

Grade 10 Chemistry Study Guide

Chapter 1. Chemistry: The science of matter

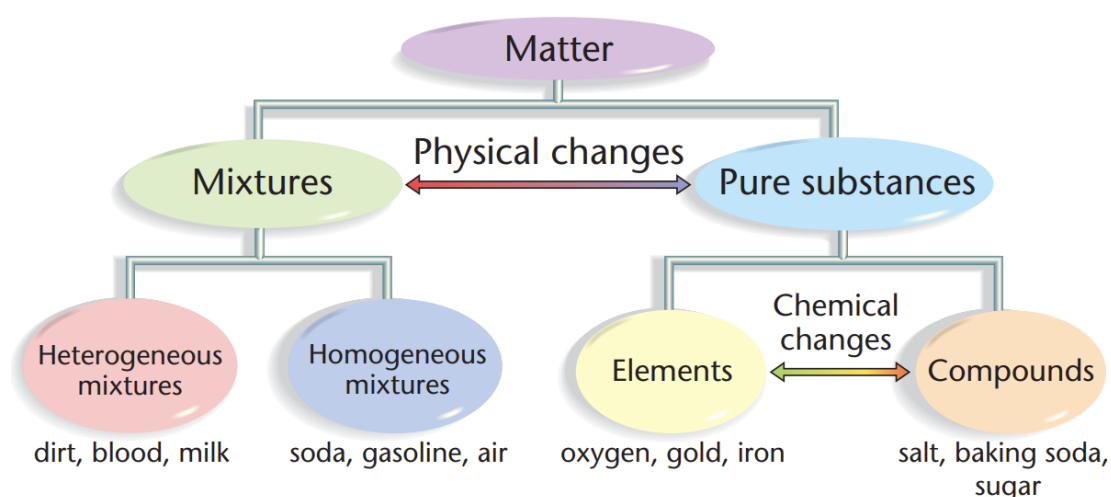
Big idea: Everything is made of matter.

1.1 The puzzle of matter

Matter can be categorized into Mixtures and Pure Substances.

Pure Substances can be further categorized into Elements and Compounds.

Mixtures can be further categorized into Heterogeneous Mixtures and Homogeneous Mixtures (Solutions).



Chapter 2. Matter is made of atoms.

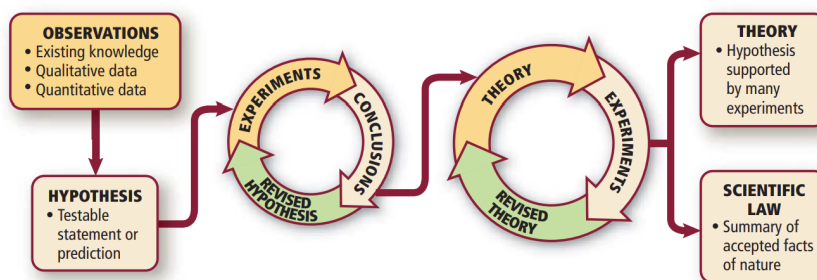
Big idea : Atoms are the fundamental building blocks of matter.

2. 1 Atoms and Their Structures

All matter is made of atoms.

Various Scientific Terminologies:

■ **Figure 2.5** Scientists make observations that lead to hypotheses. A hypothesis must be tested by multiple investigations. If the results do not support the hypothesis, they become the observations that lead to a new hypothesis. A hypothesis that is refined and supported becomes a theory that explains a fact or phenomenon in nature.



2. Evolution of the Atomic Theory

(1) John Dalton's atomic theory

(2) Thomson discovered the presence of electrons through an experiment in which he found that particles from atoms were attracted to positive charges.

(3) Scientists discovered protons similarly to how electrons were discovered.

(4) Rutherford determined the basic internal structure of atoms through an experiment.

(4) Thomson discovered Isotopes and later the presence of neutrons were confirmed.

3. Structure: An atom is made of a nucleus containing protons ("+") and neutrons; electrons ("-") move around the nucleus. The mass of an atom is concentrated in a tiny nucleus.

2. 2 Electrons in atoms

Electrons must have enough energy to keep them in constant motion around the nucleus.

Electromagnetic waves are a form of waves that transport energy. They have both electric and magnetic properties such as:

- a. They can travel through empty space.
- b. They transfer energy.
- c. Wavelength decreases and Frequency increases as energy increases.

The full range of electromagnetic radiation is called the Electromagnetic Spectrum. Electrons release certain frequencies of energy when excited. The spectrum of light released from excited atoms of an element is called the emission spectrum of that element. Electrons can only have a certain amount of energy and move around the nucleus that correspond to that amount of energy. They are called energy levels.

Valence electrons determine the chemical property of an element. Lewis dot diagrams can be used to represent the valence electrons in a given atom.

Chapter 4.

4.2 How elements form compounds

1. Noble gases are extremely stable. The octet rule says that an atom becomes stable by having eight electrons in its outer energy levels (achieving a noble gas configuration).

2. Ways to achieve stability

(1) Transfer of valence electrons between atoms (Ionic compound) i.e.: NaCl

(2) Sharing valence electrons between atoms (Covalent compound) i.e.: Water

A crystal is a regular, repeating arrangement of atoms, ions, or molecules, such as NaCl.

3. Ionic compound

(1)

(2) Properties

4. Covalent compound

(1)

(2) Properties

a. inter-particle forces

Chapter 7. Completing the model of the atom.

Big idea

Valence electrons determine the properties of elements and their positions in the periodic table.

7.1 Present-Day Atomic Theory

1. The present-day model

2. Valence electrons and the periodic table

(1) For example: The atomic number of sulfur is 16 \rightarrow 16 electrons; Sulfur is in group 16 and period 3 \rightarrow 6 valence electrons in the third level.

(2) Sublevels (Division within a level):

a. Each energy level has a specific number of sublevels, which is the same as the number of the energy level for the first four periods on the periodic table.

b. The big gaps correspond to the energy released when an electron jumps from one energy level to another.

c. If electrons are distributed over one or more sublevels within an energy level, then these electrons would have only slightly different energies.

e. x. The first energy level has one sublevel. It's called the 1s sublevel. The second energy level has two sublevels, the 2s and 2p sublevels. The third energy level has three sublevels: the 3s, 3p, and 3d sublevels; and the fourth energy level has four sublevels: the 4s, 4p, 4d, and 4f sublevels. Within a given energy level, the energies of the sublevels, from the lowest to highest, are s, p, d, f. ($s_{\max} = 2$, $p_{\max} = 6$)

There are $2n - 1$ orbitals in the n^{th} sublevel.

There are $2n^2$ electrons in the n^{th} energy level.

7.2 The periodic table and atomic structure

1. Orbitals

(1) The space in which there is this high probability of finding the electron is called an orbital.

(2) An orbital can hold a maximum of 2 electrons.

(3) An orbital has the same name as its sublevel.

2. Electron configuration

(1) e. x. Hydrogen has a single electron in the first energy level. Its electron configuration is $1s^1$. The number 1 refers to the energy level, the letter s refers to the sublevel, and the superscript refers to the number of electrons in the sublevel.

(First period)

3. (Imagine diagonal lines about the configuration)

					Noble gases
1 s					He
2 s	2 p				Ne
3 s	3 p	3 d			Ar
4 s	4 p	4 d	4 f	Kr	
5 s	5 p	5 d	5 f	Xe	
6 s	6 p	6 d			Rn
7 s	7 p				

4. Periodic table (Period: Horizontal; group: vertical)

(1) s block: active metals (group 1,2)

p block: metals, metalloids and nonmetals (13 – 18)

groups 3 – 12, d block: transition elements (Have valence electrons in both s and d sublevels).

f block: inner transition elements (Their valence electrons are in s and f sublevels).

Chemistry Test Practice

there is a surprise in the following questions

1. The number of protons in the nucleus of the atoms of an element determines the element's_____.
A. Atomic number

- B. atomic mass
 - C. mass number
 - D. valence
2. Lavoisier came to the conclusion that the air is a mixture made up mostly of these two gases.
- A. Nitrogen and oxygen
 - B. Oxygen and carbon dioxide
 - C. Hydrogen and oxygen
 - D. Oxygen and methane
3. The mass of a atom is most concentrated in_____.
- A. The electrons
 - B. The protons
 - C. The neutrons
 - D. The nucleus
4. In general, the interparticle forces in covalent compounds are_____ those in ionic compounds.
- A. Multiples of
 - B. The same strength as
 - C. Stronger than
 - D. Weaker than
5. How many electrons are shared when two atoms of oxygen combine with one atom of carbon?
- A. 8
 - B. 16
 - C. 12
 - D. 22
6. Which theory express one of the rules of the Dalton's theory?
- A. The world is composed by empty space and matter

- B. Atoms can be separated
 - C. All matter is made of atoms
 - D. Almost all mass of an atom is contained in a tiny nucleus
7. The Heisenberg uncertainty principle states that it is fundamentally impossible to know both the_____.
- A. Mass and size
 - B. Energy and orientation
 - C. Mass and position
 - D. Position and energy
8. When an iron atom loses all its 4s electrons and one 3d electron, what is its electric charge?
- A. 5+
 - B. 6+
 - C. 3+
 - D. 5-
9. The transition elements are in the place in periodic table where the_____ represents.
- A. The s area
 - B. The p area
 - C. The d area
 - D. The f area
10. The transition elements are usually have_____ oxidation elements
- A. One
 - B. More than one

The periodic table: [Periodic Table - Ptable - Electrons - Oxidation states](#)

Answers: AADDA CDCCB

11. Which of the following statement is a hypothesis (under the present circumstances)?
- A. Sun rises every day
 - B. Beavers live near the rivers, based on a period of observation
 - C. A molecule can be divided into smaller parts
 - D. Donald Trump flew an UFO above the New York City
12. The number of protons in the nucleus of the atoms of an element determines the element's_____.
- A.Atomic number
 - B.atomic mass
 - C.mass number
 - D.valence
13. Lavoisier came to the conclusion that the air is a mixture made up mostly of these two gases.
- A.Nitrogen and oxygen
 - B.Oxygen and carbon dioxide
 - C.Hydrogen and oxygen
 - D.Oxygen and methane
14. The mass of a atom is most concentrated in_____.
- A.The electrons
 - B,The protons
 - C.The neutrons
 - D.The nucleus
15. In general, the interparticle forces in covalent compounds are_____ those in ionic compounds.
- A.Multiples of
 - B.The same strength as

C.Stronger than

D.Weaker than

16. How many electrons are shared when two atoms of oxygen combine with one atom of carbon?

A.8

B.16

C.12

D.22

17. Which theory express one of the rules of the Dalton's theory?

A.The world is composed by empty space and matter

B.Atoms can be separated

C.All matter is made of atoms

D.Almost all mass of an atom is contained in a tiny nucleus

18. The Heisenberg uncertainly principle states that it is fundamentally impossible to know both the_____.

A.Mass and size

B.Energy and orientation

C.Mass and position

D.Position and energy

19. When an iron atom loses all its 4s electrons and one 3d electron, what is its electric charge?

A.5+

B.6+

C.3+

D.5-

20. The transition elements are in the place in periodic table where the_____ represents.

A.The s area

B.The p area

C.The d area

D.The f area

21. The transition elements are usually have_____ oxidation elements

A.One

B.More than one

22. What is the name of NO_2

A. nitrogen monoxide

B. Dinitrogen oxide

C. Nitrogen oxide

D. Dinitrogen monoxide

23. The sum of the charges in an ionic compound must equal

A. Negative eight

B. Positive one

C. Positive eight

D. zero

Answers: BAADD BCDCC BCD

Hope all of you can get a satisfied score on your midterm!