

## Chemistry 105, Chapter 4 Exercises

### Solutions and Molarity

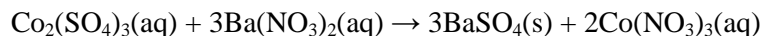
1. What is the molarity of a 250.0 mL solution containing 22.2 g of NaCl? Ans. 1.52 M
2. What is the molarity of  $\text{NO}_3^-$  in a 500.0 mL solution containing 25.0 g of  $\text{Al}(\text{NO}_3)_3$ ? Ans. 0.704 M
3. How many grams of  $\text{Ni}(\text{NO}_3)_2$  would be needed to prepare 2.00L of a 0.750 M solution? Ans. 275. g
4. How many grams of  $\text{CuCl}_2$  would be needed to prepare 500. mL of a 2.0 M solution? Ans. 135. g
5. How many grams of  $\text{CuCl}_2$  would be needed to prepare 1.00 L of a 0.750 M  $\text{Cl}^-$  solution? Ans. 50.4 g
6. How many grams of  $\text{AlCl}_3$  would be needed to prepare 50.0 mL of a 2.0 M  $\text{Cl}^-$  solution? Ans. 4.45 g
7. How many milliliters of a 0.8500 M  $\text{Al}(\text{NO}_3)_3$  solution are needed to furnish 0.2000 mole of  $\text{Al}(\text{NO}_3)_3$ ?  
Ans. 235.3 mL
8. How many milliliters of a 0.8500 M  $\text{Al}(\text{NO}_3)_3$  solution are needed to furnish 2.000 g of  $\text{Al}(\text{NO}_3)_3$ ?  
Ans. 11.0 mL
9. How many moles of  $\text{Al}(\text{NO}_3)_3$  are present in 50.0 mL of a 0.8500 M solution of  $\text{Al}(\text{NO}_3)_3$ ?  
Ans. 0.0425 mole
10. How many moles of  $\text{NO}_3^-$  are present in 10.0 mL of a 0.8500 M solution of  $\text{Al}(\text{NO}_3)_3$ ? Ans. 0.0255 mole
11. How many milliliters of a 0.450 M solution of  $\text{K}_2\text{CO}_3$  are needed to furnish 0.0100 moles of  $\text{K}_2\text{CO}_3$ ?  
Ans. 22.2 mL
12. How many milliliters of a 0.450 M solution of  $\text{K}_2\text{CO}_3$  are needed to furnish 1.00 g of  $\text{K}_2\text{CO}_3$ ? Ans. 16.1 mL
13. How many moles of  $\text{K}_2\text{CO}_3$  are present in 25.0 mL of a 0.450 M solution of  $\text{K}_2\text{CO}_3$ ? Ans. 0.0113 mole
14. How many grams of  $\text{K}^+$  are present in 20.00 mL of 0.4500 M solution of  $\text{K}_2\text{CO}_3$ ? Ans. 0.704 g

### Precipitate Formation

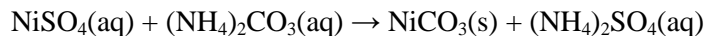
15. Decide whether a precipitate would form when the following solutions are mixed. If a precipitate forms write the molecular, complete ionic, and net ionic equations.  
 $\text{Ni}(\text{NO}_3)_2 + \text{NaOH} \rightarrow$   
 $\text{CdSO}_4 + \text{Ba}(\text{OH})_2 \rightarrow$   
 $\text{FeCl}_3 + \text{NaOH} \rightarrow$   
 $\text{CuSO}_4 + \text{NaCl} \rightarrow$   
 $\text{Mn}(\text{NO}_3)_2 + \text{NaOH} \rightarrow$   
 $\text{AgNO}_3 + \text{HCl} \rightarrow$   
 $\text{CoSO}_4 + \text{Ba}(\text{OH})_2 \rightarrow$   
 $(\text{NH}_4)_2\text{CO}_3 + \text{KOH} \rightarrow$   
 $\text{Fe}(\text{NO}_3)_3 + \text{Ba}(\text{OH})_2 \rightarrow$   
 $(\text{NH}_4)_2\text{CO}_3 + \text{CoCl}_3 \rightarrow$   
 $\text{Na}_3\text{PO}_4 + \text{Ba}(\text{OH})_2 \rightarrow$   
 $\text{Ba}(\text{NO}_3)_2 + \text{KOH} \rightarrow$

### Solution Stoichiometry

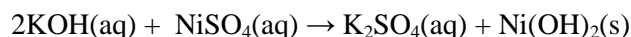
16. What volume of 0.733 M  $\text{Ba}(\text{NO}_3)_2$  is required to react completely with 20.0 mL of 0.937M  $\text{Co}_2(\text{SO}_4)_3$ ? How many grams of precipitate will form? Ans. 0.0767 L 13.12 g



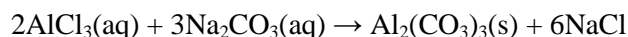
17. What volume of 0.500 M  $\text{NiSO}_4$  is required to react completely with 15.0 mL of 0.896 M  $(\text{NH}_4)_2\text{CO}_3$ ? How many grams of precipitate will form? Molar mass for  $\text{NiCO}_3 = 118.7$  g. Ans. 0.0269L, 1.60 g



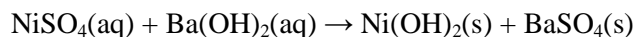
18. A solution of 100.0 mL of 0.200 M  $\text{KOH}$  is mixed with a solution of 200.0 mL of 0.150 M  $\text{NiSO}_4$ . How many grams of precipitate form? Molar mass for  $\text{Ni}(\text{OH})_2 = 92.7$  g. Ans. 0.927 g



19. A solution of 50.0 mL of 0.200 M  $\text{AlCl}_3$  is mixed with a solution of 35.5 mL of 0.137 M  $\text{Na}_2\text{CO}_3$ . How many grams of precipitate form? Molar mass for  $\text{Al}_2(\text{CO}_3)_3 = 234$  g. Ans. 0.379 g

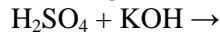
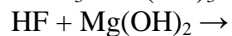


20. What volume of 0.500M  $\text{NiSO}_4$  is required to react completely with 25.6 mL of 0.250 M  $\text{Ba}(\text{OH})_2$ ? How many grams of precipitate will form? Ans. 0.0128 L 2.08 g



### Balancing Neutralization Reactions

21. Complete and balance the following neutralization reaction equations. Show the molecular, complete ionic, and net ionic equations.



### Stoichiometry and Neutralization Reactions

22. What volume of 0.285 M  $\text{Sr}(\text{OH})_2$  is required to neutralize 25.00 mL of 0.275 M  $\text{HF}$ ? Ans. 0.0121 L

23. What volume of 0.150 M  $\text{NaOH}$  is required to neutralize 50.00 mL of 0.200 M  $\text{H}_2\text{SO}_4$ ? Ans. 0.133 L

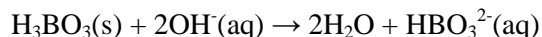
24. What is the molarity of a solution of  $\text{HNO}_3$  if 0.216 g of  $\text{Ba}(\text{OH})_2$  is required to neutralize 20.00 mL of  $\text{HNO}_3$ ? Molar mass for  $\text{Ba}(\text{OH})_2 = 171.3$  g. Ans. 0.126 M

25. What is the molarity of a solution of  $\text{H}_2\text{SO}_4$  if 0.356 g of  $\text{NaOH}$  is required to neutralize 25.00 mL of  $\text{H}_2\text{SO}_4$ ? Molar mass for  $\text{NaOH} = 40.0$  g. Ans. 0.178 M

26. What is the molarity of a solution of  $\text{H}_2\text{SO}_4$  if 23.00 mL of 0.1100 M  $\text{NaOH}$  is required to neutralize 10.00 mL of the acid? Ans. 0.1265 M

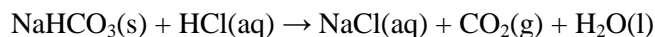
27. What is the molarity of a solution of  $\text{H}_3\text{PO}_4$  if 32.10 mL of 0.1200 M NaOH is required to neutralize 10.00 mL of the acid? Ans. 0.1284 M

28. Boric acid can be used to neutralize bases. The equation for the reaction is:



What volume of 0.216 M  $\text{Ba}(\text{OH})_2$  can be neutralized by 10.00 g of  $\text{H}_3\text{BO}_3$ ? Molar mass for  $\text{H}_3\text{BO}_3 = 61.8$  g.  
Ans. 0.749 L

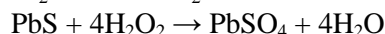
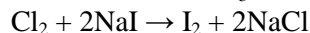
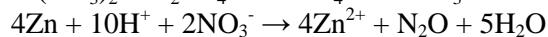
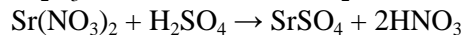
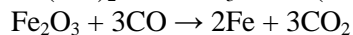
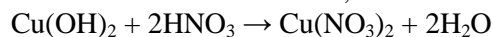
29. Some hydrochloric acid spilled on the lab floor. Sodium bicarbonate is sprinkled on the spill to neutralize the acid.



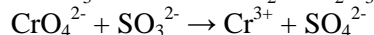
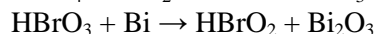
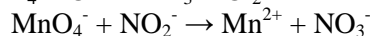
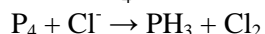
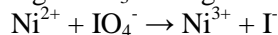
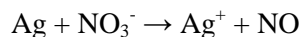
If 75. mL of 3.00 M HCl were spilled, what is the minimum amount of  $\text{NaHCO}_3$  that must be used to neutralize all the acid in the spill? Molar mass for  $\text{NaHCO}_3 = 84.0$  g. Ans. 18.9 g

### Oxidation-Reduction Reactions

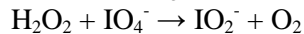
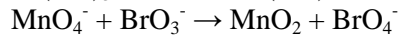
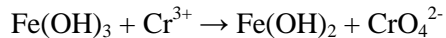
30. Assign oxidation numbers to each of the elements in the following reactions. Indicate which are redox reactions. For those that are, indicate which element is oxidized and which is reduced.



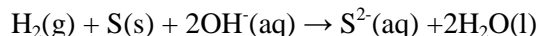
31. Use the half reaction method to balance the following reactions in acid solution.



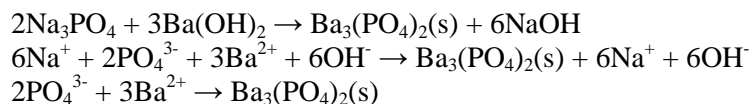
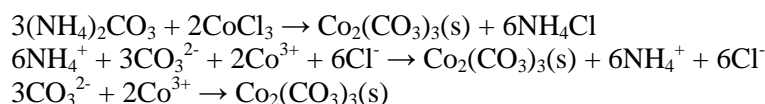
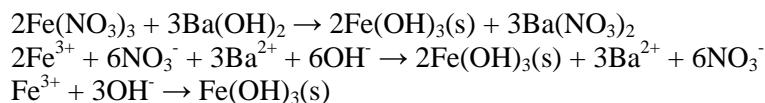
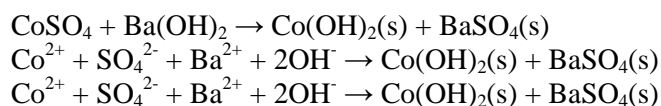
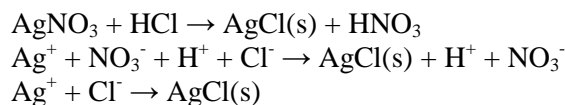
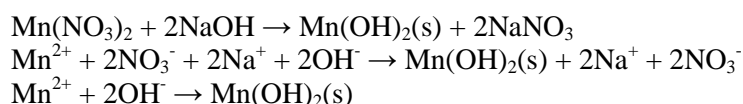
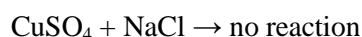
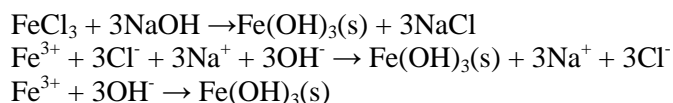
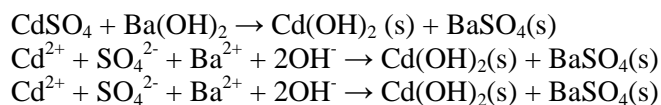
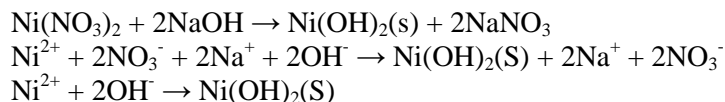
32. Use the half reaction method to balance the following reactions in basic solution.



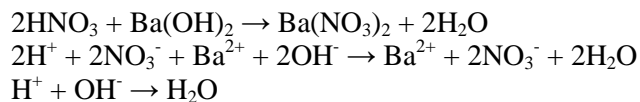
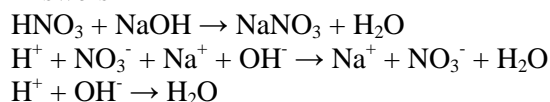
33. What volume of 0.349 M  $\text{Ba}(\text{OH})_2$  is required to react completely with 3.00 g of sulfur? Ans. 0.268 L

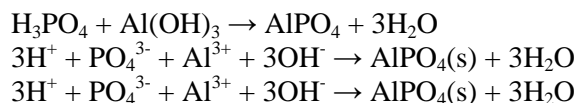
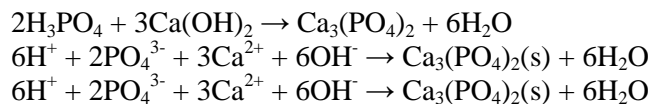
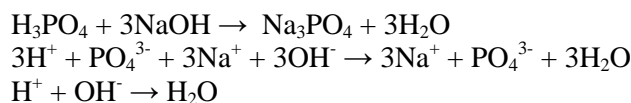
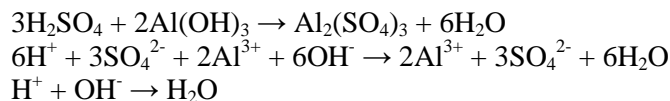
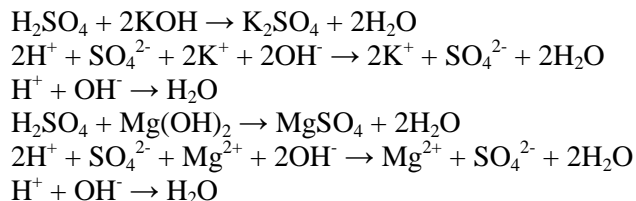
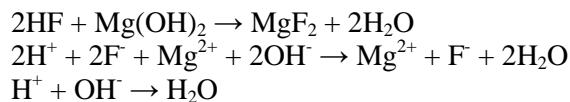
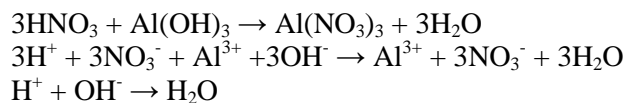


15. Answers

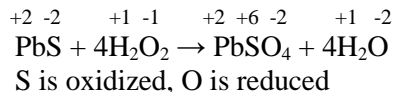
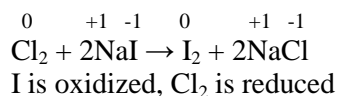
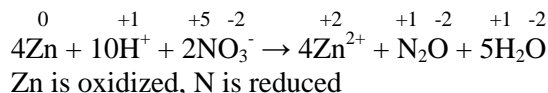
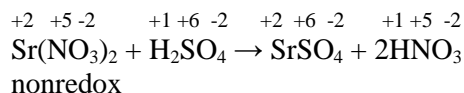
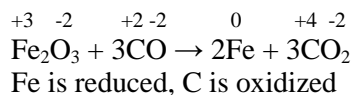
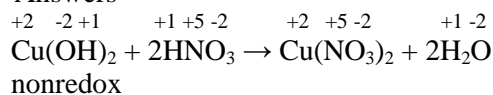


21. Answers

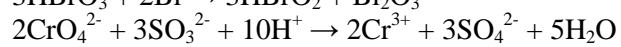
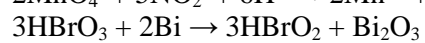
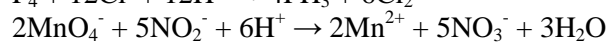
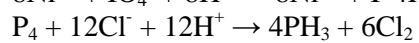
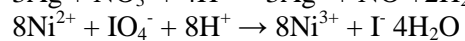
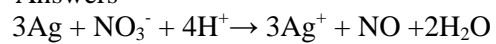




### 30. Answers



31. Answers



32. Answers

