

Unit 2 Matter and Interactions

Grade level: 8th

Length of lesson: 18 Weeks

Content Standards

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus the mass is conserved.

Big Ideas:

- Matter is composed of atom/molecule
- Matter has physical and chemical properties
- Matter have four different states
- Atoms are composed of protons, neutrons, and electrons
- The chemical combination of elements will result in different characteristics/properties

Essential Question(s):

- Which properties define matter?
- What are the chemical and physical properties of matter?
- Describe how the motion of atoms can affect the state of matter?
- Can you create/draw a model to represent the atomic structure?
- How do chemical reactions result in with different characteristics/properties?

Student objectives (outcomes):

Students will be able to:

- Define and describe matter by use of its properties.
- List and describe the chemical and physical properties of matter.
- Describe the connection between motion of matter and state of matter.
- Create a model to represent atomic structure.
- Describe how chemical reactions result in products with different characteristics and properties.

Assessment Evidence

Performance Task(s):

See Topics below

Other Evidence:

See Topics below

Learning Plan

Learning Activities:

See Topics below

Unit 2 – Topic 1 Properties of Matter

Grade level: 8th

Content Standards

MS-PS-1. Develop models to describe the atomic composition of simple molecules and extended structures.

Big Ideas:

- Matter is composed of atom/molecule
- Matter has physical and chemical properties

Essential Question(s):

- Which properties define matter?
- What are the physical properties of matter?
- How can you use the metric system to measure matter?

Student objectives (outcomes):

Students will be able to:

- Describe the structure of matter
- Discuss the physical changes of matter
- Describe way in which matter can be measured in the metric system: length, volume, mass and density

Assessment Evidence

Performance Task(s):

Measurement of Length Lab
Mass Volume Density Lab
White Powders Lab
Projects:(2)
Quiz

Other Evidence:

See Topics below

Learning Plan

Learning Activities and Resources:

Atoms and Molecules

The Basic Structure of Matter notes/discussion

BrainPop Video - Atoms

Puzzle Makers <http://www.puzzlemakers.net/samples.html>

Scientific Measurement- length, mass, volume, density

Metric Measurement Discussion/Notes

BrainPOP Video- Measuring Matter

Measurement of Length Lab (with Excel Graphing)

Flight Trials Inquiry with Metric Measurement
Mass Volume Density Lab (with Excel Graphs)
PHET Density Lab
Accuracy vs Precision Activity (target and pens)
Project: Create a Brochure - Metric Measurement

Physical Changes vs Chemical Changes

Notes/Discussion
Physical and Chemical Changes WS
Cosmic Mud Lab (physical change)
GAK Lab (chemical change)
White Powders Lab
Evidence of Chemical Change Lab
Project: Create a documentary style video: Changes (compare)

Unit 2 – Topic 2 States of Matter

Grade level: 8th

Length of Topic: 3-4 weeks

Content Standards

MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Big Ideas:

- Matter is composed of atom/molecule
- Matter has physical and chemical properties

Essential Question(s):

- Which properties define matter?
- What are the physical properties of matter?
- How can you use the metric system to measure matter?

Student objectives (outcomes):

Students will be able to:

- Describe the four states of matter.
- Describe the differences between the four states of matter.
- Predict how a change in temperature or pressure will affect the volume of a gas.

Assessment Evidence

Performance Task(s):

- Flubber Lab
- Surface Tension Lab
- Energy of Phase Changes Lab
- Ice Cream Lab
- Gas Laws Quiz
- States of Matter Quiz
- Test on States of Matter
- Vernier LabQuest Labs: 15, 15B, 18 & 19

Other Evidence:

- Particle on the Move Demonstrations
- Charles Law Demonstrations
- Plasma Ball Demonstration
- Gas Laws Demonstrations (demo a day)

Learning Plan

Learning Activities:

The following is an example of how this topic could be taught if the Holt Science and Technology textbook is available. If the textbook is not available, cK-12 Online Textbook is a good resource, see link in resources below. There is a Smart Notebook file that matches this plan in the Districtwide Staff Shared Folder>Middle School Science>8th Grade 2015 Science Units>Gr8 2015 Science Unit 2>2 States of Matter. It contains the daily lessons and printable resources as well.

Day 1: Clicker Pre-Test (Chp. 2) Start up Activity

Day 2: Particles on the Move Demonstrations

Day 3: Flubber Lab

Day 4: Discuss and Collect Labs, Notes on 2-1

Day 5: Boyle's Law Demonstrations, Boyle's Law Worksheet

Day 6: Review Boyle's Law Worksheet, Teach Temp. Conversions F to C, C to K, Temperature Conversion Worksheet

Day 7: Correct Temp. conversion Worksheet, Charles Law Worksheet

Day 8: Review, Charles Law Worksheet, Demo Plasma Ball

Day 9: Gas Laws Quiz

Day 10: Quiz Review Activities

Day 11: Quiz on 2-1 States of Matter, Correct Quizzes

Day 12: Gas Law Demo: Hand Boiler, Changes of States Notes

Day 13: Surface Tension Lab, Gas Law Demo: Hero's Steam Engine

Day 14: Gas Law Demo: Fire Piston

Day 15: Gas Law Demo: Pressure Bottle, Practice Quiz

Day 16: Label States of Matter and Phase Changes Diagram, Introduce/Do Dry Run of Stearic Acid Lab, 2-2 Worksheet

Day 17: Energy of Phase Changes Lab

Day 18: Gas Law Demo: Boil Water with What?, Discuss and Collect Lab Sheets, 2-2 Worksheet

Day 19: Ice Cream Lab

Day 20: Gas Law Demo: Egg in a Bottle

Day 21: Play Review Game

Day 22: Chapter 2 Test

Day 23: Finish and Correct Tests, Clicker Post Test (Chp. 2)

Resources:

- Discovery Education Videos on States of Matter and Gas Laws: <http://www.discoveryeducation.com/>
- Use the SMART Exchange to search for lessons and reviews on States of Matter and Gas Laws. Google search for the SMART Exchange. <http://exchange.smarttech.com/#tab=0>
- PHET Simulations from the University of Colorado <https://phet.colorado.edu/en/search?q=gas+laws>
- <https://phet.colorado.edu/en/search?q=states+of+matter>
- YouTube Bozeman Science Videos on States of Matter and Gas Laws
- Digital Pipeline (KPBSD Site)
- Vernier LabQuest Labs: 15, 15B, 18 & 19
- **ck-12 Online Textbook:** <http://www.ck12.org/saythanks>
- <http://www.ck12.org/book/CK-12-Physical-Science-Concepts-For-Middle-School/>
- Grade 8 Holt Science and Technology Textbook, Copyright 2002

Unit 2 – Topic 3 Elements, Compounds, and Mixtures

Grade level: 8th

Length of Topic: 5-8 days

Content Standards

MS-PS-1. Develop models to describe the atomic composition of simple molecules and extended structures.

Big Ideas:

- Matter is composed of atom/molecule
- Matter has physical and chemical properties
- The chemical combination of elements will result in different characteristics/properties

Essential Question(s):

- **Elements**
 - What is an element?
 - What are the properties of elements?
 - What are the categories of elements?
- **Compounds**
 - What are the properties of compounds?
 - What are the differences between an element and a compound?
 - Can you give examples of common compounds?
- **Mixtures**
 - What are some properties of mixtures?
 - Can you describe the methods of separating components of a mixture?
 - Can you analyze a solution in terms of its solute, solvent, and concentration?

Student objectives (outcomes):

Students will be able to:

- **Elements**
 - Describe an element? (pure substances).
 - Describe the properties of elements? (describe characteristics, give examples)
 - Describe categories of elements? (classify according to properties)
- **Compounds**
 - Describe the properties of compounds?
 - Identify the differences between an element and a compound.
 - Give examples of common compounds.
- **Mixtures**
 - Describe the properties of mixtures.

- o Describe the methods of separating components of a mixture
- o Analyze a solution in terms of its solute, solvent, and concentration.
- o Compare the properties of solutions, suspensions, and colloids

Assessment Evidence

Performance Task(s):

- Identifying Elements, Compounds, and Mixtures Lab
- Vernier LAB: Concentrations of Mixtures
- Quiz on Chapter 3

Other Evidence:

- **Discovery Education Videos for**
 - o Elements
 - o Compounds
 - o Mixtures

Learning Plan

Learning Activities:

- **Discovery Education Videos for**
 - o Elements
 - o Compounds

Resources:

- Bozeman Science Videos on Elements and Molecules
- Use the SMART Exchange for lessons and ideas about Elements, Compounds, and Mixtures
- Vernier Lab Quest and Concentration/pH probe and equipment/Lab Sheet
- **cK-12 Online Textbook:** <http://www.ck12.org/saythanks>
- <http://www.ck12.org/book/CK-12-Physical-Science-Concepts-For-Middle-School/>
- Grade 8 Holt Science and Technology Textbook, Copyright 2002

Unit 2 – Topic 4 Introduction to Atoms

Grade level: 8th

Length of Topic: 10-14 days

Content Standards

MS-PS-1. Develop models to describe the atomic composition of simple molecules and extended structures.

Big Ideas:

- Atoms are composed of protons, electrons, and neutrons

Essential Question(s):

- Can you create/draw a model to represent the atomic structure?
- Can you compare the different models of the atom and explain some of the experiments that lead to the atomic theory?
- What are the subunits of the atom?

Student objectives (outcomes):

Students will be able to:

- Understand the history of the atoms. Democritus, Dalton, J.J. Thomson, Rutherford, Bohr, Schrodinger and Heisenberg
- Determine what atoms are composed of: protons, neutrons, and electrons
- Understand Atomic mass, Atomic Number, Isotopes, Ions, Mass Number

Assessment Evidence

Performance Task(s):

- Lab: Model of Edible Atoms
- Atomic Model Worksheet
- Atomic Structure and Atoms Family Worksheet
- Test on Atoms

Other Evidence:

- Discovery Education Videos on Atoms and the history of atoms
- You tube Bozeman Science Videos on Atomic Models and Atoms
- PHET Simulations on Atoms
- Online

Learning Plan

Learning Activities:

- Notes on the history of atoms: Democritus, Dalton, J.J. Thomson, Rutherford, Bohr, Schrodinger and Heisenberg
- Finish notes on the history of atoms and include a timeline which each of the scientists and their discoveries. Use a Bozeman Science video about history of the atomic models.
- Notes on what atoms are composed of: Protons, Neutrons, and Electrons. Use a discovery education video on the structure of the atom. Atomic Model Worksheet to reinforce the content.

- Notes on Isotopes, Ions, Atomic Mass, Atomic Number, Practice using the periodic table to determine how many protons, neutrons, and electrons elements have. Practice using the periodic table to determine the atomic mass, atomic number of elements. Use the atomic structure worksheet and atoms family worksheet for this activity. Also use the PHET University of Colorado Website with simulations about the atom.
- LAB: In groups of 2 the students make models of an edible atom. The models are made using marshmallows, jelly bellies, and red hots to represent the protons, neutrons, and electrons. The teacher puts an elements name or symbol on the board and the students make the models of each element using the materials supplied. The students also determine the atomic number, mass number, number of protons, number of neutrons, number of electrons, if it is an isotope or an ion.
- Review for the test with an assignment or group project where they teach each other the lessons. Also use a Bozeman Science video to reinforce the concepts.
- Teach lead review: Use white boards for each student to answer questions when the teacher asks. Another option if available is a senteo response clicker questions to use as a review.
- Chapter 4 Test on Atoms

Resources:

- Discovery Education Videos on Atoms: <http://www.discoveryeducation.com/>
- Use the SMART Exchange to search for lessons and reviews on atoms. Google search for the SMART Exchange. <http://exchange.smarttech.com/#tab=0>
- Periodic Table online
- PHET Simulations from the University of Colorado <http://phet.colorado.edu/en/simulation/build-an-atom>
- You tube Bozeman Science Videos on atomic models and atoms
- cK-12 Online Textbook: <http://www.ck12.org/saythanks>
- <http://www.ck12.org/book/CK-12-Physical-Science-Concepts-For-Middle-School/>
- Grade 8 Holt Science and Technology Textbook, Copyright 2002

Unit 2 Topic 5 – The Periodic Table

Grade level: 8th

Length of lesson: 12-15 Days

Content Standards

PS1.A: Structure and Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2.)

Big Ideas:

- The **periodic table** is a tabular arrangement of the chemical elements, organized on the basis of their atomic number (number of protons in the nucleus), electron configurations, and recurring chemical properties.
- Elements are presented in order of increasing atomic number, which is typically listed with the chemical symbol in each box.

Essential Question(s):

- How are elements organized in the periodic table?
- Why is the table of elements called "periodic"?
- What one property is shared by elements in a group?

Student objectives (outcomes):

Students will be able to:

- Describe how elements are arranged in the periodic table.
- Compare metals, nonmetals, and metalloids based on their properties and on their location in the periodic table.
- Describe the difference between a period and a group.
- Explain why elements in a group often have similar properties.
- Describe the elements in the groups of the period table.

Assessment Evidence

Performance Task(s):

- Chapter 5 Test The Periodic Table

Other Evidence:

- Discovery Education Videos
- Periodic Table Game
- Setting the Periodic Table Worksheet
- Periodic Table Animations and history/patterns

Learning Plan

Learning Activities:

- Periodic Table Notes including the information on the periodic table and metals, nonmetals, and metalloids.
- Chemical Symbols and Names Worksheet
- Groups of Element Notes
- Periodic Table Worksheet Coloring Activity (need colored pencils)
- Periodic Table Online: <http://www.freezeray.com/flashFiles/discoveryDates.htm>
- Science Spot Periodic Table Resources: <http://sciencespot.net/Pages/kdzchemtable.html>
- cK-12 Online Textbook: <http://www.ck12.org/saythanks>
- <http://www.ck12.org/book/CK-12-Physical-Science-Concepts-For-Middle-School/>
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Unit 2 Topic 6 – Chemical Bonding

Grade level: 8th

Length of lesson: @9 Days

Content Standards

MS-PS1.1: Structure and Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2.)

Big Ideas:

- The chemical combination of elements will result in different characteristics/properties.
- Substances are made from different types of atoms, which combine with one another in various ways.

Essential Question(s):

- Describe how chemical reactions result in substances with different characteristics and properties.

Student objectives (outcomes):

Students will be able to:

- Chemical Bonds and chemical bonding
- Valence electrons and energy levels
- Types of bonds: Ionic, Covalent, and Metallic
- Making Electron Dot Diagrams
- Properties of Ionic bonds, covalent bonds, and metallic bonds

Assessment Evidence

Performance Task(s):

- Electron Dot/Bonding Assignment Activity
- Ch.1 Chemical Bonding Test

Other Evidence:

- Discovery Earth Video Clips on Chemical Bonds

Learning Plan

Learning Activities:

- Ch.1 Electrons and Bonding Vocabulary Words
- Ch.1-1 Notes and Discussion
- Ch.1-2 Notes/Discussion/Video Clips
- Work on the Electron Dot/Bonding Assignment Activity and Reinforcement Worksheet
- Review Assignment for the chapter
- Whiteboard review (each student has a whiteboard or a piece of paper and they write the answers to the teachers questions as the teacher reads them out loud.) Could also use a Senteo Response clicker review questions.
- Test on Chemical Bonding

Resources:

- Discovery Education Videos on Chemical Bonds: <http://www.discoveryeducation.com/>
- Use the SMART Exchange to search for lessons and reviews on atoms. Google search for the SMART Exchange. <http://exchange.smarttech.com/#tab=0>
- cK-12 Online Textbook: <http://www.ck12.org/saythanks>
- <http://www.ck12.org/book/CK-12-Physical-Science-Concepts-For-Middle-School/>
- Grade 8 Holt Science and Technology Textbook, Copyright 2002

Unit 2 Topic 7 –Chemical Reactions

Grade level: 8th

Length of lesson: 17-20 Days

Content Standards

MS-PS1.2 Chemical Reactions

Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]

Big Ideas:

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped in different molecules, and these new substances have different properties from those of the reactants.

Essential Question(s):

- Describe how chemical reactions result in substances with different characteristics/properties.

Student objectives (outcomes):

Students will be able to:

- Identify the clues to a chemical reaction
- Write and understand chemical formulas, balancing equations, and the law of conservation of mass.
- Describe the types of chemical reactions and classify a chemical equation as one of the types of chemical reactions
- Compare and Contrast exothermic and endothermic reactions
- Understand activation energy, energy diagrams, and factors that affect the rates of reactions

Assessment Evidence

Performance Task(s):

- LAB: Conservation of Mass
- LAB: Flame Testing of Compounds
- LAB: Copper Sulfate and Iron

Other Evidence:

- Counting Atoms Worksheet #1 and #2
- Balancing Equations #1 and #2
- Discovery Earth Video on chemical Reactions

- LAB: Baggie Lab Chemical Reactions
- LAB: Heating of Copper Sulfate
- Chemical Reactions Test

Learning Plan

Learning Activities:

- Ch.2-1 Notes and Chemistry Shorthand
- Counting Atoms Worksheet #1
- Counting Atoms Worksheet #2
- Notes on Chemical Equations/Balancing Equations and Balancing Equations Practice using Balancing Equations Worksheet #1
- Notes 2-2 Types of Reactions
- Work on Balancing Equations Worksheet #2
- LAB: Conservation of Mass Lab
- Notes 2-3 Notes
- LAB: Flame Testing of Compounds
- LAB: Copper Sulfate and Iron
- LAB: Baggie Lab Chemical Reactions
- LAB: Heating of Copper Sulfate
- Whiteboard Review with the class
- Chemical Reactions Test

References:

- Discovery Education Videos on Chemical Reactions: <http://www.discoveryeducation.com/>
- Use the SMART Exchange to search for lessons and reviews on chemical. <http://exchange.smarttech.com/#tab=0>
- **ck-12 Online Textbook:** <http://www.ck12.org/saythanks>
- <http://www.ck12.org/book/CK-12-Physical-Science-Concepts-For-Middle-School/>
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Students who demonstrate understanding can:

- MS-PS1-1** **Develop models to describe the atomic composition of simple molecules and extended structures.** Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [*Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.*]
- MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- MS-PS1-4** **Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.** [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]
- MS-PS1-5** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus the mass is conserved.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*

Science and Engineering Practices

Disciplinary Core Ideas

Crosscutting Concepts