

A. Measurement and Density

1. Write the formula for density. $D = \frac{m}{V}$ or $\text{Density} = \frac{\text{mass}}{\text{volume}}$
2. There are two units for density. What are they and give an example of how each unit is used and what it is used for? What instrument can be used to measure volume of an irregular shaped object? $D = \frac{\text{grams}}{\text{milliliters}}$ use a graduated cylinder to measure irreg. obj.
3. What is the volume of a sample that has a mass of 20 g and a density of 4 g/ml?

Work:

$$D = \frac{m}{V} \Rightarrow V = \frac{m}{D} = \frac{20 \text{ g}}{4 \text{ g/mL}} = 5$$

Answer: 5 mL

* final zeros to right of decimal are significant

4. How many significant figures are in the following numbers:

340.0 40.0090 24.30 3890 2

5. In proper significant figures and units find the area of a rectangle that is 4.32 cm by 31 cm?

Work:

Answer: 130 cm²

$$A = \text{length} \times \text{width}$$

$$= 4.32 \times 31 = 133.92 \rightarrow \text{round to 2 s.f.}$$

6. Solve the following problem and express the answer in proper significant figures:

$$6.25 + 9.005 + 2.53 = 17.784 \rightarrow \text{round to hundredth's place} \rightarrow 17.78$$

7. Define precision. There are 2 definitions 1.) How well a series of measurements agree (get same number every time) 2.) The number of decimal places you can read off an instrument.
8. True or False: The number of decimal places a measurement has indicates the precision of the instrument used to acquire that measurement. True

9. Which of the following sets of measurements is most precise?
- C

Instrument	First Measurement	Second Measurement	Third Measurement
A	4.52	3.52	5.52
B	4.42	4.31	4.50
C	4.48	4.51	4.47

not precise
" "
precise

10. Define and list examples of each of extensive and intensive properties:

intensive property: A physical property which does NOT depend on the1. color2. density3. melting/boiling
POINTSize of the
sampleextensive property: A physical property that DOES depend on the size of the sample1. length2. mass3. volume

B. Properties of Matter/Chemical vs Physical Changes

10. Define and give examples of the following:

	Definition	Examples
chemical property	The ability of a substance to combine with or change into one or more other substances	1. Iron will rust 2. inertness (unreactivity) of Noble gas 3. copper will react with acid
physical property	is a characteristic that can be observed or measured without changing the sample	4. Density 2. color/odor/taste 3. Melting Point/Boiling Point
chemical change always produces a new substance	The process that involves one or more substances changing into new substances.	1. explode, rust, oxidize 2. tarnish, ferment, burn, rot 3. "A chemical Reaction"
physical change are reversible!	Alter a substance without changing its composition	1. Dissolving 2. Any/all phase changes except melting boiling 3. Cutting, bending (shape changes)

11. What is the difference between a mixture and a pure substance? a mixture can be separated by physical means, such as distillation or filtration. A pure substance can't be separated by physical means only chemical means

12. Define and give examples of a homogeneous mixture, a heterogeneous mixture, and a solution.

	Definition	Examples
homogeneous mixture (smooth, all looks same)	uniform composition throughout	1. air (oxygen dissolved in nitrogen) 2. salt water 3. an alloy (solid dissolved in a solid.)
heterogeneous mixture	Does not blend smoothly, individual substances remain distinct.	1. pizza 2. orange juice (with pulp) 3. sand and water
solution	a homogeneous mixture	1. vinegar 2. Kool-Aid 3. tap water

from sink - contains ions 2

13. Classify the following items as an element, compound, homogenous mixture, or heterogeneous mixture:

element argon heterogeneous mixture orange juice heterogeneous mixture soil
compound NaCl homogeneous mixture air element Cu

C. Periodic Table and Atomic Structure

14. The smallest particle of an element that retains the properties of the element is called a/an

atom protons

15. What does atomic number represent? protons + neutrons is equivalent to the mass number of an atom.

16. How many of each of the following does a neutral atom of fluorine have?

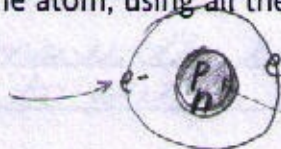
protons 9 neutrons 10 electrons 9

17. What charge does each of the following subatomic particles have?

protons +1 neutrons 0 electrons -1
neutral

18. Draw the basic structure of the atom, using all the subatomic particles.

electrons are located in the electron cloud



protons and neutrons are located in the nucleus.

19. What is an isotope? atoms that have the same number of protons but different

20. How many of each of the following does $^{123}_{51}\text{Sb}$ have? $123 - 51$

protons 51 neutrons 72 electrons 51

21. Calculate the average atomic mass of the element X. Then use the periodic table to identify the element. Show all your work on your answer sheet.

Isotope	Mass (amu)	Percent Abundance %
^{27}X	27.977	92.23
^{28}X	28.976	4.67
^{29}X	29.974	3.10

change to decimal form

Work:

Answer: Si

weighted average

$$\text{Ave Atomic mass} = (27.977 \times 0.9223) + (28.976 \times 0.0467) + (29.974 \times 0.0310) = 28.086 \text{ a.m.u.}$$

Look on periodic table, it is Silicon

22. A blank periodic table is provided below. Label the groups numbers, period numbers, representative elements, transition elements, metals, alkali metals, alkaline earth metals, inner transition metals, nonmetals, halogens, noble gases, and metalloids.

23. Which is the least reactive group? The Noble Gases (Group 18/VIII A)
24. Which is the most reactive group of metals? The Alkali Metals (IA)
25. Atoms of elements that are in the same group have the same number of –
 a. protons b. neutrons c. valence electrons d. protons and neutrons
26. Explain the octet rule. atoms will lose, gain, or share their valence electrons to get

D. Ionic Bonding and Nomenclature

27. When an atom loses one or more valence electrons, it is called a cation and has a positive charge.
28. Describe the formation of an ion (How does Li become Li^+). Lithium, Li, has one outer, or 'valence' electron. It will lose this electron and become Li^+
29. A/ An ionic bond is an attraction between oppositely charged ions.
30. Ionic bonds form between metals and nonmetals.
31. What happens to electrons in an ionic bond? The electron(s) are transferred from the metal to the nonmetal
32. How do you determine the correct subscripts in a chemical formula? add subscripts so that the overall charge ('net' charge) is zero
33. How many ^{more} electrons do the following elements need to satisfy the octet rule?
 Phosphorous 3 Oxygen 2 Bromine 1 Neon 0
34. How many valence electrons does Aluminum have? 3

35. What will Aluminum's ionic charge become when it bonds with a nonmetal? +3
36. Determine the correct formula for the ionic compound composed of the following pairs of ions:
 sodium and nitrate NaNO_3 cesium and nitrogen Cs_3N
 aluminum and bromine AlBr_3 iron (II) and sulfate FeSO_4
37. Name the following compounds:
 NaBr Sodium bromide CaCl_2 calcium chloride $\text{Cu}(\text{NO}_3)_2$ copper(II) nitrate

38. Write the formulas for the following

Iron III oxide Fe_2O_3
 Iron II oxide FeO
 Iron III sulfate $\text{Fe}_2(\text{SO}_4)_3$

Aluminum sulfide Al_2S_3
 Aluminum sulfite $\text{Al}(\text{SO}_3)_3$
 Aluminum sulfate $\text{Al}_2(\text{SO}_4)_3$

E. The Beloved Mole

39. Describe how the mole is used in chemistry. The mole lets us convert from mass in grams to number of particles.
40. What is Avogadro's number and why is it used? 6.02×10^{23} We need such a big number to count very, very small particles
41. What is molar mass? The mass of 1 mole (Avogadro's number) of a substance,
42. What is the molar mass of bromine? 79.904 g/mol
43. What is **molar mass** of Calcium Phosphate?

Work: $\text{Ca}_3(\text{PO}_4)_2$

$$\begin{aligned} & (3 \times 40.08) \\ & + (2 \times 30.974) \\ & + (8 \times 15.999) = \end{aligned}$$

Answer: 310.18 g/mol

44. What is the **percent composition** of sodium in sodium phosphate?

Work: Na_3PO_4

$$\begin{aligned} 3 \times 22.990 &= 68.970 \\ 1 \times 30.974 &= 30.974 \\ 4 \times 15.999 &= 63.996 \end{aligned}$$

$$\% \text{Na} = \frac{68.970}{158.966} \times 100 = 43.387\%$$

Answer: 43.387%

45. How many **particles** are in 26 moles of Aluminum Bromide?

Work:

$$\frac{26 \text{ mols}}{1 \text{ mol}} \times 6.02 \times 10^{23} \text{ parti} =$$

Answer: 1.6×10^{25}

(rounded to 2 sig. figs.)

46. If you have 0.125 moles of aluminum, how many **atoms** of aluminum do you have?

Work:

$$\frac{0.125 \text{ mol Al}}{1 \text{ mol}} \times 6.02 \times 10^{23} \text{ atoms} =$$

Answer: 7.53×10^{22} atoms

47. If you have 25.25 moles of aluminum, how many **grams** of aluminum do you have?

Work:

$$\frac{25.25 \text{ mol Al}}{1 \text{ mol Al}} \times 26.982 \text{ g} =$$

Answer: 681.3 g

48. How many **moles** are in 120.5 grams of calcium chloride?

Work:

$$\frac{120.5 \text{ g}}{110.99 \text{ g}} \times 1 \text{ mol CaCl}_2 =$$

Answer: 1.086 mol

CaCl_2 mm = $40.08 + 2(35.453) = 110.99$

49. What is the formula of a compound which has the smallest whole number ratio of the elements called? empirical formula

50. What is the empirical formula for $\text{C}_6\text{H}_3\text{O}_3$? $\text{C}_2\text{H}\text{O}$

F. Chemical Reactions

reactants $\xrightarrow{\text{yields}}$ products

51. What are reactants?

The "starting materials", on left side of arrow $R \rightarrow$

52. What are products?

The "ending materials", on the right side of arrow $\rightarrow P$

53. Name the reaction types for the following chemical reactions?

$\text{HCl} \rightarrow \text{H}_2 + \text{Cl}_2$ Synthesis

$\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$ Synthesis

$\text{Li}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{LiCl} + \text{BaSO}_4$ double replacement

$\text{CH}_4 + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$ combustion

54. What law dictates the need to balance chemical equations?

The Law of Conservation of Mass

55. The law of conservation of mass states that mass cannot be –
created or destroyed

a. burned

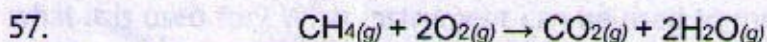
b. changed in form

c. created or destroyed

d. heated or cooled

56. According to the law of conservation of mass states the total mass of the reactants must be _____ the mass of the products in a chemical reaction?

a. more than b. equal to c. less than



For the reaction above, if 46.0 g of methane (CH_4) reacts with 96.0 g of oxygen to produce 54.0 g water, how much carbon dioxide is produced?

Work:

$$46.0 + 96.0 \rightarrow X + 54.0$$

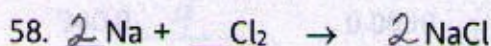
$$142.0 = X + 54.0$$

$$X = 142.0 - 54.0 = 88.0 \text{ g}$$

Answer:

88.0 g

Balance the following equations and predict the type of reaction:



Type= Synthesis

Ratio of Coefficients = 2:1:2



Type= double replacement

Ratio of Coefficients = 1:2:1:1



C-8
H-20
O-26

C-8
H-20
O-26

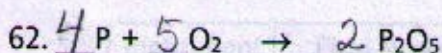
Type= Combustion

Ratio of Coefficients = 2:13:8:10



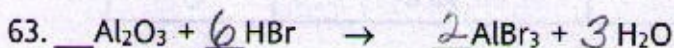
Type= single replacement

Ratio of Coefficients = 2:3:1:3



Type= Synthesis

Ratio of Coefficients = 4:5:2



Type= double replacement

Ratio of Coefficients = 1:6:2:3