

8.2 What are Chemical Reactions?

3) Chemical Compounds

Your instructor will discuss chemical compounds.

- a) The formula for acetic acid, which is found in vinegar, is $\text{HC}_2\text{H}_3\text{O}_2$. Which elements make up acetic acid? How many atoms of each element are contained in one molecule?

4) Chemical Equations

A chemical equation describes a chemical reaction. A balanced equation has the same number of atoms of each element on either side of the arrow.

Are the equations given below balanced? If not, write numbers in the blanks before the substances to indicate the number of molecules of each substance needed to balance the equation.

- a) $___ \text{H}_2 + ___ \text{O}_2 \rightarrow ___ \text{H}_2\text{O}$
- b) $___ \text{CO}_2 + ___ \text{H}_2\text{O} \rightarrow ___ \text{C}_6\text{H}_{12}\text{O}_6 + ___ \text{O}_2$
- c) $___ \text{Na}_2\text{CO}_3 + ___ \text{HC}_2\text{H}_3\text{O}_2 \rightarrow ___ \text{NaHCO}_3 + ___ \text{NaC}_2\text{H}_3\text{O}_2$
- d) $___ \text{NaHCO}_3 + ___ \text{HC}_2\text{H}_3\text{O}_2 \rightarrow ___ \text{H}_2\text{O} + ___ \text{CO}_2 + ___ \text{NaC}_2\text{H}_3\text{O}_2$

8.3 Energy and Chemical Reactions

5) Endothermic and Exothermic Reactions

Your instructor will show you how to mix acetic acid and sodium carbonate in a plastic bag.

- a) What do you feel when you touch the outside of the plastic bag? _____
- b) Is this reaction endothermic or exothermic? How do you know?

Next your instructor will show you how to mix acetic acid with sodium bicarbonate in another plastic bag.

- c) What do you feel when you touch the outside of this plastic bag? _____
- d) Is this reaction endothermic or exothermic? How do you know?

- e) Your instructor will begin a demonstration of splitting water molecules into molecules of hydrogen and oxygen gas.

- i) Is this reaction endothermic or exothermic? _____
- ii) What form of energy is involved in this process? _____

- f) Group Discussion Question: What very common endothermic reaction makes possible life on Earth as we know it?

5) Batteries

Your instructor will show you how to make a battery.

- a) Hook your battery to a voltmeter. How much voltage does your battery produce? _____
- b) What causes a voltage difference between the anode and the cathode of the battery?

6) Electroplating

Your instructor will show you electroplating with carbon and copper rods.

- a) What happens to the carbon rod?
- b) Why must the copper and carbon rods be connected to batteries?

7) Chemical and Physical Changes

- a) What is the difference between a chemical reaction and a physical change?
- b) Activate a reusable commercial hot pack. Since the hot pack emits thermal energy, what must be done to the pack before it can be reused?
- c) Activate a commercial cold pack. Does the cold pack emit or absorb energy? How do you know?

8) Activation Energy

- a) What is activation energy?
- b) Is activation energy required in endothermic reactions? _____
- c) Is activation energy required in exothermic reactions?

9) Catalysts

- a) What is the purpose of a catalyst?

- b) Your instructor will demonstrate the effect of a catalyst on hydrogen peroxide (H_2O_2).
 - 1) What is the purpose of adding a piece of platinum to the beaker?

 - 2) Is the platinum used up in the reaction? _____
 - 3) Does the platinum change the outcome of the reaction? _____

10) Electrolysis of Water

Your instructor will return to the demonstration of the electrolysis of water.

- a) What form of energy was added to this endothermic reaction?

- b) Is a catalyst used in this reaction? _____

- c) What are the reaction products?

11) Fuel Cells

- a) The fuel cell demonstrates the opposite of electrolysis of water. Is this reaction endothermic or exothermic?

- b) How is a fuel cell different from a battery?

- c) Group Discussion Question: What are some of the advantages and disadvantages to using fuel cells to power automobiles?