

#5 Reactions: Chemical reactions are processes in which atoms are rearranged into different combinations of molecules.

- Reactant atoms & molecules interact to form Products with different chemical properties.
- The idea of atoms explains the conservation of matter: In chemical reactions the NUMBER of atoms stays the same no matter how they are arranged, so their total mass stays the same.
- Chemical reactions usually liberate/release heat or ABSORB heat.
- Physical processes include freezing & boiling, in which a material changes form with no chemical reaction.
- Know how to determine whether a solution is acidic, basic, or neutral.

1/2 pt each: ____/4

Vocabulary - Write the definitions for the following terms:

- Chemical Reaction the process which 1 or more substances change to produce 1 or more different substances
- Reactants - these are what are present at the beginning of the reaction
- products: what is formed by a reaction
- 4 phases of matter:
 - Solid the state in which matter has a definite volume and shape
 - Liquid the state in which matter has a definite volume but takes the shape of its container
 - Gas a state in which matter changes in volume and shape
 - Plasma a state that does not have a definite volume and shape, but whose particles have broken apart
- physical property: a property that can be observed or measured without changing the identity of the matter
- chemical property a property that describes a substance based on its ability to change into a new substance, with different properties.
- physical change: a change that affects 1 or more physical properties (and is easy to undo)
- chemical change: a change into an entirely new substance.

Are state changes (ie freezing, melting) examples of chemical or physical change? **Any state change is a PHYSICAL CHANGE!** This is because the substance is still the same before and after, it has just changed its shape. For example, ice and water vapor are two different states (solid and gas), but they are still water. Sublimation, condensation, freezing, melting, evaporation.... all are physical changes.

Physical versus Chemical PROPERTIES: Elements, substances, & compounds have both physical & chemical properties. Physical properties are those that can be described using the senses & can be determined without destroying the object. Chemical properties describe how a substance reacts with another substance & the original is changed into something else. Classify each term as a physical (P) or chemical (C) property

- | | | | |
|------------------|--------------------------------------|-------------------|---|
| <u>P</u> density | <u>C</u> reacts with acid | <u>P</u> hardness | <u>C</u> flammability |
| <u>P</u> taste | <u>C</u> reacts with oxygen | <u>P</u> odor | <u>P</u> melting point |
| <u>P</u> color | <u>C</u> reacts with a base | <u>P</u> luster | <u>C</u> neutralizes a base |
| | <u>P</u> Water boils at 100° Celcius | | <u>C</u> Vinegar will react with baking soda. |

1/2 pt each: ____/7

Physical versus Chemical CHANGES: In a physical change, the original substance still exists, it has only changed form. These include all state changes. In a chemical change, a new substance is produced. Chem. changes always includes a change in energy & a phys. change. Chemical reactions involve chemical changes. Write **P** for physical change or **C** for chemical change.

- | | | |
|--------------------------------|--------------------------------------|--|
| <u>P</u> glass breaking | <u>P</u> cutting grass | <u>P</u> separating sand from gravel |
| <u>C</u> corroding metal | <u>C</u> burning leaves | <u>C</u> fireworks exploding |
| <u>C</u> burning toast | <u>P</u> dying your hair (or drying) | <u>P</u> water evaporating from a pond |
| <u>P</u> whipping cream | <u>P</u> dry ice sublimating | <u>P</u> freezing a Capri Sun to make it a slushie |
| <u>C</u> spoiling/rotting food | | |

1/2 pt each: ____/6

State Exam Examples: Circle the answer

1. Copper (Cu) reacts with oxygen (O) to form copper oxide (CuO). The properties of CuO are most likely

A

Properties of Some Compounds			
Compound	Melting Point	Solubility	Electrical Conductivity in Solution
A	801°C	high	yes
B	398°C	low	yes
C	20°C	low	no
D	1,200°C	high	yes

- a. different from copper or oxygen
- b. similar to both copper and oxygen
- c. similar only to copper
- d. similar only to oxygen

Chemical Reactions

1	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2$
2	$\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
3	$\text{Mg} + \text{Cl}_2 \rightarrow \text{MgCl}_2$
4	$\text{NaOH} + \text{MgCl}_2 \rightarrow \text{NaCl} + \text{MgOH}$

2. The following equations represent chemical reactions.

Which equation shows that the total mass during a chemical reaction stays the same?

- a. 1
- b. 2
- c. 3
- d. 4

3. Which of the following forms of energy is released or absorbed in most chemical reactions?

- a. light energy
- b. electrical energy
- c. sound energy
- d. heat energy

4. Which of the following describes signs that a chemical change is occurring?

- a) A substance changes shape or state.
- b) A substance gives off or absorbs heat.
- c) A substance is dense and malleable.
- d) A substance is flammable and reactive.

5. As a sample of water turns to ice,

- a. new molecules are formed.
- b. the mass of the sample is increased
- c. the arrangement of the molecules changes
- d. energy is absorbed by the molecules

6. The table below shows the pH and reaction to litmus of four body fluids. These data indicate that gastric juice is

- a. very acidic
- b. very basic
- c. positively charged
- d. negatively charged

Body Fluid	pH	red litmus	blue litmus
Blood	7.4	turns blue	no change
Bile	8.2	turns blue	no change
Saliva	6.8	no change	turns red
Gastric Juice	1.7	no change	turns red

7. Which of the compounds in the table is most likely a covalent compound?

- a. compound A
- b. compound B
- c. compound C
- d. compound D

8. Under what conditions are particles of covalent compounds formed?

- a. oppositely-charged ions transfer electrons and form a bond
- b. two or more atoms share electrons
- c. an atom of a noble gas bonds with an atom of a transition metal
- d. two metal atoms form a bond

9. What type of compound increases the number of hydronium ions when dissolved in water?

- a. an acid
- b. a base
- c. an indicator
- d. hydrogen gas

10. What factor does the pH scale measure?

- a. the degree of neutralization between acids and bases
- b. the concentration of hydroxide ions in a solution
- c. the number of salt molecules present in a solution
- d. the concentration of hydronium ions in a solution

11. Which solution listed in the table is the most acidic?

pH of Some Solutions	
Solution	pH
A	12.89
B	2.33
C	12.1
D	3.50

- a. solution A
- b. solution B
- c. solution C
- d. solution D

Chemical & Physical Properties & States of Matter QUIZ

Multiple Choice: Identify the letter of the choice that best completes the statement or answers the question AND fill in the blank.

B 12. Which of the following is NOT a chemical property?

- a. reactivity with oxygen c. flammability
b. malleability d. reactivity with acid

A 13. You accidentally break your pencil in half.

This is an example of

- a. a physical change. c. density.
b. a chemical change. d. volume.

D 14. Which of the following is NOT a physical property of matter?

- a. ductility b. color c. thermal conductivity d. reactivity to water

B 15. During physical changes, matter always retains its

- a. size. b. identity c. state. d. texture.

C 16. Which of the following is an example of a physical change?

- a. a silver spoon tarnishing c. a popsicle melting
b. a cake baking in an oven d. a car rusting

B 17. Two substances that undergo a chemical change together are ____ with one another.

- a. ductile c. conductive
b. reactive d. soluble

D 18. A favorable chemical property of iron is its

- a. malleability. c. high melting point.
b. strength. d. non-reactivity with oil and gasoline.

B 19. You are given two samples and are told that one is plastic and the other is wax. If you had to distinguish between the two using ONLY chemical properties, you could

- a. hit the samples with a hammer.
b. burn the samples.
c. determine the densities of the samples.
d. All of the above

B 20. As you clean the kitchen cupboards, you find an unlabeled container of white powder. As you set the container on the countertop, you accidentally spill some of the powder into a cup of vinegar. The mixture fizzes and bubbles, which means that the white powder is

- a. corn starch. b. baking soda. c. flour. d. powdered sugar.

A 21. The melting of butter when it is left out in a warm room is an example of

- a. a physical change. c. a physical property.
b. a chemical change d. a chemical property.

B 22. Although the Statue of Liberty is made of copper (originally an orange-brown color), it is green because the copper has interacted with substances in the air to form new substances with different properties. This is an example of a

- a. physical change. c. physical property.
b. chemical change. d. chemical property.

B 23. Precious metals in catalytic converters on cars change harmful carbon monoxide exhaust fumes to harmless ones.

This is an example of a ____ change.

- a. physical b. chemical c. characteristic d. Both (a) and (c)

B 24. Color, odor, mass, and volume are ____ of an object.

- a. chemical properties c. stationary properties
b. physical properties d. inertial properties

A 25. Flammability, solubility, and reactivity are ____ of a substance.

- a. chemical properties c. stationary properties
b. physical properties d. gravitational properties

B 26. Being able to burn wood is an example of wood's

- a. soluble properties. c. physical properties.
b. chemical properties. d. ductile properties.

B 27. When you add bleach to the water while you are washing your clothes, you are encouraging

- a. conductivity. c. ductility.
b. a chemical change. d. a physical change.

A 28. "Paper is white."

This is an example of WHAT PROPERTY?

- a. physical b. chemical c. personal d. real estate

B 29. "Paper is flammable (can burn)."

This is an example of WHAT PROPERTY?

- a. physical b. chemical c. personal d. real estate

B 30. "Water cannot burn."

This is an example of WHAT PROPERTY?

- a. physical b. chemical c. personal d. real estate

A 31. "Water evaporates"

This is an example of WHAT KIND OF CHANGE?

- a. physical b. chemical c. personal d. real estate

A 32. "Rubbing alcohol evaporates"

This is an example of WHAT KIND OF CHANGE?

- a. physical b. chemical c. personal d. real estate

A 33. You accidentally drop your cell phone, and it breaks in half! This is an example of WHAT KIND OF CHANGE?

- a. physical b. chemical c. personal d. real estate

C 34. What scale is used to measure how strong an ACID or a BASE is?

- a. gram scale b. a balance scale c. pH scale

$\frac{1}{2}$ pt each: _____/17