

Properties of Matter Pacing Guide (70 instructional days)

Lesson	Recommended Number of Periods	Focus Questions	Concepts
Lesson 1: Our Ideas About Matter Preassessment	3	<ul style="list-style-type: none"> What is meant by the term <i>matter</i>? 	<ul style="list-style-type: none"> Exploratory experiences involving mass, volume, density, states of matter, changes of state, thermal expansion, mixtures, solubility and insolubility, and chemical reactions. Making and recording accurate and complete observations and data. Explore ideas about what is matter. Using laboratory equipment.
Review: Mass vs. Volume	2	<ul style="list-style-type: none"> What is the difference between mass and volume? How are mass and volume measured? 	<ul style="list-style-type: none"> Mass and volume review
Lesson 2: Determining Density	4	<ul style="list-style-type: none"> What does density measure? What tools and units of measure are used to calculate and report mass, volume, and density? 	<ul style="list-style-type: none"> Mass is the amount of matter in an object; weight is a measure of the force of gravity. Mass is measured in grams using a balance scale. Volume is the amount of space occupied by matter. Volume is measured in cm³ when using a ruler or mL (milliliters) when using water displacement. Density is the mass per unit of volume (cm³) of a substance. Density is measured in grams per cubic centimeter (g/cm³) and calculated by dividing the mass by the volume. Changing the amount of a substance does not change its density. Objects made of the same material will have the same density. Density is a characteristic property of matter.
Lesson 3: Density Predictions	3	<ul style="list-style-type: none"> How can you accurately predict if something will sink or float in a given liquid? 	<ul style="list-style-type: none"> Liquids have density Density can be used to predict the behavior of matter in terms of floating and sinking Objects or substances float only when their density is less than that of the liquid in which they are placed Some liquids are <i>immiscible</i> with each other No matter what state it exists in (solid, liquid or gas), density can be calculated and compared. It is expressed in metric units as grams per cubic centimeter (g/cm³).

Lesson 4: Do Gases Have Density?	2	<ul style="list-style-type: none"> Does air have density? 	<ul style="list-style-type: none"> Gases (i.e., air) have mass, volume, and density, which can be measured The density of air is approximately 1000 times less dense than liquids and solids
Lesson 5: Temperature and Density	4	<ul style="list-style-type: none"> What is the relationship between temperature, expansion, contraction and density? What is the difference between heat and temperature? 	<ul style="list-style-type: none"> Heat is a form of energy that can move from a hot place to a cooler place. Heat is an agent that can change the density of materials. Even though mass stays the same, most matter increases in volume and decreases in density when there is a temperature increase. When cooled, most matter will contract and lose volume. Because mass is conserved, density will increase as temperatures decrease. Thermometers work on the basis of the expansion and contraction of the gas or liquid used in the thermometer. Temperature is a measure of the kinetic energy of the particles that make up a sample of matter. Thermometers measure temperature in <i>degrees Celsius</i>. (Heat is measured in <i>joules</i>.)
Lesson 6: Applying the Heat	1	<ul style="list-style-type: none"> What effect can heat have on solid substances? <p>(Skip Investigation 6.1. Use readings to support Lesson 7)</p>	<ul style="list-style-type: none"> The way a substance behaves when it is heated is a characteristic property of that substance. Applying heat causes matter to undergo physical and chemical changes. Evaporation, condensation, and sublimation are caused when heat energy can overcome the forces that normally hold a solid together or keep a liquid in a fluid state. Heat is responsible for thermal decomposition reactions when a pure substance (reactants) breaks down into two or more simpler substances (products) with different properties. Changes in substances caused by heat may be either reversible or irreversible upon cooling. Heating a substance may cause a phase change, a chemical reaction, or no change at all. When some substances are heated, a chemical reaction occurs which results in the formation of new substances with different observable properties.
Lesson 7: Just a Phase	3	<ul style="list-style-type: none"> What is meant by the terms melting point and boiling point? What role does heat play in phase changes? 	<ul style="list-style-type: none"> Matter exists in three phases: solid, liquid, and gas. Through melting, freezing, evaporation, and condensation, matter can move between these three phases. Phase changes occur when molecules lose kinetic (heat) energy and move closer together (i.e., gases_liquids_solids) or gain kinetic (heat) energy and move farther apart (i.e., solids_liquids_gases). Substances have melting and boiling points that are characteristic properties unique to each substance. A solid has a definite volume and a definite shape. Particles are closely packed and vibrate in relation to one another.

			<ul style="list-style-type: none"> • A <i>liquid</i> has a definite volume but no definite shape. It takes on the shape of its container. Particles in a liquid have more kinetic energy than those in a solid and can change position relative to one another. • A <i>gas</i> has no definite shape or volume. Its particles have enough kinetic energy to move to all parts of a container.
Lesson 8: Changing Matter and Mass	2	<ul style="list-style-type: none"> • What happens to the mass of water when it changes from a solid to a liquid? From a liquid to a solid? 	<ul style="list-style-type: none"> • When describing any chemical reaction or physical change, one thing remains constant: mass is conserved.
Lesson 9: The Mystery Object (Performance Assessment)	2	<ul style="list-style-type: none"> • How can density be used to identify unknown substances? 	<ul style="list-style-type: none"> • Density is often used to help identify the make up of pure substances.
Lesson 10: Starting the Anchor Activity	3	<ul style="list-style-type: none"> • Given a simple, manufactured object, what is it made from and why? 	<ul style="list-style-type: none"> • The choice of a material for a particular function is partly determined by the characteristic properties of the matter that makes up the material. • Manufactured objects are often made from a variety of materials. • Raw materials usually undergo processing before they are suitable for use in manufacturing. • Changes in the use of matter have accompanied advances in materials and changes in the design of objects.
Lesson 11: Pure Substance or Mixture	3	<ul style="list-style-type: none"> • What is meant by the term, "pure substance?" • How can you distinguish between pure substances and mixtures? 	<ul style="list-style-type: none"> • Substances can be classified as either pure substances or mixtures. • A <i>pure substance</i> is matter that has definite chemical and physical properties. • <i>Mixtures</i> are made of two or more pure substances that are physically combined while each substance in the mixture maintains its own distinct properties.
Lesson 12: What Happens When Substances Mix with Water?	3	<ul style="list-style-type: none"> • What property of matter determines what type of mixture a pure substance will form when mixed with water? 	<ul style="list-style-type: none"> • <i>Solubility</i>, the ability of a substance to dissolve, is another characteristic property of matter. • <i>Solutions</i> are the most homogeneous (best-mixed) mixtures of two or more substances. Solutions consist of a solvent and solute(s) • The substance present in the larger proportion in a solution is the <i>solvent</i>; the substance(s) present in the smaller proportion is the <i>solute(s)</i>. • The components of a solution can be solids, liquids, or gases. • Solutions in which water is the solvent are called <i>aqueous solutions</i>. • When a solid is passed into solution, it is said to <i>dissolve</i>. • Properties of solutions include uniform composition and transparency.

Lesson 13: How Much Solute Dissolves in a Solvent?	4	<ul style="list-style-type: none"> • What is a saturated solution? • Are different substances equally soluble in water? 	<ul style="list-style-type: none"> • Solubility is the amount of a solute that will completely dissolve in a given amount of a solvent. • A saturated solution has a maximum amount of solute dissolved in it. • Some solutes are more soluble than others. • Solubility is affected by temperature. Solids dissolved in water may increase or decrease in solubility with the rise in temperature. • When an unsaturated solution of a solid is cooled (i.e., copper (II) sulfate solution), some solid solute precipitates out in a process known as recrystallization
Lesson 14: Mass, Volume, and Dissolving	3	<ul style="list-style-type: none"> • What happens to the mass and the volume of one type of matter when it is dissolved in another type of matter? 	<ul style="list-style-type: none"> • The particulate nature of matter helps to explain solubility and how mass, but not volume, is conserved. • Liquid water has space between the molecules that allows soluble solids and some liquids to occupy that space.
Lesson 15: Separating a Soluble and an Insoluble Substance	3	<ul style="list-style-type: none"> • What separation techniques can be used to separate the various soluble and insoluble components of a mixture such as rock salt? 	<ul style="list-style-type: none"> • Solutes are present in solutions and their mass is conserved. • Solubility can be used to separate soluble and insoluble substances and to purify substances. • Filtration and evaporation are two separation techniques that relate to solubility. • A solid can be recovered from a solution by evaporating the solvent. • Insoluble substances will not pass through a fine filter. • Solutions will pass through a filter. • Knowledge of the properties of substances can be used to separate substances in a mixture.
Lesson 16: Researching Solvents	3	<ul style="list-style-type: none"> • How effective are three different solvents in removing a variety of stains? 	<ul style="list-style-type: none"> • Liquids other than water can act as solvents. • Different solvents have different uses.
Lesson 17: Separating Solutes	3	<ul style="list-style-type: none"> • What does the separation technique of paper chromatography indicate about an ink solution? 	<ul style="list-style-type: none"> • Solutions can contain more than one solute. Ink consists of several solutes (dyes) of different colors that are dissolved in water. • Chromatography can be used to analyze solutions that contain several solutes. • More soluble dyes move faster than the less soluble ones and eventually become separated from the slower moving dyes. • The patterns produced on chromatography paper are called a chromatogram.
Lesson 18: Changing Mixtures	3	<ul style="list-style-type: none"> • How do the properties of a mixture differ from the properties of the individual components of the mixture? 	<ul style="list-style-type: none"> • Impurities affect melting points, boiling points, and other properties. • The properties of a mixture are often very different from those of the individual components that make up the mixture. • Alloys are mixtures that contain at least one metal. • Metal alloys have properties that can be manipulated to suit a particular or desired need.

Lesson 19: Assessing Our Progress (Performance Assessment)	3	<ul style="list-style-type: none"> What are the physical properties of substances that make up a mixture? 	<ul style="list-style-type: none"> Physical properties, such as appearance, density, and solubility, can be used to determine the number of substances that make up a mixture.
Lesson 20: Breaking Down a Compound (Chemical Reactions)	Skip this lesson. Covered in 9 th grade.		
Lesson 21: Examining and Grouping Elements	5	<ul style="list-style-type: none"> What are some characteristic properties of elements that can be used to group elements? 	<ul style="list-style-type: none"> Elements can be identified by their characteristic properties. Elements can be grouped together according to similar chemical and physical properties. The <i>periodic table</i> is a widely used classification system that can help predict the chemical and physical properties of elements. Reactivity is the "readiness" or "quickness" with which one element reacts with others.
Lesson 22: Combining Elements	3	<ul style="list-style-type: none"> What are the two main groups of elements? How you would you write an equation for the chemical reaction between iron and oxygen? 	<ul style="list-style-type: none"> Elements can be classified into two major groups: <i>metals</i> and <i>nonmetals</i>. Compounds are substances formed by a chemical reaction between two or more elements. Compounds have properties different from their constituent elements. Chemical reactions can be represented by an equation. Synthesis reactions involve two elements combining to form a new substance.
Lesson 23: Chemical Reactions Involving Metals	Skip this lesson. Covered in 9 th grade.		
Lesson 24: Countering Corrosion	3	<ul style="list-style-type: none"> What conditions are required for rusting to take place? How can rusting be prevented? 	<ul style="list-style-type: none"> Rusting is a chemical reaction with identifiable reactants and products. The main cause of rusting is the exposure of iron to oxygen. Knowledge of the chemical reaction that causes rusting can be applied to prevent rusting.
Lesson 25: Mass and Chemical Reactions	2	<ul style="list-style-type: none"> What happens to the total mass of matter in a chemical reaction when one of the products is a gas? 	<ul style="list-style-type: none"> The mass of the reactants in a chemical reaction is identical to the mass of the products. A closed system is needed to demonstrate the conservation of mass.

Lesson 26: End of Module Assessment	1	<ul style="list-style-type: none">• How can the conservation of mass be demonstrated during dissolving and chemical reactions? (Substitute with WASL-like assessment)	
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