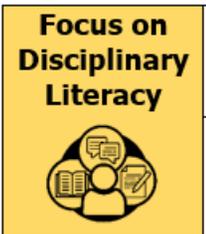


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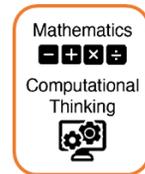
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UNIT NARRATIVE

Unit 1 combines the concepts classification of matter, properties of solutions and the behavior of thermal energy through the lens of IDEAL Coffee and Tea. In Lesson 01, students explore how caffeine affects the body and engage in the science practices of data analysis (making data tables and graphs and using data as evidence) and construction explanations (CER.) Students will begin to explore solutions in lesson 2 and discover what soluble and insoluble substances are as well as the parts of an aqueous solution. In lessons 3 and 4 students will continue to study solutions by focusing on what happens to solutions when you dilute them and determining the concentration of solutions. Lesson 5 and 6 focus on dissolution. Lesson 5, students learn what dissolution is and use models to represent agitation, temperature, and surface area. In lesson 6, students investigate how those factors affect the rate of dissolution. The difference between physical and chemical changes is taught in lesson 7 and 8. In lesson 9 and 10 students learn the difference between elements and compounds. Finally, in lesson 11-13 students learn about temperature, kinetic energy, and thermal energy transfer.



In science, disciplinary literacy is synonymous with the science and engineering practices. The SEPs are the context through which all science concepts should be taught. In the lessons, you will find the Science and Engineering practices icons when the SEPs are being explicitly used by students.



CONTENT STANDARDS

Below are the standards **taught** and **assessed** in this unit.

Readiness Standards (High Priority)

- 7.6B use the periodic table to identify the atoms and the number of each kind within a chemical formula;
- 7.6C distinguish between physical and chemical changes in matter;
- 7.6E investigate and model how temperature, surface area, and agitation affect the rate of dissolution of solid solutes in aqueous solutions.
- 7.8A investigate methods of thermal energy transfer into and out of systems, including conduction, convection, and radiation;
- 7.8C explain the relationship between temperature and the kinetic energy of the molecules within a substance.

Supporting Standards (Medium Priority)

- 7.6A compare and contrast elements and compounds in terms of atoms and molecules, chemical symbols, and chemical formulas;
- 7.6D describe aqueous solutions in terms of solute and solvent, concentration, and dilution; and
- 7.8B investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium;

UNDERSTANDINGS AND QUESTIONS

Important big ideas and processes for the unit.

Key Understandings

- Scientists use the Claim-Evidence-Reasoning (CER) framework to construct logical explanations: a claim answers a question, evidence supports the claim using data or observations, and reasoning connects the evidence to the claim using scientific principles. (Lesson 01)
- Data tables and graphs help scientists support their claims by showing patterns, trends, and relationships that can be used as clear, measurable evidence. Interpreting visual data is essential for making valid conclusions based on observations rather than opinions. (Lesson 01)
- An aqueous solution forms when a solute dissolves in a solvent, creating a homogeneous mixture that looks the same throughout. (Lesson 02)
- Whether a substance is soluble or insoluble in water depends on its physical properties, which determine how it behaves in mixtures and solutions. (Lesson 02)
- The concentration of a solution depends on the relative amounts of solute and solvent; changing either affects how strong or weak the solution is. Concentration also affects the solution's properties such as taste, color, or conductivity. (Lesson 03)
- Calculating the concentration of a solution allows us to quantify how much solute is present in a given amount of solution, which is essential for making accurate comparisons, preparing mixtures correctly, and predicting how a solution will behave. Percent concentration is one way to express this part to whole relationship. (Lesson 04)
- The rate at which a substance dissolves in a solvent depends on conditions such as temperature, stirring, and particle size, because these factors influence how often and how effectively particles interact at the molecular level. (Lesson 05)
- The rate at which a solute dissolves in a solvent depends on factors such as temperature, surface area, and agitation. Changes to these variables affect how quickly particles interact and spread throughout a solution. (Lesson 06)
- Physical and chemical changes affect matter in different ways. Physical changes alter the form or appearance of a substance without changing its identity, while chemical changes produce new substances with different properties. (Lesson 07 and 08)

- All matter is made of atoms. Elements are made of only one type of atom, while compounds are made of two or more different atoms chemically bonded together. (Lesson 09)
- By looking at the types and number of atoms in a chemical formula, we can tell what kind of substance it is. Substances can be made of just one kind of atom or different kinds of atoms. If a substance has only one type of atom, it can be a molecule of an element, like O₂. If it has different types of atoms and all of them are nonmetals, it is a molecule of a compound, like H₂O. But if the substance includes a metal and a nonmetal, it forms a formula unit, like NaCl. (Lesson 10)
- Thermal energy is directly proportional to the temperature within a given system. Adding thermal energy to a system increases the kinetic energy of the molecules. Removing thermal energy from the system decreases the kinetic energy of the molecules. (Lesson 11)
- Thermal energy is transferred between substances in one of three ways, conduction, convection, and radiation. Thermal energy moves from warmer substances to cooler substances. (Lessons 12 and 13)

Key Questions

- What are the science practices necessary to ‘do science’? (Lesson 01)
- What makes good evidence? (Lesson 01)
- How do we support a claim? (Lesson 01)
- Is a cup of coffee a solution? (Lesson 02)
- What is the solvent and solute in a cup of coffee? (Lesson 02)
- What type of solution is instant coffee? (Lesson 02)
- What is the solute in a cup of coffee when milk and sugar has been added? (Lesson 02)
- What happens to a solution when you change the amount of solute or solvent? (Lesson 03)
- How can we tell if a solution is concentrated or diluted? (Lesson 03)
- Why do different concentrations of the same solution have different properties, such as taste or color? (Lesson 03)
- What does percent concentration tell us about a solution? (Lesson 04)
- How can we calculate concentration using mass and volume data? (Lesson 04)
- Why is it important to express the concentration of a solution accurately? (Lesson 04)
- In what ways do different units (grams or milliliters) affect how we describe and compare mixtures? (Lesson 04)
- How does percent concentration help us make informed choices in real-life situations like cooking, cleaning, or medicine? (Lesson 04)
- What’s really happening to the particles when a substance dissolves? (Lesson 05)
- What causes some substances to dissolve faster than others? (Lesson 05)
- How does temperature, stirring, and particle size affect how quickly something dissolves? (Lesson 05 and 06)
- What can we do to speed up or slow down the rate of dissolution in everyday situations? (Lesson 06)
- How are the properties of a substance used to determine if a possible chemical change occurred? (Lesson 07 and 08)
- What are physical properties? What are chemical properties? (Lesson 07 and 08)
- What evidence can be used to identify the formation of a new substance from a possible chemical change? (Lesson 07 and 08)
- What is the difference between an element and a compound? (Lesson 09)
- How can chemical symbols and formulas help us identify whether a substance is an element or a compound? (Lesson 09)
- How do models or diagrams show the differences between elements and compounds? (Lesson 09)

- Why is it important to know what a substance is made of? (Lesson 09)
- How can we use patterns in chemical symbols and formulas to classify substances? (Lesson 09)
- How can I tell if a substance is a molecule of an element, a molecule of a compound, or a formula unit of a compound? (Lesson 10)
- Why does it matter whether a substance contains a metal or only nonmetals? (Lesson 10)
- How does knowing the kinds of atoms in a substance help me understand what it is made of? (Lesson 10)
- What do subscripts and coefficients in a chemical formula tell us? (Lesson 10)
- How is temperature related to the motion of molecules in a substance? (Lesson 11)
- What happens to the kinetic energy of molecules when thermal energy is added or removed from a system? (Lesson 11)
- How can we use models to represent the relationship between thermal energy, temperature, and particle motion? (Lesson 11)
- How do we know when a substance is gaining or losing thermal energy? (Lesson 11)
- How does thermal energy move from one substance to another? (Lessons 12 and 13)
- What are the differences between conduction, convection, and radiation? (Lessons 12 and 13)
- What happens to the temperature of substances in a system over time? (Lessons 12 and 13)
- How do the properties of a material affect how it transfers thermal energy? (Lessons 12 and 13)

Common Misconceptions

- Graphs just display data—they don't help explain it. (Lesson 01)
- If a substance disappears in water, it's gone. (Lesson 02)
- Water is always the solute because it's the liquid. (Lesson 02)
- If you mix two things, it always makes a solution. (Lesson 02)
- If it looks mixed, it must be a chemical change. (Lesson 02)
- If you add more water, the solution gets stronger. (Lesson 03)
- A darker color always means a different substance, not just a stronger concentration. (Lesson 03)
- You can't dilute a solution unless you remove the solute. (Lesson 03)
- Concentration only affects taste, not other properties like conductivity or boiling point. (Lesson 03)
- Confusing solute and solvent – Some students think the solvent is the smaller amount or always a liquid, but it's the substance doing the dissolving. (Lesson 04)
- Using the wrong total in the denominator – Students may divide by the amount of solvent rather than the total solution (solute + solvent). (Lesson 04)
- Assuming percent means part per hundred without understanding the ratio – Students may write the percent without doing the actual comparison (e.g., saying 50% just because two things seem "equal"). (Lesson 04)
- Thinking higher percent means more liquid – A higher percent means more solute, not more total liquid (Lesson 04)
- Dissolving is the same as melting. - Students may think that when a substance dissolves, it's melting. (Lesson 05 and 06)
- The solute disappears or is gone. - Students may believe the solute vanishes completely once dissolved. (Lesson 05 and 06)
- Only hot water can make things dissolve -They might think cold water can't dissolve anything. (Lesson 05 and 06)
- Stirring causes dissolving by itself. - Students may think stirring alone makes something dissolve, not understanding the role of collisions. (Lesson 05 and 06)
- Larger pieces have more to dissolve, so they go faster. - They may think more solute means faster dissolving. (Lesson 05 and 06)
- Solubility and rate of dissolving are the same. Students might confuse how much dissolves (solubility) with how fast it dissolves (rate). (Lesson 05 and 06)

- If it changes shape or size, it must be a chemical change. - Physical changes like tearing, melting, or dissolving do not create new substances. (Lesson 07 and 08)
- All color changes mean a chemical change occurred. - Some color changes are just physical (e.g., food coloring in water). (Lesson 07 and 08)
- Gas formation always means a new substance formed. Correction - Bubbling can occur in physical changes too (like boiling water). It's only chemical if new substances are formed. (Lesson 07 and 08)
- If something dissolves, it's a chemical change. - Dissolving is a physical change—no new substance is formed. (Lesson 07 and 08)
- A temperature change always means a chemical change. - Temperature can change in both physical (e.g., boiling, freezing) and chemical changes. (Lesson 07 and 08)
- If I can't see a change, nothing happened. - Some chemical changes are subtle or invisible (e.g., pH changes), so evidence and testing are key. (Lesson 07 and 08)
- Thinking that a compound is a mixture. - Students may confuse compounds (chemically bonded atoms) with mixtures. (Lesson 09)
- Believing that a chemical formula with more than one atom always represents a compound. (Lesson 09)
- Misinterpreting subscripts as part of the element symbol. (Lesson 09)
- Assuming that any substance with more than one element symbol is a mixture, not a compound. (Lesson 09)
- Believing that atoms in a compound keep their original properties. (Lesson 09)
- Assuming all symbols with two letters represent compounds. (Lesson 09)
- All chemical formulas represent molecules. - Some formulas represent molecules (when all elements are nonmetals), but others represent formula units (when a metal and a nonmetal are present). (Lesson 10)
- If there's only one atom of each element, it's not a compound. - Even if there's only one atom of each kind, like in NaCl or CO, it can still be a compound if it contains two different elements. (Lesson 10)
- All formulas with two elements are molecules. - The number of elements doesn't determine whether it's a molecule or a formula unit -depends on which types of elements are present (metal vs. nonmetal). (Lesson 10)
- Only big compounds can be molecules. - Even small compounds like H₂O and CO₂ are molecules as long as all elements are nonmetals. (Lesson 10)
- All elements exist as single atoms. - Some elements (like oxygen, nitrogen, and chlorine) exist as molecules of elements (O₂, N₂, Cl₂), not as single atoms. (Lesson 10)
- The subscript tells how many molecules there are. - The subscript tells how many atoms of that element are in one molecule or formula unit, not how many total molecules there are. (Lesson 10)
- Temperature and thermal energy are the same thing. → Temperature is the average kinetic energy of particles, while thermal energy is the total energy (kinetic + potential) of all particles in a system. (Lesson 11)
- Cold is a form of energy that flows. → Cold is not a substance or energy; it's the absence of thermal energy. Energy flows from warmer to cooler objects. (Lesson 11)
- Molecules stop moving completely at room temperature or when they become solid. → Molecules in solids still vibrate in place unless they reach absolute zero (which is not possible in real-life conditions). (Lesson 11)
- Only substances that change temperature have thermal energy. → All matter has thermal energy if its particles are moving—even if the temperature is constant. (Lesson 11)
- Adding thermal energy always causes a temperature increase. → During a phase change (like melting or boiling), thermal energy goes into changing the state, not raising the temperature. (Lesson 11)

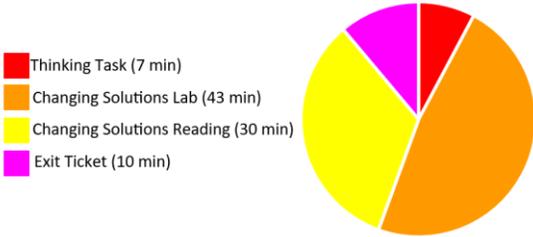
- Larger objects always have higher temperature because they have more particles. → Size and temperature are not directly related. A small object can have a higher temperature (kinetic energy) than a larger one. (Lesson 11)
- Energy flows from colder to warmer substances. → Thermal energy always flows from warmer to cooler areas until thermal equilibrium is reached. (Lesson 11)
- Cold moves from place to place. - Students may think cold is a substance that moves, when in fact only thermal energy moves—from warmer to cooler areas. (Lessons 12 and 13)
- All heat transfer happens through direct contact (conduction). - Students often don't recognize convection and radiation as types of thermal energy transfer, especially radiation, which doesn't require matter. (Lessons 12 and 13)
- Metal feels cold, so it must be a good insulator. - Actually, metal is a good conductor. It feels cold because it quickly transfers heat away from your skin. (Lessons 12 and 13)
- Objects at the same temperature can't transfer thermal energy. - If objects are in contact but one has more thermal energy (more particles or higher specific heat), energy transfer can still occur. (Lessons 12 and 13)
- Only gases and liquids can transfer heat. - While convection happens in fluids, conduction occurs in solids and radiation happens through empty space. (Lessons 12 and 13)
- Heat stops moving before thermal equilibrium is reached. - Students may not realize that thermal energy keeps moving until all parts of the system reach the same temperature. (Lessons 12 and 13)
- Radiation needs air or particles to transfer heat. - In fact, radiation can travel through the vacuum of space, which is how the Sun heats Earth. (Lessons 12 and 13)

ROADMAP

ROADMAP AT A Glance: Unit #01 Matter and Energy				
Day	Date	TEKS	Lesson	Lesson Title
There are two flex days built into this unit to use as needed. Flex days can be used for lessons that take longer than one day or for reteaching material the students may not have gotten during tier 1 instruction.				
1		7.2B 7.3A	01	Caffeine Conundrum
2		7.6D	02	What is Coffee?
3		7.6D	03	Concentration and Dilution of Solutions
4		7.6D	04	Calculating Concentrations of Solutions
5		7.6E	05	Introduction to Dissolution
6		7.6E	06	Factors that Affect the Rate of Dissolution
7		7.6C	07	Physical and Chemical Changes Part 1
8		7.6C	08	Physical and Chemical Changes Part 2
9		7.6A	09	What are Elements and Compounds?
10		7.6A 7.6B	10	Molecules of Elements and Compounds
11		7.8C 7.8B	11	Temperature and Kinetic Energy
12		7.8A 7.8B	12	Thermal Energy Transfer Part 1
13		7.8A 7.8B	13	Thermal Energy Transfer Part 2
14			Flex	Review and Catch Up
15			Unit Exam	TX_SCI_7thScience_F25_UE1 Scanning Deadline:

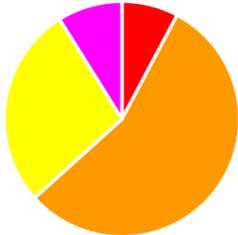
Lesson #01: Caffeine Conundrum		Date:
Objective	Instructional Notes	Lesson Look Fors
<p>SWBAT construct a scientific explanation using the Claim-Evidence-Reasoning (CER) format and justify their claims by analyzing data tables and graphs to select relevant evidence</p>	<ul style="list-style-type: none"> Students will create a data table of the data from the class and then graph the data. (Teacher may do this whole group to scaffold) The students will analyze the amount of caffeine in different caffeinated beverages and the effects of caffeine on the body. Students will analyze data from a lab “The effects of caffeine on Daphnia Magna.” Students will complete a CER on the effects of caffeine on the body. <div style="text-align: center;">  <ul style="list-style-type: none"> <li style="margin-right: 10px;">■ Thinking Task (7 min) <li style="margin-right: 10px;">■ Caffeine Check (25 min) <li style="margin-right: 10px;">■ Caffeine Scenario (10 min) <li style="margin-right: 10px;">■ Caffeine and Daphnia (40 min) <li style="margin-right: 10px;">■ Exit Ticket (8 min) </div> <div style="border: 2px solid orange; padding: 5px; margin: 10px 0;"> <p>Closing Knowledge Gaps: Teaching CER in Science Video CER Resources for the Science Classroom</p> </div> <div style="text-align: center; margin-top: 10px;">  <p>This lesson provides an opportunity for SLO Skill Practice</p> </div>	<p>Look for teachers to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. <input type="checkbox"/> Promote the use of partners and whole class discussion. <p>Look for students to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Justify their reasoning and support their ideas with evidence. <input type="checkbox"/> Analyze data to use as evidence to support claims
<p>Standards</p> <p>TEKS 7.2B analyze data by identifying any significant descriptive statistical features, patterns, sources of error, or limitations; 7.3A develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;</p>		
<p>Vocabulary</p> <p>Independent variable Dependent Variable Claim Evidence Reasoning</p>		
<p>Science Practices</p> <p>4. Analyzing and interpreting data 6. Constructing explanations and designing solutions</p>		
<p>Recurring Themes and Concepts</p> <p>A. Patterns B. Cause and Effect</p>		
		<p>Students Do and Know</p> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <ul style="list-style-type: none"> • Collect organize, and graph data from a class survey. • Analyze and calculate data from a text and determine the effects of caffeine on the human body to use as evidence • Students will analyze and graph data from a comparative investigation to collect evidence. • Use the CER format to answer the question “What are the effects of Caffeine on the Human Body?” </div> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <ul style="list-style-type: none"> • The effects of caffeine on the human body • How to create a data table and graph. • How to interpret data on a table and graph to use as evidence to support a claim. </div>

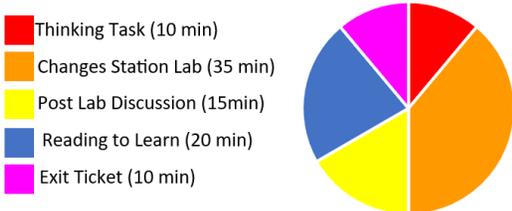
Lesson #02: What is Coffee?		Date:
Objective	Instructional Notes	Lesson Look Fors
<p>SWBAT identify solutes and solvents as parts of an aqueous solution and determine whether substances are soluble or insoluble in the context of forming homogeneous mixtures, by observing how substances behave when mixed with water.</p>	<ul style="list-style-type: none"> Students will engage in an ACTIVITY BEFORE CONTENT lab to begin to gain conceptual understanding of solutions, soluble, insoluble. Students will participate in a reading to learn to acquire knowledge of the terms solute, solvent, aqueous solution, soluble and insoluble. Students will watch a video to stamp their understanding of the concept of aqueous solutions. Students will identify a solute and solvent in an aqueous solution and determine if substances are soluble or insoluble based on how the substance interacts with water. 	<p>Look for teachers to:</p> <ul style="list-style-type: none"> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. Promote the use of partners and whole class discussion. <p>Look for students to:</p> <ul style="list-style-type: none"> Engage in discourse and productive struggle Engage in a comparative investigation. Think of solutions as a System with parts that work together.
Standards		
<p>TEKS 7.6D describe aqueous solutions in terms of solute and solvent, concentration, and dilution</p>		
Vocabulary		
<p>Aqueous Solution Insoluble Solution Solute Solvent Soluble</p>	<div style="display: flex; align-items: center;"> <ul style="list-style-type: none"> ■ Thinking Task (10 min) ■ Soluble or Insoluble Lab (30 min) ■ The Story of Coffee (20 min) ■ Solutions Video (10 min) ■ Exit Ticket (10 min)  </div>	
Science Practices		
<p>3. Planning and carrying out investigations 4. Analyzing and interpreting data 8. Obtaining, evaluating, and communicating information</p>	<div style="border: 2px solid #FFD700; padding: 10px;"> <p>Closing Knowledge Gaps: CK-12 Physical Science for Middle School Solute and Solvent Video: Solutions, Solutes & Solvents</p>  </div>	
Recurring Themes and Concepts		
<p>D. Systems and System Models</p>		<p style="background-color: #FFD700; padding: 5px;">Students Do and Know</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;">  <p style="margin-top: 100px;">Know</p>  </div> <ul style="list-style-type: none"> Identify the solute and solvent in a solution. Explain whether a substance is soluble or insoluble in water based on their observations. Describe how a homogeneous mixture forms when a solute dissolves in a solvent to make an aqueous solution. A solution is a homogeneous mixture where one or more solutes are dissolved in a solvent. An aqueous solution is a solution where water is the solvent. The solute is the substance that gets dissolved. The solvent is the substance that does the dissolving (often water). Not all substances dissolve in water; some are insoluble. </div>

Lesson #03: Concentration and Dilution of Solutions		Date:
Objective	Instructional Notes <ul style="list-style-type: none"> Students will conduct a comparative investigation how the physical properties of a solution change when the amount of solute or solvent is changed. Students will engage in a reading to learn activity to deepen their understanding of concentrations and dilutions of solutions. Students will use the knowledge they acquired from the reading to learn and apply it to the investigation by analyzing data and patterns and using the data to justify claims and answer reflection questions. Students will analyze scenarios and models to describe change to solutions in terms of concentration and dilutions. <div style="text-align: center;">  <p> ■ Thinking Task (7 min) ■ Changing Solutions Lab (43 min) ■ Changing Solutions Reading (30 min) ■ Exit Ticket (10 min) </p> </div> <div style="border: 2px solid orange; padding: 10px; margin-top: 10px;"> <p>Closing Knowledge Gaps: Khan Academy Dilutions Chemistry for Kids Solutions</p>  </div>	Lesson Look Fors
Standards		Look for teachers to:
TEKS 7.6D describe aqueous solutions in terms of solute and solvent, concentration, and dilution		<input type="checkbox"/> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. <input type="checkbox"/> Promote the use of partners and whole class discussion. <input type="checkbox"/> Engage Students in a Reading to Learn to deepen content knowledge.
Vocabulary		Look for students to:
Concentration Dilution		<input type="checkbox"/> Justify their reasoning and support their ideas with evidence. <input type="checkbox"/> Engage in a comparative investigation to being to develop a conceptual understanding of concentrations and dilutions.
Science Practices		Students Do and Know
2. Developing and using models 3. Planning and carrying out investigations 8. Obtaining, evaluating, and communicating information	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">  </div> <ul style="list-style-type: none"> Describe how increasing or decreasing solute or solvent affects a solution's concentration. Create or interpret models that represent concentrated and diluted solutions. Conduct an investigation to observe changes in concentration and dilution. Solutions are made of solutes (what is dissolved) and solvents (what does the dissolving). </div> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;">  </div> <ul style="list-style-type: none"> Concentration describes how much solute is present in a given amount of solvent. Dilution means adding more solvent to a solution, making it less concentrated. Changing the amount of solute or solvent affects the concentration of a solution. Concentration affects observable properties such as color, taste, and conductivity. </div>	
Recurring Themes and Concepts		
A. Patterns B. Cause and Effect		

Lesson #04: Calculating Concentration of Solutions		Date:	
Objective	Instructional Notes	Lesson Look Fors	
<p>SWBAT calculate percent concentration to describe solutions by analyzing mass/mass, volume/volume, or mass/volume data from real-world scenarios.</p>	<ul style="list-style-type: none"> • Students will draw models of solvent and solute in solutions and determine which solution is the most concentrated and which is the most diluted. • Students will review the Percent Concentration of Solutions student page, going over each section and calculation together. The teacher will guide the class through practice calculations to ensure understanding. • Students will calculate the percent composition from the investigation from the previous day. • Students will complete 10 practice problems to apply what they've learned. • Students will analyze mass/mass, volume/volume, or mass/volume data and calculate percent concentration to describe solutions <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"> <ul style="list-style-type: none"> ■ Thinking Task (7 min) ■ Physical Properties to Calculation (8 min) ■ Calculating Percent Concentration (25min) ■ Calculations from Investigation (20 min) ■ Practice Problems (20 min) ■ Exit Ticket (10 min) </div>  </div>	<p>Look for teachers to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. <input type="checkbox"/> Promote the use of partners and whole class discussion. <p>Look for students to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engage in discourse and productive struggle <input type="checkbox"/> Justify their reasoning and support their ideas with evidence. 	
<p>Standards</p> <p>TEKS 7.6D describe aqueous solutions in terms of solute and solvent, concentration, and dilution</p>			<p>Students Do and Know</p> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">  </div> <ul style="list-style-type: none"> • Calculate percent concentration of a solution by selecting and using the correct formula for: <ul style="list-style-type: none"> ○ mass/mass ○ volume/volume ○ mass/volume </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">  </div> <ul style="list-style-type: none"> • Use quantitative data (grams or milliliters) to describe the ratio of solute to solution • Percent concentration expresses the part-to-whole relationship between solute and total solution. • There are multiple valid ways to calculate percent concentration, depending on whether the quantities are in mass or volume. • A higher percent concentration means more solute relative to the total solution — not more liquid. </div>
<p>Vocabulary</p> <p>Percent Concentration Quantitative Data Qualitative Data</p>			
<p>Science Practices</p> <p>2. Developing and using models 4. Analyzing and interpreting data 5. Using mathematics and computational thinking</p>			
<p>Recurring Themes and Concepts</p> <p>A. Patterns C. Scale, Proportion, Quantity</p>		<p>Closing Knowledge Gaps: Concentrations of Solutions CK-12 Percent Solutions</p> <div style="border: 1px solid red; padding: 5px; display: inline-block; margin-top: 10px;"> <p>Mc Graw Hill</p> </div>	

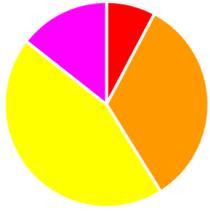
Lesson #05: Introduction to Dissolution		Date:	
Objective	Instructional Notes	Lesson Look Fors	
<p>SWBAT describe dissolution and factors that affect the rate of dissolution including temperature, surface area, and agitation, by modeling.</p>	<ul style="list-style-type: none"> Students will complete one calculation from the previous lesson for review. Then, the students will be asked to model what happens on the molecular or particle level when a solute is placed in a solvent and dissolves to form a solution. Students will engage in activity before content to develop definitions for dissolution, agitation, temperature and surface area. Students will draw models to show what happens on a particle level when solutions are agitated, experience an increase in temperature, and the surface area of the solute is increased. Students will preview the investigation they will conduct during the next lesson. They will use the information they gained today to formulate their three hypotheses. Students will use evidence from the models they created to justify the reasoning behind their three hypotheses. <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;"> <p>■ Thinking Task (10 min)</p> <p>■ Modeling Dissolution (45 min)</p> <p>■ Introduce Investigation (20 min)</p> <p>■ Exit Ticket (15 min)</p> </div>  </div> <div style="border: 1px solid orange; padding: 10px; margin-top: 10px;"> <p>Closing Knowledge Gaps: Ck- 12 Rate of Dissolving American Chemical Society</p>  </div>	<p>Look for teachers to:</p> <ul style="list-style-type: none"> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. Promote the use of partners and whole class discussion. <p>Look for students to:</p> <ul style="list-style-type: none"> Engage in discourse and productive struggle Justify their reasoning and support their ideas with evidence. 	
<p>Standards</p> <p>TEKS Investigate and model how temperature, surface area, and agitation affect the rate of dissolution of solid solutes in aqueous solutions.</p>			<p>Students Do and Know</p> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <ul style="list-style-type: none"> Develop and use models to represent how agitation, temperature, and surface area affect the movement and interaction of particles during dissolution. Define the terms: dissolution, agitation, temperature, and surface area in the context of solutions. Use their particle models to justify how each factor might change the rate of dissolution. Formulate testable hypotheses for how each factor will affect the rate of dissolution in an investigation. </div> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <ul style="list-style-type: none"> Dissolution is the process of a solute breaking apart and spreading out evenly in a solvent to form a solution. Dissolution happens when solvent particles collide with solute particles, breaking them apart and surrounding them until they are evenly mixed in the solution. Particle models can be used to explain and visualize how and why dissolution happens. </div>
<p>Vocabulary</p> <p>Agitation Dissolution Kinetic Energy Surface Area Temperature</p>			
<p>Science Practices</p> <p>2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data</p>			
<p>Recurring Themes and Concepts</p> <p>B. Cause and Effect E. Energy and Matter</p>			

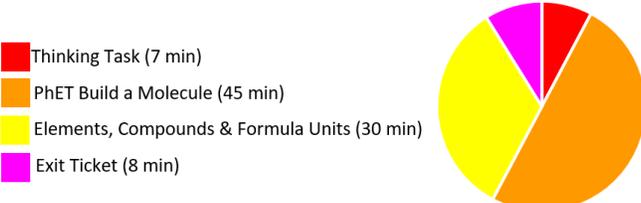
Lesson #06: Factors that Affect the Rate of Dissolution		Date:
Objective	Instructional Notes	Lesson Look Fors
SWBAT describe factors that affect the rate of dissolution including temperature, surface area, and agitation, by conducting an experimental investigation.	<ul style="list-style-type: none"> Students will investigate how temperature, agitation and surface area affect the rate of dissolution by conducting an experimental investigation. Students will use the data collected and analyzed in the lab and modeling activity, to make a claim that answers the question “How can the rate of dissolution of an aqueous solution be increased? and then provide evidence and select a reasoning to support the claim. Students will describe how factors including temperature, surface area, and agitation affect the rate of dissolution. 	Look for teachers to: <ul style="list-style-type: none"> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. Promote the use of partners and whole class discussion. Look for students to: <ul style="list-style-type: none"> Engage in discourse and productive struggle Justify their reasoning and support their ideas with evidence.
Standards		
TEKS Investigate and model how temperature, surface area, and agitation affect the rate of dissolution of solid solutes in aqueous solutions.		
Vocabulary		
No new vocabulary		
Science Practices		
3. Planning and carrying out investigations 4. Analyzing and interpreting data 6. Constructing explanations and designing solutions 8. Obtaining, evaluating, and communicating information	 <ul style="list-style-type: none"> Thinking Task (7 min) Rate of Dissolution Lab (50 min) CER (25 min) Exit Ticket (8 min) 	
Recurring Themes and Concepts	<p>Closing Knowledge Gaps: Ck- 12 Rate of Dissolving American Chemical Society</p> 	
A. Patterns B. Cause and Effect		Students Do and Know <ul style="list-style-type: none"> Investigate how temperature, agitation and surface area affect the rate of dissolution by conducting an experimental investigation. Describe how factors including temperature, surface area, and agitation affect the rate of dissolution. The rate of dissolution can be increased in several ways: Heating the solution gives solvent particles more energy, leading to more frequent and forceful collisions with the solute; stirring causes particles to move and interact more often; and crushing the solute into smaller pieces increases its surface area, allowing more solvent particles to contact and dissolve it faster.

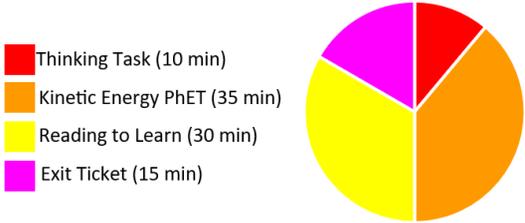
Lesson #07 Physical and Chemical Changes Part 1:		Date:
Objective	Instructional Notes <ul style="list-style-type: none"> Students will complete an investigation in which they will experience both chemical and physical changes. Students will make observations. During a post-lab discussion, the teacher will highlight the evidence of a chemical change the students observed in the stations. (Review from 6th grade) Students will complete a reading to learn to build their conceptual understanding of physical and chemical changes. Students will apply their learning of physical and chemical changes to classify the changes they observed in the lab investigation. <div style="text-align: center;">  <ul style="list-style-type: none"> ■ Thinking Task (10 min) ■ Changes Station Lab (35 min) ■ Post Lab Discussion (15min) ■ Reading to Learn (20 min) ■ Exit Ticket (10 min) </div>	Lesson Look Fors
Standards		Look for teachers to:
TEKS 7.6C distinguish between physical and chemical changes in matter		<input type="checkbox"/> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss.
Vocabulary		<input type="checkbox"/> Promote the use of partners and whole class discussion.
Chemical Change Physical Change Precipitate		Look for students to:
Science Practices		<input type="checkbox"/> Engage in discourse and productive struggle <input type="checkbox"/> Justify their reasoning and support their ideas with evidence.
3. Planning and carrying out investigations 4. Analyzing and interpreting data 8. Obtaining, evaluating, and communicating information	Students Do and Know	
Recurring Themes and Concepts	<div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>A. Patterns</p> <p>B. Cause and Effect</p> </div> <div style="border: 2px solid #FFD700; padding: 10px; width: 100%;"> <p style="margin: 0;"><u>Closing Knowledge Gaps</u></p> <p style="margin: 0;"><u>Ck-12 Physical and Chemical Changes</u></p> <p style="margin: 0;"><u>American Chemical Society Changes</u></p> <div style="text-align: center; margin-top: 10px;">  </div> </div> </div>	
	<div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>Do</p>  </div> <ul style="list-style-type: none"> Distinguish between physical and chemical changes based on observable evidence. Observe and record accurate, descriptive data during hands-on lab investigations. Analyze scenarios (real-world, video-based, or hands-on) to identify whether a physical or chemical change occurred. Physical and chemical changes affect matter in different ways. Physical changes alter the form or appearance of a substance without changing its identity, while chemical changes produce new substances with different properties. Physical properties can be observed or measured without changing the substance. Chemical properties describe how a substance behaves when its identity changes (e.g., flammability, toxicity). </div>	
	<div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>Know</p>  </div> </div>	

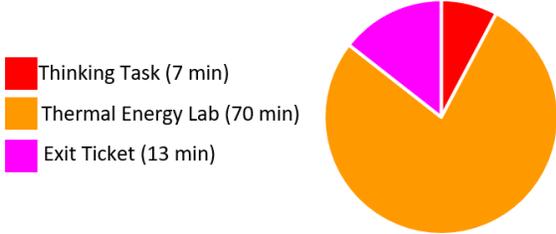
Lesson #08: Physical and Chemical Changes Part 2		Date:	
Objective	Instructional Notes	Lesson Look Fors	
SWBAT distinguish between physical and chemical changes in matter using evidence from pictures or descriptions	<ul style="list-style-type: none"> Students will analyze everyday scenarios to identify observable evidence and determine whether a chemical or physical change occurred, using scientific reasoning to justify their decisions and uncover common misconceptions. Students will examine sets of before-and-after images, identify whether the change is physical or chemical, and justify their claims with evidence. They will record responses on their data sheet and revise thinking based on peer/class discussion. Students will read an expository text titled The Journey of the Coffee Bean. The students will annotate and note evidence of physical and chemical changes. Students will write a scientific explanation in CER format to answer the question: Are the processes involved in making a cup of coffee chemical changes, physical changes, or both. <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;"> <p>■ Thinking Task (13 min)</p> <p>■ Physical or Chemical? (20 min)</p> <p>■ Is Making Coffee Physical or Chemical? (45 min)</p> <p>■ Exit Ticket (12 min)</p> </div>  </div> <div style="border: 2px solid orange; padding: 10px; margin-top: 10px;"> <p>Closing Knowledge Gaps</p> <p>Ck-12 Physical and Chemical Changes</p> <p>American Chemical Society Changes</p>  </div>	Look for teachers to: <ul style="list-style-type: none"> <input type="checkbox"/> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. <input type="checkbox"/> Promote the use of partners and whole class discussion. Look for students to: <ul style="list-style-type: none"> <input type="checkbox"/> Engage in discourse and productive struggle <input type="checkbox"/> Justify their reasoning and support their ideas with evidence. 	
Standards			
TEKS 7.6C distinguish between physical and chemical changes in matter			
Vocabulary			
No new vocabulary			
Science Practices			
6. Constructing explanations and designing solutions 7. Engaging in argument from evidence			
Recurring Themes and Concepts			
A. Patterns B. Cause and Effect			
		Students Do and Know <div style="display: flex; flex-direction: column; align-items: flex-start; margin-top: 10px;"> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <ul style="list-style-type: none"> Differentiate between physical and chemical changes using observable evidence (e.g., gas production, color change, temperature change, phase change, size change). Construct a written scientific explanation (CER) </div> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <ul style="list-style-type: none"> Physical changes involve a change in form, size, or state without forming a new substance (e.g., grinding, drying, melting). Chemical changes involve the formation of a new substance and often include signs like gas formation, color change, or heat production. The process of making coffee includes both physical and chemical changes, such as grinding (physical), roasting (chemical), and brewing (both). </div> </div>	

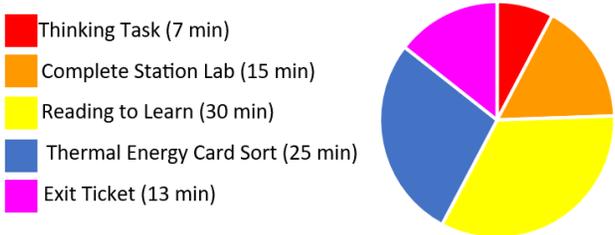


Lesson #09: What are Elements and Compounds?		Date:
Objective	Instructional Notes	Lesson Look Fors
SWBAT distinguish between elements and compounds by analyzing diagrams, models, and chemical symbols/formulas.	<ul style="list-style-type: none"> Students will review atomic structure and how to identify/determine the number of subatomic particle in each type of atom. Students will distinguish between elements and compounds using models, symbols, and formulas. Students will analyze diagrams, models, and chemical symbols/formulas to determine if a substances is an element or a compound. 	Look for teachers to: <ul style="list-style-type: none"> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. Promote the use of partners and whole class discussion. Look for students to: <ul style="list-style-type: none"> Engage in discourse and productive struggle Justify their reasoning and support their ideas with evidence.
Standards		
TEKS 7.6A - compare and contrast elements and compounds in terms of atoms and molecules, chemical symbols, and chemical formulas		
Vocabulary		
Atom Chemical bond Chemical formula Chemical symbol Compound Element Periodic Table	 <ul style="list-style-type: none"> Thinking Task (7 min) Atomic Structure Review (30 min) Classifying Elements and Compounds (40 min) Exit Ticket (13 min) 	
Science Practices		
2. Developing and using models 4. Analyzing and interpreting data 8. Obtaining, evaluating, and communicating information		
Recurring Themes and Concepts		
A. Patterns	<div style="border: 2px solid orange; padding: 10px;"> <p>Closing Knowledge Gaps Ck-12 Chemistry of Compounds Khan Academy</p>  </div>	Students Do and Know <ul style="list-style-type: none"> Distinguish between elements and compounds by analyzing chemical formulas, symbols, and particle models. Classify substances as elements or compounds using both visual models and written representations. Explain their reasoning using evidence from chemical formulas or diagram. Elements are pure substances made of only one type of atom and are represented by chemical symbols (e.g., O, Na, Co). Compounds are made of two or more different elements chemically combined and are represented by chemical formulas (e.g., H₂O, NaCl).

Lesson #10: Molecules of Elements and Compounds		Date:
Objective	Instructional Notes	Lesson Look Fors
SWBAT differentiate between molecules of elements, molecules of compounds, and formula units of compounds by analyzing the atoms (types and numbers) that make up the substances	<ul style="list-style-type: none"> Participate in an activity where they practice identifying elements vs. compounds and the teacher is able to gather evidence of the students prior understanding and misconceptions about chemical formulas. Students will build and analyze molecules using a digital simulation to explore how chemical formulas represent the types and numbers of atoms in molecules of elements and compounds, including the use of subscripts and coefficients. Students will engage in notes and a class discussion to learn how to distinguish between molecules of elements, molecules of compounds, and formula units of compounds. Differentiate between molecules of elements, molecules of compounds, and formula units of compounds by analyzing the atoms (types and numbers) that make up the substances. 	Look for teachers to: <ul style="list-style-type: none"> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. Promote the use of partners and whole class discussion. Look for students to: <ul style="list-style-type: none"> Engage in discourse and productive struggle Justify their reasoning and support their ideas with evidence.
Standards		Students Do and Know
TEKS 7.6A - compare and contrast elements and compounds in terms of atoms and molecules, chemical symbols, and chemical formulas 7.6B - use the periodic table to identify the atoms and the number of each kind within a chemical formula		 <ul style="list-style-type: none"> Distinguish between molecules of elements, molecules of compounds, and formula units of compounds. Analyze chemical formulas to: <ul style="list-style-type: none"> Identify the types and number of atoms in a substance using subscripts Determine the total number of molecules or formula units using coefficients
Vocabulary		 <ul style="list-style-type: none"> A molecule is made of nonmetals joined together (either the same or different atoms). A formula unit is a compound made from a metal and a nonmetal. Subscripts show the number of atoms of each element in one molecule or formula unit. Coefficients show the number of molecules or formula units.
Science Practices		
2. Developing and using models 7. Engaging in argument from evidence	Closing Knowledge Gaps Ck-12 Chemistry of Compounds Khan Academy	
Recurring Themes and Concepts		
A. Patterns		

Lesson #11: Temperature and Kinetic Energy		Date:
Objective	Instructional Notes	Lesson Look Fors
SWBAT explain the relationship between temperature and kinetic energy of molecule within a substance by creating particle models and citing evidence from investigations	<ul style="list-style-type: none"> Students will first explore the relationship between temperature and kinetic energy using a PhET simulation. Students will analyze the movement of the particles at various temperatures. Students will participate in science discourse and complete a reading to learn exercise where they apply what they observed in the PhET simulation. Students will explain the relationship between temperature and kinetic energy of molecule within a substance by creating particle models and citing evidence from the PhET and reading to learn. 	Look for teachers to: <ul style="list-style-type: none"> <input type="checkbox"/> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. <input type="checkbox"/> Promote the use of partners and whole class discussion. Look for students to: <ul style="list-style-type: none"> <input type="checkbox"/> Engage in discourse and productive struggle <input type="checkbox"/> Justify their reasoning and support their ideas with evidence.
Standards		
TEKS 7.8C - explain the relationship between temperature and the kinetic energy of the molecules within a substance 7.8B investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium		
Vocabulary		
Heat Kinetic Energy Temperature Thermal Energy	 <ul style="list-style-type: none"> Thinking Task (10 min) Kinetic Energy PhET (35 min) Reading to Learn (30 min) Exit Ticket (15 min) 	
Science Practices		
2. Developing and using models 4. Analyzing and interpreting data 8. Obtaining, evaluating, and communicating information		
Recurring Themes and Concepts		
A. Patterns	<div style="border: 2px solid orange; padding: 10px;"> <p>Closing Knowledge Gaps</p> <p>Ck-12 Kinetic Energy and Temperature Khan Academy</p>  </div>	Students Do and Know <ul style="list-style-type: none">  Analyze and interpret models and graphs to describe how the movement of particles changes as temperature changes. Use evidence from a simulation to explain the relationship between temperature and the kinetic energy of particles. Use reading evidence to support scientific claims about heat, temperature, and state changes. Explain thermal energy transfer using real-world examples and scientific vocabulary.  Temperature is the average kinetic energy of the molecules in a substance. As thermal energy increases, molecules move faster, increasing kinetic energy and temperature. As thermal energy decreases, molecules move slower, decreasing kinetic energy and temperature.

Lesson #12: Thermal Energy Transfer Part 1		Date:
Objective	Instructional Notes	Lesson Look Fors
SWBAT describe how thermal energy is transferred in and out of systems and moves by conducting investigation	Students will participate in a 6-station rotation investigation where they will experience the three methods of thermal energy transfer.	Look for teachers to:
Standards	 <p> ■ Thinking Task (7 min) ■ Thermal Energy Lab (70 min) ■ Exit Ticket (13 min) </p>	<input type="checkbox"/> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. <input type="checkbox"/> Promote the use of partners and whole class discussion.
TEKS		Look for students to:
7.8A investigate methods of thermal energy transfer into and out of systems, including conduction, convection, and radiation		<input type="checkbox"/> Engage in discourse and productive struggle <input type="checkbox"/> Justify their reasoning and support their ideas with evidence.
7.8B investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium		Students Do and Know
Vocabulary		<p>Heat</p> <p>Kinetic Energy</p> <p>Temperature</p> <p>Thermal Energy</p>
Science Practices	<p>Closing Knowledge Gaps</p> <p>Ck-12 Thermal Energy Transfer</p> <p>Khan Academy</p> 	
Recurring Themes and Concepts		
A. Patterns		
B. Cause and Effect		
D. Systems and System Models		
E. Energy and Matter		

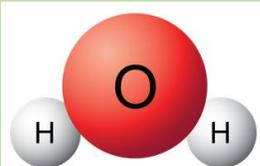
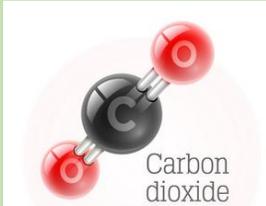
Lesson #13: Thermal Energy Transfer Part 2		Date:
Objective	Instructional Notes	Lesson Look Fors
SWBAT identify and describe the methods of thermal energy transfer by analyzing images and real-world scenarios.	<ul style="list-style-type: none"> Students will participate in a 6-station rotation investigation where they will experience the three methods of thermal energy transfer. Students will engage in a reading to learn and apply their observations from the investigations to identify the methods of thermal energy transfer that occurred at each station. Students will analyze images of everyday scenarios and identify the type of energy transfer. Students will identify and describe the methods of thermal energy transfer by analyzing images and real-world scenarios. 	Look for teachers to: <ul style="list-style-type: none"> Engage students in ABC. (Activity before content) The teacher should stamp key points AFTER students have had the time to engage in the content (productive struggle) and discuss. Promote the use of partners and whole class discussion. Look for students to: <ul style="list-style-type: none"> Engage in discourse and productive struggle Justify their reasoning and support their ideas with evidence.
Standards		
TEKS 7.8A investigate methods of thermal energy transfer into and out of systems, including conduction, convection, and radiation 7.8B investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium		
Vocabulary		
Conduction Conductor Convection Insulator Radiation	 <ul style="list-style-type: none"> Thinking Task (7 min) Complete Station Lab (15 min) Reading to Learn (30 min) Thermal Energy Card Sort (25 min) Exit Ticket (13 min) 	
Science Practices		
7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information		
Recurring Themes and Concepts		
A. Patterns	<div style="border: 2px solid orange; padding: 10px;"> <p>Closing Knowledge Gaps Ck-12 Thermal Energy Transfer Khan Academy</p>  </div>	Students Do and Know <ul style="list-style-type: none"> Students will identify and describe the methods of thermal energy transfer by analyzing images and real-world scenarios. Thermal energy is transferred between substances in one of three ways, conduction, convection, and radiation. Thermal energy moves from warmer substances to cooler substances.

UNPACKED STANDARDS

Focus standards for this unit.

Standard: 7.6A compare and contrast elements and compounds in terms of atoms and molecules, chemical symbols, and chemical formulas;		
Specificity		Content Builder
Cognition: Compare Content: Elements and Compounds Including but not limited to: <ul style="list-style-type: none"> • Element – a pure substance composed of a single type of particle (atom) <ul style="list-style-type: none"> ○ Type of particle – atom ○ Organized on the periodic table of elements ○ Represented by a chemical symbol <ul style="list-style-type: none"> ▪ One or two letters representing an element <ul style="list-style-type: none"> ➤ H - hydrogen ➤ He - helium ➤ Li - lithium ➤ Be - beryllium • Compounds – a pure substance composed of two or more different types of particles (atoms) of different elements that are joined together <ul style="list-style-type: none"> ○ Type of particle – molecule ○ Represented by a chemical formula <ul style="list-style-type: none"> ▪ Each type of element in the compound is represented by its chemical symbol. <ul style="list-style-type: none"> ➤ CO - carbon monoxide ➤ NaCl - sodium chloride ▪ The proportion (ratio) of each element in a compound is constant. ▪ The number of atoms represented by specific ratios as determined by subscripts <ul style="list-style-type: none"> ➤ CO₂ - carbon dioxide ➤ H₂O - water ➤ C₆H₁₂O₆ - glucose 		Elements and compounds differ in terms of composition and properties. Elements are pure substances consisting of one type of atom and cannot be broken down further. Compounds are made up of different types of atoms chemically bonded together to form molecules. Elements are represented by unique chemical symbols such as “H” for hydrogen and “O” for oxygen, while compounds are represented by chemical formulas, such as “H ₂ O “ for water, showing the ratio of atoms in the molecule. Clarify that the position of elements in a chemical formula does not necessarily indicate their quantity. For example, in H ₂ O, hydrogen is listed first, but it is present in a 2:1 ratio with oxygen. Clarify that changing subscripts can create entirely different compounds with distinct properties. For example, changing the subscript in H ₂ O to H ₂ O ₂ results in a different chemical, hydrogen peroxide. Students may struggle to understand the relationship between chemical symbols and formulas.
		Instructional Implications
		When you teach this concept, remember to: <ul style="list-style-type: none"> • Provide clear and concise explanations of the concepts of elements and compounds. Define atoms and molecules, emphasizing that elements consist of only one type of atom, while compounds are formed by the combination of different types of atoms. • Use diagrams, charts, or models to illustrate the differences between elements and compounds. Display the periodic table to showcase different elements and their chemical symbols. Use molecular models or diagrams to demonstrate how atoms come together to form molecules in compounds. • Encourage students to compare and contrast elements and compounds based on their properties and characteristics. Discuss how elements are represented by chemical symbols, consisting of one or two letters, while compounds have chemical formulas indicating the types and ratios of atoms present. • Provide ample practice opportunities for students to work with chemical symbols and formulas.
		Student Misconceptions
		<ul style="list-style-type: none"> • Thinking that chemical symbols with lower case letters represent more than one type of element • Thinking that no subscript means something other than the representation of only one atom present • Thinking that all elements are represented by a capital letter, forgetting they can include upper and lowercase letters
Vocabulary		
Atom	Atomic Number	Chemical formula
Compound	Element	molecule
Periodic Table	Solution	Subscript
Symbol		
Possible STAAR Stimuli		
Investigation	Chart/Table	Diagram

Model	Informational Text/List	Formula/Equation	<ul style="list-style-type: none"> • Not adding atoms of the same element if they are in the same compound (e.g., HOH has two hydrogen atoms and one oxygen atom) • Thinking that subscripts represent the number of atoms in a compound • Thinking that all chemical formulas must have subscripts • Thinking that the element listed first is always the one with the greater quantity in the compound • Thinking that compounds with the same elements but different subscripts are the same (e.g., not recognizing CO and CO₂ are different compounds with different properties)
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Standard:	7.6B use the periodic table to identify the atoms and the number of each kind within a chemical formula;	
Specificity	Content Builder	
<p>Cognition: Identify Content: The atoms and the number of each kind within a chemical formula using the Periodic Table of Elements.</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Chemical formula - identifies the elements in a compound and the proportions or ratios of the elements <ul style="list-style-type: none"> o Each type of element in the compound is represented by its chemical symbol. <ul style="list-style-type: none"> ▪ The periodic table of elements can be used to look up the name of an element using its chemical symbol. <ul style="list-style-type: none"> ➢ CO - carbon monoxide <ul style="list-style-type: none"> - C = carbon - O = oxygen ➢ NaCl - sodium chloride <ul style="list-style-type: none"> - Na = sodium - Cl = chlorine o The proportion (ratio) of each element in a compound is constant. <ul style="list-style-type: none"> ▪ The number of atoms represented by specific ratios as determined by subscripts ▪ If there is no subscript present, a single atom of that element is present in the molecule. <ul style="list-style-type: none"> ➢ CO₂ - carbon dioxide <ul style="list-style-type: none"> - C = one carbon atom - O₂ = two oxygen atoms ➢ H₂O - water <ul style="list-style-type: none"> - H₂ = two hydrogen atoms - O = one oxygen atom ➢ C₆H₁₂O₆ - glucose 	<p>To use the periodic table to identify the atoms and the number of each kind within a chemical formula, look for the chemical symbols of the elements in the formula. The chemical symbols are usually one or two letters representing each element. Then, use the subscripts in the formula to determine the number of atoms of each element present. The subscript next to the chemical symbol indicates how many atoms of that element are present in one molecule of the compound. Students may struggle to grasp the relationship between the symbols representing elements and the formulas indicating the composition of compounds.</p> <p>Chemical formulas, such as H₂O and CO₂, are used to provide information about the type and number of atoms present in a substance. The subscript numbers after each element indicate the number of atoms of that element in the formula. If there is no number after the element, then there is only one atom of that element in the formula. For example, the chemical formula for H₂O has two hydrogen atoms and one oxygen atom. CO₂ has one carbon atom and two oxygen atoms.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div data-bbox="1220 1092 1480 1304" style="text-align: center;">  <p>Water (H₂O)</p> </div> <div data-bbox="1556 1068 1822 1338" style="text-align: center;">  <p>Carbon dioxide CO₂</p> </div> </div>	
	Instructional Implications	
	<ul style="list-style-type: none"> • Help students understand that chemical symbols represent specific elements. Provide examples and exercises where they can practice matching chemical symbols to corresponding elements on the periodic table. 	

<ul style="list-style-type: none"> - C₆ = six carbon atoms - H₁₂ = twelve hydrogen atoms - O₆ = six oxygen atoms 			<ul style="list-style-type: none"> ○ Explain that subscripts in a chemical formula represent the number of atoms of each element in the compound. ○ Provide opportunities for students to practice using the periodic table to identify the atoms and the number of each kind within a chemical formula. ○ Provide students with molecular model kits or other hands-on tools to physically construct and visualize atoms and molecules. This will help them understand how atoms bond together to form molecules in compounds and how elements consist of single atoms. ○ Introduce real-world examples of elements and compounds in everyday life to make the concept more relatable. ○ Engage students in exercises to identify chemical symbols and interpret chemical formulas. Vary the complexity of chemical formulas, including subscripts and parentheses. ○ Help students see the Recurring Theme and Concept of <i>patterns</i> in reading the periodic table.
Vocabulary			
Atom	Atomic mass	Atomic Number	
Chemical formula	Chemical Symbol	Compound	
Element	Molecule	Periodic Table	
Subscript			
Possible STAAR Stimuli			
Investigation	Chart/Table	Diagram	
Model	Visual/Image	Formula/Equation	
Notes			
7.6(B) is eligible for assessment on Grade 8 STAAR. (Note: Standards designated as “readiness” are essential for success in the current grade. Standards may have a different designation when assessed on Grade 8 STAAR.)			
Student Misconceptions			
Students may make the following mistakes:			
<ul style="list-style-type: none"> • Thinking that chemical symbols with lowercase letters represent more than one type of element • Thinking that no subscript means something other than the representation of only one atom present • Thinking that all elements are represented by a capital letter, forgetting they can include upper and lowercase letters • Not adding atoms of the same element if they are in the same compound (e.g., HOH has two hydrogen atoms and one oxygen atom) • Confusing the symbols of elements, especially when they are similar [e.g., Carbon (C) and Calcium (Ca)] • Incorrectly using parentheses in chemical formulas, leading to incorrect interpretations of compound compositions 			

Standard:	7.6C distinguish between physical and chemical changes in matter;	
Specificity		Content Builder
Cognition: Distinguish Content: Between physical and chemical changes in matter Including but not limited to: <ul style="list-style-type: none"> • Physical properties - color, texture, odor, conductivity, insulator, magnetic, buoyancy, solubility, boiling and melting point, mass, and luster • Physical change - change which alters the physical properties of a substance without changing its identity 		Physical changes in matter are changes that do not alter the chemical composition of a substance. They only affect a substance’s physical properties such as shape, size, state (solid, liquid, gas), or phase transitions (melting, freezing, vaporization). Examples of physical changes include melting ice, boiling water, and crushing a can. Chemical changes , on the other hand, involve a rearrangement of atoms and result in the formation of new substances with different chemical properties. Examples of chemical changes include burning wood to produce ash and smoke, rusting of iron, and baking a cake where the ingredients undergo a chemical reaction to form a new product. Students

- Possible examples of physical changes in matter:
 - Freezing, melting, or boiling water
 - Shredding paper
 - Melting ice cream
 - Breaking glass
 - Dissolving sugar
- Chemical properties - reactivity, flammability, toxicity, and corrosivity
- Chemical change - a change in matter that produces a new substance
 - Signs of a chemical change:
 - Production of a gas
 - Odor
 - Bubbling
 - Change in temperature
 - Production of a precipitate
 - Precipitate - the formation of solids from a solution
 - Color change (permanent)
 - Production of light energy
 - Production of sound energy
 - Possible examples of chemical changes in matter:
 - Burning wood
 - Rusting of metal
 - Photosynthesis

may struggle recognizing the formation of new substances with different chemical properties, especially if the change is subtle or not readily observable.

Instructional Implications

- When you teach this concept, remember to:
- Clearly define each type of change and highlight the key differences between them. Discuss everyday situations where these changes occur (e.g., melting ice, cutting paper, cooking food, burning wood, or rusting of metal).
 - Conduct hands-on experiments and demonstrations that showcase both physical and chemical changes. Allow students to observe and record their observations during these demonstrations.
 - Engage students in critical thinking activities where they analyze scenarios and determine whether a physical or chemical change occurred. Encourage them to explain their reasoning and evidence.

Student Misconceptions

- Thinking that both physical and chemical changes create a new substance
 - Thinking that matter can be created or destroyed
 - Thinking that a color change is always evidence of a chemical change, forgetting it can be a sign of a physical change
 - Thinking that a change in state (e.g., solid to liquid) is always a chemical change
 - Thinking that the formation of a gas automatically signifies a chemical change
 - Assuming any change in energy (e.g., heat or light) indicates a chemical change, forgetting both physical and chemical changes can involve energy changes
- Assuming that a rapid change must be a chemical change and a slow change must be a physical change

Notes

7.6(C) is eligible for assessment on Grade 8 STAAR. (Note: Standards designated as “readiness” are essential for success in the current grade. Standards may have a different designation when assessed on Grade 8 STAAR.)

Vocabulary

Chemical Change	Condensation	Corrosion
Evaporation	Flammability	Freezing
Melting	Oxidation	Physical change
Precipitate		

Possible STAAR Stimuli

Investigation	Demonstration	Chart/Table
Visual/Image/Illustration	Model	Informational Text/List

Standard: 7.6D describe aqueous solutions in terms of solute and solvent, concentration, and dilution

Specificity

Cognition: describe
 Content: aqueous solutions in terms of solute and solvent, concentration, and dilution
 Including but not limited to:

- Solutions – a mixture of one kind of particles (atoms and molecules) dissolved in another, different type of particles (atoms and molecules)
 - Aqueous (solution) – a solution with water as the solvent
 - Saltwater solution
 - Sugar water solution
 - Lemon water solution
 - Solute – a substance that is dissolved into another substance
 - Salt
 - Sugar
 - Lemon juice
 - Solvent – a substance which another substance is dissolved in
 - Water
 - Concentration – the amount of solute that is dissolved in a specific amount of solvent
 - Concentrated – a solution that contains a high amount of solute
 - Saturated – a solution that contains the maximum amount of dissolved solute that a solution can hold
 - Diluted – a solution that contains a low amount of solute
 - Dilution – the process of reducing the concentration of solute / solvent in a solution by adding more solvent (water)

Content Builder

An aqueous solution is a mixture in which a substance, called the solute, is dissolved in water, the solvent. The solute can be a solid, liquid, or gas. Concentration refers to the amount of solute present in a given amount of the solution, usually expressed in terms of mass or volume. Dilution is the process of reducing the concentration of a solution by adding more solvent to it, resulting in a less concentrated solution. Students may struggle distinguishing between the solute and solvent and understanding the process of dilution and how it affects the concentration of a solution. Emphasize that dissolving is a physical process where solute particles disperse in the solvent and not a chemical reaction where new substances are formed.

Instructional Implications

When you teach this concept, remember to:

- Use diagrams, models, animations, and videos to demonstrate the process of dissolving a solute in a solvent to form an aqueous solution. Visuals help students understand the molecular-level interactions that occur during dissolution.
- Relate the concept of aqueous solutions to real-life examples that students can easily recognize (e.g., the formation of sugar water or saltwater as common everyday solutions).
- Conduct hands-on investigations where students can observe the process of dissolving different solutes in water to form solutions.
- Explain the concept of dilution and how it involves adding more solvent to decrease the concentration of a solution. Use relatable examples such as preparing different concentrations of fruit juices or beverages.
- Encourage students to compare and contrast different aqueous solutions based on their solute, solvent, and concentration.

Vocabulary

Aqueous	Aqueous solution	concentration
Dilution	Saturation	solubility
Solute	Solution	solvent

Student Misconceptions

Determining which substances are the solutes and solvents in an aqueous solution

- Thinking that the solute is always a solid
- Assuming all liquids can be considered solvents
- Assuming all solutes dissolve completely in a solvent
- Thinking that the volume of a solution is directly related to its concentration
- Thinking that concentrated solutions are always dangerous or harmful
- Confusing dissolution with chemical reactions

Possible STAAR Stimuli

Investigation	Demonstration	Chart/Table
Visual/Image/Illustration	Model	

Standard: 7.6E investigate and model how temperature, surface area, and agitation affect the rate of dissolution of solid solutes in aqueous solutions								
Specificity		Content Builder						
<p>Cognition: Investigate, Model Content: how temperature, surface area, and agitation affect the rate of dissolution of solid solutes in aqueous solutions</p> <p>Including but not limited to:</p> <ul style="list-style-type: none"> • Rate of dissolution - the length of time it takes for a certain amount of solute to dissolve in a solution • Temperature - average kinetic energy of particles in a substance <ul style="list-style-type: none"> ○ Test the rates of dissolution of sugar in cold water, room temperature water, and hot water. <ul style="list-style-type: none"> ▪ The more kinetic energy - the faster the particles move. ▪ Increased temperature will increase the rate of reaction due to the increased kinetic energy. ○ Create a model to explain how temperature affects the rate of dissolution of the sugar particles. • Surface area - the measure of how much exposed area that a solid object has <ul style="list-style-type: none"> ○ Test the rates of dissolution of a whole sugar cube, a broken-up sugar cube, and the same mass of granulated sugar in water. <ul style="list-style-type: none"> ▪ When the sugar particles are clumped together in a cube, many of the particles are surrounded by other sugar particles. <ul style="list-style-type: none"> ➢ Particles will only dissolve when exposed to water. ▪ More surface area will increase the rate of reaction due to the increased exposure to particles. ○ Create a model to explain how surface area effects the rate of dissolution of the sugar particles. • Agitation - put into motion by shaking or stirring (to achieve mixing) <ul style="list-style-type: none"> ○ Test how the rates of dissolution of granulated sugar in water are affected by letting it settle, stirring it slowly, and then stirring it faster. <ul style="list-style-type: none"> ▪ When the sugar particles are moved around, more particles are exposed to the water. <ul style="list-style-type: none"> ➢ Particles will only dissolve when exposed to water. ○ Create a model to explain how agitating affects the rate of dissolution of the sugar particles. 		<p>Temperature, surface area, and agitation all have an impact on the rate of dissolution of solid solutes in aqueous solutions. Increasing the temperature, maximizing the surface area of the solid solute, and employing agitation or stirring all promote faster dissolution rates in aqueous solutions. These factors enhance the contact and interaction between the solute and solvent particles, leading to more efficient dissolution. Students may struggle to understand the concept of dissolution itself, which involves the process of a solute dissolving in a solvent to form a solution. Students may find it difficult to comprehend how and why dissolution occurs at the molecular level.</p>						
		Instructional Implications						
		<p>When you teach this concept, remember to:</p> <ul style="list-style-type: none"> • Design hands-on experiments or investigations where students can manipulate and measure the effects of temperature, surface area, and agitation on the rate of dissolution. • Encourage students to record observations, measurements, and any trends or patterns they observe. • Use modeling activities to help students understand the molecular-level processes involved in dissolution. Provide materials or simulations that allow students to visualize and manipulate particles to represent solute and solvent interactions. • Encourage students to identify similarities, differences, and relationships between the factors affecting dissolution rate using real-world contexts. 						
		Student Misconceptions						
		<p>Students may make the following mistakes:</p> <ul style="list-style-type: none"> • Thinking that the solute is no longer in the solution when it dissolves • Thinking that all solutes dissolve at the same rate • Thinking that all solutes behave the same way in various conditions • Thinking that dissolution is solely dependent on one factor (e.g., temperature alone) 						
		Possible STAAR Stimuli						
		<table border="1"> <tr> <td>Investigation</td> <td>Demonstration</td> <td>Chart/Table</td> </tr> <tr> <td>Visual/Image/Illustration</td> <td>Model</td> <td></td> </tr> </table>	Investigation	Demonstration	Chart/Table	Visual/Image/Illustration	Model	
Investigation	Demonstration	Chart/Table						
Visual/Image/Illustration	Model							
Vocabulary								
Agitation	Aqueous solution	concentration						
Equilibrium	Rate of dissolution	solubility						
Surface area	Temperature							

Standard: 7.8A investigate methods of thermal energy transfer into and out of systems, including conduction, convection, and radiation								
Specificity		Content Builder						
Cognition: Investigation Content: methods of thermal energy transfer into and out of systems Including but not limited to: <ul style="list-style-type: none"> • Thermal energy – energy resulting from the motion of particles measured as the temperature of substances • Medium – a substance or material that carries energy • Conduction – transfer of thermal energy between objects that touch each other <ul style="list-style-type: none"> ○ Measure temperature change of a metal spoon placed in hot water. • Convection – transfer of thermal energy through liquids and gases in currents • Radiation – transfer of thermal energy through space as waves <ul style="list-style-type: none"> ○ Measure the temperature change in sand placed under a heat lamp. 		Thermal energy transfers between objects or systems in three distinct ways: conduction, convection, and radiation. <ul style="list-style-type: none"> • Conduction is the transfer of thermal energy through direct contact between particles or objects. Convection involves the transfer of thermal energy through the movement of a gas or liquid. • Convection occurs when heated particles become less dense, rise, and are replaced by cooler particles. This creates a circulating flow known as convection currents, which carries thermal energy from one region to another. • Radiation is the transfer 						
Vocabulary		Instructional Implications						
<table border="1"> <tr> <td>Conduction</td> <td>Convection</td> <td>Energy transfer</td> </tr> <tr> <td>Radiation</td> <td>Thermal energy</td> <td></td> </tr> </table>		Conduction	Convection	Energy transfer	Radiation	Thermal energy		When you teach this concept, remember to: <ul style="list-style-type: none"> • Allow students to conduct hands-on experiments that explore each method of thermal energy transfer. • Have students collect and analyze data during their investigations. This may involve measuring temperature changes, observing the behavior of fluids, or recording the intensity of radiation. By analyzing the data they collect, students can identify patterns and draw conclusions about the effectiveness and efficiency of each method of thermal energy transfer. • Use diagrams, models, animations, or videos to help students visualize and understand the mechanisms of thermal energy transfer. • Explore real-world applications of different methods of thermal energy transfer. Examine heating and cooling systems, energy-efficient designs, weather phenomena, or industrial processes to demonstrate the practical implications of each method. • Provide opportunities for students to differentiate between conduction, convection, and radiation in scenarios, card sorts, and graphics. • Explain that convection currents can be complex, with fluids moving in various directions depending on conditions. • Clarify that radiation is not always visible light. Thermal radiation covers a broad range of electromagnetic waves, including infrared radiation, which is often associated with heat.
Conduction	Convection	Energy transfer						
Radiation	Thermal energy							
Student Misconceptions		Vocabulary						
Students may make the following mistakes: <ul style="list-style-type: none"> • Thinking that radiation requires a medium to transfer thermal energy • Thinking that all materials transfer heat equally • Thinking of temperature as a measure of heat, rather than the movement of particles in a substance • Thinking that heat is a substance rather than the transfer of energy due to temperature differences • Assuming good conductors of heat are always hot to the touch • Thinking that convection always involves upward movement • Thinking that convection is the fastest method of heat transfer • Thinking that radiation needs a material medium (similar to conduction and convection) • Thinking that only hot objects emit thermal radiation • Thinking that radiation is always visible light 		<table border="1"> <tr> <td>Conduction</td> <td>Convection</td> <td>Energy transfer</td> </tr> <tr> <td>Radiation</td> <td>Thermal energy</td> <td></td> </tr> </table>	Conduction	Convection	Energy transfer	Radiation	Thermal energy	
Conduction	Convection	Energy transfer						
Radiation	Thermal energy							

Standard:	7.8B investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium
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Specificity	Content Builder
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Cognition: investigation
 Content: how thermal energy moves in a predictable pattern to reach thermal equilibrium

Including but not limited to:

- Thermal energy - energy resulting from the motion of particles measured as the temperature of the substance
- Thermal energy moves from a substance with a higher temperature to a substance with a lower temperature.
- Thermal equilibrium - when two substances in the same system exchange thermal energy equally because they are the same temperature

Thermal energy refers to the energy associated with the random motion of particles within a substance. It naturally flows from areas of higher temperature to areas of lower temperature, regardless of the direction (up, down, or sideways), until a state of balance is reached. This movement follows a consistent pattern guided by the fundamental principles of heat transfer. Clarify that different materials have different thermal conductivities, meaning they transfer heat at different rates. Emphasize that while energy can be transferred and converted into different forms, it is not destroyed. The total energy in a closed system remains constant. Students may struggle to conceptualize and visualize the movement of thermal energy without concrete examples or visual representations.

Student Misconceptions

Students may make the following mistakes:

- Thinking that heat is matter that flows from one object to another
- Thinking that all substances reach thermal equilibrium at the same rate, regardless of their specific properties
- Thinking that cold is the absence of heat
- Thinking that heat will flow from a hot object to a cold object continuously, not recognizing that it will stop once objects reach the same temperature
- Confusing heat and temperature
- Thinking that heat always moves upwards
- Thinking that only solids can conduct heat
- Thinking that heat can be “used up” or destroyed
- Thinking that all materials conduct heat at the same rate

Instructional Implications

When you teach this concept, remember to:

- Investigate and verify that thermal energy moves from warmer to cooler substances/ objects until the same temperature is attained. Use temperature probes or sensors to accurately measure and record temperature changes.
- Have students collect and analyze data during their investigations. Graphic representations help students identify trends, compare data, and understand the predictable pattern of thermal energy transfer.
- Have students create conceptual models that represent the movement of thermal energy from warmer to cooler regions.
- Use real-life examples and diagrams, animations, or videos to help students visualize and understand the concept.
- Help students see the Recurring Themes and Concepts of *patterns, stability, and change* and *flow of energy and cycling of matter* in this standard.

Vocabulary		
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Heat transfer	Temperature	Thermal energy
Thermal equilibrium		

Possible STAAR Stimuli		
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Investigation	Visual/Image/Illustration	Model
InformationalText/List		

Standard:	7.8C explain the relationship between temperature and the kinetic energy of the particles within a substance	
Specificity		Content Builder
<p>Cognition: Explain Content: relationship between temperature and the kinetic energy of the particles within a substance</p> <p>Including but not limited to:</p> <ul style="list-style-type: none"> • Temperature - measure of the average kinetic energy of the particles in a substance • Kinetic energy - the energy of motion • When a substance is heated, the substances' particles speed up, which results in an increase in temperature. 		<p>Temperature is a measure of the average kinetic energy of the particles within a substance. Kinetic energy refers to the energy associated with the motion of particles such as atoms or molecules. The higher the temperature of a substance, the greater the average kinetic energy of its particles. Students may struggle to understand how temperature and kinetic energy are interrelated because they may have preconceived notions about each concept separately.</p>
Student Misconceptions		Instructional Implications
<p>Students may make the following mistakes:</p> <ul style="list-style-type: none"> • Thinking that temperature and heat are the same • Thinking that all particles within a substance have the same kinetic energy • Thinking that increasing the temperature means adding more particles to the substance • Confusing temperature with heat content and thinking that a substance with a higher temperature contains more heat energy, not considering both temperature and mass • Thinking that particles completely stop moving at absolute zero • Thinking that cooling down a substance means the particles lose energy • Thinking that temperature is a measure of how "hot" or "cold" an object feels to the touch <p>Assuming all substances conduct heat at the same rate</p>		<p>When you teach this concept, remember to:</p> <ul style="list-style-type: none"> • Use diagrams, animations, or hands-on demonstrations to help students visualize the relationship between temperature and kinetic energy. Use analogies or relatable examples to make the relationship more tangible (e.g., compare the motion of particles at different temperatures to the movement of people in a crowded room or the behavior of vehicles on a busy highway). • Provide hands-on activities such as experiments or simulations that allow students to observe and explore the relationship between temperature and kinetic energy firsthand. • Demonstrate with different materials that have varying thermal conductivities to show how objects transfer heat. • Help students understand that particles do not "lose" energy. While the average kinetic energy decreases when matter cools, it's important to emphasize that the particles don't lose energy but rather transfer it to their surroundings. • Make sure students have opportunities to explain their understanding both verbally and in writing.
Vocabulary		
Heat		Kinetic energy
Temperature		particle
Thermal energy		
Possible STAAR Stimuli		
Demonstration	Visual/Image/Illustration	Model

VERTICAL STANDARDS

This section details the **progression** of key student expectations/standards** in the courses **before** and **after** this course. This will help you understand what **prior knowledge skills to build upon** and guide you in knowing what **skills you are preparing your students** for in the subsequent course.

6 th Grade	7 th Grade	8 th Grade
6.6A compare solids, liquids, and gases in terms of their structure, shape, volume, and kinetic energy of atoms and molecules; 6.6C identify elements on the periodic table as metals, nonmetals, metalloids, and rare Earth elements based on their physical properties and importance to modern life ;	7.6A compare and contrast elements and compounds in terms of atoms and molecules, chemical symbols, and chemical formulas; 7.6B use the periodic table to identify the atoms and the number of each kind within a chemical formula;	8.6B use the periodic table to identify the atoms involved in chemical reactions;
6.6E identify the formation of a new substance by using the evidence of a possible chemical change, including production of a gas, change in thermal energy, production of a precipitate, and color change.	7.6C distinguish between physical and chemical changes in matter;	8.6E investigate how mass is conserved in chemical reactions and relate conservation of mass to the rearrangement of atoms using chemical equations, including photosynthesis.
6.6B investigate the physical properties of matter to distinguish between pure substances, homogeneous mixtures (solutions), and heterogeneous mixtures;	7.6D describe aqueous solutions in terms of solute and solvent, concentration, and dilution;	8.6A explain by modeling how matter is classified as elements, compounds, homogeneous mixtures, or heterogeneous mixtures;
	7.6E investigate and model how temperature, surface area, and agitation affect the rate of dissolution of solid solutes in aqueous solutions.	
	7.8A investigate methods of thermal energy transfer into and out of systems, including conduction, convection, and radiation;	
	7.8B investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium; and	
6.6A compare solids, liquids, and gases in terms of their structure, shape, volume, and kinetic energy of atoms and molecules;	7.8C explain the relationship between temperature and the kinetic energy of the molecules within a substance.	

VOCABULARY GLOSSARY

Domain-specific words and definitions for this unit.

Key Content Vocabulary

List and define key vocabulary terms

Agitation: stirring or shaking something. (Lesson 05 and 06)

Atom: the smallest component of an element (Lesson 09)

Atomic Mass: the number of protons and neutrons in an atom (Lesson 09)

Atomic Number: the number of protons in an atom (Lesson 09)

Aqueous solution: A solution in which the solvent is water. (Lesson 02)

Chemical bond: the attraction between two or more atoms (Lesson 09)

Chemical change: is a process in which one or more substances are altered into one or more new and different substances. In other words, a chemical change is a chemical reaction involving the rearrangement of atoms. (Lesson 07 and 08)

Chemical Formula: a notation used by scientists to show the number and type of atoms present in a compound and/or molecule (Lesson 09)

Chemical symbol: a notation of one or two letters representing a chemical element (Lesson 09)

Claim: the answer to the question being asked (Lesson 01)

Coefficient: number that precedes a chemical formula that denotes how many molecules or formula units are present (Lesson 10)

Compound: substance composed of atoms of two or more elements chemically compound (Lesson 09)

Conduction: the transfer of thermal energy from one substance to another through direct contact (Lesson 13)

Convection: the transfer of heat through currents caused by the warming and cooling of liquids and gases (Lesson 13)

Concentration: The amount of solute dissolved in a certain amount of solvent. (Lesson 03)

Conductor: allow thermal energy to transfer easily (Lesson 12 and 13)

Dependent Variable: the variable being tested and measured in an experiment and is 'dependent' on the independent variable. (Lesson 01)

Dilution: The process of making a solution weaker by adding more solvent without changing the amount of solute. (Lesson 03)

Dissolution: The process of a solute breaking apart and spreading out evenly in a solvent to form a solution. (Lesson 05 and 06)

Electron: negatively charged particle located outside the nucleus of the atom. (Lesson 09)

Element: more than one hundred substances that cannot be chemically broken down into simpler substances and are primary constituents of matter (Lesson 09)

Evidence: Data collected during research/investigation (Lesson 01)

Formula unit: The smallest unit of a compound that contains a metal (Lesson 10)

Homogenous mixture: A mixture in which the composition is uniform throughout the mixture. **Example:** Kool-Aid drink (Lesson 02)

Heat: the transfer of thermal energy from a warmer substance to a cooler one (Lesson 11) (Lesson 12)

Independent Variable: the variable the experimenter manipulates or changes and is assumed to have a direct effect on the *dependent variable*. (Lesson 01)

Insulator: slow down the transfer of thermal energy. (Lesson 12 and 13)

Kinetic Energy: The energy of motion (Lesson 05 and 06) (Lesson 11) (Lesson 12)

Molecule: multiple nonmetal atoms connected by a chemical bond (Lesson 10)

Neutron: subatomic particle with no charge located in the nucleus of the atom (Lesson 09)

Nucleus: center part of the atom is made up of protons and neutrons (Lesson 09)

Particle: an extremely small part of matter that exerts a force (Lesson 10)

Periodic Table: a chart that contains all the elements (Lesson 09)

Percent Concentration: how much solute is in a solution, compared to the total amount of the solution, expressed as a percentage (Lesson 04)

Physical change: change in the physical properties of a substance, as size or shape (Lesson 07 and 08)

Precipitate: a solid formed by a change in a solution (Lesson 07 and 08)

Proton: positively charged subatomic particle located in the nucleus of the atom (Lesson 09)

Qualitative Data: information that describes the qualities or characteristics of something using words. (Lesson 04)

Quantitative Data: information that can be measured and expressed with numbers. (Lesson 04)

Radiation: the transfer of thermal energy through electromagnetic waves (Lesson 13)

Reasoning: Logical connections to explain how the evidence supports the claim (Lesson 01)

Solution: A solution is a homogeneous mixture of one or more solutes dissolved in a solvent. (Lesson 02)

Solute: The substance that dissolves in a solvent to produce a homogeneous mixture. **Example:** Kool-Aid Powder (Lesson 02)

Solvent: The substance in which a solute dissolve to produce a homogeneous mixture. **Example:** Water (Lesson 02)

Subscript: number in a chemical formula that denotes how many atoms of a particular element are present (Lesson 10)

Surface Area: The amount of exposed area of a solid substance (Lesson 05 and 06)

Temperature: The average kinetic energy of all the particles in a material; measured by a thermometer (Lesson 05 and 06) (Lesson 11) (Lesson 12)

Thermal Energy: the total of all kinetic energies within a given system (Lesson 11) (Lesson 12)

Consumable Materials and Lab Supplies (1 per group of 4 students unless noted)

Lesson	Commercial Vendor	Lab Supplies (Science Vendor)
Lesson 1: Caffeine Conundrum	Chart paper markers (for teacher to make class data table and graph)	None
Lesson 2: What is Coffee	Salt Sugar Flour or cornstarch Plastic containers or dose cups for solutes	3- 250 mL Beakers Spoons
Lesson 3: Concentration and Dilution of Solutions	Powdered drink mix such as Kool-Aid (dark color is the best) Small cups or dose cups to put Kool-Aid in for each group stir straw coffee filter for weigh paper spoon Map pencils	6 Beakers Balance 100 mL graduated cylinder Bucket or large container for waste
Lesson 4: Concentration Calculations	water two different sports drink mix (one dark color and one light)	Calculators
Lesson 5: Introduction to Dissolution	<ul style="list-style-type: none"> • 6 small clear plastic containers with lid (5.5 OZ snack cups are perfect) • Clear beads (to represent solvent particles – water) • Small colored beads (to represent solute particles) • 1 large colored bead (represents a large chunk of solute = less surface area) 	
Lesson 6: Factors that Affect the Rate of Dissolution	Resealable bag Spoon Sugar cubes (4) water	250 mL beakers (4) Graduated cylinder (100 mL) Textbook or something to crush sugar cube Clock Hot plate (teacher only)
Lesson 7: Chemical and Physical Changes Part 1	Station Labs <u>Station 1</u> Vinegar Baking Soda	Station Labs <u>Station 1</u> 10 mL graduated cylinder Beaker for vinegar

	Resealable plastic bag Spoon <u>Station 2</u> Milk Vinegar <u>Station 3</u> Vinegar Water <u>Station 4</u> Sugar cube Coffee filter <u>Station 5</u> Container of play-doh <u>Station 6</u> Effervescent tablet (Alka Seltzer) Resealable bag Water	Beaker or dish for baking soda <u>Station 2</u> Test tube 2 plastic pipette or medicine droppers Test tube rack Stopwatch Beaker for vinegar Beaker for Milk <u>Station 3</u> Beaker for vinegar Beaker for water 50 mL graduated cylinder 250 mL beaker <u>Station 4</u> Metal spoon <u>Station 5</u> None <u>Station 6</u> 10 mL graduated cylinder
Lesson 8: Chemical and Physical Changes Part 2	Optional <u>If you want to demo roasting green coffee beans:</u> <ul style="list-style-type: none"> • green coffee beans • skillet • hot plate • wire whisk <u>If you want to demo grinding coffee beans:</u> <ul style="list-style-type: none"> • whole coffee beans • hand grinder 	
Lesson 9: What are elements and Compounds	None	None
Lesson 10: Molecules of Elements and Compounds	None	A computer for PhET Simulation
Lesson 11: Temperature and Kinetic Energy	None	A computer for PhET Simulation
Lesson 12: Thermal Energy Transfer Part 1	<u>Station 1</u> Clothes pin Metal strip 2cm X 8 cm (cut from an aluminum pan) Candle wax shavings <u>Station 2</u>	<u>Station 1</u> Hot plate Ruler Timer Paper towels <u>Station 2</u>

	Pinwheel (purchase or make) <u>Station 3</u> Rice Plastic cup Spoon <u>Station 4</u> Bread Toaster (bring from home) <u>Station 5</u> Heat lamp <u>Station 6</u> Metal spoon Popsicle stick	Hot plate 250 mL Erlenmeyer flask 100 mL graduated cylinder Heat resistant gloves Water Paper towels <u>Station 3</u> Hot plate 250 mL glass beaker Heat resistant gloves Water Paper towels <u>Station 4</u> Paper towels <u>Station 5</u> Heat lamp <u>Station 6</u> 500 mL beaker Timer
Lesson 13: Thermal Energy Transfer Part 2	None	None