

Unit Design- Matter, Energy, and Chemical Interactions

Middle School – Grade 8

Texts to be used:
 McDougal Littell & *Unit Resource Book (URB) where noted

Matter & Energy (M&E) &
 Chemical Interactions (CI)

RI Statements of Enduring Knowledge - (Established Goals):

PS 1 All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (*independent of size or amount of substance*)

PS 2 Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.

Related Rhode Island GSE's (Understandings)	RI Assessment Targets Assessment Evidence *** High Priority
<p>PS1 (7-8) –1 Students demonstrate an understanding of characteristic properties of matter by ...</p> <p>1a measuring mass and volume of both regular and irregular objects and using those values as well as the <u>relationship</u> $D=m/v$ to calculate density.</p> <p>PS1 (5-6)-2 Students demonstrate an understanding of characteristic properties of matter by...</p> <p>2a recognizing that different substances have properties which allow them to be identified regardless of the size of the sample</p> <p>2b classifying and comparing substances using characteristic properties (e.g., solid, liquid, gas; <u>metal, non-metal</u>).</p> <p>PS1 (7-8)-2 Students demonstrate an understanding of characteristic properties of matter by...</p>	<p>S1 (5-8) INQ+POC –2 *** <i>Given data about characteristic properties of matter (e.g., melting and boiling points, density, solubility) identify, compare, or classify different substances</i></p> <ul style="list-style-type: none"> • Text reference: Chapter 1.2 pp.16-19 (M& E) • Investigation: “How do solids & liquids compare?” p.27 (M&E) • Discuss with class “A mixture of spices” p.26 (M&E) • Density Lab Developed by Department <p>PS1 (5-8) – INQ + SAE–3 <i>Collect data or use data provided to infer or predict that the total amount of mass in a closed system stays the same, regardless of how substances interact (conservation of matter).</i> <i>Math Support/Math Practice-Calculating Volume p. 59-60</i></p> <ul style="list-style-type: none"> • Activity: Calculating Volume p.12 (pizza box, block of wood,etc.-(Have students actually measure and then calculate various samples) (M& E) • Text reference: Chapter 1.0 -1.1 pp.8-15 (M&E) <p>Investigation: Measuring Volume by Displacement p. 13 (M& E)</p> <ul style="list-style-type: none"> • Investigation: Mass and Volume UNIT RESOURCE BOOK pp..67-69 Investigation: “What happens when substances are mixed?” p.21 (M& E) • Investigation: “How well do oil and water mix?” p. 24 (M& E) & URB p. 41 • Activity: Density of Materials p.49 (Also, use as an investigation with marbles & density) • Investigation: Conservation of Mass, (CI) URB p. 150

2a identifying an unknown substance given its characteristic properties.

2b classifying and comparing substances using characteristic properties (e.g., solid, liquid, gas; metal, non-metal).

PS1 (5-6)-3

Students demonstrate an understanding of conservation of matter by...

3a explaining that regardless of how parts of an object are arranged, the mass of the whole is always the same as the sum of the masses of its parts.

PS1 (7-8)-3

Students demonstrate an understanding of conservation of matter by...

3a citing evidence to conclude that the amount of matter before and after undergoing a physical or chemical change in a closed system remains the same.

PS1 (5-6)-4

Students demonstrate an understanding of states of matter by...

4a differentiate among the characteristics of solids, liquids, and gases.

4b predicting the effects of heating and cooling on the physical state, volume and mass of a substance.

PS1 (7-8)-4

Students demonstrate an understanding of states of matter by...

4a creating diagrams or models that represent the states of matter at the molecular level.

PS1 (5-8) – SAE + MAS–4 ***

Represent or explain the relationship between or among energy, molecular motion, temperature, and states of matter.

- Investigation: How does a thermometer work? (M&E) URB p.212
- Investigation: "Freezing Point" p. 56 (M&E) URB p.128-131
- Text reference: 2.2 – 2.3pp. 50-57 (M& E)
- Investigation: Use "Think about" p.50 and have students observe a plastic cup or glass of ice water and dew drops forming on outer surface. Focus question: Where did the drops observed come from?
- Text reference: 2.2 – 2.3pp. 50-57 (M& E)
- Investigation: Use "Think about" p.50 and have students observe a plastic cup or glass of ice water and dew drops forming on outer surface. Focus question: Where did the drops observed come from?
- Investigation: "How can you observe a flow of energy?" p. 116 (M&E)
- **P.109 How Hot is Hot? (M&E)**

PS1 (5-8) –MAS–5

Given graphic or written information, classify matter as atom/molecule or element/compound (Not the structure of an atom).

- Investigation: "How do you measure the mass of an atom?" (M& E) URB p.30
- Investigation: "What are some signs of a chemical change?" p.47 (M& E)
- Activity: Density of Materials p.49 (Also, use as an investigation with marbles & density)
- Text reference: 1.0-1.3 pp.8-37 (CI)
- Investigation: How small can you cut paper? P.9 (CI)
- Investigation: How can you model the relative masses of atomic particles? P.13 (CI)
- Class discussion: The periodic table organization p.20 & 21 (CI)

PS2 (5-8)-SAE+ POC- 6

Given a real-world example, show that within a system, energy transforms from one form to another (i.e., chemical, heat, electrical, gravitational, light, sound, mechanical).

- Investigations: Energy Conversions pp. 84 85 (M&E)
- Investigation: Why does a solar calculator need a large solar cell? P.86 (M&E)
- Investigation: What improves the collection of solar energy? P.89 (M&E)
- Class Discussion: p. 94 "in-line skater"
- Discuss "Why does water warm up so slowly?"p.110 (M&E) Emphasize conduction of heat as a process.

4b explaining the effect of increased and decreased heat energy on the motion and arrangement of molecules.

4c observing the physical processes of evaporation and condensation, or freezing and melting, and describe these changes in terms of molecular motion and conservation of mass.

PS1 (5-6)-5

Students demonstrate an understanding of the structure of matter by...

5a distinguishing between solutions, mixtures, and “pure” substances, i.e., compounds and elements

PS1 (7-8)-5

Students demonstrate an understanding of the structure of matter by...

5a using models or diagrams to show the difference between atoms and molecules.

5b classifying common elements and compounds using symbols and simple chemical formulas.

5c interpreting the symbols and formulas of simple chemical equation

5d using symbols and chemical formulas to show simple chemical arrangements that produce new substances (chemical change).

5e explaining that when substances undergo physical changes, the appearance may change but the chemical make-up and chemical properties do not.

5f explaining that when substances undergo chemical changes to form new substances, the properties of the new combinations may be very different from those of the old.

PS1 (5-8) –MAS–5

Given graphic or written information, classify matter as atom/molecule or element/compound (Not the structure of an atom).

- Text reference: 2.1-2.2 pp.40-47 **(M&E)**
- Discuss p.81 Chemical equations must be balanced **(CI)**
- Text reference: 1.0-1.3 pp.8-37 **(CI)**
- Investigation: How small can you cut paper? P.9 **(CI)**
- Investigation: How can you model the relative masses of atomic particles? P.13 **(CI)**
- Class discussion: The periodic table organization p.20 & 21 **(CI)**

PS2 (5-8) –SAE + POC–6

Given a real-world example, show that within a system, energy transforms from one form to another (i.e., chemical, heat, electrical, gravitational, light, sound, mechanical).

- Ref. Chap. 3, p.71-90 (M&E)
- Investigation: URB p. 183-186 Energy Conversions (M&E)

PS2 (7-8)-6

Students demonstrate an understanding of energy by...

6c explaining that while energy may be stored transferred, or transformed, the total amount of energy is conserved.

PS2 (7-8)-7

Students demonstrate an understanding of heat energy by...

7a designing a diagram, model, or analogy to show or describe the motion of molecules for a material in a warmer and cooler state.

Texts to be used:
 McDougal Littell & *Unit Resource Book (URB) where noted

Matter & Energy (M&E) &
 Chemical Interactions (CI)

Unit	Focus Questions (Essential Questions)	Instructional Activities & Investigations (INQ)	Big Ideas (Understandings)
1	What is a substance? What are the physical states that matter can exist? What is mass and volume?	<ul style="list-style-type: none"> • Text reference: Chapter 1.4 (M&E) • Investigation: “How do solids & liquids compare?” p.27 (M&E) • Discuss with class “A mixture of spices” p.26 (M&E) <hr/> <ul style="list-style-type: none"> • Text reference: Chapter 1.1 pp.8-15 (M&E) • Investigation: Measuring Volume by Displacement p. 13 (M&E) <hr/> <ul style="list-style-type: none"> • Activity: Calculating Volume p.12 (pizza box, block of wood, etc.)-(Have students actually measure and then calculate various samples) (M&E) <hr/> <ul style="list-style-type: none"> • Investigation: Mass and Volume URB p. 67-69 (M&E) 	<ul style="list-style-type: none"> • A substance is a form of matter with a unique composition and distinct purposes. • A mixture are two or more substances mixed together but, not chemically combined.
2	What is an element? What is a compound? What is an atom? What is a molecule? What is a mixture? NOTE: THESE QUESTIONS ARE ALSO ADDRESSED IN Chemical Interactions Text	<ul style="list-style-type: none"> • Text reference: Chapter 1.2 pp.16-19 (M&E) <hr/> <ul style="list-style-type: none"> • Investigation: “How do you measure the mass of an atom?” URB p.30 (M&E) <hr/> <ul style="list-style-type: none"> • Investigation: “What happens when substances are mixed?” p.21 (M&E) 	<ul style="list-style-type: none"> • An element is a basic substance that cannot be broken into simpler substances during chemical interactions. • There are 90 naturally occurring elements on Earth. • Elements combine to make all the substances on Earth. • The smallest particle of an element is called an atom. • The periodic table of the elements displays all the naturally occurring and synthesized elements. • A Compound is two or more elements chemically combined to form a new substance.. • Substances can be represented with common names, chemical names and chemical formulas. • The smallest particle of a compound is called a

		<ul style="list-style-type: none"> Investigation: “How well do oil and water mix?” URB, p.41 (M& E) 	<p>molecule.</p> <ul style="list-style-type: none"> The relative abundance of elements varies with location in the universe.
3	What is a physical property?	Text reference: 2.1 pp.40-47 (M& E)	<ul style="list-style-type: none"> A chemical change occurs when substances interact to form new substances A physical change occurs when the identity of the substance remains unchanged
	What is a physical change?	<ul style="list-style-type: none"> Investigation: “How can a substance be changed?” p.41 (M& E) Department developed density lab Investigation: “What are some signs of a chemical change?” p.47 (M& E) 	
	What is a chemical property?	<ul style="list-style-type: none"> Activity: Density of Materials p.49 (Also, use as an investigation with marbles & density) (M&E) 	
4	What is a change in state and why is it a physical change?	<ul style="list-style-type: none"> Text reference: 2.2 – 2.3pp. 50-57 (M& E) Investigation: Use “Think about” p.50 and have students observe a plastic cup or glass of ice water and dew drops forming on outer surface. Focus question: Where did the drops observed come from? 	<ul style="list-style-type: none"> Matter is made of particles. Particles in gas are widely spaced. Every substance is defined by a unique particle. Gas is matter- it has mass and occupies space. Gases are composed of widely spaced individual particles in constant motion. Matter exists on Earth in three common phases (states).
	What are the effects of pressure on gases?	<ul style="list-style-type: none"> Investigation: “Freezing Point” URB p. 128-131 (M&E) 	

		<ul style="list-style-type: none"> Students should examine and construct temperature graphs of phase changes (states of matter) 	<ul style="list-style-type: none"> Change of state is the result of change of energy in the particles in a sample of matter. During phase change, particles do not change; relationships between particles do change. Different substances change phase at different temperatures. The processes of phase change are evaporation, condensation, melting, freezing, sublimation and deposition. There is nothing between gas particles except space. Gas compresses under force and expands when force is withdrawn. During compression and expansion, the number and character of particles in a sample of gas do not change; the space between the particles does change.
5	How does the process of energy transfer occur?	<ul style="list-style-type: none"> Investigations: Energy Conversions URB p.183-186 (M&E) Investigation: Why does a solar calculator need a large solar cell? P.86 (M&E) Ref. Chapter 3, p.71-90 Investigation: What improves the collection of solar energy? P.89 (M&E) Class Discussion: p. 94 “in-line skater” 	<ul style="list-style-type: none"> Kinetic energy is energy of motion. The particles in substances gain kinetic energy as they warm, and lose kinetic energy as they cool. Matter expands when the kinetic energy of its particles increases; matter contracts when the kinetic energy of its particles decreases. Substances “heat up” and “cool down” as a result of energy transfer. Energy transfers between particles when they collide. Energy transfer by contact is conduction. Energy always transfers from particles with more kinetic energy to particles with less kinetic energy.

6	<p>What is temperature? How does energy flow from warmer to cooler? What is conduction, convection, and radiation and how are they different?</p>	<ul style="list-style-type: none"> Investigation: How does a thermometer work? URB p.212 (M&E) Text references: 4.2-4.3 (M&E) Investigation: "How can you observe a flow of energy?" p. 116 (M&E) Discuss "Why does water warm up soil slowly?p.110 (M&E) Emphasize conduction of heat as a process. Discuss" Where in the cycle is air more dense?"p.118 (M&E) 	<ul style="list-style-type: none"> Heat energy flows from a warmer object to a cooler object by either conduction, convection, or radiation.
7	<p>What is a mixture? What is a solution? What is concentration?</p>	<ul style="list-style-type: none"> Text Reference: 2.3 –pp.58-65 (M&E) Investigation: How can a mixture of sand, salt, & pepper be separated? P.61 (M&E) Text reference: 4.1 pp.110-121 (CI) Investigation: Which substances dissolve in water? P. 111 (CI) 	<ul style="list-style-type: none"> A solution is a mixture in which one substance dissolves in another. Dissolving occurs when one substance (solute) is reduced to particles and is distributed uniformly throughout the particles of a second substance (solvent) Dissolving involves both kinetic interactions (collisions) and attractive forces (bonds). Concentration is the ratio of solute particles to solvent particles. Mixture: a substance which contains elements and/or compounds physically mixed together. There is no chemical reaction and they can be separated.

8	<p>What else do we know about atoms?</p> <p>What else do we know about molecules?</p> <p>What is a chemical reaction?</p>	<ul style="list-style-type: none"> • Text reference: 1.0-1.3 pp.8-32 (CI) • Investigation: How small can you cut paper? P.9 (CI) • Investigation: How can you model the relative masses of atomic particles? P.13 (CI) • Class discussion: The periodic table organization p.20 & 21 (CI) <hr/> <ul style="list-style-type: none"> • Text reference 2.0 -2.1,pp. 41-45 (CI) • Investigation: How are compounds different from elements? P.41 (CI) • Investigation: How can you model a compound? P.43 (CI) <hr/> <ul style="list-style-type: none"> • Text reference: 3.0 – 3.3, pp.66-86, (CI) • Investigation: Changing Steel Wool, p.67(CI) • Investigation: A different rate, p.67 (CI) <hr/> <ul style="list-style-type: none"> • Investigation: How can you identify a chemical change? P.69 (CI) <hr/> <ul style="list-style-type: none"> • Investigation: How can the rate of a reaction be changed? P.74, (CI) 	<ul style="list-style-type: none"> • Atoms are the fundamental particles of elements. • A compound is a substance made of two or more elements. • Atoms combine to make particles of substances: molecules and ionic compounds. • Molecules and ionic compounds are held together by attractive forces called bonds. • A chemical reaction is a process in which atoms of substances (reactants) rearrange to form new substances (products).
9	<p>How do scientists interpret the symbols and formulas of simple chemical equation?</p> <p>How do scientists use symbols and chemical formulas to show simple chemical arrangements that produce new substances (chemical change)?.</p>	<ul style="list-style-type: none"> • Investigation: Conservation of Mass, p. 79, (CI) • Why is it important to measure the masses of reactants and products? <hr/> <ul style="list-style-type: none"> • Discuss p.81 Chemical equations must be balanced (CI) <hr/> <ul style="list-style-type: none"> • Discuss Coefficients to Balance Equations,p.82 (CI) 	<p>Common symbols found on the periodic table to represent elements</p> <ul style="list-style-type: none"> • Formulae of simple chemical compounds. • Note: *GSE's do not require subatomic particles/ nor recall/memorization of elements and compound formulae.