

Chemical Reactions
4.1 Introduction for Reactions
4.2 Net Ionic Equations
4.3 Representations of Reactions
4.4 Physical and Chemical Changes
Worksheet

- 1) The following questions pertain to the formation of an $\text{Al}(\text{NO}_3)_3$ solution.
 - a. Write the balanced chemical equation for the dissolving of aluminum nitrate in water.
 - b. Is the dissolving of aluminum nitrate in water a chemical process, a physical process, or both? Justify your answer.
- 2) The following questions pertain to the melting of ice.
 - a. Write a balanced chemical equation for the melting of a pure sample of ice, H_2O .
 - b. Is the melting ice to create liquid water a chemical process, a physical process, or both? Justify your answer.
- 3) Two solutions at 25°C are mixed. The temperature of the combined solution increases to 32°C and a white precipitate forms. Has a chemical change occurred or has a physical change occurred? Justify your answer.
- 4) A piece of paper catches on fire and burns. Has a chemical change occurred or has a physical change occurred? Justify your answer.
- 5) Classify each of the following processes as a physical change, a chemical change, or both. Justify your answer by identifying the types of intermolecular or intramolecular forces that are involved in each of the following processes and describing what happens to those forces while the processes are occurring.
 - a. $\text{CO}_2(s) \rightarrow \text{CO}_2(g)$
 - b. $\text{CO}_2(g) \rightarrow \text{C}(s) + \text{O}_2(g)$
 - c. $\text{NH}_2\text{F}(l) \rightarrow \text{NH}_2\text{F}(g)$
 - d. $\text{NaCl}(s) \rightarrow \text{Na}^+(aq) + \text{Cl}^-(aq)$
 - e. $\text{NH}_2\text{F}(l) \rightarrow \frac{1}{2} \text{N}_2(g) + \text{H}_2(g) + \frac{1}{2} \text{F}_2(g)$
 - f. $\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(l)$
- 6) Draw a representation that shows the interactions between the solute and solvent in an aqueous solution of potassium bromide. Use space-filling or ball-and-stick models for the solvent molecules.
- 7) C_2H_4 reacts with O_2 to form CO_2 and water.
 - a. Make a particulate drawing which shows that atoms are conserved during this reaction.
 - b. Use your drawing to explain why all atoms were conserved during this reaction.
 - c. Use your drawing to explain how the law of conservation of mass applies to this reaction.

8) Balance the following chemical equations.

- a. $\underline{\quad} \text{AlBr}_3 + \underline{\quad} \text{K}_2\text{SO}_4 \rightarrow \underline{\quad} \text{KBr} + \underline{\quad} \text{Al}_2(\text{SO}_4)_3$
- b. $\underline{\quad} \text{C}_3\text{H}_8 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$
- c. $\underline{\quad} \text{FeCl}_3(aq) + \underline{\quad} \text{NaOH}(aq) \rightarrow \underline{\quad} \text{Fe}(\text{OH})_3(s) + \underline{\quad} \text{NaCl}(aq)$
- d. $\underline{\quad} \text{Ba}^{2+} + \underline{\quad} \text{S}^{2-} \rightarrow \underline{\quad} \text{BaS}(s)$
- e. $\underline{\quad} \text{P} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{P}_2\text{O}_5$
- f. $\underline{\quad} \text{S}_8 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{SO}_3$
- g. $\underline{\quad} \text{H}_2\text{O} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{H}_2\text{O}_2$
- h. $\underline{\quad} \text{Cu} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CuO}$
- i. $\underline{\quad} \text{Pb}(\text{NO}_3)_2 + \underline{\quad} \text{NaI} \rightarrow \underline{\quad} \text{PbI}_2(s) + \underline{\quad} \text{NaNO}_3$
- j. $\underline{\quad} \text{ZnS} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{ZnO} + \underline{\quad} \text{S}_8$
- k. $\underline{\quad} \text{C}_7\text{H}_6\text{O}_3 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$
- l. $\underline{\quad} \text{Na} + \underline{\quad} \text{ZnI}_2 \rightarrow \underline{\quad} \text{NaI} + \underline{\quad} \text{Zn}$
- m. $\underline{\quad} \text{V}_2\text{O}_5 + \underline{\quad} \text{Ca} \rightarrow \underline{\quad} \text{CaO} + \underline{\quad} \text{V}$
- n. $\underline{\quad} \text{C}_{12}\text{H}_{22}\text{O}_{11} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$
- o. $\underline{\quad} \text{N}_2 + \underline{\quad} \text{H}_2 \rightarrow \underline{\quad} \text{NH}_3$
- p. $\underline{\quad} \text{KClO}_3 \rightarrow \underline{\quad} \text{KCl} + \underline{\quad} \text{O}_2$

9) Aqueous solutions of potassium chloride and silver nitrate are mixed and a silver chloride precipitate forms.

- a. Write the complete ionic equation for this reaction.
- b. Write the net ionic equation for this reaction.

10) A solution of iron (II) nitrate is poured into a sodium sulfide solution and a iron (II) sulfide precipitate forms.

- a. Write the balanced complete ionic equation for this reaction.
- b. Write the balanced net ionic equation for this reaction.

11) A solution of lithium carbonate is poured into a solution of calcium nitrate and a white precipitate forms.

- a. Write the balanced complete ionic equation for this reaction.
- b. Write the balanced net ionic equation for this reaction.