be formed?

$$15 \text{ g Ca(OH)}_2 \times (1 \text{ mol Ca(OH)}_2 / 74.092 \text{ g Ca(OH)}_2) \times (1 \text{ mol CaCl}_2 / 1 \text{ mol Ca(OH)}_2) = \\ 0.202 \text{ mol CaCl}_2$$

$$0.075 \text{ L HCl} \times (0.500 \text{ mol HCl} / 1 \text{ L HCl}) \times (1 \text{ mol CaCl}_2 / 2 \text{ mol HCl}) = \boxed{0.01875 \text{ mol CaCl}_2}$$

The lower number of moles is the amount produced.

$$0.01875 \text{ mol CaCl}_2 \times (110.98 \text{ g CaCl}_2 / 1 \text{ mol CaCl}_2) = 2.08 \text{ g CaCl}_2$$