

Chapter 2

This chapter's focus is on MATTER.

Introduction: This chapter explores what everything is. Everything happens because of chemistry, and everything is made up of matter, and everything happens because of how it is organized and how it changes.

Chapter 2.1 Summary - *Particulate Nature of Matter*

- Matter is the “stuff” of which the universe is composed.
- The main properties of matter is that it has mass, and takes up space.
- Matter is composed of small particles called atoms.
- Atoms are too small to see with the naked eye.
- Objects are much more particulate than they appear, but objects of similar atoms will appear much more similar under high magnification.

Chapter 2.2 Summary - *Elements and Compounds*

- There are about 100 different types of atoms that make up matter.
- Each different type of atom is known as an individual element.
- Each element's atoms are different from another element's atoms, but atoms from the same element are uniform.
- When elements are combined, it is known as a compound.
- A compound is a substance made by bonding two or more substances in a specific way.
- Atoms in a given compound are uniform.
- A molecule is made up of atoms that are stuck together, such as H₂O and CO₂.
- Atoms of the same element can also bond to form molecules, such as O₂ or Cl₂.
- Different amounts of atoms from the same element can form different molecules, for example, depending on the amount of carbons, a carbon molecule can form diamond or graphite.
- A compound always has the same composition, for example water will always be composed of H₂O. Pure oxygen and pure hydrogen always have the same composition as well.

Chapter 2.3 Summary - *The States of Matter*

- The three states of matter are solid, liquid, and gas.
- Water has examples of these three states of matter, we know them as ice, water, and steam.
- Ice is the solid form of water, water is the liquid form of H₂O and steam is water as a gas.
- Solids are rigid, a liquid has a measurable volume, but is not rigid and takes the form of it's container, while gas has no volume or shape, but it takes the form of it's container.

Chapter 2.4 Summary - *Physical and Chemical Properties and Changes*

- Physical properties are what we can distinguish people and things by.
- Physical properties are those that we can detect with our senses. (Color, texture, odor, etc.)
- Chemical changes apply to somethings ability to form new substances.
- Chemical changes are changes like burning and digestion. A chemical change changes molecules, and changes substances (not atoms) fundamental characteristics, essentially

making them new substances.

- If a change occurs and the molecules are still intact, the change is physical (ex: heating something, cutting it, sanding it, etc. NOT BURNING, that's chemical.)
- If something is electrified and becomes a different substance (as in the molecules being split to become different molecules), then the change is chemical.
- Chemical changes, like rust, are called reactions.

Chapter 2.5 Summary - *Mixtures and Pure Substances*

- A mixture has variable composition (like wood, sand and sugar, soda, pizza, and much much more).
- Even air is a mixture of various molecules. It is not a pure substance.
- The main difference between a mixture and a compound is that a mixture's composition and ratio varies, while a compound's composition and ratio does not.
- The composition of a pure substance never changes
- Pure substances are either elements or compounds.
- Mixtures can be separated into two or more pure substances.
- Homogeneous mixtures are the same throughout, such as dissolved substances or substances such as some drinks, sauces, or soups (those that don't have chunks or different parts floating around).
- Homogeneous mixtures are also called solutions.
- Solutions of solids, like metals, also exist.
- Metal solutions are called alloys, and are things such as brass (copper and zinc). They sometimes have different names based on the ratios of each metals.
- Heterogeneous mixtures have different properties in some areas than in others, and different ratio between the areas.

Chapter 2.6 Summary - *Separation of Mixtures*

- A method of separating mixtures into their pure substances is distillation
- This is used to separate water from its other contents, and is performed by heating the water into gas. When it cools it flows into a separate area, leaving the other contents in the original spot.
- The individual substances stay the same, and the changes to the water are physical.
- We can separate other things from water by filtration.
- In this method of separation, the water mixture is poured onto a mesh, or some filter paper. The water passes through but the other substances cannot (as long as they are solid or have a different consistency than the water).

Vocabulary

1. Matter - What everything in the universe is composed of.
2. Atom - The smallest particle of matter.
3. Compound - A substance made of two or more elements bonded in a specific way.
4. Molecule- Made up of two or more atoms that are "stuck together".
5. Element - A specific type of atom.
6. Solid - A rigid substance with shape and form.
7. Liquid - A substance that takes the shape of it's container but has specific volume.

8. Gas - A substance without shape that takes shape of it's container.
9. Physical properties - A substance's odor, color, shape, volume, density, etc.
10. Chemical properties - A substance's ability to form new substances, such as firewood being able to release heat and gas and then reduce to ash.
11. Physical change - A process that can affect appearance and tangible properties of a substance does not affect the chemical composition of a substance, such as melting ice.
12. Chemical change - A process that affects the chemical composition of a substance, such as electrolysis.
13. Reaction - Another word for a chemical change.
14. Mixture - A substance with variable composition.
15. Alloy - A mixture of metals to change their composition.
16. Pure substance - A specific elements or compound in a large quantity.
17. Homogeneous mixture - A mixture that's the same throughout.
18. Solution - Another word for a homogeneous mixture.
19. Heterogeneous mixture - A mixture whose ratio and properties change in different areas.
20. Distillation - A method to separate mixtures containing liquids and solids into pure substances through heating.
21. Filtration - A method to separate mixtures containing liquids and solids into pure substances by filtering the water out.

20 Vocabulary Questions

1) Vocab Match up:

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|--------------------------|---|
| A. Distillation | a. A change that effects tangible properties |
| B. Filtration | b. A substance's ability to form new substances |
| C. Pure Substance | c. A method of separating liquids by filtering out solids |
| D. Gas | d. Everything in the universe |
| E. Compound | e. A substance with a set shape or form (other than physical change) |
| F. Solid | f. A word for chemical change |
| G. Reaction | g. A mixture of metals |
| H. Heterogeneous Mixture | h. A mixture with inconsistent properties and substance ratios |
| I. Alloy | i. A substance made of two or more elements |
| J. Solution | j. An element or compound in large quantities |
| K. Chemical Properties | k. A substance that can easily shift and takes the shape of its container |
| L. Mixture | l. A mixture that stays the same throughout (in ratio and composition) |
| M. Chemical Change | m. A change affecting chemical composition |

N. Physical Properties

n. The smallest particle of matter (each element has a different one)

O. Homogeneous Mixture

o. A substance with variable composition (two or more elements, molecules, or compounds)

P. Element

p. Two or more elements that are stuck together by a bond

Q. Matter

q. A method of separating substances through heating

R. Physical Change

r. The measurable qualities of a substance that we can perceive with our senses

S. Atom

s. Another term for a heterogeneous mixture

T. Liquid

t. A specific type of atom

U. Molecule

u. A substance that can take the shape of its container but has a specific mass (tangible)

2) What is matter?

3) What would be a heterogeneous mixture

4) What would be a homogeneous mixture

5) What can you use distillation for?

6) What can you use filtration for?

Chemical or Physical Property? (C or P)

7) Roughness

8) Rusting

9) Electrocution

10) Color

11) Change from liquid to solid

12) Shattered

13) Heavy

14) Reacted with energy to form a new molecule

15) Smashed into another particle with a particle accelerator

Element, Compound, or Mixture (E, C, or M)

16) Soup

17) Sea Water

18) Oxygen

19) Starch

20) Caffeine

10 Problems Relating to the Chapter

1. Give 2 examples of a physical property
2. Give 2 examples of a chemical property
3. Give 2 examples of a physical change
4. Give 2 examples of a chemical change
5. What is the difference between a compound and a molecule?
6. Are compounds homogeneous mixtures? Explain.
7. How is distillation performed?
8. How do chemical changes occur?
9. Give an example of a reaction.
10. Give an example of a substance as a liquid, a metal, and a gas.

5 Questions Integrating Material from other Chapters.

1. How many elements are in the molecule Al_2O_3 ?
2. How many molecules are in the molecule $(\text{Al}_2\text{O}_3)_4$?
3. What are the three main types of elements?

4. With what unit are (concentrated) substances measured with?

5. What is phosphorus (II) oxide? A- Compound B- Molecule C- Element