

Review of Chemistry 11

HCl C₃H₈ SO₂ NH₄Cl KOH H₂SO₄ H₂O AgNO₃ PbSO₄ H₃PO₄ Ca(OH)₂ Al(OH)₃
 P₂O₅ Ba(OH)₂ CH₃COOH

1. Classify the above as ionic or covalent by making two lists. Describe the difference between an ionic and covalent compound.

Ionic **NH₄Cl KOH AgNO₃ PbSO₄ Ca(OH)₂ Al(OH)₃ Ba(OH)₂**

Covalent **C₃H₈ SO₂ H₂O P₂O₅ H₃PO₄ CH₃COOH H₂SO₄**

2. Classify the above as acids, bases, salts and molecular (covalent compounds) by making four lists.

Acids **HCl H₂SO₄ CH₃COOH H₃PO₄**

Bases **KOH Ca(OH)₂ Ba(OH)₂ Al(OH)₃**

Salts **NH₄Cl AgNO₃ PbSO₄**

Molecular **C₃H₈ SO₂ H₂O P₂O₅**

3. Describe how you can identify each of the four categories by the formula of the compound.

Acids **The formula starts with H or ends in COOH except H₂O.**

Bases **The formula starts with a metal or NH₄ and ends in OH.**

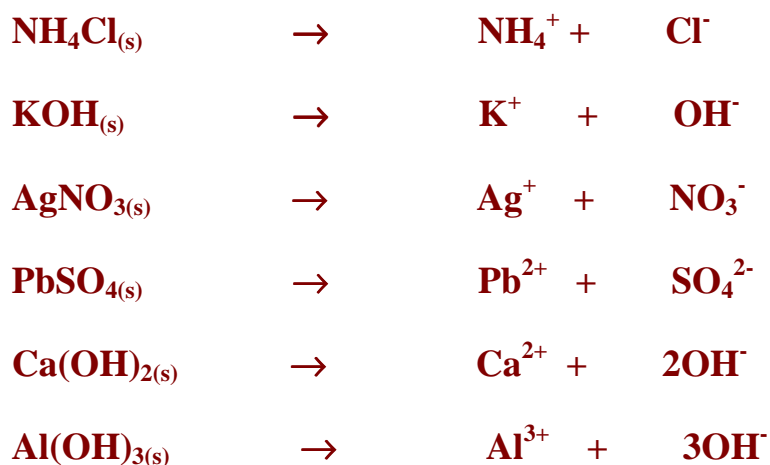
Salts **The formula starts with a metal or NH₄ and does not end in OH.**

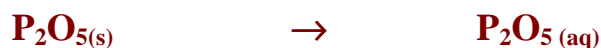
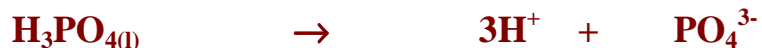
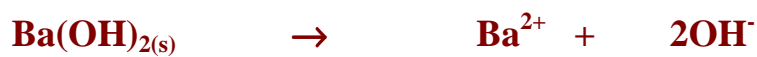
Molecular **The formula starts with a nonmetal other than H.**

4. Describe how each of the four categories would react with litmus and conduct electricity when aqueous.

	Litmus	Conductivity
Acids	Red	Yes
Bases	Blue	Yes
Salts	Neutral	Yes
Molecular	Neutral	No

5. For each compound that conducts electricity, write a dissociation equation to show how it ionizes in water.





6. Calculate the molar mass of $\text{FeSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{Co}_3(\text{PO}_4)_2 \cdot 6\text{H}_2\text{O}$.

$$\mathbf{241.9 \text{ g/mol} \quad 474.7 \text{ g/mol}}$$

7. 0.300 moles of NaCl is dissolved in 250.0 ml of water, calculate the molarity.

$$\mathbf{\text{Molarity} = \frac{0.300 \text{ moles}}{.250 \text{ L}} = 1.20 \text{ M}}$$

8. 500. g of $\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ is dissolved in 600. ml of water, calculate the molarity.

$$\mathbf{\text{Molarity} = \frac{500 \text{ g}}{259.9 \text{ g}} \times \frac{1 \text{ mole}}{.600 \text{ L}} = 3.21 \text{ M}}$$

9. How many grams of NaCl are required to prepare 100.0 ml of a 0.200 M solution?

$$\mathbf{.100 \text{ L} \times \frac{0.200 \text{ mole}}{1 \text{ L}} \times \frac{58.5 \text{ g}}{1 \text{ mole}} = 1.17 \text{ g}}$$

10. 20. g of MgCl_2 are dissolved in 250. ml of water, calculate the concentration of each ion.

$$\mathbf{\text{Molarity} = \frac{20 \text{ g}}{95.3 \text{ g}} \times \frac{1 \text{ mole}}{0.250 \text{ L}} = 0.84 \text{ M}}$$

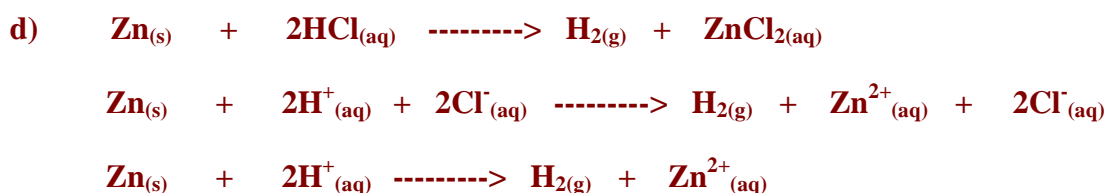
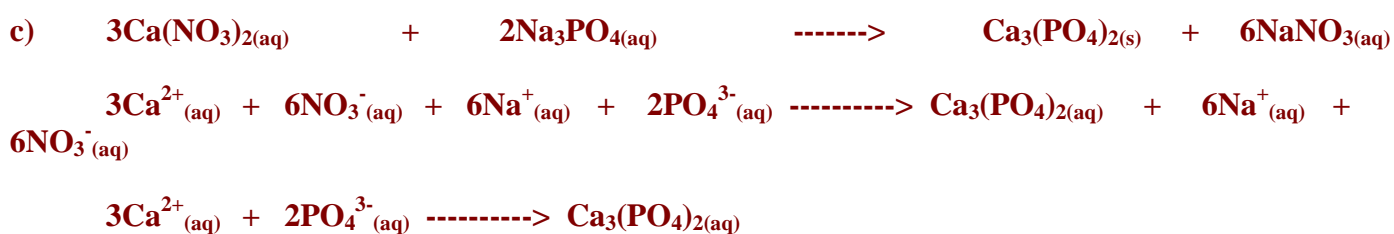
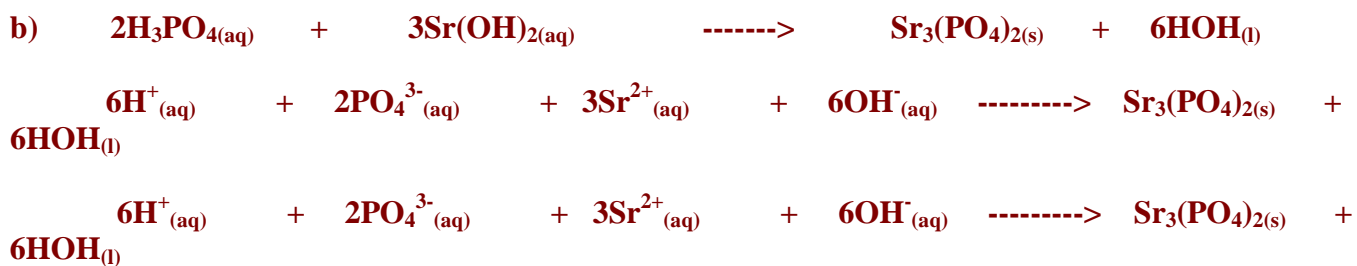
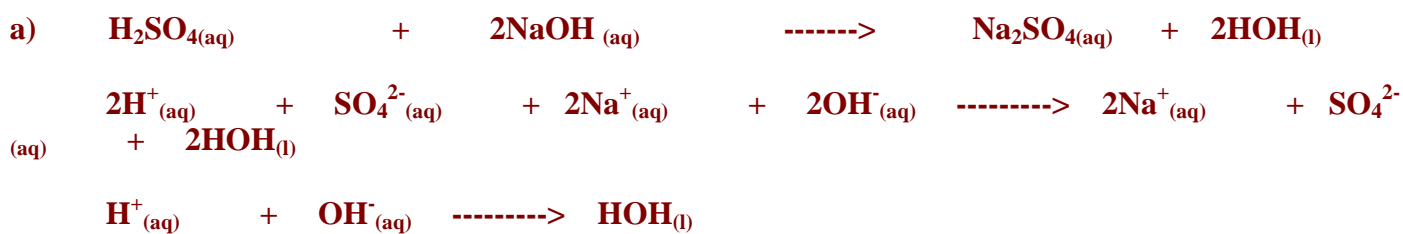
$$\mathbf{\text{MgCl}_2 \rightarrow \text{Mg}^{2+} + 2\text{Cl}^-}$$

$$\mathbf{0.84 \text{ M} \quad 0.84 \text{ M} \quad 1.7 \text{ M}}$$

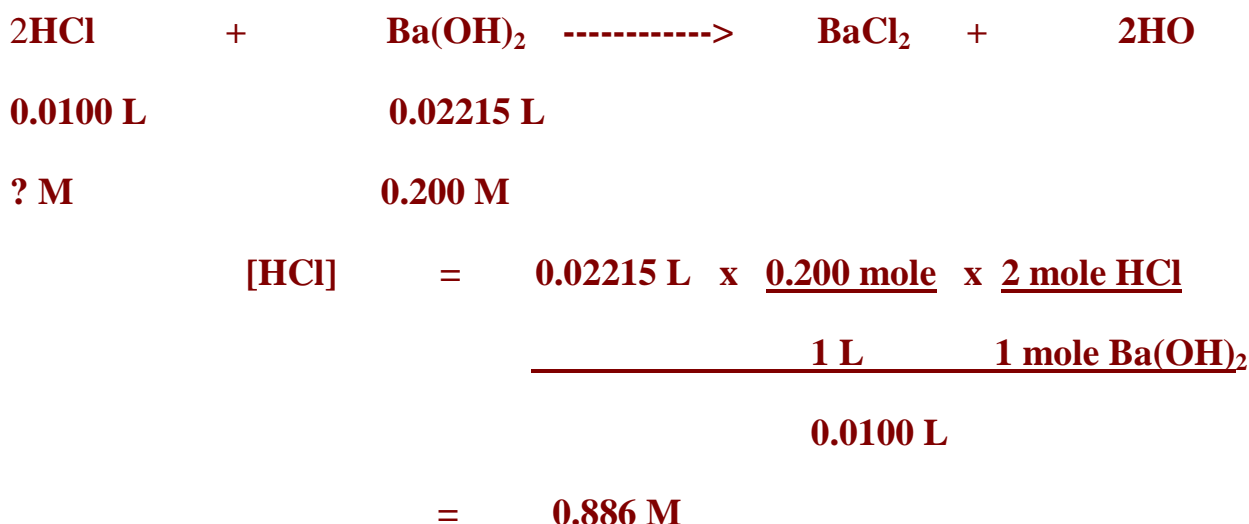
11. How many liters of 0.300 M NaCl contains 10.0 g of NaCl?

$$\mathbf{10.0 \text{ g} \times \frac{1 \text{ mole}}{58.5 \text{ g}} \times \frac{1 \text{ L}}{0.300 \text{ mole}} = 0.570 \text{ L}}$$

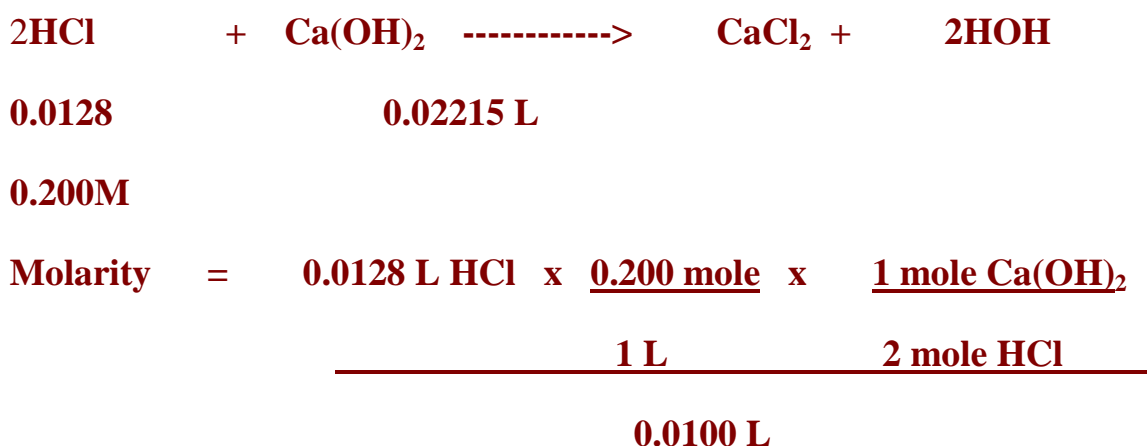
12. For each double replacement reaction write the formula equation, the complete ionic equation and the net ionic equation.



13. In three runs of a titration 22.8, 22.1 and 22.2 ml of .200 M Ba(OH)₂ were required to neutralize 10.0 ml of HCl, calculate the acid concentration.



14. In three runs of a titration 12.1, 12.8, 12.8 ml of 0.200 M HCl were required to neutralize 10.0 ml of Ca(OH)₂, calculate the base concentration.



$$= \quad \mathbf{0.128 \text{ M}}$$

15. 35.0 ml of 1.00 M H₂SO₄ reacts with 175 ml 0.250M NaOH, calculate the concentration of the excess base.



$$\mathbf{0.0350L \times \underline{1.00 \text{ mole}} = 0.0350 \text{ mole} \quad \quad \mathbf{0.175L \times \underline{0.250 \text{ mole}} = 0.04375 \text{ mole}}$$

1 L

1 L

$$\mathbf{I} \quad \quad \quad \mathbf{0.0350 \text{ mole}} \quad \quad \mathbf{0.04375 \text{ mole}}$$

$$\mathbf{C} \quad \quad \quad \mathbf{0.02188 \text{ mole}} \quad \quad \mathbf{0.04375 \text{ mole}}$$

$$\mathbf{E} \quad \quad \quad \mathbf{0.01312 \text{ mole}} \quad \quad \mathbf{0 \text{ mole}}$$

$$\mathbf{Total \ Volume = 210 \ mL = 0.210 \ L}$$

$$\mathbf{Molarity = \quad \underline{0.01312 \ mole} \quad = 0.0625 \ M}$$

$$\mathbf{0.210L}$$

16. 350.0 ml of 0.200 M HCl reacts with 175 ml 0.125 M Ca(OH)₂, calculate the concentration of the excess acid.



$$\mathbf{0.350L \times \underline{0.200 \ mole} = 0.0700 \ mole} \quad \quad \mathbf{0.175L \times \underline{0.125 \ mole} = 0.02188 \ mole}$$

1 L

1 L

$$\mathbf{I} \quad \quad \quad \mathbf{0.0700 \ mole} \quad \quad \mathbf{0.02188 \ mole}$$

$$\mathbf{C} \quad \quad \quad \mathbf{0.0438 \ mole} \quad \quad \mathbf{0.02188 \ mole}$$

$$\mathbf{E} \quad \quad \quad \mathbf{0.0262 \ mole} \quad \quad \mathbf{0.000 \ mole}$$

$$\mathbf{Total \ Volume = 525 \ mL = 0.525 \ L} \quad \quad \mathbf{Molarity = \quad \underline{0.0262 \ mole} \quad = 0.0499M}$$

$$\mathbf{0.525L}$$

17. 25.0 g of sodium reacts with water, how many grams of hydrogen are produced? How many grams of sodium hydroxide are produced?



$$\mathbf{25.0 \ g \ Na \ x \quad \underline{1 \ mole} \quad \times \quad \underline{1 \ mol \ H_2} \quad \times \quad \underline{2.02 \ g} \quad = \quad 1.10 \ g}$$

$$\mathbf{23.0 \ g} \quad \quad \mathbf{2 \ mol \ Na} \quad \quad \mathbf{1 \ mole}$$

$$\mathbf{25.0 \ g \ Na \ x \quad \underline{1 \ mole} \quad \times \quad \underline{2 \ mol \ NaOH} \quad \times \quad \underline{40.0 \ g} \quad = \quad 43.5 \ g}$$

$$\mathbf{23.0 \ g} \quad \quad \mathbf{2 \ mol \ Na} \quad \quad \mathbf{1 \ mole}$$

18. 25.0 g of calcium reacts with water, how many grams of hydrogen are produced? How many grams of calcium hydroxide are produced?



$$25.0 \text{ g Ca} \times \frac{1 \text{ mole}}{40.1 \text{ g}} \times \frac{1 \text{ mol H}_2}{1 \text{ mol Ca}} \times \frac{2.0 \text{ g}}{1 \text{ mole}} = 1.25 \text{ g}$$

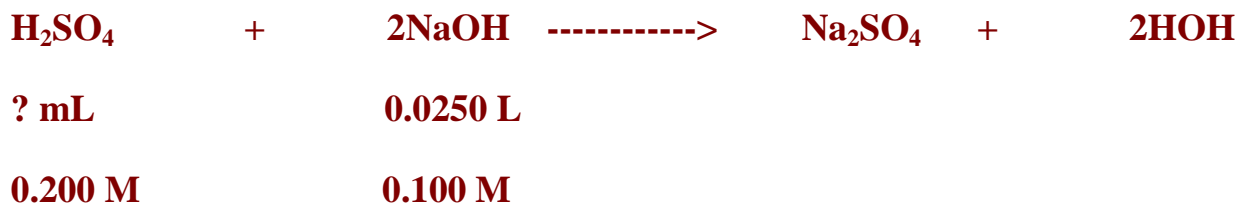
$$25.0 \text{ g Ca} \times \frac{1 \text{ mole}}{40.1 \text{ g}} \times \frac{1 \text{ mol Ca(OH)}_2}{1 \text{ mol Ca}} \times \frac{74.1 \text{ g}}{1 \text{ mole}} = 46.2 \text{ g}$$

19. How many millilitres of 0.200M NaOH is required to neutralize 25.0 ml of 0.100 M H₂SO₄ ?



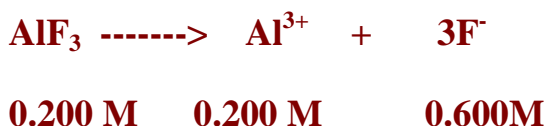
$$0.0250 \text{ L NaOH} \times \frac{0.100 \text{ mole}}{1 \text{ L}} \times \frac{2 \text{ mole NaOH}}{1 \text{ mole H}_2\text{SO}_4} \times \frac{1 \text{ L}}{0.200 \text{ mole}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 25.0 \text{ mL}$$

20. How many millilitres of 0.200M H₂SO₄ is required to neutralize 25.0 ml of 0.100 M NaOH ?



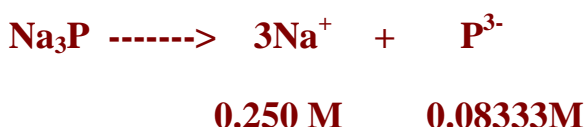
$$0.0250 \text{ L NaOH} \times \frac{0.100 \text{ mole}}{1 \text{ L}} \times \frac{1 \text{ mole H}_2\text{SO}_4}{2 \text{ mole NaOH}} \times \frac{1 \text{ L}}{0.200 \text{ mole}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 6.25 \text{ mL}$$

21. If the [F⁻] = 0.600 M in a AlF₃ solution, calculate the [Al⁺³] and the number of grams required to make 1.00 L of the solution.



$$1.00 \text{ L} \times \frac{0.200 \text{ mole}}{1 \text{ L}} \times \frac{84.0 \text{ g}}{1 \text{ mole}} = 16.8 \text{ g}$$

22. If the [Na⁺] = 0.250 M in a Na₃P solution, calculate the [P³⁻] and the number of grams required to make 1.50 L of the solution.



$$1.50\text{L} \times \frac{0.08333 \text{ mole}}{1 \text{ L}} \times \frac{100 \text{ g}}{1 \text{ mole}} = 12.5 \text{ g}$$

23. A beaker of mass = 25.36g contains 2.00 L of a solution of BaCl₂ and is evaporated to dryness mass = 28.59 g. Calculate the molarity of the solution.

$$28.59\text{g} - 25.36 = 3.23\text{g}$$

$$\text{Molarity} = 3.23\text{g} \times \frac{1 \text{ mole}}{208.3\text{g}}$$

$$\frac{3.23\text{g}}{208.3\text{g}} = 0.0155 \text{ mole}$$

$$\frac{0.0155 \text{ mole}}{2.00 \text{ L}} = 0.00775 \text{ M}$$

23. A beaker has a mass of 25.36 g. A solution that contains 2.00 L of a solution of BaCl₂ has a mass of 163.59 g. The solution is evaporated to dryness and it then has a mass of 28.59 g. Calculate the molarity of the solution.

$$62.31 - 55.66 = 6.65\text{g}$$

$$\text{Molarity} = 6.65\text{g} \times \frac{1 \text{ mole}}{84.0\text{g}}$$

$$\frac{6.65\text{g}}{84.0\text{g}} = 0.0792\text{M}$$

$$\frac{0.0792\text{M}}{1.00 \text{ L}} = 0.0792\text{M}$$

25. A titration was performed by adding 0.175 M H₂C₂O₄ to a 25.00 mL sample of NaOH. The following data was collected. Calculate the molarity of the base.

	Trial #1	Trial # 2	Trial #3
Final volume of H ₂ C ₂ O ₄ (mL)	23.00	39.05	20.95
Initial volume of H ₂ C ₂ O ₄ (mL)	4.85	23.00	5.00

18.15 mL

16.05 mL

15.95 mL

Average 16.00 mL

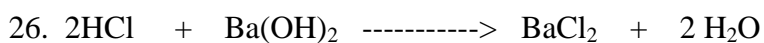


$$0.0160 \text{ L} \qquad 0.0250 \text{ L}$$

$$0.175 \text{ M} \qquad ?\text{M}$$

$$[\text{NaOH}] = \frac{0.0160 \text{ L} \times 0.175 \text{ mole} \times 2 \text{ mole NaOH}}{1 \text{ L} \times 1 \text{ mole H}_2\text{C}_2\text{O}_4 \times 0.0250 \text{ L}}$$

$$= 0.224 \text{ M}$$



When 3.16 g samples of Ba(OH)₂ were titrated to the endpoint with HCl solution. 37.80mL, 35.49mL, 35.51 mL of HCL was required. Calculate the HCl concentration.



$$0.03500 \text{ L} \quad 3.16\text{g}$$

$$? \text{ M} \quad 171.3\text{g/mole}$$

$$[\text{HCl}] = \frac{3.16\text{g} \times \frac{1 \text{ mole}}{171.3 \text{ g}} \times \frac{2 \text{ mole HCl}}{1 \text{ Ba(OH)}_2}}{0.03500 \text{ L}}$$

$$= 1.05 \text{ M}$$

27. A 0.960 g sample of impure Na₂CO₃ is dissolved in water and then completely reacted with 0.200 M HCl requiring 65.3 mL. Calculate the percentage by mass of Na₂CO₃ in the sample.



$$0.00653 \text{ L}$$

$$? \text{ g} \quad 0.200 \text{ M}$$

$$0.0653 \text{ L HCl} \times \frac{0.200 \text{ moles}}{1 \text{ L}} \times \frac{1 \text{ mole Na}_2\text{CO}_3}{2 \text{ moles HCl}} \times \frac{106 \text{ g}}{1 \text{ mole}} = 0.069218\text{g}$$

$$\% = \frac{0.069218 \text{ g}}{0.960 \text{ g}} \times 100 \% = 7.21 \%$$