MILADY STANDARD COSMETOLOGY COURSE MANAGEMENT GUIDE CLASS SIGN-IN SHEET 12.0

INSTRUCTOR NAME: _____ **DATE TAUGHT:** _____

SUBJECT: GENERAL SCIENCES

TOPIC: BASICS OF CHEMISTRY

LESSON OBJECTIVES:

Upon completion of the lesson, the student will be able to:

1. Explain the difference between organic and inorganic chemistry.
2. Explain oxidation-reduction (redox) reactions.
3. Discuss the different forms of matter: elements, compounds, and mixtures.
4. Explain the difference between solutions, suspensions, and emulsions.
5. Explain pH and the pH scale.

IMPLEMENTS, EQUIPMENT, SUPPLIES REQUIRED:

Student	Instructor	Items
x	x	*Milady Standard Cosmetology*
x	x	*Milady Standard Cosmetology Theory Workbook, Practical Workbook,* and *Study Guide: The Essential Companion*
x		Student notebook
x		Pens, pencils

TEACHING AIDS (Audio/visual equipment, handouts, etc. used by Instructor):

1. Board
2. LCD Projector and *Milady Standard Cosmetology Instructor Support Slides* OR Overhead Projector and Transparencies
3. *Milady Standard Cosmetology DVD Series* and DVD player

FACILITY: Theory Classroom

TIME ALLOTMENT: 1–2 hours (adjust based on school schedule and student activities/participation)

PRIOR STUDENT ASSIGNMENT:

1. Read Chapter 12, *Milady Standard Cosmetology*

EDUCATOR REFERENCES:

1. *Milady Standard Cosmetology*
2. *Milady Standard Cosmetology Theory Workbook, Practical Workbook,* and *Study Guide: The Essential Companion*

INSTRUCTOR NAME	DATE TAUGHT	INSTRUCTOR NAME	DATE TAUGHT
INSTRUCTOR NAME	DATE TAUGHT	INSTRUCTOR NAME	DATE TAUGHT
INSTRUCTOR NAME	DATE TAUGHT	INSTRUCTOR NAME	DATE TAUGHT

NOTES TO EDUCATOR:

1. Review chapter, entire lesson plan, and *Milady Standard Cosmetology Instructor Support Slides* prior to lesson.
2. Review Learning Reinforcement ideas/activities and predetermine which are to be used.
3. Check the projector to ensure it is working properly.
4. Gather all materials and supplies needed for demonstrations prior to starting class.
5. Have students sign in for class and document attendance based on school's procedure.
6. During the Instructor preparation time and while students are entering and getting settled for the class, have the first *Milady Standard Cosmetology Instructor Support Slide* containing the inspirational quote projected (or write it on the board or flip chart). This will help get instructors and students into the appropriate mind-set for learning and for the day.
7. The information found in this lesson correlates to the information found in Chapter 10 of *Milady Standard Cosmetology Course Management Guide,* 2008 edition.

LEARNING MOTIVATION (WHY?)

Inspirational thought for the day:

"We only become what we are by the radical and deep-seated refusal of that which others have made of us."

—Jean-Paul Sartre

As a professional cosmetologist, it is essential that you understand the chemicals you will be using in the services you perform. Throughout the course of study, we stress the importance of safety in the workplace. The knowledge you will gain in this unit of study will be invaluable to your own safety and that of your client.

When you think about it, chemistry has an important role in every product you use, from the water used to shampoo hair, to the cosmetics applied during a facial, to the chemicals used to chemically reform the hair's texture, to the products used to care for the hands, feet, and nails.

Chemistry may be a frightening subject to you, but there is no need for that, especially when you think about what chemistry is. It is simply the study of matter, its composition, structure, and properties, and the *changes* it may undergo under different chemical conditions. Since matter is anything that occupies space and has weight, it is significant to our profession.

Remember, our intention in this unit is not to make you a scientist, but to help you develop a comfort level with the basics and your ability to discuss chemistry in relation to your profession. This ability will make a significant contribution to your many client consultations.

PRESENTATION OF THE SKILLS AND/OR INFORMATION LESSON PLAN 12.0

SUBJECT OUTLINE	IN-DEPTH NOTES *(Information to share during presentation)*
	OPENING ACTIVITY: Explain to the students that you are continuing the unit of study of cosmetology sciences and that you will be covering chemistry in detail in the next few lessons. Divide students into small groups. Ask them to discuss and record everything they did between waking up this morning and arriving for school, beginning with the alarm clock going off. After they have completed their list, have them indicate which tasks used chemistry. For example: brushed teeth—chemistry (in the water and toothpaste); took shower—chemistry (water, soap, shampoo, conditioner, etc.). After they have completed their group assignment, conduct a discussion about how during their first two hours or so of being awake today nearly every aspect of their lives was affected by chemistry.
I. CHEMISTRY	The science that deals with the composition, structures, and properties of matter and how matter changes under different conditions
A. ORGANIC CHEMISTRY	The study of substances that contain carbon, which allows them to burn; all living or formerly alive things contain carbon. Just because something is organic does not always mean it is natural or safe. Examples: Poison ivy, gasoline, motor oil, plastics, synthetic fabrics, pesticides, and fertilizers are all organic substances.
B. INORGANIC CHEMISTRY	The study of substances that do not contain carbon but may contain hydrogen; most inorganic substances do not burn and were never alive. Examples: Metals, minerals, glass, water, and air are inorganic substances. Titanium dioxide, a white pigment used to make white enhancement powders, and nail polish are examples of inorganic substances.
II. MATTER	Anything that occupies space, has physical and chemical properties, and exists as either a solid, liquid, or gas.
A. ELEMENTS	An element is the simplest form of matter.
1. Composed of a single part or unit	
2. Cannot be reduced to a simpler substance	At least not without loss of identity

SUBJECT OUTLINE	IN-DEPTH NOTES *(Information to share during presentation)*
3. 90 naturally occurring elements	
4. Identified by a letter symbol Examples: a. C: Carbon b. O: Oxygen c. H: Hydrogen d. N: Nitrogen e. S: Sulfur	Remember the acronym: COHNS
B. ATOMS	Atoms are the particles from which all matter is composed. An atom is the smallest particle of an element capable of showing the properties of that element. Example: If you took a piece of gold (an element) and divided it into smaller and smaller pieces, you would eventually come to a particle so small that it no longer showed the properties of the element. (It would no longer be recognizable as gold.)
C. MOLECULES	A molecule is the result of two or more atoms which are joined together. For example, water is made from hydrogen and oxygen.
1. Elemental molecules	A chemical combination of atoms of the same element; the air we breathe is an elemental molecule: O_2. The ozone in the atmosphere is an elemental molecule: O_3.
2. Compound molecule	These are chemical compounds of two or more atoms of different elements. Sodium Chloride (NaCl), or common table salt, is a compound molecule that contains one atom of sodium (Na) and one atom of chlorine (Cl).
III. STATES OF MATTER	All matter exists in three different physical forms: solid, liquid, or gas. Matter takes on one of these forms or states depending on its temperature. See Table 12–1.
A. SOLIDS	Have a definite shape, volume, and weight (ice)
B. LIQUIDS	Have a definite volume and weight but not a definite shape (water takes on the shape of its container)
C. GASES	Do not have a definite volume or shape (steam)
D. PHYSICAL AND CHEMICAL PROPERTIES	
1. Physical properties	Those characteristics determined without a chemical reaction; they do not cause a chemical change in the identity of a substance. Examples are color, odor, weight, and density.
2. Chemical properties	Those characteristics that can only be determined with a chemical reaction and cause a chemical

SUBJECT OUTLINE	IN-DEPTH NOTES *(Information to share during presentation)*
	change in the identity of a substance. Examples are rusting iron and burning wood. A chemical reaction known as oxidation causes the chemical change in the identity.
E. PHYSICAL CHANGE	A physical change changes the form without forming a new substance. Example: solid ice melts and becomes water—there are no new chemicals, just a different form.
F. CHEMICAL CHANGE	A chemical change is a change in a substance's chemical composition. A chemical change creates new substances with different properties. Examples: iron to rust; wood into ashes; newspaper discoloring in the sun; the oxidation of haircolor; or the polymerization of artificial nail enhancements
1. Oxidation	This is a chemical reaction that combines a substance with oxygen to produce an oxide. An example is wood turning into charcoal after it has burned.
2. Oxidation-reduction (redox)	This is a chemical reaction in which the oxidizing agent is reduced (by losing oxygen) and the reducing agent is oxidized (by gaining oxygen). *Redox* is a contraction for the term oxidation-reduction.
3. Oxidizing agent	A substance that releases oxygen; hydrogen peroxide (an oxidizing agent) can be thought of as water with an extra atom of oxygen.
4. Reducing agent	A substance that adds hydrogen to a chemical compound or subtracts oxygen from the compound
5. Reduction	The process through which oxygen is subtracted or hydrogen is added to a substance through a chemical reaction called *reduction reaction*
6. Exothermic reaction	A chemical reaction in which heat is released
7. Combustion	The rapid oxidation of a substance accompanied by the production of heat and light; lighting a match is an example of rapid oxidation. You cannot have fire without oxygen.
G. PURE SUBSTANCES	A pure substance is a chemical combination of matter in definite proportions. They have unique properties. All atoms, elements, elemental molecules, and compound molecules are pure substances.
H. PHYSICAL MIXTURES	These are a physical combination of matter in any proportions. They have combined chemical and physical properties. Example: Concrete is a mixture of sand, gravel, and cement; the sand and gravel are held together by the cement, but they retain their identity and can be picked apart. Air is a mixture of gases, mostly nitrogen and oxygen. See Table 12–2.

SUBJECT OUTLINE	IN-DEPTH NOTES *(Information to share during presentation)*
I. SOLUTIONS, SUSPENSIONS, EMULSIONS	All contain two or more different substances
1. Solution	A stable uniform blend of two or more mixable substances; they do not separate on standing.
2. Solute	The dissolved substance in a solution
3. Solvent	The substance, usually liquid, which dissolves another substance to form a solution, with no change in chemical composition. For example, when sugar is dissolved in hot water, the sugar (a solid) is the solute and the water (liquid) is the solvent. Water is the universal solvent.
4. Miscible liquids	Are mutually soluble; they can be mixed with each other in any proportion without separating (for example, water and alcohol).
5. Immiscible liquids	Not capable of being mixed (for example, oil and water)
6. Suspension	An unstable mixture of undissolved particles in a liquid; the particles are generally visible to the naked eye but not large enough to settle quickly to the bottom. Suspensions are unstable and separate over time (for example, salad dressings often have to be shaken well before using to mix them thoroughly).
7. Emulsion	An emulsion is an unstable mixture of two or more immiscible substances united with the aid of a binder or emulsifier. *Emulsify* means to form an emulsion. They have a tendency to separate over time but if properly formulated and stored, emulsions can be stable for at least three years.
8. Emulsifier	An emulsifier is an ingredient that brings two normally incompatible materials together and binds them into a uniform and fairly stable blend. An example is hand lotion.
9. Surfactants	These are substances that act as a bridge to allow oil and water to mix, or emulsify. The term is a contraction for *surface active agent.*
a) Head of the surfactant	Is hydrophilic, or water-loving, and dissolves in water
b) Tail of the surfactant	Is lipophilic, or oil-loving, and dissolves in oil
c) Surfactant molecule	Mixes with both oil and water and joins them together to form an emulsion
d) Oil-in-water emulsion	Represented as O/W; in these emulsions oil droplets are suspended in a water base. The oil droplets are surrounded by surfactants; their lipophilic tails point in and their hydrophilic heads point out. Oil-in-water emulsions usually contain a much

SUBJECT OUTLINE	IN-DEPTH NOTES *(Information to share during presentation)*
	greater amount of water than oil. Mayonnaise is O/W. Oil and water are immiscible, but the egg yolk emulsifies the oil droplets and distributes them uniformly in the water. Most emulsions used in the salon are O/W. Haircoloring, shampoos, and conditioners are O/W.
e) Water-in-oil emulsion	Represented as W/O; in these emulsions, water droplets are suspended in an oil base. The droplets are surround by surfactants; their hydrophilic heads point in and their lipophilic heads point out. Water forms the internal portion of a W/O emulsion and there is a much greater amount of oil than water. Cold cream is an example of a water-in-oil emulsion.
	ACTIVITY: Have students perform the oil and water activity found in the textbook.
J. OTHER PHYSICAL MIXTURES	
1. Combined ingredients	Semisolid mixtures made with any combination of petrolatum (petroleum jelly), oil, and wax; they include ointments, pastes, pomades, and styling waxes.
2. Powders	A physical mixture of two solids; free-flowing powders are rarely found in cosmetics. Powders that tend to stick together, such as talc, are more common.
K. COMMON PRODUCT INGREDIENTS	
1. Volatile alcohols	Evaporate easily—isopropyl (rubbing alcohol), ethyl (hairspray and alcoholic beverages)
2. Fatty alcohols	Cetyl and cetearyl alcohols are nonvolatile oils used as skin conditioners.
3. Alkanolamines	Alkaline substances used to neutralize acids or raise the pH of many hair products
4. Glycerine	Sweet, colorless, oily substance used as a solvent and moisturizer
5. Silicones	Used as hair conditioners and water-resistant lubricants for the skin; they are less greasy than many other oils and can impart a silky, smooth feel on skin and give shine to hair.
6. Volatile organic compounds	VOCs are two or more elements combined chemically (compounds) that contain carbon (are organic) and evaporate quickly (are volatile). The most common VOC used in hair sprays is ethyl alcohol.
L. POTENTIAL HYDROGEN (PH)	The small *p* represents a quantity and the capital *H* represents the hydrogen ion.
M. WATER AND PH	In pure water, some of the water molecules naturally ionize into hydrogen ions and some into hydroxide ions. The pH scale measures those ions.

SUBJECT OUTLINE	IN-DEPTH NOTES *(Information to share during presentation)*
1. Ion	An atom or molecule that carries an electrical charge
2. Ionization	Causes an atom or molecule to split in two, creating a pair of ions with opposite electrical charges
3. Anion	An ion with a negative electrical charge
4. Cation	An ion with a positive electrical charge
5. Hydrogen ion (H+) is acidic.	
6. Hydroxide ion (OH-) is alkaline.	Only aqueous solutions have pH. Nonaqueous solutions (oil and alcohol) do not have pH. Without water, there is no pH. Pure water contains the same number of hydrogen ions as hydroxide ions. Pure water is neutral because it is an equal balance of both acid and alkaline.
N. THE PH SCALE	It means either *parts hydrogen* or *potential hydrogen* and indicates the relative degree of acidity or alkalinity of a substance. The symbol pH represents the number of hydrogen ions in a water solution.
1. A scale of 0 to 14	
2. 7 indicates a neutral solution	
3. Below 7 indicates an acidic solution	
4. Above 7 indicates an alkaline solution	
5. Logarithm	Means multiples of ten; the pH scale is *logarithmic* because a change of one whole number represents a tenfold change in pH. A change of two whole numbers represents a change of 10 times 10 (or a one-hundredfold change).
O. ACIDS	Owe their chemical relativity to the hydrogen ion (H+); alpha hydroxyl acids are derived from plants and are often used to exfoliate the skin and help adjust the pH of lotions and creams.
1. pH below 7	
2. Turn litmus paper from blue to red	
P. ALKALIS	Owe their chemical relativity to the hydroxide ion (OH-)
1. Term is interchangeable with *base*	
2. pH above 7	
3. Turn litmus paper from red to blue	
4. Feel slippery and soapy on the skin	

SUBJECT OUTLINE	IN-DEPTH NOTES *(Information to share during presentation)*
5. Known as lye	Used in chemical hair relaxers, callous softeners, and drain cleaners **ACTIVITY**: Have students conduct an activity wherein litmus paper is dipped into numerous products and the various pH levels are determined.
Q. ACID-ALKALI NEUTRALIZATION REACTIONS	The same reaction that naturally ionizes water to create hydrogen (H+) ions and hydroxide ions (OH-); when acids (H+)and alkalis (OH-) are mixed together in equal proportions, they neutralize each other to form water (H_2O).

SUMMARY AND REVIEW

The science that deals with the composition, structure, and properties of matter and how matter changes under different chemical conditions is called *chemistry*. Organic chemistry deals with all substances in which carbon is present, while inorganic chemistry deals with substances that do not contain carbon. Matter is anything that occupies space, has physical and chemical properties, and exists as either a solid, a liquid, or a gas. Matter exists in the form of elements, compounds, and mixtures. Atoms are the smallest particle of an element (which shows the properties of that element), while a molecule is two or more atoms joined together chemically. Matter can be changed either physically or chemically.

There are many benefits for the client who takes advantage of the various salon services that use chemical products. While the use of chemical products has great benefits, we must always remember they create a potential for damage or injury as well. As a professional cosmetologist, your ability to stay informed about new developments and products and how to use them effectively and safely will greatly impact your success.

LET'S REVIEW:

1. What is chemistry?
   Answer: Chemistry is the science that deals with the composition, structure, and properties of matter and how matter changes under different conditions.

2. Why is a basic understanding of chemistry important to a cosmetologist?
   Answer: To use professional products effectively and safely, all cosmetology professionals must have a basic understanding of chemistry. It is important to understand chemistry because haircolor products, chemical texturizers, shampoos, conditioners, styling aids, nail enhancements, nail tips, and nail polishes have chemical substances.

3. What is the difference between organic and inorganic chemistry?
   Answer: Organic chemistry is the study of substances that contain the element carbon. Inorganic chemistry is the study of substances that do not contain carbon, but may contain hydrogen.

4. What is matter?
   Answer: Matter is any substance that occupies space and has mass (weight).

5. What is an element?
   Answer: An element is the simplest form of chemical matter. It cannot be broken down into a simpler substance without a loss of its identity.

6. What are atoms?
   Answer: Atoms are the chemical particles from which all matter is composed. All matter is made entirely of chemicals. They are the structural units that make up elements.

7. Explain the difference between elemental molecules and compound molecules. Give examples.
   Answer: Elemental molecules are molecules containing two atoms of the same element in definite proportions. An example is the atmospheric air that we breathe. Compound molecules are a chemical combination of two or more atoms of different elements in definite proportions. An example is table salt.

8. Name and describe the three states of matter.
   Answer: The three states of matter are:
   - Solids: they are rigid and have a fixed shape and volume.
   - Liquids: they have a definite volume but take the shape of their containers.
   - Gases: they do not have a fixed volume or shape; they take the shape and volume of their containers.

9. What are the physical and chemical properties of matter? Give examples.
   Answer: Physical properties of matter are characteristics that can be determined without a chemical reaction, and do not involve a chemical change. Examples of physical properties are color, size, weight, hardness, and glossiness. Chemical properties of matter are characteristics that can only be determined by a chemical reaction and a chemical change in the substance. Examples of chemical properties are rusting iron, burning wood, or hardening of nail enhancements.

10. What is the difference between physical and chemical change? Give examples.
    Answer: Physical change is a change in the form or physical properties of a substance, without a chemical reaction or the creation of a new substance. Examples of physical change are when ice melts into water and then into a vapor, when a temporary haircolor is applied to the hair, or when nail polish is taken off the nail with a remover solvent. Chemical change is a change in the chemical composition or make-up of a substance. Examples of chemical change are the oxidation of haircolor or wood turning into charcoal after it has burned.

11. Explain oxidation-reduction (redox).
    Answer: Oxidation-reduction is a chemical reaction in which the oxidizing agent is reduced and the reducing agent is oxidized. Chemical services would not be possible without oxidation-reduction (redox) reactions.

12. Explain pure substances and physical mixtures. Give examples.
    Answer: Pure substances are chemical combinations of matter in definite (fixed) proportions. Water is an example of a pure substance. All atoms, elements, elemental molecules, and compound molecules are pure substances. Physical mixtures are physical combinations of matter in any proportions. Salt water is an example of a physical mixture.

13. What is the difference between solutions, suspensions, and emulsions? Give examples.
    Answer: A solution is a stable physical mixture of two or more substances. An example of a solution is salt water. A suspension is an unstable physical mixture of undissolved particles floating in a liquid. An example of a suspension is oil and vinegar salad dressing, in which the oil droplets are suspended in the vinegar. An emulsion is an unstable mixture of two or more substances that normally will not stay blended without a special ingredient called an emulsifier. An example of an emulsion is hand lotion.

14. Define pH and the pH scale.
    Answer: pH is the abbreviation used for potential hydrogen.
    The pH scale measures the acidity and alkalinity of a substance. It has a range of 0 to 14, with 7 being neutral. A pH below 7 is an acidic solution and a pH above 7 is an alkaline solution.

LEARNING REINFORCEMENT IDEAS AND ACTIVITIES

1. Have students complete Chapter 12 of *Milady Standard Cosmetology Theory Workbook, Practical Workbook,* and *Study Guide: The Essential Companion.*
2. Have students complete review and final testing with *Milady Standard Cosmetology Online Licensing Preparation.*
3. Have students gather a wide variety of products used by the school and test their pH with litmus paper. Have students analyze the ingredients of the products and estimate their effects on hair. Students may then make a poster listing the ingredients, their pH, and an estimate of the products' effects on the hair.
4. Have students make a list of all the products they can find at home and identify them as either acids or alkalis.
5. Invite a high school chemistry teacher to talk to the class about chemistry in cosmetology.

6. Have students perform the alka seltzer test at home and report back the combustion results they experienced. Items needed are a small film canister, construction paper, scissors and tape, alka seltzer tablets and water. Instruct students to make a cone-shaped object that is just a little larger than the film canister at the open end. Have students experiment by placing one alka seltzer tablet into the film canister and adding various levels and temperatures of water. Instruct students to quickly place the lid on the film canister and then place the paper cone (or rocket) over the canister and wait. Have them time how long it takes for combustion to occur, the lid to pop off, and the "rocket" to go into orbit. Water levels and temperature of the water will affect the degree of combustion that occurs.
7. Have students mix powdered lemon drink mix with the appropriate amount of water. Observe the powder as it dissolves; lemonade has been created. Have students identify which ingredient is the solute (the powdered lemon drink mix), which ingredient is the solvent (the water), and what the resulting solution is called (lemonade).
8. Have students pour a small amount of oil into a transparent container or test tube, followed by a small amount of water; have them put their thumb (or other cover) over the top and shake the container. Have them write down their observations. Then have them add a small amount of liquid soap and again cover and shake. Have them write down their observations. Then lead a discussion about the fact that when the soap was added, a milky white emulsion was created. The chemical nature of soap allows it to keep the small drops or globs of oil suspended in the water. This is why soap has a cleaning action. Dirt clings to your skin and clothes because a film of grease holds it there. The purpose of soap is to break up this film so the dirt can be washed away.
9. To gain knowledge in density and viscosity of products, divide the students into groups. Provide each group with six glass bottles or vials and tell students they are going to layer two substances in each vial. Instruct students to layer all six combinations of liquids as follows: oil and shampoo; corn syrup and shampoo; soy sauce and shampoo; oil and corn syrup; oil and soy sauce; and soy sauce and corn syrup. Have students line up their vials and observe what liquid always becomes the uppermost layer, no matter what it is layered with. (They will see that it is oil, as it is the least dense.) Have students observe which liquid always becomes the bottom layer, no matter what it is layered with. (They will see that it is corn syrup, as it is the densest.) Have students note that some vials were not layered with liquids of adjacent densities (corn syrup and shampoo, soy sauce and oil, and corn syrup and oil). Ask students to predict how the liquids would layer if all four liquids were poured into one vial (oil on top, then shampoo, then soy sauce, then corn syrup). Lead a discussion about how density is a property of solids, liquids, and gases. It is really how heavy a substance is for its size and quantity. For example, a box of coal is considered more dense than the same size box filled with feathers. Density is the mass per unit volume. Viscosity is a resistance to flow. Viscosity determines the thickness or heaviness of a product, and sometimes thick, heavy shampoo is less dense than the free-flowing soy sauce.
10. On the lines below, write any activities, assignments, or ideas that have been used effectively with this lesson in order to aid other instructors who may use this lesson plan in the future:

_____

_____

_____

TEST—CHAPTER 12—BASICS OF CHEMISTRY

1. A combination of substances that are held together by physical rather than chemical ties is called a:
   a) mixture
   b) compound
   c) synthesis
   d) solvent

2. What type of change occurs when ice melts and becomes water?
   a) chemical
   b) physical
   c) soluble
   d) reactive

3. If a product has a pH of 8.9, it is considered:
   a) neutral
   b) acid
   c) alkaline
   d) balanced

4. A special type of oil used in nail polish dryers and as a skin protectant is:
   a) silicone
   b) glycerine
   c) ammonia
   d) alcohol

5. There are about _____ naturally occurring elements, each with its own distinctive physical and chemical properties.
   a) 60
   b) 70
   c) 80
   d) 90

6. Pure water with a pH of 7 is considered to be:
   a) neutral
   b) alkaline
   c) acid
   d) mineral

7. The separating of a substance into ions is known as _____.
   a) deionization
   b) ionization
   c) cation
   d) decomposition

8. When fermented to make wine, the sugar in grapes is converted into:
   a) soft water
   b) ethyl alcohol
   c) distilled water
   d) cetyl alcohol

9. Liquids that mix easily are known as:
   a) miscible
   b) immiscible
   c) compatible
   d) incompatible

10. In creating a solution, the liquid used to dissolve a substance is called the:
    a) solute
    b) solvent
    c) suspension
    d) emulsion

11. A molecule is formed by joining two or more _____ chemically.
    a) atoms
    b) neurons
    c) protons
    d) anions

12. An alteration of the properties of a substance without the formation of a new substance is a:
    a) mixture
    b) compound
    c) chemical change
    d) physical change

13. The tail of a surfactant molecule is _____, meaning *oil-loving*.
    a) aquaphilic
    b) lipophilic
    c) hydrophilic
    d) oilophilic

14. A preparation made by dissolving a solid, liquid, or gaseous substance in another substance is:
    a) a suspension
    b) an ointment
    c) an emulsion
    d) a solution

15. _____ are substances used to neutralize acids or raise the pH of many hair products.
    a) Alcohols
    b) Alkanolamines
    c) Ammonia
    d) Silicones

16. A permanent mixture of two or more substances that are united with the aid of a binder is:
    a) an ointment
    b) an emulsion
    c) a suspension
    d) a solution

17. Temporary mixtures of two kinds of matter are:
    a) solutions
    b) emulsions
    c) mixtures
    d) suspensions

18. Organic chemistry is the study of all substances containing:
    a) hydrogen
    b) nitrogen
    c) carbon
    d) sulfur

19. Substances that act as a bridge to allow oil and water to mix or emulsify are:
    a) miscibles
    b) surfactants
    c) compounds
    d) solutions

20. When two or more elements combine chemically, they form a new substance called a:
    a) mixture
    b) suspension
    c) compound
    d) solution

21. The branch of chemistry which deals with products that do not contain carbon is called:
    a) organic chemistry
    b) inorganic chemistry
    c) atomic chemistry
    d) molecular chemistry

22. Anything that occupies space, has physical and chemical properties, and exists in either a solid, liquid, or gas form is known as:
    a) matter
    b) compounds
    c) elements
    d) organic substance

23. The smallest particle of an element is the:
    a) proton
    b) neuron
    c) atom
    d) electron

24. Substances that cannot be reduced to simpler substances are called:
    a) bases
    b) solutes
    c) elements
    d) gases

25. A new product formed by the uniting of two or more elements is known as:
    a) a synthetic
    b) a compound
    c) a solution
    d) an emulsion

26. _____ organic compounds are substances containing carbon and evaporate very quickly and easily.
    a) Volatile
    b) Weighty
    c) Liquescent
    d) Resolute

27. When two or more atoms are joined together chemically, what is created?
    a) molecule
    b) atom
    c) neuron
    d) electron

28. Another name for alkalis is:
    a) nonmetals
    b) bases
    c) foundations
    d) metals

29. When a substance is combined with oxygen, the substance is _____.
    a) reduced
    b) subtracted
    c) oxidized
    d) suspended

30. A chemical reaction in which oxygen is subtracted from or hydrogen is added to a substance is called:
    a) physical change
    b) chemical change
    c) reduction reaction
    d) organic chemistry

31. Redox is a contraction for:
    a) oxidation-reduction
    b) reduction-oxidation
    c) reaction-oxidation
    d) organic reaction

32. A substance that adds hydrogen to a chemical compound or subtracts oxygen from the compound is known as:
    a) a reaction agent
    b) a reducing agent
    c) a hydrogen agent
    d) an oxidizing agent

33. The head of a surfactant molecule is _____, meaning *water-loving*.
    a) aquaphilic
    b) lipophilic
    c) hydrophilic
    d) oilophilic

TEST—CHAPTER 12—BASICS OF CHEMISTRY ANSWER KEY

1. a
2. b
3. c
4. a
5. d
6. a
7. b
8. b
9. a
10. b
11. a
12. d
13. b
14. d
15. b
16. b
17. d
18. c
19. b
20. c
21. b
22. a
23. c
24. c
25. b
26. a
27. a
28. b
29. c
30. c
31. a
32. b
33. c