Chemistry classifying matter worksheet answers

Learning Goals Explain the difference between a pure substance and a mixture. Explain the difference between an item and a compound. Explain the difference between a homogeneous mixture and a heterogeneous mixture. A useful way to organize our understanding of matter is to think of a hierarchy that extends down from the most general and complex to the simplest and most fundamental (Figure \(\PageIndex{1}\)). Matter can be classified into two broad categories: pure substances and mixtures. A pure substance is a form of matter that has a constant composition (which means it is the same everywhere) and properties that are constant throughout the sample (which means that there is only one set of properties, such as melting point, color, boiling point, etc. throughout the matter). A material composed of two or more substances is a mixture. Elements and compounds are both examples of pure substances. A substance that cannot be broken down into chemically simpler components is an element. Aluminum, which is used in soda cans, is an element. A substance that can be broken down into chemically simpler components (because it has more than one element) is a compound. For example, water is a compound composed of hydrogen and oxygen elements. Today, there are about 118 elements in the known universe. Instead, scientists have identified tens of millions of different compounds to date. Figure \(\PageIndex{1}\): The relationships between the types of matter and the methods used to separate mixtures Regular table salt is called sodium chloride. It is considered a substance because it has a uniform and defined composition. All sodium chloride samples are chemically identical. Water is also a pure substance. Salt dissolves easily in water, but salt water cannot be classified as a substance, as its composition may vary. You can dissolve a small amount of salt or a large amount in a certain amount of water. A mixture is a physical mixture of two or more components, each of which retains its own identity and properties in the mixture. Only the form of salt changes when dissolved in water. It retains its composition and properties. A homogeneous mixture is a mixture in which the composition is uniform throughout the mixture. The salt water described above is homogeneous because the dissolved salt is evenly distributed over the entire saltwater sample. Often it is easy to confuse a homogeneous mixture with a pure substance, as both are uniform. The difference is that the composition of the substance is always the same. The amount of salt in salt water may vary from sample to sample. All solutions are considered homogeneous because the dissolved material is present the same amount throughout the solution. A heterogeneous mixture is a mixture in which the composition is not uniform throughout the mixture. Mixture. soup is a heterogeneous mixture. Any spoonful of soup will contain different amounts of different vegetables and other components of the soup. Phase A is any part of a sample that has a uniform composition and properties. By definition, a pure substance or a homogeneous mixture consists of a single phase. A heterogeneous mixture consists of two or more phases. When oil and water are combined, they do not mix evenly, but instead form two separate layers. Each of the layers is called a phase. Example \(\PageIndex{1}\) Identify each substance as a compound, element, heterogeneous mixture, or homogeneous mixture (solution). Freshly squeezed filtered tea orange juice a compact aluminum oxide disc, a white powder containing a ratio of 2:3 aluminum and oxygen selenium atoms Given: a chemical Asked: its classification strategy: Decide whether a substance is chemically pure. If pure, the substance is either an element or a compound. If a substance can be separated into its elements, it is a compound. If a substance is not chemically pure, it is either a heterogeneous mixture or a homogeneous mixture. If its composition is uniform throughout, it is a homogeneous mixture. Solution A) Tea is a solution of compounds in water, so it is not chemically pure. It is usually separated from tea leaves by filtration. B) Since the composition of the solution is uniform throughout, it is a homogeneous mixture. A) Orange juice contains solid particles (pulp) as well as liquids; is not chemically pure. B) Since its composition is not uniform throughout, orange juice is a heterogeneous mixture. A) A compact disc is a solid material containing more than one element, with regions of different compositions visible along its edge. Therefore, a compact disc is not purely chemical. B) Regions with different composition indicate that a compact disc is a heterogeneous mixture. A) Aluminum oxide is a unique, chemically pure compound. A) Selenium is one of the known elements. Exercise \(\PageIndex{1}\) Identify each substance as a compound, element, heterogeneous mixture, or homogeneous mixture (solution). white wine mercury ranch-style salad sugar table sauce (sugar) Answer to: homogeneous mixture (solution) Answer b: element Answer c: heterogeneous mixture Response d: compound Example \(\PageIndex{2}\) would classify a chemist every example of matter? Saltwater Oxygen Solution Saltwater works as if it would be a single substance, even if it contains two salt substances and water. Salt water is a homogeneous mixture, or a solution. The soil is composed of small pieces of a variety of materials, so it is a heterogeneous mixture. Water is a substance. Specifically, because water is composed of hydrogen and oxygen, it is a compound. Oxygen, a substance, is an element. Exercise would be a classify each example of matter? Answer a: a homogeneous mixture (solution), assuming coffee is filtered Answer b: element Answer c: heterogeneous mixture. Matter can be classified into two broad categories: pure substances and mixtures. A pure substance is a form of matter that has a constant composition and properties that are constant throughout the sample. Mixtures are physical combinations of two or more elements and/or compounds. Mixtures may be classified as homogeneous or heterogeneous. Elements and compounds are both examples of pure substances. Compounds are substances that are made up of more than one type of atom. The elements are the simplest substances made up of a single type of atom. Vocabulary element: A substance that consists of a single type of atom. Compound: A substance that consists of more than one type of atom bound together. Mixture: A combination of two or more elements or compounds that have not reacted to unions; each part of the mixture retains its own properties. By the end of this section, you will be able to: Describe the basic properties of each physical state of matter: solids, liquids and gas Define and give examples of atoms and molecules Classify matter as element, compound, homogeneous mixture or heterogeneous mixture in terms of its physical state and composition Distinguish between mass and weight Apply the law of preservation of matter Matter is defined as anything that occupies space and has mass, and is all around us. Solids and liquids are more obvious: We can see that they take up space, and their weight tells us that they have mass. Gases are also matter; if the gases do not take up space, a balloon would remain collapsed rather than swell when filled with gas. Solids, liquids and gases are the three states of matter commonly found on earth (Figure 1). A solid is rigid and has a precise shape. A liquid flows and takes the form of a container, except that it forms a flat or slightly curved upper surface when driven by gravity. (In zero gravity, liquids assume a spherical shape.) Both liquid and solid samples have volumes that are almost independent of pressure. A gas takes the form of both the shape and the volume of its container. Figure 1. The three most common states or phases of matter are solids, liquids and gas. A plasma is a gaseous state of matter containing an appreciable number of electrically charged particles (Figure 2). The presence of these charged particles confers unique properties on plasmas that justify their classification as a distinct state of gas matter. In addition to stars, plasmas are found in other environments with high temperatures (both natural and man-made), lightning, certain television screens and specialised analytical instruments used for traces of metals. Figure 2. A plasma torch can be used to cut metal. (credit: Hypertherm/Wikimedia Commons) In a small cell in a plasma TV, plasma emits ultraviolet light, which causes the display in that location to appear in a certain color. The composite of these small dots of color make up the image you see. Watch this video to learn more about plasma and where you meet it. Some matter samples appear to have solid, liquid and/or gas properties at the same time. This can happen when the sample is composed of several small pieces. For example, we can pour sand as it would be a liquid, because it is composed of many small grains of solid sand. Matter can also have properties of more than one state when it is a mixture, it would be with clouds. Clouds seem to behave somewhat like gases, but they are actually mixtures of air (gas) and small particles of water (liquid or solid). The mass of an object is a measure of the amount of matter in it. It takes much more force to accelerate a car than a bicycle, because the car has much more mass. A more common way to determine the mass of an object is to use a balance to compare its mass with a standard mass. Although the weight is related to the mass, it is not the same. Weight refers to the force that gravity exerts on an object. This force is directly proportional to the mass of the object. The weight of an object changes as the force of gravity changes, but its mass does not. An astronaut's mass doesn't change just because it goes to the moon. But its weight on the moon is only one-six of its earth-bound weight because the moon's gravity is only one-another-one-half that of the earth. She may feel weightless during her journey, when she experiences negligible external forces (gravitational or any other), although she is of course never massless. The Law on the Preservation of Matter summarizes many scientific observations on matter: It is stated that there is no detectable change in the total amount of matter present when matter transforms from one type to another (a chemical change) or changes between solid, liquid or gaseous states (a physical change). Beer and battery operation provide examples of material preservation (Figure 3). During the preparation of beer, the ingredients (water, yeast, grains, malt, hops and sugar) are converted into beer (water, alcohol, carbonation and flavouring substances) without real loss of substance. This is most clearly seen during the bottling process, when glucose converts to ethanol and carbon dioxide, and the total mass of substances does not Change. This can also be seen in a lead-acid machine battery: the original substances (lead, lead oxide, and sulfuric acid) that are capable of producing are converted into other substances (lead sulphate and water) which do not produce electricity without any change in the actual amount of matter. Figure 3. (a) The mass of the precursor materials of beer is the same as the mass of the beer produced: Sugar has become alcohol and carbonate. (b) The mass of lead, lead oxide plates and sulphuric acid entering electricity production shall be exactly equal to the mass of lead sulphate and the water forming. Although this conservation law applies to all material conversions, compelling examples are few and far between because, outside of controlled conditions in a laboratory, we rarely collect all the material that is produced during a particular conversion. For example, when you eat, digest and assimilate food, all the material in the original food is preserved. But because some of the matter is embedded in your body, and much is excreted as different types of waste, it is a challenge to check by measuring. An atom is the smallest particle of an element that has the properties of that element and can enter into a chemical combination. Consider the golden element, for example. Imagine cutting a gold nugget in half, then cutting one of the halves in half, and repeating this process until a piece of gold remained that was so small that it could not be cut in half (no matter how small the knife can be). This minimum sized piece of gold is an atom (from Greek atom, which means indivisible) (Figure 4). This atom would no longer be golden if it were divided further. Figure 4. (a) This photo shows a gold nugget. (b) A scanning-tunnel microscope (STM) can generate views of solid surfaces, would be this image of a gold crystal. Each sphere represents a golden atom. (credit a: modification of works by the United States Geological Survey; credit b: modification of works by Erwinrossen/Wikimedia Commons) The first suggestion that matter is composed of atoms is attributed to the Greek philosophers Leucippus and Democritus, who developed their ideas in the 5th î.Hr. However, it was not until the early 19th century that John Dalton (1766–1844), a British professor of particular interest in science, supported this hypothesis with quantitative measurements. Since then, repeated experiments have confirmed many aspects of this hypothesis, and has become one of the central theories of chemistry. Other aspects of Dalton's atomic theory are still used, but with minor revisions (details of Dalton's theory are provided in the chapter on atoms and molecules). An atom is so small that its size is hard to imagine. One of the smallest things we can see with our eye without help is a Thread of a spider web: These threads are about 1/10,000 one centimeter (0.0001 cm) in diameter. Although the cross section of a wire is almost impossible to see a microscope, it's huge on an atomic scale. A single carbon atom in the web has a diameter of about 0.0000015 centimeters, and would take about 7000 carbon atoms to comprise the diameter of the wire. To put this in perspective, if a carbon atom were the size of a penny, the cross-section of a wire would be larger than a football field, which would require about 150 million carbon atom dimes to cover it. (Figure 5) shows microscopic and atomic views of ordinary cotton. Figure 5. These images offer an increasingly close view: (a) a cotton boll, (b) a single cotton fibre seen under an optical microscope (increased 40 times), (c) an image of a cotton fiber obtained with an electron microscope (enlargement much larger than with an optical microscope); and (d and e) atomic models of the fibre (different colour spheres represent atoms of different elements). (credit c: modification of the work by Featheredtar/Wikimedia Commons) An atom is so light that its mass is also hard to imagine. One billion lead atoms (1,000,000,000 atoms) weigh about 3 × 10−13 grams, a mass far too light to weigh even in the most sensitive hips in the world. It would take over 300,000,000,000,000 lead atoms (300 trillion, or 3 × 1014) to be weighed, and would weigh only 0.00001 gram. It is rare to find collections of individual atoms. Only a few elements, such as helium, neon and argon gases, consist of a collection of individual atoms that move independently of each other. Other elements, such as hydrogen, nitrogen, oxygen and chlorine gases, are composed of units consisting of pairs of atoms (Figure 6). One form of the phosphorus element consists of units composed of four phosphorus atoms. The sulfur element exists in different forms, one of which is composed of units composed of eight sulphur atoms. These units are called molecules. A molecule consists of two or more atoms joined by powerful forces called chemical bonds. Atoms in a molecule move like a unit, just like soda boxes in a six pack or a bunch of keys joined on a single key ring. A molecule may consist of two or more identical atoms, as in molecules found in hydrogen, oxygen and sulfur elements, or it may consist of two or more different atoms, as in molecules found in water. Each water molecule is a unit containing two hydrogen atoms and one oxygen atom. Each glucose molecule is a unit containing 6 carbon atoms, 12 hydrogen atoms and 6 oxygen atoms. Like atoms, molecules are incredibly small and light. If a regular glass of water were increased to the size of the earth, the water molecules inside the size of the golf balls. Figure 6. The elements hydrogen, oxygen, phosphorus and sulfur form molecules consisting of two or more atoms of the same element. Also, water, carbon dioxide, and glucose consist of combinations of atoms of different elements. We can classify matter into several categories. Two main categories are mixtures and pure substances. A pure substance has a constant composition. All specimens of a pure substance have exactly the same makeup and properties. Any sucrose sample (mass sugar) consists of 42.1% carbon, 6.5% hydrogen and 51.4% mass oxygen. Any sucrose sample also has the same physical properties, such as melting point, colour and sweetness, regardless of the source from which it is isolated. We can divide pure substances into two classes: elements and compounds. Pure substances that cannot be broken down into simpler substances by chemical modifications are called elements. Iron, silver, gold, aluminum, sulfur, oxygen and copper are familiar examples of the more than 100 known elements, of which about 90 occur naturally on earth, and two dozen or so have been created in laboratories. Pure substances that can be broken down by chemical changes are called compounds. This breakdown can produce either elements or other compounds, or both. Mercury oxide(II), an orange, crystalline solid, can be broken down by heat in the mercury and oxygen elements (Figure 7). When heated in the absence of air, compound sucrose is broken down into the carbon element and compound water. (The initial stage of this process, when the sugar is turning brown, is known as caramelization-this is what gives the characteristic sweet and nutty flavor to caramel apples, caramelized onions, and caramel). Silver chloride (I) is a white solid that can be broken down into its elements, silver and chlorine, by the absorption of light. This property is the basis for the use of this compound in photographic films and photochromic glasses (those with lenses that darken when exposed to light). Figure 7. (a) Mercury(II compound oxide), (b) when heated, (c) breaks down into silver ydrops of liquid mercury and invisible oxygen gas. (credit: change of work by Paul Flowers) Many compounds decompose when heated. This site shows the breakdown of mercury oxide, HgO. You can also view an example of photochemical decomposition of silver chloride (AgCl), the basis of the early photo. The properties of the combined elements are different from those in the free or uncombined state. For example, white crystalline sugar (saharosis) is a compound resulting from the chemical combination of the carbon element, which is a black solid in one of its uncombined forms, and the two hydrogen and oxygen elements, which are colorless gases when uncombined. Free sodium, an element that is a soft, shiny, solid metallic, and free chlorine, an element that is a yellow-green gas, combine to form sodium (mass salt), a compound that is a white, solid crystalline. A mixture is composed of two or more types matter that may be present in different quantities and can be separated by physical changes, would be evaporation (you will learn more about this later). A mixture with a composition that varies from point to point is called a heterogeneous mixture. The Italian dressing is an example of a heterogeneous mixture (Figure 8). Its composition can vary because we can make from different amounts of oil, vinegar, and herbs. It is not the same from point to point throughout the mixture-a drop can be mostly vinegar, while a different drop can be mostly oil or herbs, because the oil and vinegar separately and herbs settle. Other examples of heterogeneous mixtures are chocolate cookies (we can see separate bits of chocolate, nuts, and cookie dough) and granite (we can see maple, small, feldspat, and more). A homogeneous mixture, also called a solution, has a uniform composition and appears visually the same throughout. An example of a solution is a sports drink, consisting of water, sugar, staining, aroma and electrolytes mixed evenly (Figure 8). Each drop of sports drink has the same taste, because each drop contains the same amounts of water, sugar, and other components. Note that the composition of a sports drink can vary- it could be made with something more or less sugar, flavor, or other components, and still be a sports drink. Other examples of homogeneous mixtures include air, maple syrup, gasoline and a solution of salt in water. Figure 8. (a) Oil and vinegar salad sauce is a heterogeneous mixture, as its composition is not uniform throughout. (b) A commercial sports drink is a homogeneous mixture because its composition is uniform throughout. (credit left: change of work by John Mayer; credit a right: change the work of Umberto Salvagnin; credit b left: change the work of Jeff Bedford) Although there are only over 100 elements, tens of millions of chemical compounds result from different combinations of these elements. Each compound has a specific composition and possesses defined chemical and physical properties through which we can distinguish it from all other compounds. And, of course, there are countless ways to combine elements and compounds to form different mixtures. A summary of how to distinguish between the different major classifications of matter is presented in (Figure 9). Figure 9. Depending on its properties, a particular substance may be classified as a homogeneous mixture, a heterogeneous mixture, a compound or an element. Eleven elements represent about 99% of the earth's crust and atmosphere (Table 1). Oxygen constitutes almost half and silicon about a quarter of the total quantity of these elements. Most of the elements on earth are found in chemical combinations with other elements; a quarter of the items are also found in the free state. Element Element Percentage Mass Element Symbol Percentage Oxygen Mass O 49.20 chlorine Cl 0.19 silicon Si 25.67 phosphorus P 0.11 aluminum Al 7.50 manganese Mn 0.09 iron Fe 4.71 carbon C 0.08 calcium Ca 3.39 sulfur S 0.06 sodium Na 2.63 barium Ba 0.04 potassium K 2.40 nitrogen N 0.03 magnesium Mg 1.93 fluoride F 0.03 hydrogen H 0.87 strontium Sr 0.02 titanium Ti 0.58 all others – 0.47 Table 1. The elemental composition of terrestrial water consists of the elements of hydrogen and oxygen combined in a ratio of 2 to 1. Water can be broken down into hydrogen and oxygen gases by adding energy. One way to do this is with a battery or a power supply, as shown in (Figure 10). Figure 10. The decomposition of water is presented at the macroscopic, microscopic and symbolic level. The battery supplies an electrical current (microscopically) that breaks down the water. At the macroscopic level, the liquid separates in the gases hydrogen (left) and oxygen (on the right). Symbolically, this change is presented showing how the H2O liquid separates into the H2 and O2 gases. The breakdown of water involves a rearrangement of the atoms in the water molecules into different molecules, each composed of two hydrogen atoms and two oxygen atoms, respectively. Two water molecules form an oxygen molecule and two hydrogen molecules. Representation for what is happening, [latex]2\text{H}_2\text{O}(l) \rightarrow 2\text{H}_2(g) + \text{O}_2(g)[/latex], will be explored more thoroughly in subsequent chapters. The two gases produced have distinct properties. Oxygen is not flammable, but it is necessary for the combustion of a fuel, and hydrogen is highly flammable and a powerful energy source. could this knowledge be applied in our world? An app involves research into more fuel-efficient transportation. Fuel cell vehicles (FCVs) run on hydrogen instead of gasoline (Figure 11). They are more efficient than vehicles with internal combustion engines, do not pollute and reduce greenhouse gas emissions, which makes us less dependent on fossil fuels. However, the FCVs are not yet economically viable and the current hydrogen production depends on natural gas. If we can develop a process of economic decomposition of water or hydrogen production in another ecological way, FCVs may be the way of the future. Figure 11. A fuel cell generates electricity from hydrogen and oxygen through an electrochemical process and produces only water as a residual product. Imagine how different your life would be without mobile phones (Figure 12) and other smart devices. Mobile phones are made of numerous chemicals, which are extracted, refined, purified and assembled using an extensive and in-depth understanding of chemical principles. Approximately 30% of the items found in nature are found in a typical smart phone. The housing/body/frame consists of a combination of strong and durable, durable polymers, oxygen, and nitrogen (acrylonitril butadien styrene (ABS) and polycarbonate thermoplastics),, and light, strong, structural metals, would be aluminum, magnesium, and iron. The display screen is made of a specially reinforced glass (silica bottle reinforced by the addition of aluminium, sodium and potassium) and covered with a material to make it conductive (such as indium tin oxide). The circuit board uses a semiconductor material (usually silicon); commonly used metals, such as copper, tin, silver and gold; and several unknown elements, such as yttrium, praseodymium, and gadolinium. The battery is based on lithium ions and a variety of other materials, including iron, cobalt, copper, polyethylene oxide and polyacrylonitations. Figure 12. Almost a third of the items that occur naturally are used to make a mobile phone. (credit: change of work by John Taylor) Matter is everything that takes up space and has mass. The basic element of matter is the atom, the smallest unit of an element that can enter into combinations with atoms of the same or other elements. In many substances, atoms are combined into molecules. On earth, matter usually exists in three states: solid, fixed shape and volume; liquids, variable in shape, but with fixed volume; variable form and volume. Under high temperature conditions, matter can also exist as plasma. Most of the matter is a mixture: It is composed of two or more types of matter that can be present in different quantities and can be separated by physical means. Heterogeneous mixtures vary in composition from point to point; homogeneous mixtures have the same composition from point to point. Pure substances consist of a single type of matter. A pure substance may be an element, consisting of a single type of atom and cannot be broken down by a chemical modification, or a compound, consisting of two or more types of atoms. Chemistry End of the Exercises chapter Why do we use the mass of an object, rather than its weight, to indicate the amount of matter it contains? What properties distinguish liquid solids? Gas liquids? Solids of gas? differ sour edp of a heterogeneous mixture from a homogeneous mixture? are similar? differ sour edp of a homogeneous mixture of a pure substance? are similar? differ sib in an element of a compound? are similar? differ the molecules from the elements and molecules of the compounds? In what ways are they similar? differs an atom from a molecule? In what ways are they similar? Many of the items you purchase are mixtures of pure compounds. Select three of these commercial products and prepare a list of ingredients that are pure compounds. Classified each of the following as an element, compound or mixture: (a) copper (b) water (c) nitrogen (d) sulphur (e) air (f) sucrose (g) a compound substance molecules, each of which contains two two atoms (h) petrol Classify each of the following as element, compound or mixture: (a) iron (b) oxygen (c) mercury oxide (d) pancake syrup (e) carbon dioxide (f) a substance composed of molecules, each of which contains a hydrogen atom and an atom of chlorine (g) sodium bicarbonate (h) baking powder A sulphur atom and a sulphur molecule are not identical. What's the difference? are the molecules in the oxygen gas, the molecules in the hydrogen gas and the similar water molecules? Differ? We refer to astronauts in space as weightless, but not without mass. Why is that? While driving a car, we don't think about the chemicals consumed and produced. Prepare a list of the main chemicals consumed and produced during the operation of a car. Matter is all around us. Make a list by name of fifteen different types of matter that you encounter each day. The list must include (and label at least one example of each) the following: a solid, a liquid, a gas, an element, a compound, a homogeneous mixture, a heterogeneous mixture and a pure substance. When the elemental iron corrodes it combines with the oxygen in the air to eventually form brown red iron oxide (III) which we call rust. (a) If a shiny iron nail with an initial mass of 23,2 g is weighed after being covered in a layer of rust, would you expect the mass to have increased, decreased or remained the same? Explain. (b) If the mass of the iron nail increases to 24,1 g, what mass of oxygen combined with iron? As stated in the text, convincing examples demonstrating the law of preservation of matter outside the laboratory are few and far between the laboratory. Indicate whether the mass would increase, decrease or remain the same for the following scenarios in which chemical reactions occur: (a) Exactly one pound of bread dough is placed in a baking box. The dough is cooked in an oven at 350°F, releasing a wonderful flavour of freshly baked bread during the cooking process. Is the meal of baked bread smaller than, larger than, or just like a pound of original dough? Explain. (b) When magnesium burns in the air, a white ash with magnesium oxide flakes is produced. Is the mass of magnesium oxide lower than, higher than, or just like the original piece of magnesium? Explain. (c) Antoine Lavoisier, the French researcher credited with the first time to specify the law of preservation of matter, heated a mixture of tin and air in a sealed flask to produce tin oxide. The mass of the sealed flask and the contents decreased, increased or remained the same after heating? Yeast converts glucose into ethanol and carbon dioxide during anaerobic fermentation, as described in the simple chemical equation here: [latex]\text{glucose} \rightarrow \text{ethanol + carbon dioxide}[/latex] (a) 200.0 g of glucose is fully converted, what will be the total mass of ethanol and carbon dioxide produced? (b) If fermentation fermentation in an open container, would you expect the mass of the container and the contents after fermentation to be smaller, larger than the mass of the container and the contents before fermentation? Explain. (c) If 97,7 g of carbon dioxide is produced, what mass of ethanol is produced? the smallest particle atom of an element which may enter into a chemical compound combination of pure substance which can be broken down into two or more elements substance element which is composed of a single type of atom; a substance which cannot be broken down by a state of chemical modification gas in which matter has neither a defined volume nor a form of a heterogeneous combination of substances with a composition which varies from one point to another homogeneous mixture (also solution) a combination of substances with a uniform composition throughout the liquid state of matter, which has a defined volume but the undefined form of the law of preservation of matter when matter transforms from one type to another or changes form, there is no detectable change in the total amount of matter present fundamental mass of property indicating the amount of material something that occupies space and has mass mixture material that can be separated into its components by physical means glued molecule collection of two or more atoms of the same elements or different plasma gaseous state of matter containing a large number of electrically charged atoms and/or substance molecules Pure homogeneous that has a constant solid state composition of matter that is rigid, has a defined shape, and has a fairly constant volume weight force that gravity exerts on an object Responses for Chemistry End of Chapter 2 exercises. Liquids can change shape (flow); solids can't. Gases can undergo large changes in volume as the pressure changes; liquids do not. Gas flow and change volume; solids do not. 4. The mixture may have a variety of compositions; a pure substance has a defined composition. Both have the same composition from one point to the point. 6. Element molecules contain a single type of atom; compound molecules contain two or more types of atoms. They are similar in that both are composed of two or more chemically bound atoms together. 8. Responses will vary. Sample response: Gatorade contains water, sugar, dextrose, citric acid, salt, sodium chloride, monopotasic phosphate and sucrose acetate isobutyrate. 10. (a) item; (b) the item; (c) compound; (d) mixture, (e) compound; (f) compound; (g) compound; (h) mixture 12. In each case, a molecule consists of two or more combined atoms. They differ in that the types of atoms change from one substance to another. 14. Gasoline (a mixture of compounds), oxygen, and to a lesser extent, nitrogen are consumed. Carbon dioxide and are the main products. Carbon monoxide and nitrogen oxides are produced in smaller quantities. 16. (a) Grew as combined with the oxygen in the air, thereby increasing the amount of matter and therefore the mass. (b) 0,9 g 18. (a) 200,0 g; (b) The mass of the container and the contents would decrease as carbon dioxide is a gaseous product and would leave the container. (c) 102,3 g