

PROPERTY OF:

EARTH SCIENCE – UNIT 1 – CHAPTER 2 NOTES

MATTER

2.1 Levels of Organization

3. MOLECULE = a chemical made of 2 or more atoms
(water = H₂O, carbon dioxide = CO₂)
2. ATOM = the smallest unit made of only one element
(hydrogen, carbon, helium, nitrogen)
1. SUBATOMIC PARTICLE = particles found inside an atom
(protons, neutrons, electrons)

2.1 Subatomic Particles

1. PROTON
Location: found in the “nucleus” of an atom
Function: # of protons determines the type of atom
Charge: positive
2. NEUTRON
Location: found in the “nucleus” of an atom
Function: helps to stabilize the protons
Charge: neutral
3. ELECTRON
Location: spin around in “orbitals” that surround the nucleus
Function: used to form ionic bonds and covalent bonds
Charge: negative

2.1 The Periodic Table

1. Proper notation of elements: first letter capitalized, second letter lowercase
EX: N = nitrogen
I = iodine
Ni = nickel
NI = nitrogen iodine
2. 4 most common elements in biology: carbon, hydrogen, oxygen, nitrogen
3. atomic number = the number of protons, neutrons, and electrons in an atom (usually)
4. inert gases = He, Ne, Ar, Kr, Xe, Rn = elements that do not react with others because their outer orbitals are already filled with electrons (non-reactive!)
5. metals = located to the left of the staircase, have positive charges
6. non-metals = located to the right of the staircase, have negative charges

2.2 Three Rules for Orbital Diagrams

1. Write the number of protons and neutrons in the middle.
 2. Draw the first 2 electrons in the 1st orbital.
 3. Draw up to 8 electrons in each additional orbital.
- Provide examples of orbital diagrams in class (Li, C, S, Mg).*

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2.2 Types of Chemical Bonds

1. IONIC BOND

a bond that forms when one atom gives an electron to another atom in order to make both outer orbitals filled

also called a “give and take” bond

ion = an atom that has gained or lost electrons

+1 ion = an ion that has lost one electron

+2 ion = an ion that has lost 2 electrons

+3 ion = an ion that has lost 3 electrons

-1 ion = an ion that has gained 1 electron

-2 ion = an ion that has gained 2 electrons

-3 ion = an ion that has gained 3 electrons

Provide examples of ion orbital diagrams in class (Na⁺, Cl⁻).

Provide examples of ionic bond formation in class (BeO, LiCl).

2. COVALENT BOND

a bond that forms when atoms must share electrons

so that their outer orbitals are completely filled

also called a “sharing” bond

Provide examples of covalent bond formation in class (N₂, H₂O, O₂).

2.2 Properties

1. Chemical Property = characteristics of an element or compound that determine how it will react with other elements or compounds
(EX: effect of acid, effect of air, effect of water)
2. Physical Property = characteristics of an element or compound that do NOT determine how it will react with other elements or compounds
(EX: density, color, mass, boiling point)

2.2 Combinations

1. Mixture = a combination of different substances in which each of the components keeps its own physical and chemical properties
EX: Heterogenous Mixture = each component CAN be separated (EX: salad)
EX: Homogenous Mixture = each component CAN NOT be separated (EX: cake batter)
2. Solution = a type of mixture in which one substance is dissolved in another
3. Compound = a combination of different elements in which the physical and chemical properties are different than the properties of the original elements (also called a molecule).

2.3 States of Matter

1. SOLID
2. LIQUID
3. GAS
4. PLASMA

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Density, Rates, and Gradients

DENSITY:

the amount of matter that occupies a particular amount of space

matter → MASS → grams

space → VOLUME → ml or cm³

density = mass ÷ volume

units: g/ml or g/cm³

RATE:

a change in a value over a particular period of time

rate = $\frac{\text{change in value}}{\text{change in time}}$

units: value/time

EX: A baby grows from 7 pounds to 21 pounds in 7 months. What is the rate of growth?

change in value = 21 – 7 = 14 pounds

change in time = 7 months

rate = 14 ÷ 7

rate = 2 pounds/month

GRADIENT:

a change in a value over a particular distance

gradient = $\frac{\text{change in value}}{\text{change in distance}}$

units: value/distance

EX: In the front of a classroom, there are 5 grams of tar fumes. In the back of the classroom, there are 2 grams of tar fumes. The classroom is 30 feet long. What is the gradient?

change in value = 5 – 2 = 3 grams of tar

change in distance = 30 feet

gradient = 3 ÷ 30

gradient = 0.1 grams/foot