

Chapter 2 The Nature of Matter

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LINKS™



Quick Take
Quiz

EXIT

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MENU



Chapter Preview Questions

1. A piece of iron is made up of
 - a. iron molecules.
 - b. iron compounds.
 - c. iron atoms.
 - d. iron salts.

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Chapter Preview Questions

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- a. carried from one place to another.
 - b. created or destroyed.
 - c. changed to light and heat.
 - d. used to create nuclear reactions.

Chapter Preview Questions

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 - c. precision.
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- a. meter stick.
 - b. balance.
 - c. graduated cylinder.
 - d. thermometer.

Chapter Preview Questions

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Chapter 2 The Nature of Matter



Focus on the
BIG Idea

What is chemistry?

Suppose you have a whole cookie. You break the cookie into tiny pieces and crumbs. Then, you weigh all the pieces and crumbs. How do you think the weight of the whole cookie compares to the total weight of all the cookie crumbs?



Build Science Vocabulary

Prefixes

Prefix	Meaning	Example Word
com-	With, together	Compound

Build Science Vocabulary

Prefixes

Prefix	Meaning	Example Word
hetero-	Different	Heterogenous

Build Science Vocabulary

Prefixes

Prefix	Meaning	Example Word
homo-	Same	Homogenous

Build Science Vocabulary

Prefixes

Prefix	Meaning	Example Word
endo-	In, within	Endogenous

Build Science Vocabulary

Prefixes

Prefix	Meaning	Example Word
exo-	Out	Exothermic

Build Science Vocabulary

Apply It!

The Greek root *therm* means “heat.” Use the previous table to learn the meaning of the prefix *endo-* . Then predict the meaning of the adjective *endothermic*. Read Section 1 to see if your predicted definition is accurate or needs to be changed.

Sample answer: Students should figure out that *endothermic* means a change in which heat is taken in.

End of Chapter Preview

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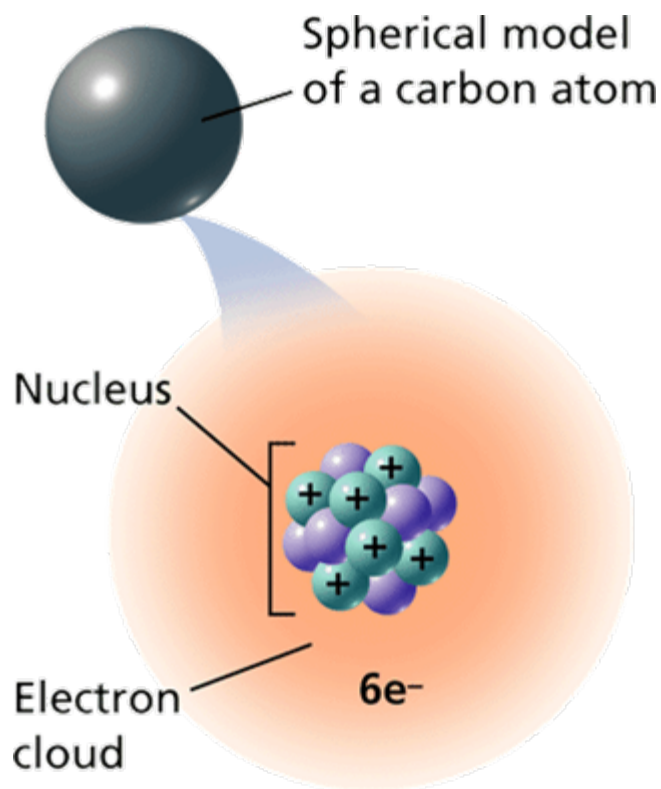
MENU



Section 1: Describing Matter

-  What kinds of properties are used to describe matter?
-  What are elements, and how do they relate to compounds?
-  What are the properties of a mixture?





Modeling an Atom

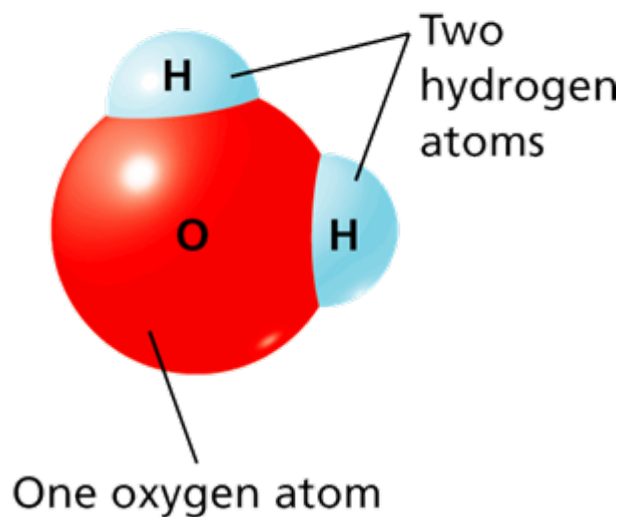
Pencil “lead” is made of mostly graphite, a form of carbon. Two ways to model atoms used in this presentation are shown here for carbon.

A cloud model of an atom shows the electron cloud and the particles in the nucleus.

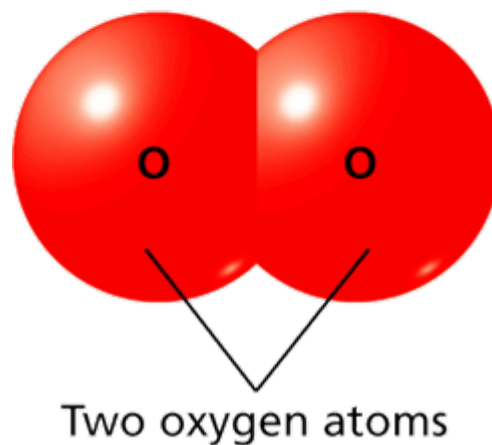
Modeling Molecules

Models of molecules often consist of colored spheres that stand for different kinds of atoms.

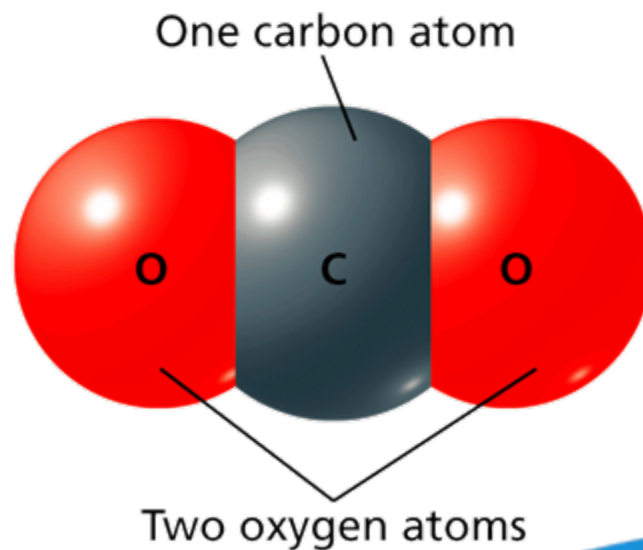
Water molecule



Oxygen molecule



Carbon dioxide molecule



End of
Slide

Ratios

A ratio compares two numbers. It tells you how much you have of one item compared to how much you have of another. For example, a cookie recipe calls for 2 cups of flour to every 1 cup of sugar. You can write the ratio of flour to sugar as 2 to 1, or 2:1.

The chemical formula for rust, a compound made from the elements iron (Fe) and oxygen (O), may be written as Fe_2O_3 . In this compound, the ratio of iron atoms to oxygen atoms is 2:3. This compound is different from FeO , a compound in which the ratio of iron atoms to oxygen atoms is 1:1.



Ratios

Practice Problem

Q. What is the ratio of nitrogen atoms (N) to oxygen atoms (O) in a compound with the formula N_2O_5 ? Is it the same as the compound NO_2 ? Explain.

A. N_2O_5 contains two nitrogen atoms for every five oxygen atoms. Both N_2O_5 and NO_2 are made up of only nitrogen atoms and oxygen atoms. However, the two compounds are different because NO_2 contains one nitrogen atom for every two oxygen atoms.

End of
Slide



Links on Describing Matter



Click the SciLinks button for links on describing matter.

End of Section: Describing Matter

Section 2: Changes in Matter

-  What is a physical change?
-  What is a chemical change?

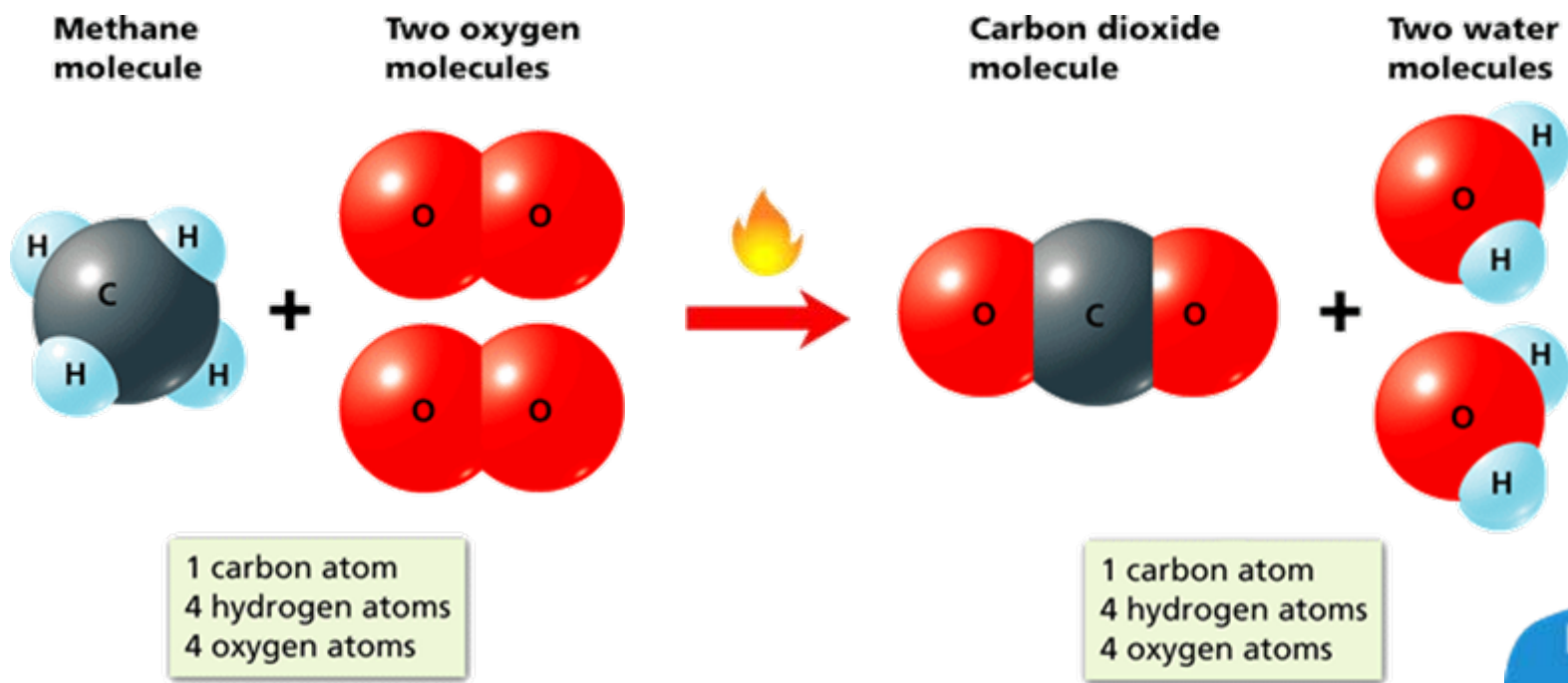
Chemical Change

A change in matter that produces one or more new substances is a chemical change, or a chemical reaction.

Examples of Chemical Change		
Chemical Change	Description	Example
Combustion	Rapid combination of a fuel with oxygen; produces heat, light, and new substances	Gas, oil, or coal burning in a furnace
Electrolysis	Use of electricity to break a compound into elements or simpler compounds	Breaking down water into hydrogen and oxygen
Oxidation	Slow combination of a substance with oxygen	Rusting of an iron fence
Tarnishing	Slow combination of a bright metal with sulfur or another substance, producing a dark coating on the metal	Tarnishing of brass

Conserving Matter

The idea of atoms explains the law of conservation of matter. For every molecule of methane that burns, two molecules of oxygen are used. The atoms are rearranged in the reaction, but they do not disappear.



End of
Slide

Conserving Matter Activity



Click the Active Art button to open a browser window and access Active Art about conserving matter.

Chapter 2 The Nature of Matter

Math

Analyzing Data

Is Matter Conserved?

Propane Combustion		
Mass of C ₃ H ₈ Reacted (g)	Mass of O ₂ Reacted (g)	Mass of CO ₂ Produced (g)
44	160	132
250	909	1,691
400	1,455	1,200
465	1,691	1,395

Propane (C₃H₈) is a fuel that is often used in camping stoves. When propane burns, it reacts with oxygen, producing carbon dioxide gas and water vapor. The data table shows how much carbon dioxide is produced when different amounts of propane burn in oxygen.

Is Matter Conserved?

Propane Combustion		
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44	160	132
250	909	1,691
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465	1,691	1,395

Interpreting Data:

Q.

Based on the data in the table, how do you know that carbon dioxide is not the only substance formed in this chemical change?

A.

The mass of carbon dioxide is less than the sum of the masses of oxygen and propane.

End of Slide

Chapter 2 The Nature of Matter

Math

Analyzing Data

Is Matter Conserved?

Calculating:

Propane Combustion		
Mass of C_3H_8 Reacted (g)	Mass of O_2 Reacted (g)	Mass of CO_2 Produced (g)
44	160	132
250	909	1,691
400	1,455	1,200
465	1,691	1,395

Q.

Copy the data table and add a new column on the right. In the new column, enter how much water vapor is produced for each amount of propane burned.

A.

Students should enter the "missing" mass of the products.

End of Slide

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Chapter 2 The Nature of Matter

Math

Analyzing Data

Is Matter Conserved?

Graphing:

Propane Combustion		
Mass of C_3H_8 Reacted (g)	Mass of O_2 Reacted (g)	Mass of CO_2 Produced (g)
44	160	132
250	909	1,691
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Q.

Use the data in the table to make a graph. Plot the mass of C_3H_8 reacted on the horizontal axis, and the mass of CO_2 produced on the vertical axis.

A.

The graph will produce a straight line.

End of Slide

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Is Matter Conserved?

Propane Combustion		
Mass of C_3H_8 Reacted (g)	Mass of O_2 Reacted (g)	Mass of CO_2 Produced (g)
44	160	132
250	909	1,691
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Reading Graphs:

Q.

Use the graph to predict how much CO_2 would be produced if 100 grams of propane burned in oxygen.

A.

300 g

End of
Slide

Links on Chemical Changes



Click the SciLinks button for links on chemical changes.

Chemical Change



Click the Video button to watch a movie about chemical change.

End of Section: Changes in Matter

Section 3: Energy and Matter

-  What are some forms of energy that are related to changes in matter?
-  How is chemical energy related to chemical change?

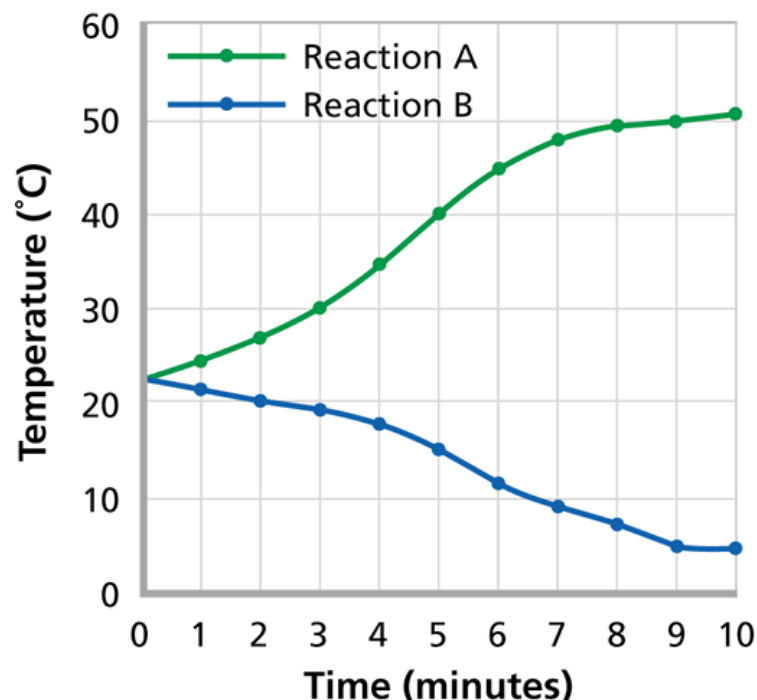
Chapter 2 The Nature of Matter

Math

Analyzing Data

Comparing Energy Changes

Energy of Two Reactions



A student observes two different chemical reactions, one in beaker A, and the other in beaker B. The student measures the temperature of each reaction every minute. The student then plots the time and temperature data and creates the following graph.

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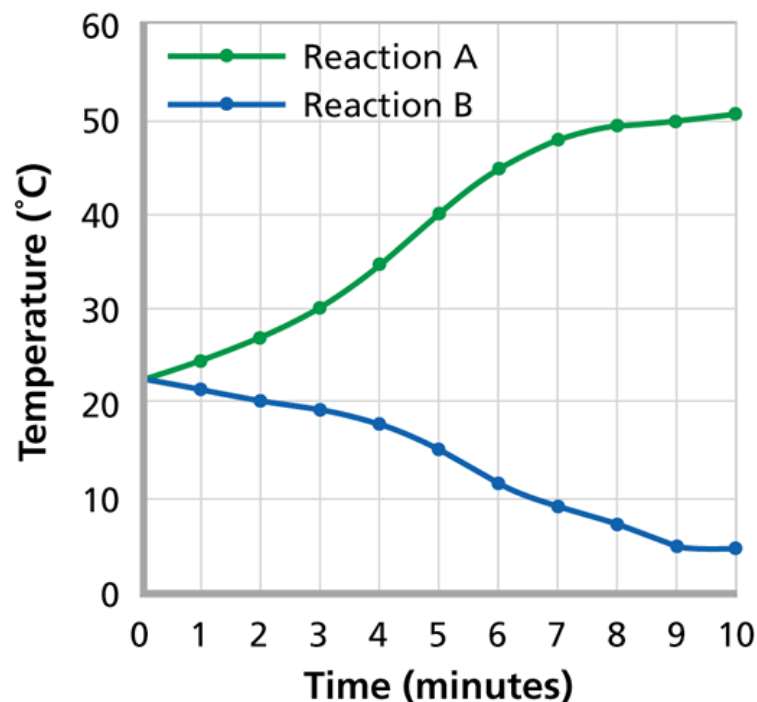
Chapter 2 The Nature of Matter

Math

Analyzing Data

Comparing Energy Changes

Energy of Two Reactions



Reading Graphs:

Q.

What do the numbers on the x-axis tell you about the length of the experiment?

A.

The experiment lasted for 10 minutes.

End of Slide

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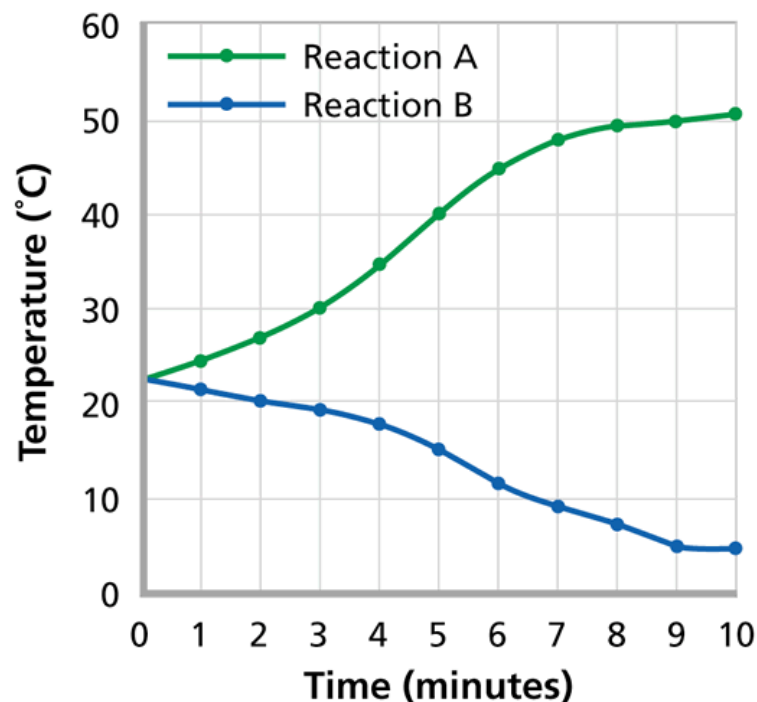
Chapter 2 The Nature of Matter

Math

Analyzing Data

Comparing Energy Changes

Energy of Two Reactions



Comparing and Contrasting:

Q.

How did the change in temperature in beaker B differ from that in beaker A?

A.

The temperature decreased in beaker B, but increased in beaker A.

End of Slide

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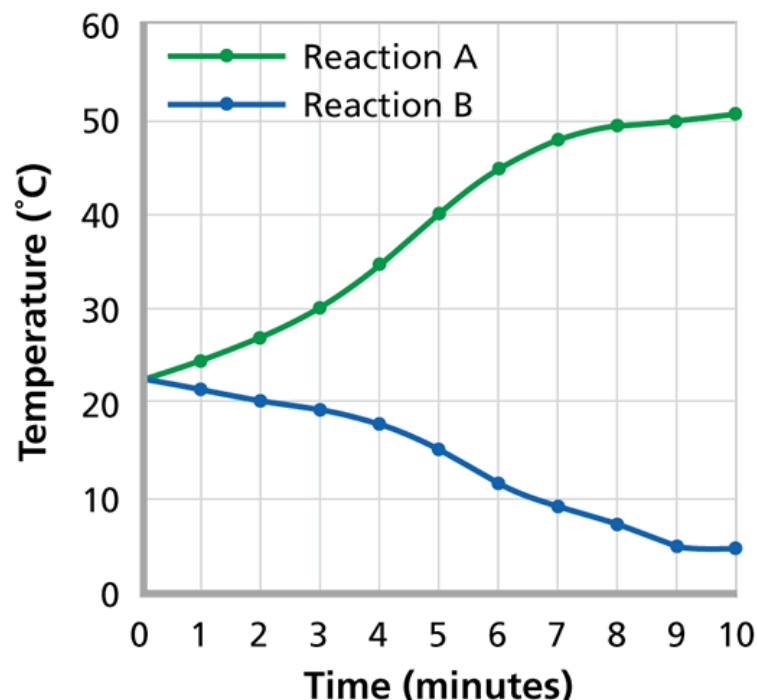
Chapter 2 The Nature of Matter

Math

Analyzing Data

Comparing Energy Changes

Energy of Two Reactions



Interpreting Data:

Q.

Which reaction is exothermic?
Explain your reasoning.

A.

Reaction A is exothermic because thermal energy was released, causing an increase in temperature.

End of
Slide

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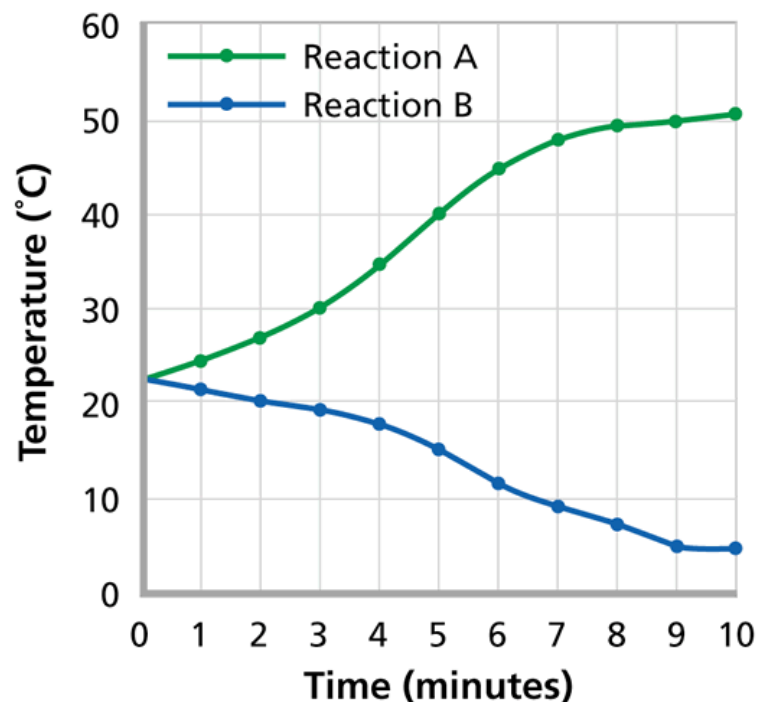
Chapter 2 The Nature of Matter

Math

Analyzing Data

Comparing Energy Changes

Energy of Two Reactions



Calculating:

Q.

Which reaction results in a greater change in temperature over time?

A.

Reaction A

End of Slide

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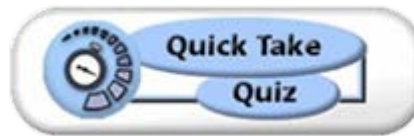
Links on Matter and Energy



Click the SciLinks button for links on matter and energy.

End of Section: Energy and Matter

QuickTake Quiz



Click to start quiz.