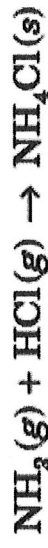


Consider this reaction:



Which type of reaction does this equation represent?

- A combustion
- B decomposition
- C single replacement
- D synthesis

Page 2

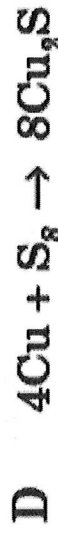
What coefficients are required to balance this equation?



- A 2, 6, 3, 6
- B 1, 3, 2, 3
- C 1, 1, 2, 2
- D 1, 1, 2, 1

Page 4

Which equation is correctly balanced?



Page 3

Metallic sodium reacts violently with water to form hydrogen and sodium hydroxide according to the balanced equation:



How many moles of hydrogen gas are generated when 4.0 moles of sodium react with excess water?

- A 1.0 mole
- B 2.0 moles
- C 3.0 moles
- D 4.0 moles

Page 5

A compound has an empirical formula of CH_2O and a molecular mass of 180 g. What is the compound's molecular formula?

- A $\text{C}_3\text{H}_6\text{O}_3$
- B $\text{C}_6\text{H}_{12}\text{O}_6$
- C $\text{C}_6\text{H}_{11}\text{O}_7$
- D $\text{C}_{12}\text{H}_{22}\text{O}_{11}$

Page 6

Consider this reaction:



How many moles of calcium are required to produce 60.0 g of calcium phosphate?

- A 0.145 mole
- B 0.194 mole
- C 0.387 mole
- D 0.581 mole

Page 7

According to the equation $2\text{H}_2\text{O} (l) \rightarrow 2\text{H}_2 (g) + \text{O}_2 (g)$, what mass of H_2O is required to yield 22.4 L of O_2 at STP?

- A 12 g
- B 18 g
- C 24 g
- D 36 g

Page 8

Methane (CH_4) is burned in oxygen according to this balanced chemical equation:



What volume of carbon dioxide is formed when 9.36 liters of methane are burned in excess oxygen at STP?

- A 9.36 L
- B 15.0 L
- C 18.7 L
- D 22.4 L

Page 9

Consider this reaction:



How many grams of magnesium phosphate should be produced if 5.40 grams of magnesium react with excess phosphoric acid?

- A 1.80 grams
- B 19.5 grams
- C 58.4 grams
- D 175 grams

Page 10

What is the percent by mass of N in $\text{Ca}(\text{CN})_2$?

- A 15.21%
- B 21.19%
- C 30.42%
- D 42.39%

Page 11

How many molecules are contained in 55.0 g of H_2SO_4 ?

- A 0.561 molecule
- B 3.93 molecules
- C 3.38×10^{23} molecules
- D 2.37×10^{24} molecules

Page 12

How many moles are in 59.6 grams of BaSO_4 ?

- A 0.256 mole
- B 3.91 moles
- C 13.9 moles
- D 59.6 moles

Page 13

Analysis shows a compound to be, by mass, 43.8% N, 6.2% H, and 50.0% O. Which is a possible molecular formula for the substance?

- A NH_4NO_2
- B NH_4NO_3
- C NH_3OH
- D N_2OH

Page 14

What is the volume of two moles of hydrogen gas at STP?

- A 44.8 L
- B 22.4 L
- C 11.2 L
- D 2.00 L

Page 15

How many grams of KCl are necessary to prepare 1.50 liters of a 0.500-M solution of KCl?

- A 224 g
- B 74.6 g
- C 56.0 g
- D 24.9 g

Page 16

Which correctly lists four atoms from smallest to largest radii?

- A I, Br, Cl, F
- B F, I, Br, Cl
- C Si, P, S, Cl
- D Cl, S, P, Si

Which *best* explains why cations are smaller than the atoms from which they are formed?

- A The metallic atom gains electrons, causing a larger effective nuclear pull.
- B The metallic atom loses electrons, resulting in loss of an entire energy level.
- C The nonmetallic atom gains electrons, causing a larger effective nuclear pull.
- D The nonmetallic atom loses electrons, resulting in loss of an entire energy level.

Which have the lowest electronegativities?

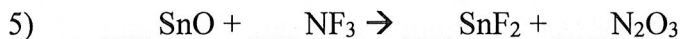
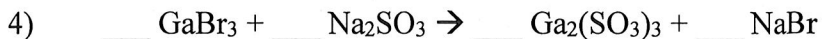
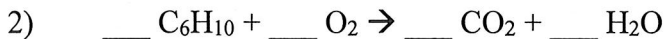
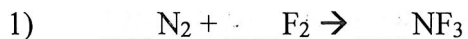
- A alkali metals
- B halogens
- C rare earth elements
- D transition metals

Page 17

Goal 3.03

NAME _____

Balance the following equations:



How many liters of nitrogen gas are needed to make 25 mol of nitrogen trifluoride?

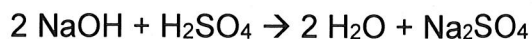
How many gram of the hydrocarbon Hexine would need to be combusted in order to form 500L of carbon dioxide?

How many molecules of dinitrogen trioxide would form if 88 mol of tin(II) oxide reacted with an excess of nitrogen trifluoride?

How many moles of bromic acid are needed to produce 15 mol of potassium bromide salt?

How many molecules of sodium bromide salt would form if 84 mol of gallium bromide were reacted with an excess of Sodium Sulfite?

Using the following equation:



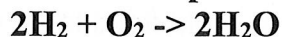
How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid?

Using the following equation:

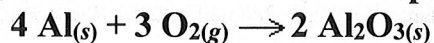


How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

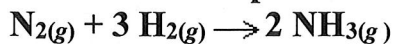
How many moles of water are produced from 3 moles of hydrogen gas?



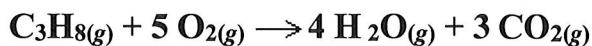
How many molecules of aluminum oxide are produced from 64L of oxygen gas?



How many grams of ammonia are produced by 100g of nitrogen gas?



How many moles of carbon dioxide form when 700g of propane is combusted in an excess of oxygen?



Quiz: Trends, Ions, Bohr (CFA 1)**Multiple Choice**

Identify the choice that best completes the statement or answers the question.

- _____ 1. Which of the following statements is true about ions?
- Cations form when an atom gains electrons.
 - Cations form when an atom loses electrons.
 - Anions form when an atom gains protons.
 - Anions form when an atom loses protons.
- _____ 2. The metals in Groups 1A, 2A, and 3A _____.
- gain electrons when they form ions
 - all form ions with a negative charge
 - all have ions with a 1^+ charge
 - lose electrons when they form ions
- _____ 3. Which of the following elements has the smallest atomic radius?
- Li
 - B
 - O
 - C
- _____ 4. Which of the following elements has the lowest electronegativity?
- Iodine
 - Chlorine
 - bromine
 - fluorine
- _____ 5. Compared with the electronegativities of the elements on the left side of a period, the electronegativities of the elements on the right side of the same period tend to be _____.
- lower
 - higher
 - the same
 - unpredictable
- _____ 6. Which of the following statements correctly compares the relative size of an ion to its neutral atom?
- The radius of an anion is greater than the radius of its neutral atom.
 - The radius of an anion is identical to the radius of its neutral atom.
 - The radius of a cation is greater than the radius of its neutral atom.
 - The radius of a cation is identical to the radius of its neutral atom.
- _____ 7. As you move from left to right across the second period of the periodic table _____.
- ionization energy increases
 - atomic radii increase
 - electronegativity decreases
 - atomic mass decreases
- _____ 8. Of the following elements, which one has the smallest first ionization energy?
- boron
 - carbon
 - aluminum
 - silicon
- _____ 9. Which color of visible light has the shortest wavelength?
- yellow
 - green
 - blue
 - violet
- _____ 10. Which of the following electromagnetic waves have the highest frequencies?
- ultraviolet light waves
 - X-rays
 - microwaves
 - gamma rays

_____ 11. Emission of light from an atom occurs when an electron _____.

- a. drops from a higher to a lower energy level
- b. jumps from a lower to a higher energy level
- c. moves within its atomic orbital
- d. falls into the nucleus

_____ 12. How does calcium obey the octet rule when reacting to form compounds?

- a. It gains electrons.
- b. It gives up electrons.
- c. It does not change its number of electrons.
- d. Calcium does not obey the octet rule.

_____ 13. What is the formula of the ion formed when potassium achieves noble-gas electron configuration?

- a. K^{2+}
- b. K^+
- c. K^{1-}
- d. K^{2-}

_____ 14. What is the electron configuration of the oxide ion (O^{2-})?

- a. $1s^2 2s^2 2p^4$
- b. $1s^2 2s^2 2p^6$
- c. $1s^2 2s^2$
- d. $1s^2 2s^2 2p^2$

_____ 15. How many valence electrons are in an atom of phosphorus?

- a. 15
- b. 3
- c. 4
- d. 5

_____ 16. What color light would result from an electron moving from $n=3$ to $n=2$?

- a. orange
- b. red
- c. blue
- d. green
- e. non-visible EM radiation

_____ 17. Each period in the periodic table corresponds to _____.

- a. a principal energy level
- b. an energy sublevel
- c. an orbital
- d. a suborbital

_____ 18. What element has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^2$?

- a. nitrogen
- b. selenium
- c. silicon
- d. silver

_____ 19. Which of the following is true about the electron configurations of the noble gases?

- a. The highest occupied s and p sublevels are completely filled.
- b. The highest occupied s and p sublevels are partially filled.
- c. The electrons with the highest energy are in a d sublevel.
- d. The electrons with the highest energy are in an f sublevel.

_____ 20. In which of the following groups of ions are the charges all shown correctly?

- a. Li^- , O^{2-} , S^{2+}
- b. Ca^{2+} , Al^{3+} , Br^-
- c. K^{2-} , F^- , Mg^{2+}
- d. Na^+ , I^- , Rb^-

Take out your Green Sheets!

How many protons and electrons are in a ${}^{64}_{29}\text{Cu}^{2+}$ ion?

- A 27 protons, 29 electrons
- B 27 protons, 31 electrons
- C 29 protons, 27 electrons
- D 29 protons, 31 electrons

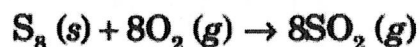
What is the name of the compound PbO_2 ?

- A lead oxide
- B lead(II) oxide
- C lead oxide(II)
- D lead(IV) oxide

If two oxygen atoms combine to make a molecule, what type of bond will they form?

- A an ionic bond
- B a hydrogen bond
- C a double covalent bond
- D a metallic bond

What type of chemical reaction is represented by this balanced equation?



- A synthesis
- B decomposition
- C single replacement
- D double replacement

How does an S^{2-} ion differ from an electrically neutral sulfur atom?

- A mass number
- B atomic number
- C nuclear charge
- D number of electrons

Which orbital notation represents an s-block element in the third period?

- A $\uparrow\downarrow$ $\uparrow\downarrow$
1s 2s
- B $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$
1s 2s 2p 3s
- C $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$
1s 2s 2p 3s 3p
- D $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$
1s 2s 2p 3s 3p 4s 3d

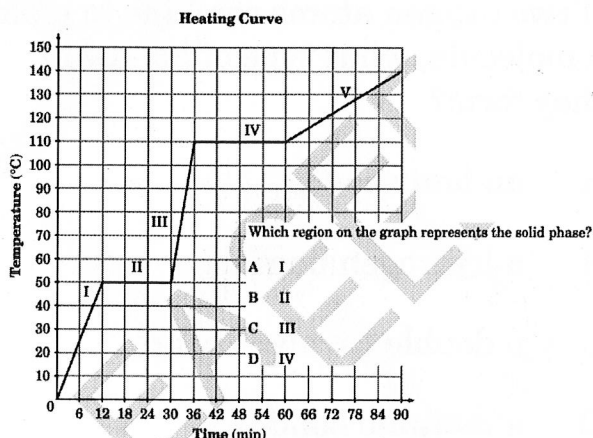
Page 7

What do the ions K^+ , Ca^{2+} , and Cl^- have in common?

- A They have the same number of protons.
- B They will form covalent bonds with oxygen.
- C They have the same electron configuration as argon.
- D They are larger than their corresponding atoms.

Page 8

This graph represents a heating curve of a substance.



Page 9

What is the name of the compound with the chemical formula $CrCl_3$?

- A chromium tetrachloride
- B chromium trichloride
- C chromium(II) chloride
- D chromium(III) chloride

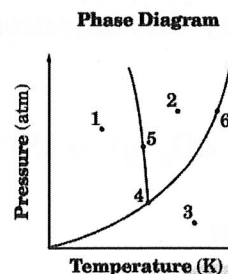
Page 10

Which substance can act as either an acid or a base according to the Brønsted-Lowry definition?

- A H_3O^{1+}
- B NH_4^{1+}
- C HOH
- D HCl

Page 11

This diagram represents a phase diagram for a substance.

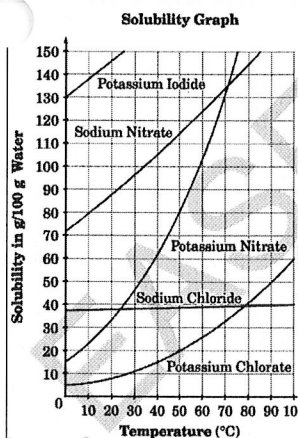


At which point do solid, liquid, and gas phases exist in equilibrium?

- A 1
- B 2
- C 3
- D 4

Page 12

Using the solubility graph provided, a student performs an experiment to find the solubility of a substance. The student finds the amount of substance needed to make a saturated solution in 100 g of water at different temperatures. The student's data are shown in the table below the graph.



Student Data

Trial	Temperature (°C) of Water	Salt in 100 g of water (g)
1	25	40
2	68	126

What is the identity of the substance?

- A Sodium Nitrate
- B Potassium Nitrate
- C Sodium Chloride
- D Potassium Chlorate

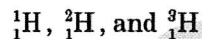
What is the correct chemical formula for sodium sulfate?

- A NaSO_4
- B Na_2SO_4
- C $\text{Na}(\text{SO}_4)_2$
- D $\text{Na}_2(\text{SO}_4)_2$

Which compound contains both covalent and ionic bonds?

- A CaCO_3
- B CO_2
- C H_2O
- D NaCl

What are the differences between these isotopes of hydrogen shown below?



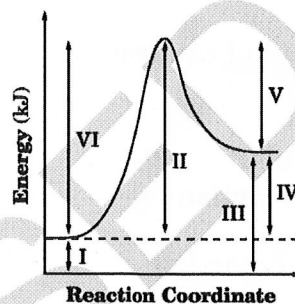
- A the number of electrons and the atomic number
- B the number of protons and the atomic number
- C the number of neutrons and the mass number
- D the number of electrons and protons

Which element is located in Group 2 (IIA) and Period 6 of the periodic table?

- A barium (Ba)
- B molybdenum (Mo)
- C radium (Ra)
- D tungsten (W)

This graph is a potential energy diagram for a chemical reaction.

Potential Energy Diagram



- A II
- B IV
- C V
- D VI

Which energy measure will remain unchanged with the addition of a catalyst?

Which electron transmission in the hydrogen atom will result in the emission of red light?

- A $n = 2$ to $n = 3$
- B $n = 2$ to $n = 4$
- C $n = 3$ to $n = 2$
- D $n = 4$ to $n = 2$

Page 19

In which group are the particles arranged in order of decreasing mass?

- A alpha, beta, neutron
- B alpha, neutron, beta
- C neutron, beta, alpha
- D neutron, alpha, beta

Page 20

Consider this incomplete chemical equation:



What are the products of this equation?

- A BaCl_2 and CuCl_2
- B BaCuCl_2 and Ba
- C BaCl_2 and Cu
- D BaCu and Cl_2

Page 21

What is the nuclear composition of uranium-235?

- A 92 electrons + 143 protons
- B 92 protons + 143 electrons
- C 143 protons + 92 neutrons
- D 92 protons + 143 neutrons

Page 22

What is the **best** reason for using iron filings instead of an iron nail in a chemical reaction?

- A to decrease the amount of catalyst during the reaction
- B to increase the molecular structure during the reaction
- C to decrease the rate of reaction
- D to increase the surface area of the reaction

Page 23

Which is a characteristic of a strong acid?

- A It has a pH greater than 7.
- B It completely ionizes in solution.
- C It contains many hydroxide ions.
- D It reacts only with a strong base.

Page 24

Which elements have the same number of neutrons?

- A $^{10}_5\text{B}$ and $^{12}_6\text{C}$
- B $^{55}_{25}\text{Mn}$ and $^{56}_{26}\text{Fe}$
- C $^{108}_{47}\text{Ag}$ and $^{112}_{48}\text{Cd}$
- D $^{197}_{79}\text{Au}$ and $^{201}_{80}\text{Hg}$

Page 25

What compound has the chemical formula MgI_2 ?

- A di-iodide magnesium
- B iodide(II) magnesium
- C magnesium iodide
- D magnesium(I) iodine(II)

Page 26

This chart represents the melting point of several substances.

Substance	Melting Point ($^{\circ}\text{C}$)
Cl_2	-101.5
Na	97.72
NaCl	801

What **best** explains the high melting point of the salt?

- A the strong electrostatic attraction between Na^0 and Cl^0
- B the weak electrostatic attraction between Na^0 and Cl^0
- C the weak electrostatic attraction between Na^+ and Cl^-
- D the strong electrostatic attraction between Na^+ and Cl^-

Page 27

Which one of these compounds is soluble in water?

- A aluminum sulfide
- B calcium carbonate
- C iron(III) hydroxide
- D potassium sulfate

Page 28

In which block does an element with the electron configuration $[\text{Xe}] 6s^2 4f^{14} 5d^{10} 6p^1$ belong?

- A s block
- B p block
- C d block
- D f block

Page 29

Which orbital notation shows the lowest energy arrangement of valence electrons for $1s^2 2s^2 2p^3$?

- A $2s \uparrow\downarrow$
- B $2s \uparrow\downarrow \quad 2p \uparrow\downarrow \uparrow \quad _$
- C $2s \uparrow\downarrow \quad 2p \uparrow \downarrow \uparrow$
- D $2s \uparrow\downarrow \quad 2p \uparrow \uparrow \uparrow$

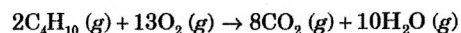
Page 30

What is the $[H^+]$ of an HCl solution if the pH is measured to be 6?

- A $1 \times 10^{-7} M$
- B $1 \times 10^{-6} M$
- C $6 \times 10^{-6} M$
- D $8 \times 10^{-1} M$

Page 31

This balanced equation represents a chemical reaction.



What type of chemical reaction is represented by the equation?

- A combustion
- B decomposition
- C double replacement
- D single replacement

Page 32

A scientist hypothesizes that a colorless gas produced during a chemical reaction is carbon dioxide. Which observation would confirm this hypothesis?

- A The gas will react violently with water.
- B A glowing splint placed in the gas will burn brighter.
- C Burning the gas in the presence of oxygen will produce water.
- D Bubbling the gas through lime water will make the lime water cloudy.

Page 33

When $^{42}_{19}K$ undergoes radioactive decay, the result is two products, one of which is calcium-42. What is the other product?

- A 4_2He
- B 2_4He
- C 1_1e
- D $^0_{-1}e$

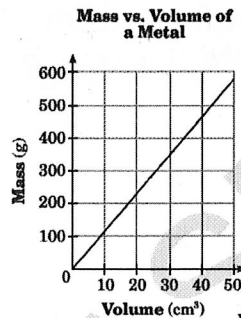
Page 34

A gas under a pressure of 74 mmHg and at a temperature of $75^\circ C$ occupies a 500.0-L container. How many moles of gas are in the container?

- A 1.7 moles
- B 7.9 moles
- C 13 moles
- D 59 moles

Page 35

A chemistry student is given 5 samples of a metal. The student measures and records the mass and the volume of each sample and then graphs the data, as shown below.



What is the identity of the metal?

- A aluminum
- B iron
- C nickel
- D lead

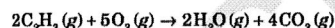
Page 36

What is the volume of 2.00 moles of nitrogen gas (N_2) at STP?

- A 11.2 L
- B 28.0 L
- C 44.8 L
- D 56.0 L

Page 37

According to this balanced chemical equation, what volume of C_2H_2 is required to form 40.0 L of CO_2 ?



- A 20.0 L
- B 44.8 L
- C 80.0 L
- D 100 L

Page 38

In an experiment, 2.62 g of iron react completely with 1.50 g of sulfur. What is the empirical formula for the compound produced?

- A FeS
- B FeS₂
- C Fe₂S
- D Fe₂S₃

Page 39

Which chemical equation is balanced?

- A $LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$
- B $2LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$
- C $LiOH + 3CO_2 \rightarrow 2Li_2CO_3 + H_2O$
- D $4LiOH + CO_2 \rightarrow Li_2CO_3 + 2H_2O$

Page 40

Neutralization occurs when 15.0 mL of KOH react with 25.0 mL of HNO_3 . If the molarity of HNO_3 is 0.750 M, what is the molarity of the KOH?

- A 1.67 M
- B 1.25 M
- C 0.600 M
- D 0.450 M

Page 41

In a flexible container, 15.9 L of gas is under 589 kPa of pressure at a temperature of 56.5°C. If the pressure and temperature change to STP, what is the new volume?

- A 10.2 L
- B 76.6 L
- C 92.4 L
- D 112 L

Page 42

Atomic Structure

1. Atomic Number is the same as _____
2. Atoms overall have a _____ charge because the number of _____ equals the number of _____.
3. Mass Number/Atomic Mass = _____ + _____
 - a. If you have the mass how do you get the number of neutrons?
4. Define 1 amu:
5. For Oxygen-18
 - a. Atomic Number _____
 - b. Atomic Mass _____
 - c. Protons _____
 - d. Neutrons _____
 - e. Electrons _____
 - f. Valence Electrons _____
 - g. Write this element in symbol notation _____
6. Electrons in the outermost energy level are called _____ electrons.

Periodic Table

1. Term for a Row: _____
2. Term for a Column: _____
3. Elements in the same group have similar _____ because they have the same number of _____

4. Name the element in Group 6A Period 4: _____

5. Group Names

- a. Group 1A: _____
- b. Group 2A: _____
- c. Group 7A: _____
- d. Group 8A: _____
- e. B Groups: _____

f. What's the least reactive group? Most ~~Least~~ Reactive Metals Most ~~Least~~ Reactive Nonmetals _____

6. Types of Elements

a. Metals

- i. On the _____ side of the table
- ii. _____ Melting and Boiling Points
- iii. Usual state: _____
- iv. Brittle OR Ductile and Malleable?
- v. High Luster/Lustrous meaning they are _____

b. Nonmetals

- i. On the _____ side of the table
- ii. _____ Melting and Boiling Points
- iii. Usual state: _____

Physical Science Benchmark 1 Study Guide

iv. Brittle OR Ductile and Malleable?

c. Metalloids

i. Touch the _____ on the table

ii. Name the two in Group 4A:

Draw a Bohr Diagram for elements 3, 7, 10, and 13:

Draw a Lewis Structure/Electron Dot Diagram for elements 2, 5, 9, and 18:

Periodic Trends

1. Decreases as you move UP and to the RIGHT on the Periodic Table

a. Which has a bigger radius? N or O K or Na Br or Cl Ga or S

b. Which has a bigger radius? N or N³⁻ K or K⁺

c. Which has a bigger Ionization Energy? N or O K or Na Br or Cl Ga or S

d. Which has a bigger Electronegativity? N or O K or Na Br or Cl Ga or S

e. Define Electronegativity:

Name of element	Isotope Symbol	Atomic Number	Mass Number	Number of protons	Number of Electrons	Number of Neutrons
	¹² ₆ C					
Helium-4						
³⁰				30		35
Gold-197		79				
	¹⁶ ₈ O					
⁸²			207	82		
					19	20

Chemistry Quiz: Bonding

- _____ 1. Which of these elements does not exist as a diatomic molecule?
a. Ne c. H
b. F d. I
- _____ 2. Which of the following elements can form diatomic molecules held together by triple covalent bonds?
a. carbon c. fluorine
b. oxygen d. nitrogen
- _____ 3. When one atom contributes both bonding electrons in a single covalent bond, the bond is called a(n) _____.
a. one-sided covalent bond c. coordinate covalent bond
b. unequal covalent bond d. ionic covalent bond
- _____ 4. What is the shape of a molecule with a triple bond?
a. tetrahedral c. bent
b. pyramidal d. linear
- _____ 5. A bond formed between a silicon atom and an oxygen atom is likely to be _____.
a. ionic c. polar covalent
b. coordinate covalent d. nonpolar covalent
- _____ 6. Which of the following covalent bonds is the most polar?
a. H—F c. H—H
b. H—C d. H—N
- _____ 7. Which of the forces of molecular attraction is the strongest?
a. dipole interaction c. hydrogen bond
b. dispersion d. single covalent bond
- _____ 8. What is required in order to melt a network solid?
a. breaking Van der Waals bonds c. breaking hydrogen bonds
b. breaking ionic bonds d. breaking covalent bonds
- _____ 9. When Group 2A elements form ions, they _____.
a. lose two protons c. lose two electrons
b. gain two protons d. gain two electrons
- _____ 10. Which of the following compounds contains the Mn^{3+} ion?
a. MnS c. Mn_2O_3
b. MnBr_2 d. MnO
- _____ 11. Which of the following formulas represents an ionic compound?
a. CS_2 c. N_2O_4
b. BaI_2 d. PCl_3
- _____ 12. Which of the following shows correctly an ion pair and the ionic compound the two ions form?
a. $\text{Sn}^{4+}, \text{N}^{3-}; \text{Sn}_4\text{N}_3$ c. $\text{Cr}^{3+}, \text{I}^-; \text{CrI}$
b. $\text{Cu}^{2+}, \text{O}^{2-}; \text{Cu}_2\text{O}_2$ d. $\text{Fe}^{3+}, \text{O}^{2-}; \text{Fe}_2\text{O}_3$

- ____ 13. Which set of chemical name and chemical formula for the same compound is correct?
- iron(II) oxide, Fe_2O_3
 - aluminum fluoride, AlF_3
 - tin(IV) bromide, SnBr_4
 - potassium chloride, K_2Cl_2
- ____ 14. How do atoms achieve noble-gas electron configurations in single covalent bonds?
- One atom completely loses two electrons to the other atom in the bond.
 - Two atoms share two pairs of electrons.
 - Two atoms share two electrons.
 - Two atoms share one electron.
- ____ 15. Which of the following compounds contains the lead(II) ion?
- PbO
 - PbCl_4
 - Pb_2O
 - Pb_2S
- ____ 16. Which set of chemical name and chemical formula for the same compound is correct?
- ammonium sulfite, $(\text{NH}_4)_2\text{S}$
 - iron(III) phosphate, FePO_4
 - lithium carbonate, LiCO_3
 - magnesium dichromate, MgCrO_4
- ____ 17. Molecular compounds are usually ____.
- composed of two or more transition elements
 - composed of positive and negative ions
 - composed of two or more nonmetallic elements
 - exceptions to the law of definite proportions
- ____ 18. Which of the following formulas represents a molecular compound?
- ZnO
 - Xe
 - SO_2
 - BeF_2
- ____ 19. What is the correct name for the compound CoCl_2 ?
- cobalt(I) chlorate
 - cobalt(I) chloride
 - cobalt(II) chlorate
 - cobalt(II) chloride
- ____ 20. What is the correct name for $\text{Sn}_3(\text{PO}_4)_2$?
- tin diphosphate
 - tin(II) phosphate
 - tin(III) phosphate
 - tin(IV) phosphate
- ____ 21. What is the formula for sodium sulfate?
- NaSO_4
 - Na_2SO_4
 - $\text{Na}(\text{SO}_4)_2$
 - $\text{Na}_2(\text{SO}_4)_2$
- ____ 22. Which of the following is NOT a characteristic of most ionic compounds?
- They are solids.
 - They have low melting points.
 - When melted, they conduct an electric current.
 - They are composed of metallic and nonmetallic elements.
- ____ 23. What characteristic of metals makes them good electrical conductors?
- They have mobile valence electrons.
 - They have mobile protons.
 - They have mobile cations.
 - Their crystal structures can be rearranged easily.

24. What causes dipole interactions?

- sharing of electron pairs
- attraction between polar molecules
- bonding of a covalently bonded hydrogen to an unshared electron pair
- attraction between ions

- _____ 11. When Group 2A elements form ions, they _____.
a. lose two protons
b. gain two protons
c. lose two electrons
d. gain two electrons
- _____ 12. Which of the following compounds contains the Mn^{3+} ion?
a. MnS
b. MnBr_2
c. Mn_2O_3
d. MnO
- _____ 13. Which of the following formulas represents an ionic compound?
a. CS_2
b. BaI_2
c. N_2O_4
d. PCl_3
- _____ 14. Which of the following shows correctly an ion pair and the ionic compound the two ions form?
a. $\text{Sn}^{4+}, \text{N}^{3-}; \text{Sn}_4\text{N}_3$
b. $\text{Cu}^{2+}, \text{O}^{2-}; \text{Cu}_2\text{O}_2$
c. $\text{Cr}^{3+}, \text{I}^-; \text{CrI}$
d. $\text{Fe}^{3+}, \text{O}^{2-}; \text{Fe}_2\text{O}_3$
- _____ 15. Which of the following compounds contains the lead(II) ion?
a. PbO
b. PbCl_4
c. Pb_2O
d. Pb_2S
- _____ 16. Which set of chemical name and chemical formula for the same compound is correct?
a. iron(II) oxide, Fe_2O_3
b. aluminum fluoride, AlF_3
c. tin(IV) bromide, SnBr_4
d. potassium chloride, K_2Cl_2
- _____ 17. Which set of chemical name and chemical formula for the same compound is correct?
a. ammonium sulfite, $(\text{NH}_4)_2\text{S}$
b. iron(III) phosphate, FePO_4
c. lithium carbonate, LiCO_3
d. magnesium dichromate, MgCrO_4
- _____ 18. Molecular compounds are usually _____.
a. composed of two or more transition elements
b. composed of positive and negative ions
c. composed of two or more nonmetallic elements
d. exceptions to the law of definite proportions
- _____ 19. Which of the following formulas represents a molecular compound?
a. ZnO
b. Xe
c. SO_2
d. BeF_2
- _____ 20. What is the correct name for the compound CoCl_2 ?
a. cobalt(I) chlorate
b. cobalt(I) chloride
c. cobalt(II) chlorate
d. cobalt(II) chloride
- _____ 21. What is the correct name for $\text{Sn}_3(\text{PO}_4)_2$?
a. tritin diphosphate
b. tin(II) phosphate
c. tin(III) phosphate
d. tin(IV) phosphate

Half-Life Problems

1. An isotope of cesium (cesium-137) has a half-life of 30 years. If 1.0 mg of cesium-137 disintegrates over a period of 90 years, how many mg of cesium-137 would remain?
2. A 2.5 gram sample of an isotope of strontium-90 was formed in a 1960 explosion of an atomic bomb at Johnson Island in the Pacific Test Site. The half-life of strontium-90 is 28 years. In what year will only 0.625 grams of this strontium-90 remain?
3. Actinium-226 has a half-life of 29 hours. If 100 mg of actinium-226 disintegrates over a period of 58 hours, how many mg of actinium-226 will remain?
4. The half-life of isotope X is 2.0 years. How many years would it take for a 4.0 mg sample of X to decay and have only 0.50 mg of it remain?
5. After 3 half-lives have passed, 0.375 grams of Bismuth-218 remain. How big was the original sample?
6. The half-life of a radioactive element is 30 seconds. In what period of time would the activity of the sample be reduced to one-sixteenth of the original activity?
7. The half-life of francium is 3 minutes. After 18 minutes, what fraction of the original sample remains?

VSEPR Molecule Modeling

After sketching the structural diagram, build the following molecules. After you have built the molecule, answer the questions for that molecule. Work as a group and help each other understand. The point of this group activity is to give each member a thorough understanding of how to draw structural diagrams and to determine VSEPR shapes. **DON'T LET ANYONE ELSE DO YOUR PART AND CHEAT YOU OUT OF LEARNING!**

Note: Choose carefully what color modeling piece you choose for the central atom. Only certain color center piece shapes can build certain VSEPR shapes.

1. Sketch the structural diagram for CH_4 .

Shared Pairs (around central atom):
VSEPR Shape:

Unshared Pairs (around central atom):

2. Sketch the structural diagram for NH_3 .

Shared Pairs: Unshared Pairs:
VSEPR Shape:

I want to see this molecule once you have it built. Be prepared to discuss/describe it! Raise your hand and I will sign off here ____.

3. Sketch the structural diagram for H_2O .

Shared Pairs: Unshared Pairs:
VSEPR Shape:

4. Sketch the structural diagram for BF_3 .

What is special about this molecule? It has a _____
VSEPR Shape:

5. Sketch the structural diagram for I_2 .

Shares Pairs: Unshared Pairs:
VSEPR Shape:

6. Sketch the structural diagram for H_2S .

Shared Pairs: Unshared Pairs:
VSEPR Shape:

Show me, Discuss, Sign off again: _____

What is the shape of any molecule with 4 single covalent bonds?

What is the shape of any molecule with 3 single covalent bonds and 1 unshared pair?

What is the shape of any molecule with 2 double covalent bonds?

What is the shape of any molecule with 2 single covalent bonds and 2 unshared pairs?

What is the shape of any molecule with 2 single covalent bonds and one double covalent bond?

What is a coordinate covalent bond?

What is the VSEPR shape of a carbon monoxide (CO) molecule? Draw the molecule.

Covalent Bonding always occurs between a _____ and a _____.

In Covalent Bonding electrons are _____ between atoms.

Covalent Compounds, also called _____ compounds, have a _____ MP & BP, and are _____ conductors of heat and electricity.

VSEPR Theory is used to determine the _____ of molecules.

VSEPR is an acronym, which stands for _____.

Ionic Bonding always occurs between a _____ and a _____.

In Ionic Bonding electrons are _____ between atoms.

Ionic Compounds, also called _____, have a _____ MP & BP, and are good conductors of heat and electricity only when _____ or in _____.

Metallic Bonding occurs between atoms of the same _____, has a _____ MP & BP, and are _____ conductors as solids or as liquids because they have a shared _____ of mobile _____.

Which compound has a longer bond: HF or HCl? How do you know?

Which VSEPR shape has a smaller bond angle, Linear or Bent?

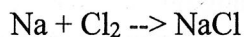
Which VSEPR shape has a larger bond angle, Trigonal Planer or Tetrahedral?

Which is stronger, a single or double bond? Which is longer?

1. What element is in period 4, group 2 of the periodic table?
2. Which is more electronegative, Gallium or Germanium?
3. Which has a larger radius, sodium atom or sodium ion?
4. Which has a larger radius, Sulfur or Arsenic?
5. Which has a higher ionization energy, nitrogen or oxygen?
6. Define Atomic Mass Unit (amu):
7. Where do the atomic masses on the periodic table come from?
8. How many protons, neutrons, and electrons are in an atom of Carbon-14?
9. Write Carbon-14 in shorthand notation.
10. What is the least reactive group of elements?
11. Why do atoms bond?
12. Name an element with properties similar to Calcium.
13. Given another name for group 14.
14. How many electrons can an orbital hold?
15. How many total electrons will fit in the 3rd principle energy level?
16. What is the maximum number of d orbitals in a given energy level?
17. Write the orbital diagram for Oxygen. (arrows)
18. Draw a Lewis Structure for phosphorous.
19. Write the electron configuration (longhand) for silicon.
20. Write the electron configuration (shorthand) for Iodine.
21. Write the electron configuration (longhand) for sulfide anion.
22. What is the oxidation number of aluminum?
23. What is the chemical formula for zinc chloride?
24. What is the chemical formula for Iron (III) oxide?
25. What is the chemical formula for diphosphorus pentoxide?
26. What is the chemical formula for tricarbon tetrafluoride?
27. What is the chemical formula for ammonium phosphate?
28. Define electronegativity:
29. Two atoms of an element with different numbers of neutrons are called what?
30. What is the atomic number of carbon?
31. A soft substance with a low melting point and low boiling point contains what type of bonds?
32. Is water polar or nonpolar?
33. Would water be able to dissolve a nonpolar solute?
34. Name an alkaline earth metal.
35. What are the 4 indicators of a chemical change?
36. What are the names and formulas of the 4 acids you are supposed to know?
37. Define temperature:

- Units (Temperature, heat energy, mass, volume)
- R Values
- Standard Temperature/Pressure
- ΔT
- Hf vs. Hv
- Specific Heat
- Choosing Cp for Water
- Density, Identifying unknown samples
- Temperatures in Kelvin

1. What is the mass of a sample of ice that requires 10,000 J of heat to melt at 0 Celsius?
 2. What is the concentration of hydrogen ions in a sample with a pOH of 11?
 3. What is the volume of 2 mol of N₂ gas at standard pressure and a temperature of 22°C?
 4. To prepare a 200ml of 0.1 Molar HCl, how many milliliters of stock 2M HCl would be needed?
 5. In a steel chamber of fixed volume, oxygen gas initially at a pressure of 250kPa is heated from 20 Kelvin to 85 Kelvin. What would be the resulting pressure after this change has occurred?
 6. What mass of water can a microwave heat from 20°C to 45°C using 10kJ of energy?
 7. What is the pressure in a balloon that contains helium at 22kPa, oxygen at 44kPa, and nitrogen at 80kPa?
 8. What is the concentration of 140g of NaCl dissolved in 400ml of water?
 9. What mass of I₂ gas is needed to fill a 4L balloon to 125kPa at 25 degrees Celsius?
 10. How much energy is needed to heat a 100g aluminum can by 30 degrees Celsius?
1. What is the volume of 88g of chlorine gas?
 2. How many molecules of water are in 72g of water?
 3. How many moles of chlorine gas would react with 5 moles of sodium according to the *unbalanced* equation below?



4. Using the equation above, determine the amount of product that can be produced from 24.7 g of chlorine gas.
5. What is the percentage, by mass, of the Hydrogen in C₈H₁₈?
6. What mass of Carbon atoms are in a 2500g sample of C₈H₁₈?
7. What is the molecular formula of a compound whose molar mass is 34g and empirical formula is HO?
8. Find the empirical formula of a compound that is 62.1% C, 13.8% H, and 24.1% N.