

I. Properties of Matter, Atomic Structure, & Measurement

A. Circle all chemical changes below:

Condensation Erosion Corrosion Evaporating Melting Freezing
Rotting Cutting Vaporizing Combustion Boiling

B. Place (e) for element, (c) for compound, (he) for heterogeneous (ho) for homogeneous

C sugar HO Lotion C salt C water HO salt water
C water E Oxygen E Zinc HE oil and water

C. Circle or highlight the correct word that completes the statement.

- Pure substances such as compounds can only be broken down by (physical / chemical) means, whereas mixtures can be (physically / chemically) separated.
- Density is a physical (property / change). Two different amounts of pure aluminum would have the (same / different) density.
- The (more / fewer) increments on an instrument used for measurement, the more precise it is.
- (Halogens / Noble gases) have 7 valence electrons. Elements in the same (group / period) have similar reactivity; thus, Beryllium, Magnesium and (Calcium / Sodium) have similar reactivity and similar properties.
- Metals tend to (gain / lose) electrons when bonding, whereas nonmetals tend to (gain / lose) electrons in bonding. Noble gases do not react, thus they neither gain nor lose electrons in bonding.
- In gases the particles are (close together / far apart). In liquids the particles are (tightly packed / loosely sliding past one another). In solids the particles are tightly packed.
- A graduated cylinder has a volume of 25.0 ml. When a rock is placed into the water of the graduated cylinder the volume rises to 27.2 ml. If the rock weighs 2.5 grams, what is the density? Show your work! ($d=m/v$)

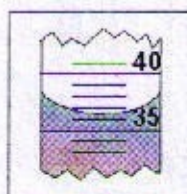
$$\frac{27.2 \text{ ml} - 25.0 \text{ ml}}{2.5} = 0.88 \text{ g/ml}$$

$$D = \frac{\text{mass}}{\text{volume}}$$

$$D = \frac{2.5 \text{ g}}{2.2 \text{ ml}}$$

$$D = 1.13 \text{ g/ml}$$

D. Answer the following questions or statements.



- What is the precise reading for this graduated cylinder? 36.2 ml
- Using correct significant figures, calculate the following: $239.8 \times 0.630 =$ 151



3. electrons are found in the orbitals or outer rings.
4. An element has 14, protons, 13 electrons, and 16 neutrons, what element is it? Silicon
5. Isotopes have fewer or more neutrons than a neutral atom.
6. Atomic mass equals the sum of the protons and neutrons.

II. Ionic Bonding

1. If an atom has 35 protons and 36 electrons, what charge does it have?
☒ a. -1 b. it's neutral c. +1 d. it's an isotope
2. If an atom has 56 protons and 54 electrons, what charge does it have?
a. -2 b. -1 c. +1 ☒ d. +2
3. Which is the Lewis Dot structure for sodium.

- a. $\cdot \text{Na} \cdot$ ☒ b. $\text{Na} \cdot$ c. $\cdot \text{Na} \cdot$ d. $\cdot \text{Na} \cdot$

4. Know how to write the formula of a compound based on its name.

- a. For covalent compounds, use the prefixes to determine the subscripts.

Write the name for P_2O_5 Diphosphorus Pentoxide

- b. For ionic compounds, use the charge on the positive and negative ions to determine the subscripts (use cross-your-heart.)

Write the name for MgCl_2 magnesium chloride

5. Know that a Roman numeral in a compound's name tells you the charge on the positive ion of a transition metal.
6. Know how to write the formula of a compound based on its name.
 - a. For covalent compounds, use the prefixes to determine the subscripts.
 - b. For ionic compounds, use the charge on the positive and negative ions to determine the subscripts (use cross-your-heart.)
 - c. For acids, always write the hydrogen first and use the name to determine the negative ion.
 - d. Know that the positive ion is always written before the negative ion.

7. What's the name for P_2Cl_5 ? (P_2Cl_5)
 - a. phosphorus chloride
 - b. phosphorus pentachloride
 - ☒ c. diPhosphorus pentachloride
 - d. phosphorus V chloride

8. What's the formula for dinitrogen trioxide?
 - a. NO_3
 - b. 2NO_3
 - c. $2\text{N}_3\text{O}$
 - ☒ d. N_2O_3

9. What's the name for Fe_2O_3 ?
 - a. iron oxide
 - b. diiron trioxide
 - c. iron II oxide
 - ☒ d. iron III oxide

10. What's the formula for lead IV oxide?

- a. FeO b. Fe₄O c. Pb₄O₂ d. PbO₂

11. What's the name for HBr?

- a. Hydrogen bromide b. hydrobromic acid c. bromous acid d. bromic acid

III. Bonds and Molecular Shapes

metal + nonmetal

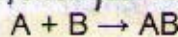
1. Know the types of bonds: ionic, polar covalent, (non-polar covalent) usually same element bonded to itself.
2. Know how to draw a Lewis Dot Structure for compounds. *valence electrons = # dots
3. If given a Lewis Dot Structure for a compound, know how to count the number of bonded and un-bonded pairs of electrons. 2 electrons per bond
4. What type of bond does NaCl have (Na electronegativity = 0.9 and Cl electronegativity = 3.0) (van
a. polar covalent b. non-polar covalent c. ionic d. electronegative
5. What type of bond does H₂ have (H electronegativity = 2.1)
a. polar covalent b. non-polar covalent c. ionic d. electronegative
6. What type of bond does H₂O have (H electronegativity = 2.1 and O electronegativity = 3.5)
a. polar covalent b. non-polar covalent c. ionic d. electronegative
7. What shape does CH₄ have?
a. bent b. tetrahedral c. trigonal planar d. trigonal pyramidal
8. What shape does BF₃ have?
a. bent b. tetrahedral c. trigonal planar d. trigonal pyramidal

IV. Chemical Reactions

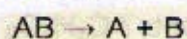
A. Things to know

1. Know how to identify the five types of chemical reactions.

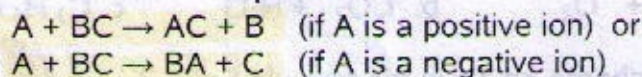
a. Synthesis or Combination



b. Decomposition



c. Single Replacement



d. Double Replacement



e. Combustion



2. Know that the reactants are on the left and the products are on the right. Reactants → products
3. Know that single replacement reactions will use the metals activity series to predict if the reaction will take place.
4. Know how to balance the equation by counting the number of each element and making sure they're equal on each side.
5. Know how to properly use coefficients and subscripts to count elements. For example, 3Al₂(SO₄)₃ means there are 6 Al's, 9 S's and 36 O's.

B. Identify the type of reaction for the following equations.

- a. Single $\text{CaCl}_2 + \text{F}_2 \rightarrow \text{CaF}_2 + \text{Cl}_2$
- b. Decomposition $2\text{H}_2\text{O} \rightarrow \text{O}_2 + 2\text{H}_2$
- c. Combustion $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- d. Double $\text{MgCl}_2 + 2\text{AgNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{AgCl}$
- e. Synthesis $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$

C. Answer the following questions.

1. Which of the following equations is balanced.

- ~~a.~~ $2\text{C}_3\text{H}_6\text{O}_2 + 9\text{O}_2 \rightarrow 6\text{CO}_2 + 12\text{H}_2\text{O}$
- b. $2\text{C}_3\text{H}_6\text{O}_2 + 9\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$
- ~~c.~~ $2\text{C}_3\text{H}_6\text{O}_2 + 7\text{O}_2 \rightarrow 6\text{CO}_2 + 12\text{H}_2\text{O}$
- d. $2\text{C}_3\text{H}_6\text{O}_2 + 7\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$

2. Which of the following equations is balanced?

- ~~a.~~ $3\text{K}_2\text{CO}_3 + 2\text{H}_3\text{PO}_4 \rightarrow 2\text{K}_3\text{PO}_4 + 3\text{H}_2\text{O} + 3\text{CO}_2$
- ~~b.~~ $3\text{K}_2\text{CO}_3 + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O} + 2\text{CO}_2$
- ~~c.~~ $3\text{K}_2\text{CO}_3 + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + \text{H}_2\text{O} + 3\text{CO}_2$
- d. $3\text{K}_2\text{CO}_3 + \text{H}_3\text{PO}_4 \rightarrow 2\text{K}_3\text{PO}_4 + \text{H}_2\text{O} + 3\text{CO}_2$

3. Will this reaction happen? $\text{Zn} + \text{MgSO}_4 \rightarrow$

Yes or No because Zn is lower on activity series!

4. Which of the following is a product of this reaction: $\text{ZnSO}_4 + \text{SrCl}_2 \rightarrow ?$

- a. ZnSr b. Cl_2SO_4 c. ZnCl_2 d. SO_4Sr

5. In this equation, which compound(s) are the reactants? $\text{C}_3\text{H}_6\text{O}_2 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

- a. $\text{C}_3\text{H}_6\text{O}_2 + \text{O}_2$ b. $\text{CO}_2 + \text{H}_2\text{O}$ c. $\text{C}_3\text{H}_6\text{O}_2$ only d. CO_2 only

6. What's the charge on Sn in the formula SnO_2 ?

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

7. What's the charge on Pb in the formula PbCl_2 ?

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

8. How many atoms of oxygen are there in $\text{Cu}_3(\text{PO}_4)_2$?

- a. 4 b. 6 c. 8 d. 12

9. How many atoms of oxygen are there in $6\text{Cu}_3(\text{PO}_4)_2$?

- a. 4 b. 6 c. 8 d. 48

10. What percent of $\text{C}_2\text{H}_4\text{O}_2$ is oxygen?

- a. 26.6 % b. 62.0 % c. 54.21 % d. 42.13 %

$$\begin{array}{l} \text{C}(2)(12) = 24 \\ \text{H}(4)(1) = 4 \\ \text{O}(2)(16) = 32 \\ \hline 60\text{g} \end{array}$$

$$\frac{32}{60} \times 100 = 54.21$$

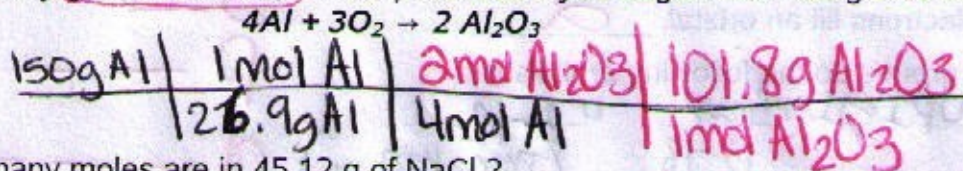
V. Stoichiometry & Molar Conversions

A. Things to know

1. Know the steps for solving all stoichiometry problems.
 - a. Write a balanced equation. Know that the coefficients for each compound represent the ratio of moles in the equation.
 - b. If you are not given moles, change what you are given into moles.
 - c. Change your moles to grams, to Liters or to number of atoms/molecules.
2. Know how to convert grams, Liters and numbers of atoms or molecules to moles.
3. Know how to convert moles to grams, Liters and numbers of atoms or molecules.
4. If you're converting to moles, you will be dividing.
5. If you have moles and are converting to something else, you will multiply.
6. Know when to use 22.4 L, molar mass and Avogadro's number (6.02×10^{23} atoms or molecules).
7. Know how to use scientific notation. If you move the decimal point to the right, you subtract. If you move it to the left, you add.

B. Solve the following problems

1. How many grams of Al_2O_3 will be produced if you began with 150 grams of Al?



SF \rightarrow 284

283.82g
 Al_2O_3

2. How many moles are in 45.12 g of NaCl?

$$\frac{45.12\text{g NaCl}}{58.5\text{g NaCl}} \times \frac{1\text{mol NaCl}}{1\text{mol NaCl}} = 0.7713\text{mol NaCl}$$

3. How many liters are in 32 g of KCl?

$$\frac{32\text{g KCl}}{74.5\text{g KCl}} \times \frac{22.4\text{L}}{1\text{mol KCl}} = 9.6\text{L}$$

VI. Electromagnetic Spectrum

1. As this energy travels through space, it exhibits wavelike behavior. This type of energy is called

Electromagnetic Radiation

2. Cellular damage due to over exposure to the sun is caused by UV waves.

3. Gamma waves are very high energy waves. They have short wavelengths and high frequency.

4. What is the frequency of a wave if its wavelength is 10 meters? (Speed of light is 3×10^8)

- a. 3×10^9 meters
- b. 3×10^9 Hz
- c. 3×10^7 Hz
- d. 3×10^7 meters

$$c = \lambda \nu \quad (\text{Speed of Light} = \text{Wave Length} \times \text{Frequency})$$
$$3 \times 10^8 = 10(x)$$

5. As frequency increases, the wavelength –

- a. Decreases
- b. Increases in length
- c. Remains the same
- d. Increases in amplitude

VII. Electron Configuration

A. Identify the elements for the electron configurations below and write the total number of electrons for the element.

$1s^2 2s^2 2p^6 3s^2 3p^2$	Element <u>Si</u>	# of electrons <u>14</u>
$1s^2 2s^2 2p^6 3s^2 3p^4$	<u>S</u>	<u>16</u>
$1s^2 2s^2 2p^6 3s^2 3p^4$	<u>S</u>	<u>16</u>
$1s^2 2s^2 2p^6 3s^2 3p^2$	<u>Si</u>	<u>14</u>

B. Answer the questions below

1. How many electrons fill an orbital. 2

2. Across what groups do the following orbitals fill:

s GROUP I & II p GROUP 13-18 d 3-12 (Transition Metals)

Sublevel s 14 orbital electrons
p —
d —

VIII. Solutions

1. In a sugar water solution, the water is the solvent and the sugar is the solute

2. What 3 factors affect the rate of dissolving a solid into a liquid.

Agitation (stirring), Raising temperature, increases solubility
and using smaller particles

3. An alloy is used in construction, because it is very cost effective. It is made of 99% aluminum and 1% carbon. What is the solute? Carbon (Aluminum is solvent)

4. Increasing the pressure and decreasing the temperature increase the solubility of a gas in a liquid.

5. The structure of water makes it a good solvent for most polar substances.

6. The molarity of a 2.5 g of KCl dissolved in 650 mL of water is:

$$M = \frac{\text{mol}}{\text{Liter}} \quad \frac{2.5 \text{ g KCl}}{74.5 \text{ g KCl}} \times \frac{1 \text{ mol}}{1} = \frac{0.0335 \text{ mol}}{0.650 \text{ L}}$$

7. If I mix 3 L of water and 1 L of lemon juice, which of the following is true?

- a. water is the solvent ✓
- b. lemon juice is the solvent
- c. water is the solution
- d. lemon juice is the solution

IX. Acids & Bases

A. Answer the following questions.

1. What ion does an acid release when added to water? H^+
2. What ion does a base release when added to water? OH^-
3. Define neutralization. Strong Acid + Strong Base \rightarrow water & salt
4. What are the reactants in a neutralization reaction? Strong Acid and Strong base
5. What are the products in a neutralization reaction? Salt and Water
6. List 3 properties of an acid. Taste SOUR, TURN Litmus Red (pH 0-6)
and React w/metal to form H_2 Gas
7. List 3 properties of an base. Taste bitter, TURN Litmus BLUE (pH 8-14)
and feel slippery
8. Define electrolyte. a solution that can carry (conducts) electric current
9. Most household cleaners are Bases

B. Determine if the following items are acid, base or neutral. In the second blank, indicate whether BLUE litmus paper would stay blue or turn red in contact with each substance.

- Base 1. seawater.....pH 8.3 STAY BLUE / TURN RED
Acid 2. apples.....pH 3.2 STAY BLUE / TURN RED

3. Which of the above contains the highest concentration of H^+ ions? Apples
4. Which of the above contains the highest concentration of OH^- ions? seawater

X. Nuclear Chemistry

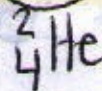
A. Things to know

- * Definition 1. An isotope is an element with a different atomic mass. (It has the same number of protons but a different number of neutrons.)
2. A nuclear decay is when an unstable isotope tries to become more stable by emitting a particle.
 3. A beta particle is the same thing as an electron. Its symbol is written as either e^- or β . In an equation it is written as ${}^0_{-1}e$. Beta particle
 4. An alpha particle is the same thing as a Helium nucleus. Its symbol is written as α . In an equation, it is written as 4_2He . Alpha particle
 5. Equations for nuclear decays are written in the format:
Isotope \rightarrow (decay particle) + (new isotope or element)
 6. Equations for nuclear fission are written in the format:
Isotope \rightarrow (new isotope or element #1) + (new isotope or element #2)
 7. Equations for nuclear fusion are written in the format:
Isotope #1 + Isotope #2 \rightarrow new isotope

B. Answer the following questions.

1. The nuclear reaction in which the nucleus of an atom breaks down to produce another element. This happens through the process of neutrons bombarding the nuclei of other atoms which causes them to split and occurs as a chain reaction. FISSION
2. The nuclear reaction in which the nuclei of atoms combine to make different atoms. FUSION
3. What does the number stand for in Na-23?
a. # protons b. # neutrons c. atomic number d. mass
4. What is the symbol of a beta particle and how do we write it in an equation?
a. ϕ and 1_0e b. α and 2_4He c. β and 1_0e d. β and 1_0e
5. What is the symbol of an alpha particle and how do we write it in an equation?
a. ϕ and 2_4He b. γ and 2_4He c. β and 1_0e d. α and 2_4He
6. Which equation shows the decay of Th-230 by alpha emission.
a. $Th-230 + {}^2_4He \rightarrow U-234$ b. $Th-230 + {}^1_0e \rightarrow Ac-230$ c. $U-234 \rightarrow Th-230 + {}^2_4He$ d. $Th-230 \rightarrow {}^2_4He + Ra-226$

Typo!



XI. Gas Laws

1. Check which of the following are main ideas of the Kinetic Molecular Theory?
☒ almost all of the volume of a gas is empty space
☒ gas particles are in constant, random motion
☐ gas particles lose kinetic energy when they collide with walls or other particles
☒ gas particles do not attract or repel each other
2. Atmospheric pressure is measured with an instrument known as a barometer.
3. In Boyles law, which two variables are inverse proportional to each other? Pressure and Volume
4. What is the new pressure of 200.0 mL of a gas that is compressed to 35.0 mL, when the original pressure was 4.00 atm and the temperature remains constant?
$$4(200) = x(35)$$
$$x = 22.8 \text{ atm}$$
6. 2.65 moles of chlorine gas at STP will have a volume of:
$$\frac{2.65 \text{ mole}}{1 \text{ mole}} \times 22.4 \text{ L} = 59.36 \text{ L}$$
 OR
$$PV = nRT$$
$$1(x) = 2.65(0.0821)(273)$$
$$x = 59.36$$
7. Calculate the volume of a 2.50 mole sample of gas at 25.0 °C and a pressure of 4.75 atm.
$$PV = nRT$$
$$4.75(x) = 2.5(0.0821)(298)$$
$$x = 12.8 \text{ L}$$
8. I placed 40 mL of shaving cream in my vacuum pump and decreased the pressure from 1 atm to 0.05 atm. What was the volume of my shaving cream?
$$0.05(40) = 1(x)$$
$$x = 2 \text{ mL}$$