VERITAS Chemistry Name: _____ Date: _____

Chapter 2 – Matter and Change – Answer Key

Chapter 2: 1 - 12, 13, 14 – 23, 29, 33, 38, 40, 43, 45 (26 total)

Section Review 2.1

1. Is every sample of matter a substance? Explain. What is the definition of *matter*?

No; a substance is a particular kind of matter that has uniform and definite composition. Pure substances contain only one kind of matter. Matter is anything that has mass and occupies space.

2. Contrast the characteristics of the three states of matter.

a. Solids have a definite shape and volume, and are nearly imcompressible.

b. Liquids have definite volume but no definite shape, are nearly incompressible, and can flow.

c. Gases have neither definite shape or volume, and are easily compressed.

3. Which of the following are physical changes?

a. making caramel from sugar

b. carving a wooden figurine √

c. freezing mercury √

d. dissolving salt in water √

4. Use Table 2.1 to answer the following questions.

a. Which of the liquids listed has the highest boiling point? mercury

b. What two properties of sucrose distinguish it from sodium chloride? Melting point and density

c. What single property do neon, oxygen, and ethanol have in common? All are colorless

Section Review 2.2

7. What is the difference between a heterogeneous and a homogeneous mixture?

Homogeneous mixtures have the same composition throughout (such as ketchup), whereas heterogeneous mixtures have compositions comprised of two or more phases (such as vinaigrette salad dressing – the oil and vinegar phases separate).

8. Describe a procedure that could be used to separate a mixture consisting of sand and salt.

Add water to this mixture in order to dissolve the salt; pour the resulting mixture through a piece of filter paper to capture the larger sand particles. Then with the salt water that remains evaporate off the water so the salt then recrystallizes.

9. Classify each of the following as a substance or a mixture.

a. silver (s) b. alphabet soup (m) c. textbook (m) d. table salt (sodium chloride) (s)

10. Describe in your own words the difference between a *pure substance* and a *mixture*.

A pure substance consists of only one kind of matter, whereas a mixture contains two or more kinds of matter that may or may not be uniform in composition.

11. Describe ways in which the various components of a mixture can be separated.

Constituents within a mixture may be separated by filtration, distillation, chromatography, or evaporation.

12. Explain the term *phase* as it relates to homogeneous and heterogeneous mixtures.

A phase is any part of a system with uniform composition; a homogeneous mixture consists of only one phase, whereas a heterogeneous mixture consists of two or more.

Practice Problem

13. A clear liquid in an open container is allowed to evaporate. After three days, a solid residue is left. Was the original liquid an element, a compound, or a mixture? How do you know?

The original liquid was a mixture of a solid dissolved in a solvent. If the liquid was an element or compound, all of it would have evaporated without leaving a residue.

Section Review 2.3

14. How can you distinguish between an *element* and a *compound*?

Compounds can be separated by chemical means into elements. Elements cannot be separated into simpler substances by chemical techniques – would require nuclear fission to accomplish this.

15. Write the chemical symbols for each of the following elements.

a. copper Cu b. oxygen O c. phosphorus P

d. silver Ag e. sodium Na f. helium He

16. Name the chemical elements represented by the following symbols.

a. Sn _tin_____ b. Ca _calcium____ c. S _sulfur_____
d. Cd _cadmium_____ e. P _phosphorus___ f. Cl _chlorine____

17. Classify each of these samples of matter as an element, a compound, or a mixture.

a. spaghetti sauce mixture b. glass mixture

c. table sugar compound d. river water mixture

e. cough syrup mixture f. nitrogen element

18. What elements make up the pain reliever acetaminophen (chemical formula is $C_8H_9O_2N$)? Which element is present in the greatest proportion by number of atoms?

Carbon, hydrogen, oxygen, and nitrogen; Hydrogen is present in the greatest proportion by number of atoms (9).

Section Review 2.4

19. a. State the difference between a physical change and a chemical change, and list three likely indications that a chemical change has occurred. Which indication is most suggestive of a chemical reaction?

a. In a chemical change, the chemical composition of the reactants changes as one or more different products is formed. In a physical change, the chemical composition of the substance remains the same even if its physical appearance changes. Indicators of a chemical change are (1) a change in color or odor, or production of gas; (2) energy released or absorbed; (3) irreversibility. (3) is the most reliable indicator of chemical change.

b. State the law of conservation of mass. How does the mass of reactants compere with the mass of products in a given reaction?

b. In any physical change or chemical reaction, mass is neither created nor destroyed; it is conserved. The mass of the products equals the mass of the reactants in a chemical reaction.

20. Classify the following changes as physical or chemical.

a. cookies are baked chemical b. water boils physical

c. salt dissolves in water physical d. a firefly emits light chemical

e. milk spoils chemical f. a metal chair rusts chemical

21. Consider the law of conservation of mass as you answer this problem. When ammonium nitrate (NH_4NO_3) breaks down explosively, it forms nitrogen gas (N_2), oxygen gas (O_2), and water (H_2O). When 40 grams of ammonium nitrate explode, 14 grams of nitrogen gas and 8 grams of oxygen gas are formed. How many grams of water are formed?

40 g ammonium nitrate = 14 g nitrogen gas + 8 g oxygen gas + x g water; x = 18 g water

22. State several physical or chemical properties that could be used to distinguish between each of the following pairs of substances and mixtures.

a. gasoline and water color, odor, reaction upon heating, boiling point

b. copper and silver color, melting point, reactions with other substances, hardness, brittleness, strength

c. water and a saltwater solution boiling point, freezing point, density

d. aluminum and steel density, melting point, magnetic properties

23. Hydrogen and oxygen react chemically to form water. How much water would be formed if 4.8 grams of hydrogen reacted with 38.4 grams of oxygen?

4.8 g hydrogen + 38.4 g oxygen = x g water; x = 43.2 g water

Chapter 2 Review

29. Use Table 2.1 to identify four substances that undergo a physical change if the temperature is decreased from 50℃ to -50℃. Describe the nature of the physical change. 2.1

Chlorine, mercury, bromine, and water; Chlorine condenses, and mercury, bromine, and water all freeze when the temperature drops within the stated range.

33. Name the elements found in each of the following compounds. 2.3

a. ammonium chloride (NH_4Cl) nitrogen, hydrogen, and chlorine

b. potassium permanganate ($KMnO_4$) potassium, manganese, and oxygen

c. isopropyl alcohol (C_3H_7OH) carbon, hydrogen, and oxygen

d. calcium iodide (CaI_2) calcium and iodine

38. Devise a way to separate sand from a mixture of charcoal, sand, sugar, and water.

Add enough water to dissolve all the sugar; separate the sand and charcoal from the liquid by filtration; large pieces of charcoal could be separated out by color, and small pieces could be burned.

40. Use Table 2.1 to answer each question.

a. Which property most easily distinguishes sulfur from the other solid substances? color

b. How many of these substances are elements? six

c. Which compound has the highest boiling point? Sodium chloride

d. The solids are gradually heated. Which one will melt first? sulfur

43. How do you know that each of these is a chemical change?

a. food spoils – color and odor change

b. a foaming antacid tablet fizzes in water – gas is produced

c. a ring of scum forms around your bathtub – formation of a precipitate (solid)

d. iron rusts – color and texture change

e. a firecracker explodes – energy change, odor, spark, irreversible reaction

45. Compare the relationships among individual particles in the three states of matter.

In gases, particles are very far apart and high in energy; in liquids, the particles are closer together and slide past one another; in solids, the particles have minimal energy and are packed closely together.

50. Each day of your life you encounter some chemical changes that are helpful and some that are harmful. Cite three examples of each. For each example, list the indications that identified the change as chemical.

Helpful:

a. process of digestion – evidenced by irreversible reaction.

b. roasting of coffee beans – delicious odor and color change of the beans.

c. raising of bread dough is a chemical change - production of a gas.

Harmful:

a. burning of meat so that carcinogens are formed – evidenced by color change.

b. spoiling of butter – evidenced by rancid odor.

c. breakdown of gasoline into carbon dioxide, water, and exhaust fumes – evidenced by emission of gases, particulate matter (exhaust) and energy.