Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Chemistry Department Midterm Review

1. **Unit 1 Matter & Measurement**
2. **Vocabulary Practice:**

Chemical change

Coefficient

Compound

Diatomic element

Element

Endothermic

Exothermic

Gas

Heterogeneous

Homogeneous

Matter

Mixtures

Percent composition

Percent error

Physical change

Pure substances

Qualitative

Quantitative

STP

Subscript

**MATTER\_\_**1. Anything that has mass and volume

**\_% COMP\_\_**2. The composition of a compound of each element compared with the total mass of the compound

**COMPOUND** 3. Substance in which the atoms exist in a fixed ratio

**CHEMICAL**4. A reaction in which the composition of a substance is changed

**DIATOMIC** 5. An element containing two identical atoms

**PHYSICAL**\_6. A change that does not alter the chemical properties of a substance

**PURE SUBSTANCE**\_7. Type of matter that includes compounds and elements only

**MIXTURE**8. Type of matter that includes homogeneous or heterogeneous substances

**QUANTITATIVE**\_9. Description of numerical information

**QUALITATIVE**10. Description of non-numerical information

**% ERROR**\_11. Actual error divided by the accepted value and multiplied by a factor of one hundred

**SUBSCRIPT**12. The number that indicates the number of atoms present

**COEFFICIENT**13. The number that indicates the number of units or molecules of that substance

**ENDOTHERMIC**14. Process in which energy is absorbed

**EXOTHERMIC**15. Process in which energy is released

**HETEROGENEOUS**16. Mixture in which the substances are not uniformly distributed

**HOMOGENEOUS**\_17. Mixture in which the substances are uniformly distributed

**STP**\_18. 1°C, 273K, 1 atm, 101.3 kPa

**ELEMENT\_\_**19. Form of matter which cannot be simplified or broken down any further by chemical means

**GAS**\_20. Phase of matter without definite shape or volume

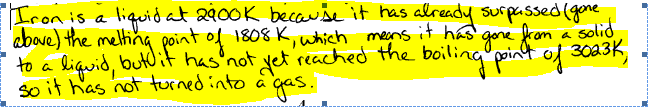
2 The particles of a substance are arranged in a definite geometric pattern and are constantly vibrating. This substance can be in

1. **the solid phase, only** (3) either the solid or the liquid phase
2. the liquid phase, only (4) neither the liquid nor the solid phase

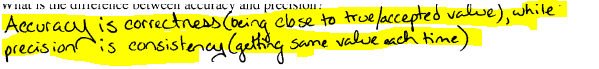
3. Use Table S to determine if these elements are in the solid, liquid, or gas state at STP. If the name is given, give the symbol, or vice versa.

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Name** | **State** |
| S | SULFUR | SOLID |
| Na | SODIUM | SOLID |
| **Ne** | Neon | GAS |
| N | NITROGEN | GAS |
| **Mg** | Magnesium | SOLID |

4. Iron is heated up to 2900 degrees Kelvin. Using the data on Table S, determine whether the iron is in the solid, liquid or gas state at this temperature. Explain how you know.



5. What is the difference between accuracy and precision?



6. Do the following conversions:

a. 109.77 mL = 0.10977 L

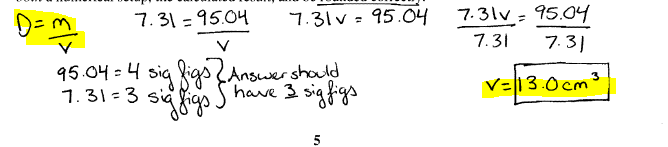
b. 52.6 kg = 52600 g

c. 93.9 g = 93900 mg

**Use the informationin the table to answer the following question:**

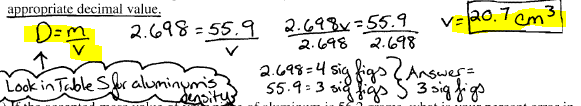
|  |  |
| --- | --- |
| **Element** | **Density at STP (g/cm3)** |
| C | 3.51 |
| Si | 2.33 |
| Ge | 5.32 |
| Sn | 7.31 |
| Pb | 11.35 |

7. Calculate the volume of a tin block that has a mass of 95.04 grams at STP. Your response must include *both* a numerical setup, the calculated result, and proper significant figures.

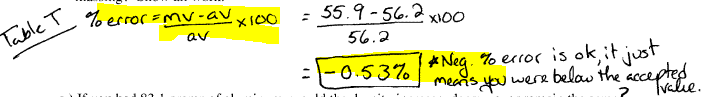


8. Density is a key property because it is so useful in identifying a substance. You determine the mass of a piece of aluminum to be 55.9 grams.

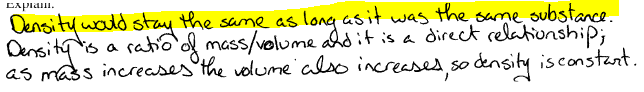
a.) Calculate the *volume* of the piece of metal that you massed. Show all work and round to the appropriate decimal value.



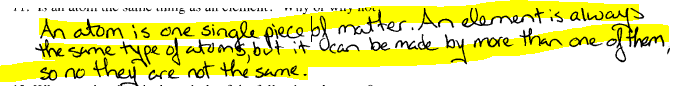
b.) If the accepted mass value of your piece of aluminum is 56.2 grams, what is your percent error in massing? Show all work.



c.) If you had 83.1 grams of aluminum, would the density increase, decrease, or remain the same. Explain.



9. Is an atom the same thing as an element? Why or why not?

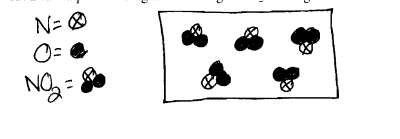


10. What are the chemical symbols of the following elements?

a. bromine **Br** c. potassium **K**

b. sodium **Na** d. hydrogen **H**

11. Draw a particle diagram showing 5 NO2 in the gas state. Include a key.



12. Which statement describes the composition of potassium chlorate, KClO3?

**(1) The proportion by mass of elements combined in potassium chlorate is fixed.**

(2) The proportion by mass of elements combined in potassium chlorate varies.

(3) Potassium chlorate is composed of four elements.

(4) Potassium chlorate is composed of five elements.

13. Every water molecule has two hydrogen atoms bonded to one oxygen atom. This fact supports the concept that elements in a compound are

**(1) chemically combined in a fixed proportion**

(2) chemically combined in proportions that vary

(3) physically mixed in a fixed proportion

(4) physically mixed in proportions that vary

14. Which particle model diagram represents only one compound composed of elements *X* and *Z*?



An unidentified sample is tested in a chemical laboratory. It is shown to contain the elements copper and iodine. Bart thinks the sample is a mixture of copper (Cu) and iodine (I2). Lisa thinks the sample contains the compound “copper iodide” (CuI).

15. Draw particle diagrams of at least 6 particles in each diagram, to represent both ideas.

Use these symbols to construct the particles in your diagrams: Iodine = Copper =



Lisa’s idea Bart’s idea

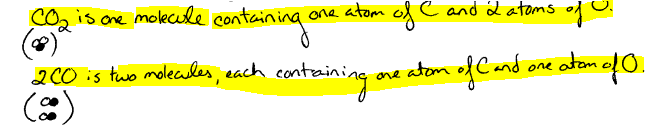
(the compound CuI) (mixture of Cu and I2)

16 How many of each type of atom are given in the following compounds? *(Draw them if it helps.)*

a.) Ba3(PO4)2 3 Ba atoms 2 P atoms 8 O atoms

b.) 3 Ba3(PO4)2 9 Ba atoms 6 P atoms 24 O atoms

17. What is the difference between CO2 and 2 CO?



18. A compound differs from a mixture in that a compound always has a

**(1) homogeneous composition**

(2) maximum of two components

(3) minimum of three components

(4) heterogeneous composition

19. Which of these terms refers to matter that could be heterogeneous?

(1) element (3) compound

**(2) mixture** (4) solution

20. When sugar is dissolved in water and mixed well, the resulting solution is classified as a

**(1) homogeneous mixture**

(2) heterogeneous mixture

(3) homogeneous compound

(4) heterogeneous compound

21. Which is a characteristic of all mixtures?

(1) They are homogeneous.

(2) They are heterogeneous.

(3) Their composition is a definite ratio.

**(4) Their composition can be varied.**

22. Which is true of *all* mixtures?

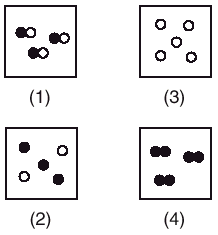
(1) They are homogeneous

(2) They are heterogeneous

**(3) They are able to be separated into their components by physical change**

(4) They are able to be separated into their components by chemical change

23. Given: Which diagram represents a mixture?

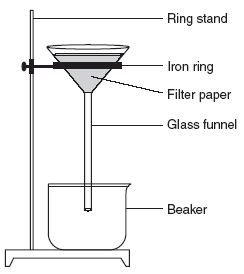


24. Which formula represents a mixture?

(1) C6H12O6(*ℓ*) **(3) LiCl(aq)**

(2) C6H12O6(s) (4) LiCl(s)

a. Explain how you chose your answer.



b. How would this mixture be classified?

**homogeneous**

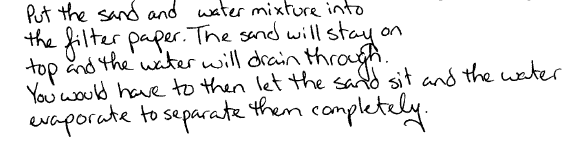
c. How would you separate this mixture back into its components?

**Evaporation/distillation**

25. The apparatus to the right was used in lab.

1. Which type of mixture can be separated using the apparatus shown?

1. salt and water
2. oil and water
3. **sand and water**
4. carbon dioxide gas and water
5. Describe the procedure you would use to separate the mixture you chose in part a.



26. Which pair can be classified as pure chemical substances?

(1) mixtures and solutions

(2) elements and mixtures

(3) compounds and solutions

**(4) compounds and elements**

Use the diagrams below to answer questions 27 – 30:



(1) (2) (3) (4)

27. Which particle diagram is showing a sample where the particles are considered to be “fixed in place, vibrating?  **2= solid**

28. Why is Sample #1 considered a pure substance, even though there are two types of atoms involved?



29. Which sample contains a “diatomic” element? **3\_\_\_\_\_** How do you know? **2 atoms same type**

30. Which sample contains a “diatomic” compound? \_**\_4**\_\_\_How do you know? **2 atoms different type**

31. Indicate whether the following is a **chemical change, physical change**,or **neither**.

\_\_\_\_\_CHEM\_a) a hydrogen balloon explodes \_PHYS\_\_\_c) a puddle of water evaporates

\_PHYS\_\_\_\_\_\_b) snow melts \_\_\_PHYS\_\_\_d) sand and salt mixture are separated

32. Which substance can *not* be decomposed by a chemical change?

(1) ammonia (3) propanol

(**2) copper** (4) water

33. Which substance can be decomposed by chemical means?

(1) aluminum (3) silicon

(2) octane (4)Xenon

34. Which equation represents a physical change?

**(1) H2O(s) + heat → H2O(l)** (3) H2(g) + I2(g) + heat → 2HI(g)

(2) 2H2(g) + O2(g) → 2H2O(g) + heat (4) N2(g) + 2O2(g) + heat → 2NO2(g)

Use the diagram below to answer questions

🡪

35. Words for the change that is shown should read

a) Two molecules of the element H2 and two molecules of the element Cl2 interacted physically and formed into four molecules of the compound HCl.

**b) Two atoms of the element H2 and two atoms of the element Cl2 interacted chemically and formed into four atoms of the compound HCl.**

c) Two molecules of the compound H2 and two molecules of the compound Cl2 interacted chemically and formed into four molecules of the compound HCl.

d) Two molecules of the element H2 and two molecules of the element Cl2 interacted chemically and formed into four molecules of the compound HCl.

1. **Unit 2 Atomic Theory**

**Vocabulary Practice:**

Alkali Metal

Alkaline Earth Metal

Atom

Atomic Mass

Atomic Mass Unit (amu)

Atomic Number

Bohr

Electron

Group

Halogen

Ion

Isotope

Mass Number

Metal

Metalloid

Neutron

Noble Gas

Nonmetal

Orbit (Shell)

Period

Proton

Rutherford

Thomson

Transition Metals

Valence Electrons

Wave-Mechanical Model

**\_alkaline earth metal\_**1. An element of Group 2.

**\_mass number\_\_\_\_\_** 2. The total number of protons and neutrons in the nucleus of an atom.

**\_group\_\_\_\_\_\_** 3. A vertical column on the periodic table.

**\_atomic number\_\_\_\_\_**4. The number of protons in the nucleus of an atom.

\_**nonmetal\_\_\_\_\_\_** 5. Element whose atoms will gain or share electrons in chemical reactions.

**\_isotope\_\_\_\_\_\_** 6. Atom of an element that has a specific number of protons and neutrons.

**\_Bohr**\_\_\_\_\_\_ 7. Scientist who discovered that electrons must reside in fixed energy levels around

the nucleus.

\_**metalloid\_\_\_\_\_\_** 8. An element that has both metallic and nonmetallic properties.

\_**atomic mass**\_\_\_\_\_\_ 9. The weighted average mass of all naturally-occurring isotopes in a sample of an

element.

**\_electron**\_\_\_\_\_\_ 10. These negatively-charged subatomic particles can be found in a “cloud”

surrounding the positive nucleus of an atom.

**\_period\_\_\_\_\_\_** 11. A horizontal row on the periodic table.

**\_alkali metal\_\_\_\_\_\_** 12. An element of Group 1.

\_**noble gas**\_\_\_\_\_\_ 13. A non-reactive element that can be found in Group 18 on the periodic table.

**\_ion\_\_\_\_\_\_** 14. An atom that has either lost or gained electron(s).

\_**neutron**\_\_\_\_\_\_ 15. A subatomic particle with no charge, that can be found in the nucleus of an atom.

\_**valence electron**\_\_\_\_16. The outer electrons of an atom that can be exchanged or shared with other atoms.

\_**halogen\_\_\_\_\_\_** 17. An element of Group 17.

**\_Thomson\_\_\_\_\_\_** 18. Scientist whose use of cathode ray tubes led to the discovery of the electron.

\_**proton\_\_\_\_\_\_** 19. A subatomic particle with positive charge that tells the identity of an atom.

\_**metal\_\_\_\_\_\_** 20. Element whose atoms lose electrons in chemical reactions to become positive ions.

**\_transition metal\_\_\_\_** 21. Groups 3-12 on the periodic table.

**\_Rutherford\_\_\_\_\_\_** 22. Scientist who performed the gold foil experiment, and concluded that an atom

must be composed of mostly empty space with a small, dense, positively-charged nucleus.

\_**orbit (shell)\_\_\_\_\_\_** 23. An electron configuration tells how many electrons belong in each .

**\_atom\_\_\_\_\_\_** 24. The smallest part of an element.

**wave-mechanical model** 25. The most current model of the atom states that electrons are found in “orbitals” – regions of most probable location.

**atomic mass unit (amu**)26. Atoms are so small that we cannot measure their mass in grams. We must use \_\_\_.

1. Describe Dalton’s Atomic Model-

**Dalton theorized that the smallest piece of matter was solid, indivisible (couldn’t be broken down any further), and a sphere**

2. In the modern model of the atom, each atom is composed of three major subatomic particles.

a) Name the subatomic particles contained in the nucleus of the atom.

**Protons and Neutrons**

b) State the charge associated with each type of subatomic particle contained in the nucleus of the atom.

Proton= +1 Neutron=0

c) What is the net charge of the nucleus? **POSITIVE**

3 . Fill in the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Particle** | **Charge** | **Mass** | **Location** |
| neutron | 0 | 1 | Inside the nucleus |
| proton | +1 | 1 | Inside the nucleus |
| electron | -1 | 0 | Outside the nucleus |

4. Give the names and chemical symbols for the elements that correspond to these atomic numbers:

a. 10 b. 18 c. 36 d. 51

**Neon-Ne Argon-Ar Krypton-Kr Antimony-Sb**

5. What is the charge on the nucleus of…

a) a Cr atom? **\_\_\_+24\_\_\_** b) a Ni atom? \_\_\_**+28**\_\_\_\_ c) a sodium atom? \_\_\_**+11**\_\_\_\_

6. The number of neutrons in the nucleus of an atom can be determined by

(1) adding the atomic number to the mass number

**(2) subtracting the atomic number from the mass number**

(3) adding the mass number to the atomic mass

(4) subtracting the mass number from the atomic number

7. Which statement best describes electrons?

(1) They are positive subatomic particles and are found in the nucleus.

(2) They are positive subatomic particles and are found surrounding the nucleus.

(3) They are negative subatomic particles and are found in the nucleus.

**(4) They are negative subatomic particles and are found surrounding the nucleus**.

8. The atomic number of an atom is always equal to the number of its

**(1) protons, only** (2) neutrons, only (3) protons plus neutrons (4) protons plus electrons

9. The nucleus of an atom of K-42 contains

**(1) 19 protons and 23 neutrons**     (3) 19 protons and 42 neutrons

            (2) 20 protons and 19 neutrons     (4) 23 protons and 19 neutrons

10. Which particles are found in the nucleus of an atom?

(1) electrons, only (3) neutrons, only (2) protons and electrons **(4) protons and neutrons**

11. What is the total number of neutrons in an atom of an element that has a mass number of 19 and an atomic number of 9?

(1) 9 (2) 19 **(3) 10** (4) 28

12. A neutral atom contains 12 neutrons and 11 electrons. The number of protons in this atom is

(1) 1 (2) 11 (3) 12 (4) 23

13. Which statement is true about the charges assigned to an electron and a proton?

 (1) Both an electron and a proton are positive.

**(2) An electron is negative and a proton is positive.**

        (3) An electron is positive and a proton is negative.

(4) Both an electron and a proton are negative.

14. What is the charge of the nucleus in an atom of oxygen-17?

(1) 0 (2) -2 **(3) +8** (4) +17

15. Describe Rutherford’s experiment (his observations) and his conclusions.

**Rutherford shot positively charged alpha particles through a piece of gold foil and found that most of the particles went straight through, so he concluded that the atom was mostly empty space. Some of the particles were deflected, so he concluded that there must be a positively charged core that they were bouncing off of.**

16. How do isotopes of the same element differ from each other?

**They have the same number of protons, which cause them to have the same atomic number, but they have different numbers of neutrons, which cause them to have a different mass.**

17. Which two notations represent different isotopes of the same element?



18. State the number of valence electrons in an atom of:

a. sulfur b. calcium c. chlorine d. arsenic

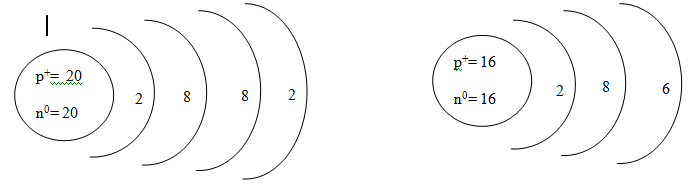
**6 2 7 5**

19. Draw Lewis dot structures for each of the structures in #20.



20. Draw Bohr diagrams for the following (include protons and neutrons in nucleus):

a. 40Ca b. 32S



c. 23Na d. 20Ne



21. Which of the above in Question #22 has a stable octet? **Ne**

22. According to the wave-mechanical model of the atom, electrons in an atom

(1) travel in defined circles

(2) are most likely found in an excited state

(3) have a positive charge

**(4) are located in orbitals outside the nucleus**

23. An atom has seven valence electrons. This atom could be an atom of which element?

(1) calcium (3) oxygen

**(2) fluorine** (4) sodium

24. What is the total number of electrons in an atom of potassium?

(1) 18 (3) 20

**(2) 19** (4) 39

25 Which Lewis electron-dot diagram represents an atom for a Group 13 element?



(1) (2)  **(3)** (4)

**Base your answers to #26 and 27 on the diagram below.**

**Rutherford Thomson**

Shaded areas represent the (+) charged area of the atom. “ “ represent electrons.

26. Label each drawing as either representing the Thomson model of the atom or the Rutherford model.

27. Match observation with conclusion. Use an arrow to connect observation with the matching conclusion.

|  |  |
| --- | --- |
| **Observation** | **Conclusion** |
| CRT (cathode ray tube) device produces a stream of charged particles. | (+) charge exists in very small inner part of the atom. |
| The path of most alpha particles shot at gold foil was not changed | An atom has some (-) charged particles in it. |
| The path of a very few alpha particles were deflected (bent) as they passed thru the gold foil. | Most of the atom is made up of empty space. |

**C. Unit 3 Periodic Table of Elements- Unit 7 Vocabulary Practice:**

Alkali Metal

Alkaline Earth Metal

Allotropes

Atomic Mass

Atomic Number

Bohr

Bright-Line Spectrum

Electron

Electronegativity

Excited State

Ground State

Halogen

Ion

Ionization Energy

Isotope

Mass Number

Metalloid

Neutron

Noble Gas

Proton

Reactivity

Rutherford

Thomson

Valence Electrons

Wave-Mechanical Model

\_alkaline earth metal\_\_. An element of Group 2.

Mass number 2. The total number of protons and neutrons in the nucleus of an atom.

Electronegativity 3. A scale ranking the desire for electrons, with nonmetals having the highest values.

Atomic Number 4. The number of protons in the nucleus of an atom.

Isotope 5. Atom of an element that has a specific number of protons and neutrons.

Bohr 6. Scientist who discovered that electrons must reside in fixed energy levels around

the nucleus.

Allotropes 7. A different structural form of the same element, resulting in different properties.

Metalloid 8. An element that has both metallic and nonmetallic properties.

Atomic Mass 9. The weighted average mass of all naturally-occurring isotopes in a sample of an

element.

Electron 10. These negatively-charged subatomic particles can be found in a “cloud”

surrounding the positive nucleus of an atom.

Ground State 11. The state of an atom when electrons fill the lowest energy levels.

Alkali Metal 12. An element of Group 1.

Noble Gas 13. A non-reactive element that can be found in Group 18 on the periodic table.

Ion 14. An atom that has either lost or gained electron(s).

Neutron 15. A subatomic particle with no charge, that can be found in the nucleus of an atom.

Valenece Electrons 16. The outer electrons of an atom that can be exchanged or shared with other atoms.

Halogens 17. An element of Group 17.

Thomson 18. Scientist whose use of cathode ray tubes led to the discovery of the electron.

Proton 19. A subatomic particle with positive charge that tells the identity of an atom.

Ionization Energy 20. The amount of energy necessary to remove an outermost electron.

Rutherford 21. Scientist who performed the gold foil experiment, and concluded that an atom

must be composed of mostly empty space with a small, dense, positively-charged nucleus.

Reactivity 22. For metals, it is the ability for metals to readily lose electrons. For nonmetals, it is the ability for nonmetals to readily gain electrons.

Bright-Line Spectrum 23. An element’s “fingerprint”, produced when electrons move from higher to lower

energy levels.

Wave-Mechanical Model24. The most current model of the atom states that electrons are found in “orbitals”

regions of most probable location.

Excited State 25. The state of an atom where electrons occupy higher energy levels.

1. Where, generally, are the metals located on the periodic table?

Left of staircase

1. Where, generally, are the nonmetals located on the periodic table?

Right of staircase

1. List three physical properties of metals and one chemical property.

***Physical- Malleable, ductile, high melting points, conducts electricity and heat, and has luster***

***Chemical- reacts with acids***

1. List three physical properties of nonmetals and one chemical property.

***Physical- Brittle, dull, low melting points, and non-conductive***

***Chemical- reacts with acids***

1. What kinds of properties do metalloids have?

***An element that has properties of both a metal and nonmetal***

1. What at the diatomic elements?

*Diatomic elements are chemical elements whose stable form at STP consists of diatomic molecules. The diatomic elements are H2, N2, O2, F2, Cl2, Br2, and I2.*

1. What are the Group 1 elements called?

Alkaline metals

1. What are the Group 2 elements called?

Alkaline earth metals

1. What are the Group 17 elements called?

Halogens

1. What are the Group 18 elements called?

Noble Gases

1. List the three lightest members of the noble gases.

Ne, Ar, Kr

1. What is the heaviest noble gas?

Radon

1. What is the heaviest alkaline earth metal?

Radium

1. List all of the alkali metals

Li, Na, K, Rb, Cs, Fr

1. Which alkali metal belongs to the sixth period?

Cs

1. Which halogen belongs to the fourth period?

Br

1. What element is in the fifth period and the eleventh group?

Ag

1. Circle one or more in each group: (Use Table S to help with some of these)

a) transition metal Cu Al Ag Mg

b) alkali metal Al Sn Ag Rb

c) largest radius Mg Ca Sr

d) lowest boiling point Kr Ni Li

e) metalloid Sb Cu P Ne

f) halogen F Cl O S

1. By what property did Mendeleev first arrange the Periodic Table?

Atomic number (number of protons)

1. What is the periodic law?

physical and chemical properties of the elements tend to recur in a systematic manner with increasing atomic number

1. What is a period? How many are there in the periodic table?

Horizontal row- 7

1. What is a group (also called a family)? How many are there in the periodic table?

Vertical column-18

1. List, by number, both the period and group of each of these elements.

Symbol Period Group

a. beryllium Be 2 2

b. iron Fe 4 8

c. lead Pb 6 14

1. Which of the following pairs of elements belong to the same period?

**a. Na and Cl**  b. Na and Li c. Na and Cu d. Na and Ne

1. Which of the following pairs of elements belong to the same group?

a. H and He b. Li and Be **c. C and Pb** d. Ga and Ge

1. How does an element’s period number relate to the number of the energy levels of its valence electrons?

**The period is the same as the number of energy levels.**

1. Why do all the members of a group have similar properties?

**They all have the same number of valence electrons.**

1. Would you expect strontium to be, chemically, more similar to calcium or rubidium?

WHY?

**Calcium because they both are located in the same group, which means they have the same number of valence electrons, so they interact/react the same with other atoms, and therefore have the same chemical properties.**

1. In going from top to bottom of any group, each element has \_\_**1**\_\_\_\_ more occupied energy level(s) than the element above it.
2. Which element on the periodic table is the most likely to lose an electron (that means it’s the most active metal)? Explain.

**Francium is the most likely to lose an electron, because like all Group 1 elements it only has one valence electron to lose before becoming stable. It has more energy levels than the other elements, which means it has a larger radius, so there is less attraction between the positive nucleus and the outer electrons, making it easier for that e- to be lost.**

1. In which list are the elements arranged in order of increasing atomic mass?

        (1) Cl, K, Ar            (2) Fe, Co, Ni          **(3) Te, I, Xe**              (4) Ne, F, Na

1. Which element has both metallic and nonmetallic properties?

(1) Rb **(3) Si**

(2) Rn (4) Sr

1. An element that is malleable and a good conductor of heat and electricity could have an atomic number of

(1) 16 **(3) 29**

(2) 18 (4) 35

1. Which Group 14 element is classified as a metal?

(1) carbon (3) silicon

(2) germanium **(4) tin**

1. As an atom becomes an ion, its mass number

(1) decreases                (2) increases                 (3) remains the same

1. The following equation represents the formation of a



(1) fluoride ion, which is smaller in radius than a fluorine atom

(2) fluorine atom, which is smaller in radius than a fluoride ion

(3) fluoride ion, which is larger in radius than a fluorine atom

(4) fluorine atom, which is larger is radius than a fluoride ion

1. What is the total number of electrons in a Cu+ ion?

(1) 28 (2) 29  (3) 30 (4) 36

1. After a neutral sulfur atom gains two electrons, what is the resulting charge of the ion? -2
2. What is the total number of electrons in a Cr3+ ion?

(1) 18 (2) 21 (3) 24 (4) 27

1. How many electrons are contained in an Au3+ ion?

(1) 76 (2) 79 (3) 82 (4) 197

1. How are neutral atoms converted into cations? **Electrons are lost.**
2. How are neutral atoms converted into anions? **Electrons are gained.**
3. Metals usually form what type of ions? **Cations**
4. Nonmetals usually form what type of ions? **Anions**
5. When combining with non-metallic atoms, metallic atoms will \_\_lose\_\_\_\_\_\_\_ electrons to

(lose, gain)

form \_\_positive\_\_\_\_\_\_\_ ions.

(positive, negative)

1. Sulfur atoms can form \_anions\_\_\_\_ with a \_-\_ \_2\_\_\_\_ charge in order to get a full octet.

(cations, anions) (+, - ) (1,2,3,4)

1. When an atom becomes an anion, what happens to its radius?

increases

1. When an atom becomes a cation, what happens to its radius?

decreases

1. For each of the following pairs, circle the atom or ion having the larger radius.
2. a. **S** or O c. Na1+ or **K1+** e. **S2–** or O2–
3. b. **Ca** or Ca2+ d. Na or **K** f. F or **F1–**
4. For each of the following pairs, identify the smaller ion.
5. a. K1+ or Ca2+ **(same)** c. **C4+** or C4– e. O2– or F1–**(same)**
6. b. **F1–** or Cl1– d. S2– or **F1–** f. Fe2+ or **Fe3+**
7. Draw Lewis dot structures for the following:

a. sulfide anion b. magnesium cation c. bromide anion d. P3-

**[ S ]-2** [Mg] 2+ [ P ]-3

[ Br ]1-

1. Draw Bohr diagrams for the following (include protons and neutrons in nucleus):
2. 40Ca2+ b. 32S2-

8

8

8

2

8

2

1. The **ions** which are normally formed from K and Cl have the same electron configuration.

What is it?\_\_\_\_\_\_\_\_\_ **2-8-8\_\_\_**\_\_\_\_\_\_.

This is the same configuration as which noble gas? \_\_Argon\_\_\_\_\_\_\_\_\_

How are the two ions different? **They have a different number of protons and neutrons in the nucleus and different charges (K+1, Cl-1)**

1. Give the symbol for one (1) cation and one (1) anion that have the same electron configuration as the noble gas, krypton.

**Cations:** **Rb+1, Sr+2, Y3+ Anions: As3-, Se2-, Br1-**

1. Write the equation (equation means reactants, products, and an arrow between them) for each of the following.

*For example:* Na Na+1 + 1e-1

a. formation of Sr2+ from Sr

Sr Sr+2 + 2e-1

b. O2- from O

O+ 2e-1 O2-

1. What is the formula of the compound formed by

a. lithium ion and chloride ion? LiCl

b. potassium ion and nitride ion? K3N

c. calcium ion and oxide ion? CaO

d. aluminum ion and sulfide ion? Al2S3

e. rubidium ion and iodide ion? RbI\_\_\_\_\_\_\_\_\_

1. Find the number of p, n, and e- in the following species.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Br** | **K+** | **N3-** | **Ti2+** | **H-** | **H+** |
| **p+** | 35 | 19 | 7 | 22 | 1 | 1 |
| **no** | 45 | 20 | 7 | 26 | 0 | 0 |
| **e-** | 35 | 18 | 10 | 20 | 2 | 0 |
|  | **Br** | **K+** | **N3-** | **Ti2+** | **H-** | **H+** |

Draw Bohr diagrams for the following:

a.) 32S in the ground state b.) 32S in the excited state



58.**True/False**: If the statement is true, tell how you know. If false, correct the statement to make it true.

False\_\_\_\_\_\_ a.) When an electron moves from a higher to a lower energy level, the electron absorbs energy, producing a bright-line spectrum. ***releases (emits)***

True b.) Emission of light occurs when an electron drops from the excited state to the ground state.

True c.) The amount of energy required to remove the outermost electron from a gaseous atom in the ground state is known as the first ionization energy.

59. Which of the following represents an excited state of an atom? (Circle all that apply.) Explain how you know.



60.) Which electron configuration represents the electrons of an atom in an excited state?



61.) When an electron moves from a higher to a lower energy level, the electron:

(1) absorbs energy, producing a bright-line spectrum.

(2) absorbs energy but no bright-line spectrum is produced.

(3) releases energy, producing a bright-line spectrum.

(4) releases energy but no bright-line spectrum is produced.

62.) Emission of light occurs when an electron

(1) drops from a higher to a lower energy level

(2) jumps from a lower to a higher energy level

(3) moves around within its orbital

(4) crashes into the nucleus

63) Which electron configuration represents an atom in an excited state?

(1) 2–7 (2) 2–6–2 (3) 2–8–1 (4) 2–8–8–2

64.) What are isotopes? Give an example.

***Atoms of an element with a different mass number due to different amounts of neutrons in the nucleus.***

***Example: Isotopes of Carbon- C-12, C-13, and C-14***

65.) What is the atomic mass of the element “Q” if its isotopes are 45% Q-17, 50% Q-18, and 5% Q-19?

***45% = 45/100 = .45***

***50% = 50/100 = .50***

***5% = 5/100 = .05***

***Q-17 = 17 x .45 = 7.65***

***Q-18 = 18 x .50 = 9.00***

***Q-19 = 19 x .05 = + 0.95***

***17.60 amu***

66.) Carbon has three naturally occurring isotopes, C-12, C-13, and C-14. Diamond and graphite are familiar forms of solid carbon. Diamond is one of the hardest substances known, while graphite is a very soft substance. Diamond has a rigid network of bonded atoms. Graphite has atoms bonded in thin layers that are held together by weak forces. Recent experiments have produced new forms of solid carbon called fullerenes. One fullerene, C60, is a spherical, cage-like molecule of carbon.

Determine *both* the total number of protons and the total number of neutrons in an atom of the naturally occurring carbon isotope with the largest mass number.

***C-14 has six protons and 8 neutrons***

***Base your answers to questions 67 and 68 on the information below.***



67.) State, in terms of the number of subatomic particles, *one* similarity and *one* difference between the atoms of these isotopes of sulfur.

***All isotopes of sulfur contain 16 protons. The isotopes of sulfur differ in the amount of neutrons they contain in the nucleus.***

68.) Show a correct numerical setup for calculating the atomic mass of sulfur.

***S-32 = 31.97 x .9493 = 30.349***

***S-33 = 32.97 x .0076 = 0.251***

***S-34 = 33.97 x .0429 = 1.457***

***S-36 = 35.97 x .0002 = +0.007***

***amu***

69.) The table below shows the number of subatomic particles in atom *X* and in atom *Z*.

**Subatomic Particles in Two Atoms**



Atom *X* and atom *Z* are isotopes of the element

(1) aluminum (2) carbon (3) magnesium (4) nitrogen

70.) Which value of an element is calculated using both the mass and the relative abundance of each of the naturally occurring isotopes of this element?

(1) atomic number (2) atomic mass (3) half-life (4) molar volume

71.) Which two notations represent different isotopes of the same element?



72. a. List three physical properties of metals.

***Malleable, ductile, high melting points, conducts electricity and heat, and has luster***

b. List three physical properties of non-metals.

***Brittle, dull, low melting points, and non-conductive***

c. What is a metalloid?

***An element that has properties of both a metal and nonmetal.***

73. When combining with non-metallic atoms, **metallic atoms** will \_\_\_\_\_***lose*** electrons to

(*lose* or *gain*)

form ***positive\_\_\_\_*** ions.

(*positive* or *negative*)

74. Sulfur atoms can form ***anions\_\_\_*** with a \_**-** 2 in order to get a full octet.

(*cations* or *anions*) (+ or ─) (1, 2, 3, 4)

75. Which element on the periodic table is the most metallic? Explain using the definition for a metal.

***Francium (Fr) is the most metallic element. A metal is defined as the ability to lose electrons. Francium most easily loses electrons because of its 7 shells and 1 valence electron. Since the electrons are farther away from its positively charged nucleus they are not held on (attracted) to and are easily lost.***

76. Which element on the periodic table is the most electronegative? Explain using the definition for electronegativity.

***Fluorine (F) is the most electronegative element. Electronegativity is the ability to attract electrons and fluorine most easily attracts electrons because it has 2 shells, and 7 valence electrons. Since the electrons are close to the positively charged nucleus they are held on (attracted to) strongly and can easily gain electrons.***

***Use the information below for questions 77through 78.***



The atomic and ionic radii for sodium and chlorine are shown in the table.

***77.***  Write the ground state electron configuration for the ion that has a radius of 181 picometers.

***2-8-7***

78. Explain, in terms of atomic structure, why the radius of an Na atom is larger than the radius of an Na+ ion.

***1 meter = 1 x 10+12 pm 102 pm 1 m = 1.02 x 10-10m or 0.000000000102 m***

***1 x 10+12pm***

79. Is the ion formed from the S atom smaller or larger than the S atom itself? Larger\_\_\_\_\_\_\_\_

80. The most active metals are contained in which group of the periodic table? one

81. For the following, circle the element that can be characterized by the given property.

a) transition metal Cu Al Ag Mg

b) alkali metal Al Sn Ag Rb

c) largest radius Mg Ca Sr

d) lowest boiling point Kr Ni Li

e) metalloid Cu Sb P Ne

f) halogen F Cl O

82.

a.) According to Table S, how do the following properties change from **top to bottom** of a group of elements?

Atomic size ***The atomic size increases from top to bottom.***

Electronegativity ***The electronegativity decreases from top to bottom.***

Ionization Eneregy ***The ionization energy decreases from top to bottom.***

b.) According to Table S, how do the following properties change from **left to right** of a period of elements?

Atomic size decreases

Electronegativity increases

Ionization Eneregy increases

83. In the ground state, each atom of an element has two valence electrons. This element has a lower first ionization energy than calcium. Where is this element located on the Periodic Table?

(1) Group 1, Period 4 (3) Group 2, Period 3

(2) Group 2, Period 5 (4) Group 3, Period 4

84. Which element is a metalloid?

(1) Al (2) Ar (3) As (4) Au

85. An element that is malleable and a good conductor of heat and electricity could have an atomic number of

(1) 16 (2) 18 (3) 29 (4) 35

86. On the modern Periodic Table, the elements are arranged in order of increasing

(1) atomic mass (3) mass number

(2) atomic number (4) oxidation number

87. An element that has low first ionization energy and is a good conductivity of heat and electricity is classified as a

(1) metal (2) metalloid (3) nonmetal (4) noble gas

88. How do the atomic radius and metallic properties of sodium compare to the atomic radius and metallic properties of phosphorus?

(1) Sodium has a larger atomic radius and is more metallic.

(2) Sodium has a larger atomic radius and is less metallic.

(3) Sodium has a smaller atomic radius and is more metallic.

(4) Sodium has a smaller atomic radius and is less metallic

89. As atomic number increases within Group 15 on the Periodic Table, atomic radius

(1) decreases, only (3) decreases, then increases

(2) increases, only (4) increases, then decreases

90. At STP, which element is solid, brittle, and a poor conductor of electricity?

(1) Al (2) K (3) Ne (4) S

91. Which Group 14 element is classified as a metal?

(1) carbon (2) germanium (3) silicon (4) tin

92. Which element is a solid at STP and a good conductor of electricity?

(1) iodine (2) mercury (3) nickel (4) sulfur

93. Which element has both metallic and nonmetallic properties?

(1) Rb (2) Rn (3) Si (4) Sr

94. Which of the following represent a pair of allotropes?

(1) 16O and 15O (2) O0 and O2- (3) O2 and O3 (4) O2 and S2

95. Which element is a liquid at STP?

(1) argon (2) bromine (3) chlorine (4) sulfur

96. Which statement correctly describes two forms of oxygen, O2 and O3?

(1) They have identical molecular structures and identical properties.

(2) They have identical molecular structures and different properties.

(3) They have different molecular structures and identical properties.

(4) They have different molecular structures and different properties.

97. Which Group 15 element exists as diatomic molecules at STP?

(1) phosphorus (2) nitrogen (3) bismuth (4) arsenic

**D. Unit 4 Bonding and Nomenclature**

**Vocabulary Practice:**

Anion

Balanced Equation

Cation

Chemical Formula

Coefficient

Compound

Conservation of Mass

Covalent Bonding

Electron Pair

Endothermic

Exothermic

Ionic Bonding

Lewis Dot

Molar Mass

Mole

Mole ratio

Molecular Bonding

Molecular Formula

Molecule

Monatomic Ion

Multiple Bond

Octet rule

Polyatomic Ion

Product

Reactant

Single Bond

Subscript

Valence electrons

\_\_\_\_\_\_\_ Compound 1. Substance in which the atoms exist in a fixed ratio

\_\_\_Subscript\_ 2. The number that indicates the number of atoms present

\_\_\_Coefficient 3. The number that indicates the number of units or molecules of that substance

\_\_\_Exothermic\_\_\_\_ 4. Process in which energy is released (occurs when bonds are formed)

\_\_\_Endothermic\_\_\_\_ 5. Process in which energy is absorbed (occurs when bonds are broken)

\_\_\_Polyatomic Ion\_\_\_6. A covalently bonded group of atoms that have a net electric charge

\_\_\_Product\_\_\_\_ 7. Substance formed as a result of a chemical reaction, shown to the right of the arrow.

\_\_\_Chemical Formula 8. Combination of symbols and subscripts, used to represent the ratio of atoms of a substance

\_\_\_Reactant\_\_\_\_ 9. A substance that a chemical reaction occurs upon, shown to the left of the arrow.

\_\_\_Molecule\_\_\_\_ 10.The smallest unit of a covalently bonded substance that has the properties of that substance

\_\_\_Covalent\_\_\_\_ 11a. Bond formed by the sharing of valence electrons between 2 nonmetallic nuclei.

\_\_\_Molecular\_\_\_\_\_\_\_11b. Bond formed by the sharing of valence electrons between 2 nonmetallic nuclei.

\_\_\_Molar Mass\_\_\_\_ 12. The mass of one mole of a substance

\_\_\_Lewis Dot\_\_\_\_ 13. A type of diagram Chemist’s use to show how atoms bond

\_\_\_Cation\_\_\_ 14. An atom that has lost electrons to obtain a positive charge

\_\_\_Anion\_\_\_ 15. An atom that has gained electrons to obtain a negative charge

\_\_\_Valence electrons 16. The outer electrons of an atom that can be exchanged or shared with other atoms. \_\_\_Single Bond\_\_\_\_ 17. Occurs when only one pair (2 electrons) are shared between two nuclei.

\_\_\_Multiple Bond\_\_\_18. Occurs when more than 1 pair (4 or more electrons) are shared between two nuclei

\_\_\_Monatomic Ion 19. A single element with a positive or negative charge due to the loss or gain of e-.

\_\_\_Octet Rule\_\_\_\_ 20. The stable valence electron configuration of 8 electrons, which every element tries to obtain by bonding; the driving force behind why atoms bond the way they do

\_\_\_Electron Pair\_\_\_\_ 21. Represented by a single line in a Lewis diagram of a covalent compound

\_\_\_Ionic\_\_\_\_ 22. Bond formed by a transfer of valence electrons from a metal to a nonmetal

\_\_Molecular Formula 23. A specific type of chemical formula that tells exactly how many of each atom are in a substance, not just the ratio of these atoms

\_Balanced Equation\_ 24. An equation that has the correct coefficients in place in order to demonstrate conservation of mass.

\_Cons. of Matter\_\_\_\_25. The idea that matter can be changed, but an equation should always start and end with the same number and type of each atom.

\_ Mole\_\_\_\_\_\_ 26. A measure of the number of particles in a substance, which we use to calculate the number of grams of a substance

\_\_\_Mole ratio\_\_\_\_ 27. The ratio of moles of atoms needed to complete a chemical reaction, depicted by a balanced equation

1. Which substance can *not* be decomposed (broken down) by a chemical change?

(1) ammonia (3) ammonium nitrate

***(2) copper*** (4) water

2. When a metal atom becomes an ion, it \_\_***loses***\_\_\_ *(gains/loses)* electrons and has a \_***+***\_\_ *(+*/−)charge. The ion is called a(an) \_\_\_***cation***\_\_\_\_ *(anion/cation)*.

3. When a non-metal atom becomes an ion, it \_\_\_\_***gains***\_\_\_\_\_ *(gains/loses)* electrons and has a \_\_\_***−***\_\_\_\_\_ *(+/−)* charge. The ion is called a(an) \_\_\_***anion***\_\_\_*(anion/cation)*.

Write the names from the formula:

4. KBr \_\_\_\_\_\_ ***potassium bromide*** \_\_\_\_\_\_\_\_\_\_

5. Al2O3 \_\_\_\_\_\_\_ ***aluminum oxide*** \_\_\_\_\_\_\_\_\_

6. MgS \_\_\_\_\_\_ ***magnesium sulfide***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Write the formula from the name:

7. Sodium Phosphide \_\_\_\_\_\_\_\_\_\_***Na3P***\_\_\_\_\_\_\_\_\_ ***Na1+ P 3-***

8. Barium Chloride \_\_\_\_\_ ***BaCl2***\_\_\_\_\_\_ ***Ba2+ Cl 1-***

9. Calcium Nitride \_\_\_\_ ***Ca3N2***\_\_\_\_\_\_\_\_\_\_\_ ***Ca2+ N 3-***

10. Gold (III) Sulfide \_\_\_\_ ***Au2S3***\_\_\_\_\_\_\_\_ ***Au 3+ S 2-***

11. Chromium (II) Nitride \_\_\_\_ ***Cr3N2***\_\_\_\_\_\_\_ ***Cr******2+N 3-***

12. What is the IUPAC name for the compound FeS?

(1) iron (II) sulfate ***(3) iron (II) sulfide (S = -2, therefore Fe = +2 for a 1:1 ratio)***

(2) iron (III) sulfate (4) iron (III) sulfide

13. In which compound is the ratio of metal ions to nonmetal ions 1 to 2?

***(1) calcium bromide*** ***(CaBr2)*** (3) calcium phosphide ***(Ca3P2)***

(2) calcium oxide ***(CaO)*** (4) calcium sulfide ***(CaS)***

14. In the formula *X*2O5, the symbol *X* could represent an element in Group:

(1) 1 ***(3) 15 Since O= -2, X must be +5***

(2) 2 (4) 18

15. Which element forms a compound with chlorine with the general formula *M*Cl?

***(1) Rb*** (3) Re ***Since Cl = -1, M must be +1***

(2) Ra (4) Rn

16. Which formula represents copper (I) oxide?

(1) CuO ***(3) Cu2O Cu = +1 and O = -2***

(2) CuO2  (4) Cu2O2

17. Which element, represented by *X*, reacts with fluorine to produce the compound *X*F2?

(1) aluminum ***(3) magnesium*** ***Since F = -1, X must be +2***

(2) argon (4) sodium

18. The compound *X*Cl is classified as ionic if *X* represents the element

(1) H ***(3) Rb Must be a metal with a +1 charge!***

(2) I (4) Br

19. What is the chemical formula for iron (III) oxide?

(1) FeO (3) Fe3O ***Fe = +3 and O = -2***

***(2) Fe2O3*** (4) Fe3O2

20. An ionic compound is formed when there is a reaction between the elements

***(1) strontium and chlorine*** ***Must be a metal with a nonmetal!***

(2) hydrogen and chlorine

(3) nitrogen and oxygen

(4) sulfur and oxygen

21. Which formula represents an ionic compound?

(1) H2 (3) CH3OH ***Must be made of cations & anions!***

(2) CH4 ***(4) NH4Cl***

22. A barium atom attains a stable electron configuration when it bonds with

(1) one chlorine atom ***(Ba would only lose 1 e-) Barium wants to lose 2 electrons to be stable***

***(2) two chlorine atoms*** ***(Ba would lose 2 e-)***

(3) one sodium atom ***(metal does not want to react with metal)***

(4) two sodium atoms ***(metal does not want to react with metal)***

23. The nitrogen atoms in a molecule of N2 share a total of

(1) one pair of electrons



(2) one pair of protons

***(3) three pairs of electrons***

(4) three pairs of protons

24. It is possible for bonds to be single, double or triple covalent. Which molecule contains 3 single covalent bonds?



(1) H2 (3) I2

***(2) NH3*** (4) H2O



25. When covalent compounds bond, they share valence electrons.

a. If **one pair** of valence electrons are shared between two atoms, this is called a ***single***

covalent bond. It represents a total of ***2*** *(how many?)* **total shared** valence electrons.

b. If a **total of four** valence electrons are shared between two atoms, this is called a ***double*** covalent bond. It represents ***2*** *(how many?)* **pairs** of shared valence electrons.

c. If **three pairs** of valence electrons are shared between two atoms, this is called a ***triple***

covalent bond. It represents a total of ***6*** *(how many?)* **total shared** valence electrons.

26. Which compound has both ionic and covalent bonding? ***Must have a metal & polyatomic ion!***

***(1) CaCO3*** (3) CH3OH

(2) CH2Cl2 (4) C6H12O6

27. The chemical bonding in sodium phosphate, Na3PO4, is classified as

(1) ionic, only ***(3) both covalent and ionic***

(2) metallic, only (4) both covalent and metallic

28. Two categories of compounds are ***Molecular = covalent! (Two terms that mean the same thing!)***

(1) covalent and molecular ***(3) ionic and molecular***

(2) covalent and metallic (4) ionic and metallic

29. Which type of substance can conduct electricity in the liquid phase but *not* in the solid phase?

***(1) ionic compound*** (3) metallic element ***Choices 2 & 4 never conduct,***

(2) molecular compound (4) nonmetallic element ***Choice 3 conducts as a solid***

30. The bonds in BaO are best described as

(1) covalent, because valence electrons are shared

(2) covalent, because valence electrons are transferred

(3) ionic, because valence electrons are shared

***(4) ionic, because valence electrons are transferred***

31. Which compound contains both ionic and covalent bonds? ***Metal & polyatomic ion***

(1) ammonia ***(3) sodium nitrate***

(2) phosphate (4) potassium chloride

32. Tell whether the following are ionic, molecular (covalent), both, or neither. Name them.

a.) Ag3(PO4) b.) Mg c.) Rb(CO3)2 d.)PH3

***Both Neither Both Molecular***

***silver phosphate magnesium rubidium carbonate***

e.) MgBr2 f.) ClBr g.) Br2 h.) Al2O3

***Ionic Molecular Neither Ionic***

***magnesium bromide bromine aluminum oxide***

i.) FeCl2 j.) H2O k.) NO2

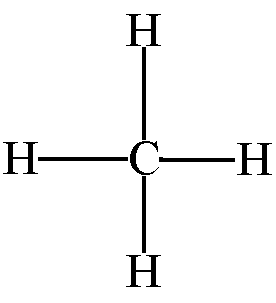
***Ionic Molecular Molecular***

***iron (II) chloride***

33. Draw Lewis dot structures for the following (Remember to first determine whether they are ionic or molecular (covalent)!!)

a.) Na2O b.) CH4 c.) CaCl2

***ionic covalent ionic***



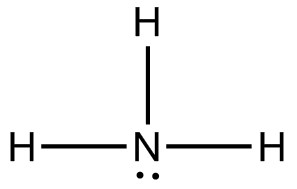
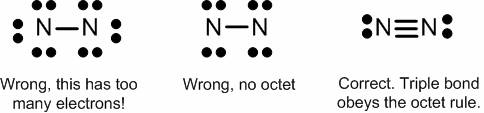
**[Na]+1  [ O ]-2[Na]+1  [ Cl ]-1[Ca]+2[ Cl ]-1**

d.) NH3 e.) N2 f.) Al2S3

***covalent covalent ionic***



***OR***



**[ S ]-2 [Al]+3[ S ]-2**

**[Al]+3[ S ]-2**

34. Fill in the following chart, which compares characteristics of both ionic and covalent bonding.

|  |  |  |
| --- | --- | --- |
| **Defining Characteristic** | **Ionic** | **Covalent (Molecular)** |
| Type of atoms involved? | ***Metal & Nonmetal*** | ***2 Nonmetals*** |
| Describe how the valence electrons are interacting in the bond | ***They are transferred from metal (loses) to nonmetal (gains)*** | ***They are shared*** |
| Does it have electrical conductivity as a solid? | ***No*** | ***No*** |
| Does it have electrical conductivity when/if dissolved in water? | ***Yes! The more ions there are in the chemical formula, the more conductive it is!*** | ***No*** |
| At STP, tend to be…  🡪 Brittle Solids?  🡪 Tend not to be a solid at STP? | ***Brittle Solids*** | ***Tend not to be a solid at STP*** |
| Relative melting/boiling point temperature: High or Low? | ***High MP/BP*** | ***Low MP/BP*** |
| Particle attractions are: Stronger or Weaker? | ***Stronger*** | ***Weaker*** |
| Describe how you would draw Lewis Structures. (Feel free to draw an example!) | ***First, draw the Lewis structures for the atoms involved prior to bonding. Then draw arrows to show how e- are transferred. Rewrite these atoms as ions with brackets and charges (no electrons around metals, 8 electrons around nonmetals).*** | ***First, draw the Lewis structures for the atoms involved prior to bonding. Then draw loops around unpaired electrons to show how e- are shared. Rewrite these atoms showing the correct number of electrons shared between them, remember that one line= 2 electrons. Check your answer to make sure you have 8 electrons around each atom. (Hydrogen will only have 2 e-)*** |
| Describe how you would name one of these compounds. | ***Name the cation first. If it is a transition metal, use a roman numeral to indicate the correct charge. Next, name the anion. If it’s a nonmetal, give it an “-ide” ending. Use Ref. Table E for any polyatomic ions. Remember that sometimes these will not be in parentheses!*** | **NO NAME NECESSARY!!** |

35. Which formula represents lead (II) chromate?

***(1) PbCrO4*** (3) Pb2CrO4

(2) Pb(CrO4)2 (4) Pb2(CrO4)3

36. Which formula represents barium phosphate?

(1) BaPO4 (3) Ba2(PO4)3

***(2) Ba3(PO4)2*** (4) Ba3PO8

37. Which polyatomic ion contains the greatest number of oxygen atoms?

(1) acetate (3) hydroxide

***(2) carbonate*** (4) peroxide

38 Given the formula: Al2(SO4)3

a) How many sulfate ions are shown? \_\_\_***3***\_\_\_

b) How many total ions? \_\_***5***\_\_\_\_

c) How many atoms… Al? \_\_\_***2***\_\_\_ S? \_\_\_***3***\_\_\_ O? \_\_\_***12***\_\_\_\_

d) Describe how the atoms are bonded together.

***The nonmetallic sulfur and oxygen atoms are bonded to one another covalently, forming a negatively charged particle, which will then bond ionically to aluminum.***

Write the formula from the name:

5. SodiumPhosphate ***\_\_\_\_\_Na3(PO4)\_\_\_\_\_\_\_\_\_\_\_***

6. Ammonium Fluoride \_\_\_\_\_***NH4F***\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Aluminum Carbonate \_\_\_\_\_***Al2(CO3)3***\_\_\_\_\_\_\_\_\_\_\_

8. Iron (III) Hydroxide \_\_\_\_\_***Fe(OH)3***\_\_\_\_\_\_\_\_\_\_\_\_

9. Copper (II) Nitrate \_\_\_\_\_***Cu(NO3)2***\_\_\_\_\_\_\_\_\_\_\_

40. Write the name from the formula:

10. Al2(SO4)3 \_\_\_***aluminum sulfate***\_\_\_\_\_\_

11. (NH4)3(PO4) \_\_\_***ammonium phosphate***\_\_\_

12. Fe2O3 \_\_\_***iron (III) oxide***\_\_\_\_\_\_\_\_\_

13. Ca(NO3)2 \_\_\_***calcium nitrate***\_\_\_\_\_\_\_\_\_

**E. Unit 5: Moles &Stoichiometry**

**DON’T FORGET THE PROPER UNITS FOR EACH ANSWER!!!**

**1.** What is the molar mass (gram formula mass) of Fe(C2H3O2)3?

**Fe: 1 x 56.0 g = 56.0 g**

**C: 6 x 12.0 g = 72.0 g**

**H: 9 x 1.0 g = 9.0 g**

**O: 6 x 16.0 g = + 96.0 g Answer: *233.0 g/1 mole***

2. How many moles of NaOH (molar mass = 40 g/mole) are represented by 210 grams of NaOH?

210 g NaOH =

40 g NaOH **Answer: *5.25 mol NaOH***

3. What is the gram-formula mass of Ca3(PO4)2?

(1) 248 g/mol (3) 279 g/mol

(2) 263 g/mol ***(4) 310. g/mol***

4. A 1.0-mole sample of krypton gas has a mass of

(1) 19 g (3) 39 g

(2) 36 g ***(4) 84 g***

5.What is the mass of 0.02 moles of CO2? **SHOW WORK!**

***GFM CO2=44g/mol*** 0.02 moles CO2 x 44g = **0.88 g CO2**

6. What is the mass of 0.4 moles of H2O? **SHOW WORK!**

***GFM H2O=18g/mol*** 0.4 moles H2O x 18g = **7.2 g H2O**

7. How many moles in 60.0 grams of Ca(NO3)2?

***GFM Ca(NO3)2=164g/mol*** 60.0 g Ca(NO3)2 = **0.37mol Ca(NO3)2**

164 g Ca(NO3)2

8. How many grams of Ca(NO3)2 in 0.23 moles of Ca(NO3)2?

***GFM Ca(NO3)2=164g/mol*** 0.23mol Ca(NO3)2 x 164 g Ca(NO3)2  = **37.7g Ca(NO3)2**

9. How many grams in 12 moles of P2O5?

***GFM P2O5=142g/mol*** 12 moles P2O5  x 142 g P2O5 = **1,704 g P2O5**

10. Give the empirical formula that corresponds to each of the following molecular formulas

a. Sodium peroxide, Na2O2 Ionic compounds are already in empirical formula

b. Tetraphthalic acid C8H6O4 C4H3O2

c. Phenobarbital, C12H12N2O3 Cannot reduce it so it is an empirical formula

d. 1, 4 dichloro-2-butene, C4H6Cl2 C2H3C6