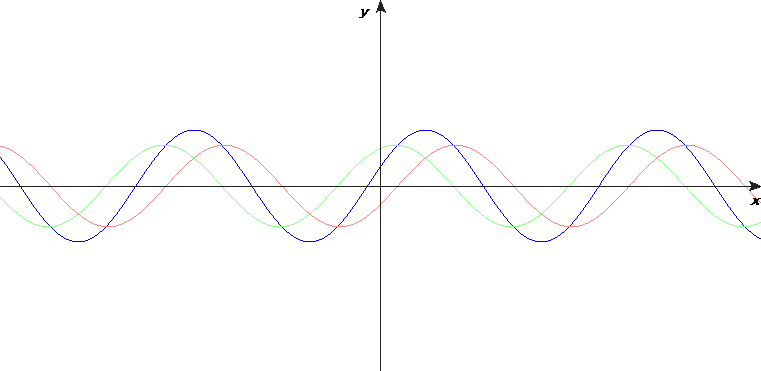
**Chemistry 2nd Semester Review Packet: 2013-2014**

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**Chemistry**

**2013-2014**

**They can because they think they can.**

**-Virgil**

Name:

Date:

Period:

**Unit 2: Properties of Matter**

**Chem.4A: Physical and Chemical Changes**

**Notes:**

* Physical Change: Does not create something new, can be reversed
* Chemical Change: Creates something new, cannot be reversed

1. Which of the following is not evidence that a chemical change has taken place?
2. A color change
3. A phase change
4. A temperature change
5. Formation of a gas
6. Which of the following is an example of a physical change?
7. Acid rain causes the decomposition of a marble statue.
8. Concentrated hydrochloric acid is diluted with water.
9. Hydrochloric acid is neutralized by a base to produce a salt and water.
10. Zinc metal is added to hydrochloric acid and a gas is released.
11. Which of the following is an example of a physical change?
12. Cutting a block of wood in half
13. Cooking an egg
14. Splitting an atom
15. Iron rusting outside
16. **Read these statements and decide which represent(s) a physical property:**

Your letter choices follow the statements.

I. The freezing point of nitrogen is -209.86 ºC.

II. Oil and water do not mix.

III. An iron nail will rust when left outside.

IV. White phosphorus ignites when exposed to air.

1. I, II, & III
2. I & IV
3. III & IV
4. I & II
5. Which grouping identifies chemical properties?
6. Malleability, ductility, conductivity
7. Luster, hardness, texture
8. Combustibility, flammability, reactivity
9. Density, melting point, boiling point

**Chem.4B: Intensive vs. Extensive**

**Notes:**

* Intensive Property: Stays the same regardless of the amount of a substance
* Extensive Property: Changes based on the amount of a substance (Ex: Weight, mass, length, volume)

1. A ball has a mass of 12 grams. If the mass is broken in half, what is the mass of each of the pieces?
2. An aluminum cube has a density of 6.2 g/mL. If the aluminum is broken into a fourth of the original size, what is the density of each piece?

Below are some observations a student made in an experiment:

1. The student obtains 15 g of an unknown substance.
2. The student notes that at room temperature the substance is a solid and is colored white.
3. The student determines that the density of the substance is 2.17 g/cm3
4. The student then determines that the substance is soluble in water.
5. The student determines that the unknown substance is sodium chloride. Which of the following is an intensive property of sodium chloride?
6. Mass of 15 g
7. White Color
8. Density of 2.17 g/ cm3
9. Both (b) and (c)
10. Student X heats a sample of 100 grams of H2O to 100˚C. Student Y heats a sample of 200 grams of H2O to 100˚C. Compared to sample X, sample Y’s boiling point should be:
11. Lower, because boiling point is an extensive property
12. Greater, because boiling point is an extensive property
13. Greater, because boiling point is an intensive property
14. Equal, because boiling point is an intensive property.
15. Classify the following properties as either intensive or extensive
    1. Weight \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    2. Odor\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    3. Volume\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    4. Freezing Point \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chem.4C: Solids, Liquids, and Gases; Phase Changes**

1. Which phase of matter has an indefinite shape and an indefinite volume?
2. solid
3. liquid
4. gas
5. plasma
6. The phase that has sliding particle motion while maintaining contact is
7. Gas
8. Solid
9. Liquid
10. All of the above
11. Which phase of matter has an indefinite shape and a definite volume?
12. solid
13. liquid
14. gas
15. plasma
16. Which set of properties does a substance such as solid gold have?
17. definite shape and definite volume
18. definite shape but no definite volume
19. no definite shape but definite volume
20. no definite shape and no definite volume

**Chem.4D: Pure Substances vs. Mixtures**

**Notes:**

* Pure Substances: Cannot be separated physically.
  + Compound 🡪 can be separated chemically
  + Element 🡪 cannot be separated
* Mixture: Cannot be separated chemically
  + Homogeneous Mixture: Same appearance throughout (uniform composition)
  + Heterogeneous Mixture: Different appearance throughout (non-uniform composition)

1. Which of the following is an example of a pure substance?
2. Lemonade
3. Trail mix
4. Distilled water
5. Air
6. An unknown blue powder has a constant melting point and cannot be chemically or physically separated into other substances. The unknown substance can be classified as \_\_\_\_.
7. an alloy
8. an element
9. a compound
10. a mixture
11. Which of these is the general term for something that can only be separated chemically?
12. Compound
13. Mixture
14. Solution
15. Element
16. Which of these examples of matter is composed of more than one substance, can be physically separated, and has a non-uniform composition?
17. Nickel, Ni
18. Sodium Chloride, NaCl
19. Turkey Sandwich
20. Pepsi

**Unit 3: The Periodic Table**

**Chem.5A: Development of the Periodic Table**

**Notes:**

* Groups: Columns (top to bottom) on the periodic table
  + Elements in the same group have the same number of valence electrons
  + Elements in the same group have similar chemical properties
* Periods: Rows (left to right) on the periodic table
  + Periods are also known as *Energy Levels*
* Metals are on the left side of the periodic table
* Nonmetals are on the right side of the periodic table

1. List the number of energy levels in each atoms of the element.
   1. Copper\_\_\_\_\_\_\_\_ b. Boron\_\_\_\_\_\_\_\_\_ c. Barium \_\_\_\_\_\_
2. Circle the elements that have the most similar chemical properties
3. Sulfur b. Aluminum c. Sodium d. Chlorine e. Oxygen
4. Circle the elements that have the same number of energy levels.
5. Sulfur b. Aluminum c. Sodium d. Chlorine e. Oxygen
6. Circle the elements that are chemically most similar to bromine.
7. Gallium b. Tin c. Iodine d. Cobalt e. Fluorine
8. Oxygen is a \_\_\_\_\_\_\_\_\_ and Silicon is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   1. metal, metalloid
   2. nonmetal, metal
   3. metal, nonmetal
   4. nonmetal, metalloid

**Fill in the blank.**

1. Elements within a group have a similar number of \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_.
2. Elements across the same period have the same number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_
3. The elements in which of these sets have chemical properties that are the most similar?
4. K, Ca, Sc
5. B, Al, Ga
6. Na, Ca, Y
7. P, S, Cl

**Chem.5B: Properties of Periodic Families**

**Notes:**

* Alkali Metals are in Group 1 (1 valence electron)
* Alkaline Earth Metals are in Group 2 (2 valence electrons)
* Transition Metals are in Groups 3-12 ***(valence electrons vary)***
* Halogens are in Group 17 (7 valence electrons)
* Noble Gases are in Group 18 (8 valence electrons)

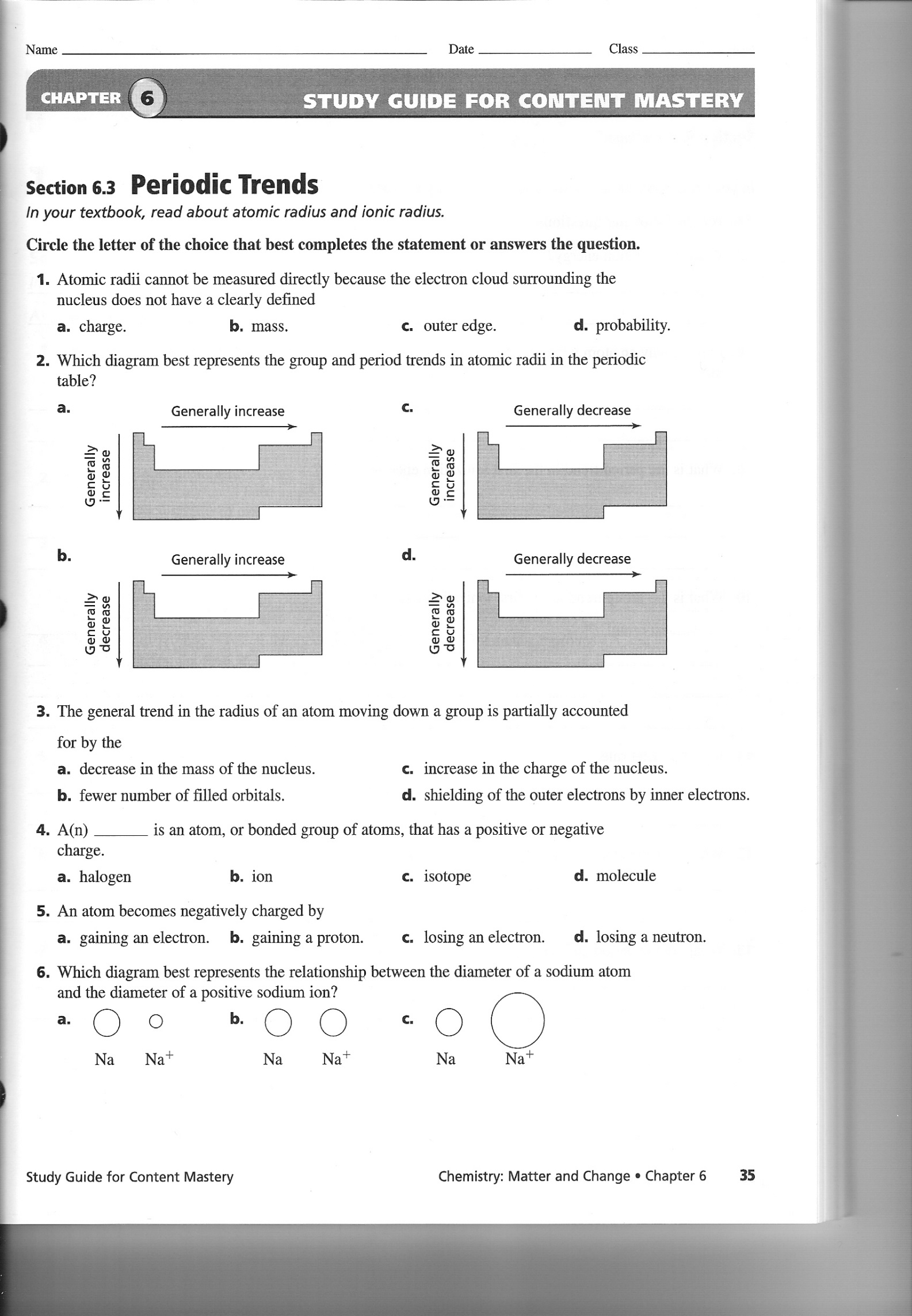
1. An element is discovered that has an atomic number of 111 and 1 valence electron. The element is most likely\_\_\_\_
2. A noble gas
3. An alkali metal
4. A halogen
5. A transition metal
6. Which of the following sections of the periodic table contains only metals?
7. Group 2
8. Group 18
9. Period 2
10. Period 6
11. Which statement explains why Phosphorus is classified as a Group 15 element?
12. A phosphorus atom has 5 valence electrons.
13. A phosphorus atom has 15 neutrons.
14. Phosphorus is a silvery solid at STP.
15. Phosphorus reacts with most noble gases
16. Victoria finds an element with 7 valence electrons in period 5. She correctly classifies it as a halogen. Which element did she find?
    1. Bromine
    2. Strontium
    3. Iodine
    4. Phosphorus
17. Jose was walking through the chemical cabinet and found an element. He determined that it was one of the most reactive metals and that it was in period 4. Which element did he find?
18. Calcium
19. Potassium
20. Fluorine
21. Sodium
22. Tyronne went hiking in Fort Bend and found an element that was part of the family that has the most reactive elements. He also found that it was in the 6th period. What element did he find?
    1. Cesium
    2. Iodine
    3. Astatine
    4. Sodium

**Chem.5C: Periodic Trends**

**Notes:**

* Electronegativity increases up and to the right (Towards the E)
* Ionization Energy increases up and to the right (Towards the E)
* Atomic radii increases down and to the left (Towards the R)
* Ionic radii increases down and to the left (Towards the R)

E

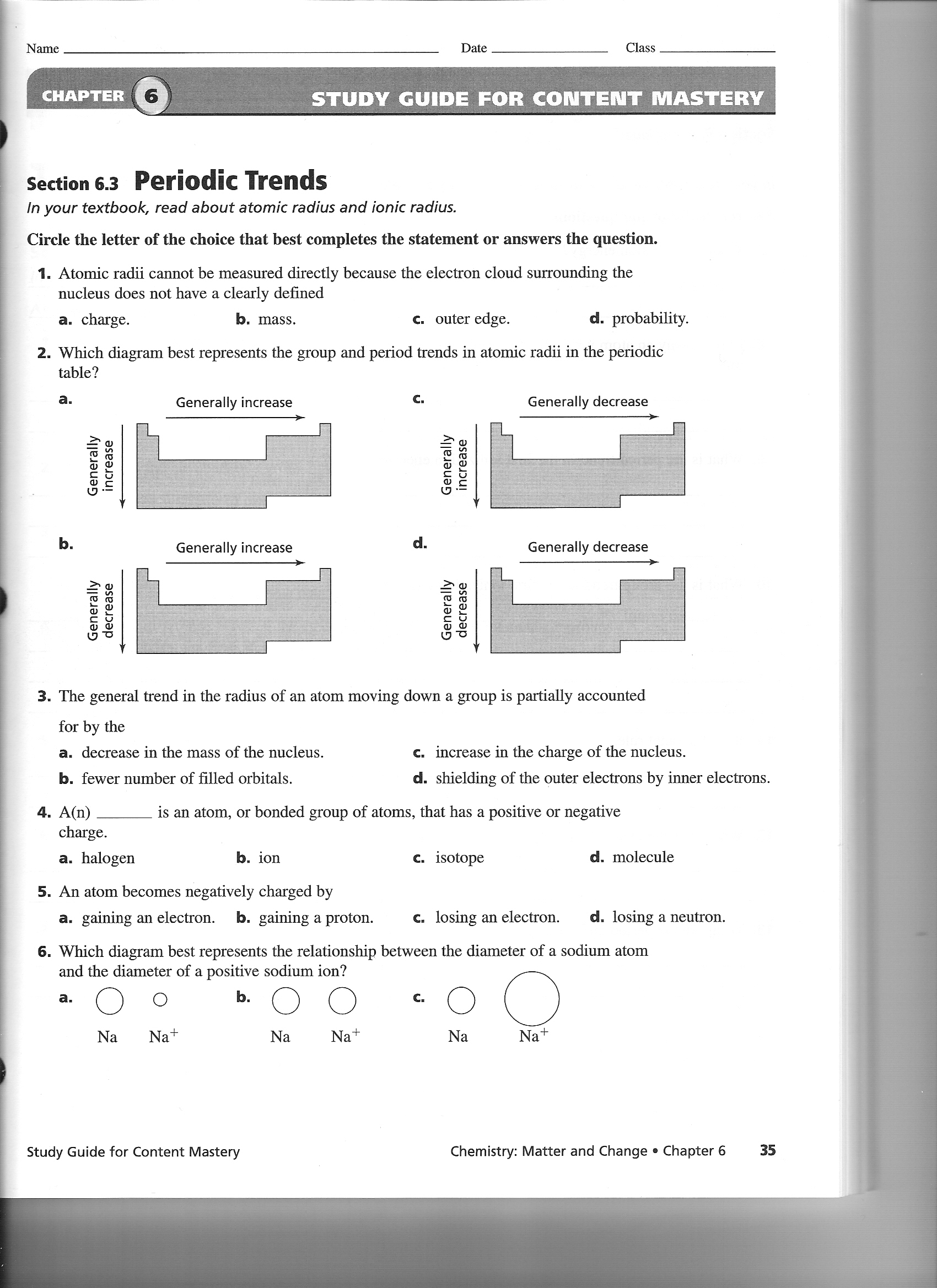


B

A

R

1. Which diagram best represents group and period trends for electronegativity?



1. Which of the following will have a smaller value for Magnesium than for Strontium?
2. Electronegativity
3. Ionic Radius
4. Atomic Radius
5. I only
6. I and III
7. II and III
8. I and II
9. Which of the following properties increase from left to period across period 3?
10. Luster
11. Ionic Radii
12. Electronegativity
13. Atomic Radii
14. Which of the following trends the periodic table should be expected as the atomic number decreases in the Halogen?
15. Electronegativity Increase
16. Atomic Radius Increase
17. Ionization Energy Decrease
18. Ionic Radius Increase

**Unit 4: Atomic Chemistry**

**Chem.6A: Atomic Theory Scientists, Experiments**

**Notes:**

* John Dalton composed the four initial postulates of atomic theory
* J.J. Thomson discovered the electron (cathode ray experiment)
* Ernest Rutherford discovered that atoms were mostly empty space (Gold foil experiment)
* Niels Bohr discovered that electrons travel in energy levels

1. Consider the following selected postulates of Dalton’s atomic theory:

* 1. Each element is composed of extremely small particles called atoms.
  2. Atoms are indivisible.
  3. Atoms of a given element are identical.
  4. Atoms of different elements are different and have different properties.

Which of the above statements is (are) no longer considered to be true?

1. (iii) and (iv)
2. (ii) only
3. (i) and (ii)
4. (ii) and (iii)
5. As a result of Rutherford’s gold foil experiment, it was determined that the atom:
6. Was indivisible.
7. Was composed of a small, dense negative center but was mostly empty space.
8. Was composed of a small, dense positive center but was mostly empty space.
9. was composed of negatively charged particles spread throughout a positively charged substance
10. Based on his observations, the English chemist John Dalton formulated an atomic theory.



In 1897, J.J. Thomson showed that negative charges could be made to move from one end of a cathode ray to another, causing the tube to glow. Because of this, Thomson is credited with the discovery of the electron. Based on this information, which part of Dalton’s atomic theory conflicted with Thomson’s new data?

1. 1
2. 2
3. 3
4. 4
5. The planetary model of the atom was proposed by \_\_\_\_\_.
6. Bohr
7. Thomson
8. Dalton
9. Democritus

**Chem.6B: Energy, Frequency, and Wavelength (general relationships)**

**Notes:**

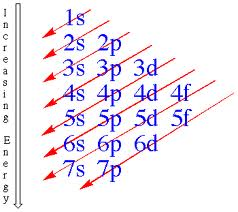
* Energy and frequency are directly related (same)
* Energy and wavelength are inversely related (opposite)
* Frequency and wavelength are inversely related (opposite)

1. What happens to energy and frequency when wavelength decreases?
2. What happens to energy and frequency when wavelength increases?
3. What happens to wavelength and frequency when energy decreases?
4. What happens to wavelength and frequency when energy increases?
5. What happens to energy and wavelength when frequency decreases?
6. What happens to energy and wavelength when frequency increases?

**Chem.6E: Electron Configuration, Lewis Dot Structures**

**Notes:**

* The electron configuration of an element must be in order of increasing energy levels



* *Pauli Exclusion Principle*: Each atomic orbital may hold a maximum of two electrons, each with opposite spin direction
* *Aufbau Principle*: Electrons enter orbitals of lowest energy first
* *Hund’s Rule*: Electrons fill orbitals within a sublevel with the same spin first. Then they pair up.

|  |  |  |
| --- | --- | --- |
| **Sublevel** | **# of orbitals** | **Maximum # of electrons** |
| s | 1 | 2 |
| p | 3 | 6 |
| d | 5 | 10 |
| f | 7 | 14 |

* Lewis Dot structures only show the *valence electrons* for an element
  1. Write the FULL orbital notation electron configuration for Fluorine
  2. Write the shorthand electron configuration for Fluorine
  3. How many unpaired electrons are in Fluorine?
  4. Write the FULL orbital notation electron configuration for Niobium
  5. Write the shorthand electron configuration for Niobium
  6. How many unpaired electrons are in Niobium?

1. Draw the Lewis Dot Structure for Sulfur
2. Draw the Lewis Dot Structure for Aluminum
3. Draw the Lewis Dot Structure for Krypton
4. Draw the Lewis Dot Structure for Lithium

**Unit 5: Nuclear Chemistry**

**Chem.12A: Alpha, Beta, and Gamma Radiation**

**Notes:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Alpha** | **Beta** | **Gamma** |
| Symbol |  |  |  |
| Charge | +2 | -1 | 0 |
| Relative Mass | Heavy | Light | No Mass |
| Penetration Power | Low | Medium | High |

1. Which of the following statements accurately describes beta particles in terms of charge and mass?
2. Beta particles are positively charged and less massive than alpha particles.
3. Beta particles are negatively charged and less massive than alpha particles.
4. Beta particles are positively charged and more massive than alpha particles.
5. Beta particles are negatively charged and more massive than alpha particles.
6. Which of the following statements describes an alpha particle?
7. An alpha particle has no mass.
8. An alpha particle has a negative charge.
9. An alpha particle has low penetrating power
10. An alpha particle has a symbol of
11. The three main types of nuclear radiation are alpha, beta, and gamma. Which of the following lists these types of radiation from lowest penetrating power to highest penetrating power?
12. Alpha, beta, gamma
13. Beta, gamma, alpha
14. Beta, alpha, gamma
15. Gamma, alpha, beta
16. Which of the following best describes alpha particles, beta particles, and gamma rays?
17. Beta particles are negatively charged and are easy to stop
18. Alpha particles have no charge and are easy to stop
19. Gamma rays are positively charged and are hard to stop
20. Alpha particles are positively charged and are easy to stop

**Chem.12B: Balancing Nuclear Equations**

**Notes:**

* The sum of the mass numbers must be equal on both sides of the equation
* The sum of the atomic numbers must be equal on both sides of the equation

1. Thorium-231 decays to form protactinium-231 via the following nuclear equation:

What is the decay product represented by X?

1. Uranium-234 decays to Lead-214 through a series of alpha decays. How many alpha particles are emitted in this decay series?

Balance the following reactions:

3. \_\_\_\_\_\_\_ 🡪 Ni + + γ

**Chem.12C: Fission and Fusion Reactions**

**Notes:**

* Fission reactions involve a large nucleus breaking up in smaller nuclei (Big 🡪 small)
  + Involves a chain reaction
* Fusion reactions involve several small nuclei joining together to form a larger one (small 🡪 big)
* Both reaction types release a lot of energy

1. Which of the following equations shows a fusion reaction?
3. ![](data:None;base64,183GmgAAAAAAAOAAYAIDCQAAAACSXAEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYALgABIAAAAmBg8AGgD/////AAAQAAAA8P///7f////QAAAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3ZR5mxQQAAAAtAQAACAAAADIK9ABKAAEAAAAxeQgAAAAyCgACOQABAAAAMHkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAAZR5mxQAACgAhAIoBAAAAAP////+88xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)n + ![](data:None;base64,183GmgAAAAAAAMABYAICCQAAAACzXQEACQAAA6YAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYALAARIAAAAmBg8AGgD/////AAAQAAAA8P///7f///+wAQAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV38R5mlgQAAAAtAQAACQAAADIK9AA9AAMAAAAyMzVlCAAAADIKAAKqAAIAAAA5MgoAAAAmBg8ACgD/////AQAAAAAAHAAAAPsCEAAHAAAAAAC8AgAAAAABAgIiU3lzdGVtAADxHmaWAAAKACEAigEAAAAA/////7zzEgAEAAAALQEBAAQAAADwAQAAAwAAAAAA)U 🡪 + ![](data:None;base64,183GmgAAAAAAAGABYAIBCQAAAAAQXQEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYAJgARIAAAAmBg8AGgD/////AAAQAAAA8P///7f///9QAQAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3CB9mNgQAAAAtAQAACAAAADIK9AA9AAIAAAA5MwgAAAAyCgACNgACAAAAMzkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAACB9mNgAACgAhAIoBAAAAAP////+88xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)Y + 4 ![](data:None;base64,183GmgAAAAAAAOAAYAIDCQAAAACSXAEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYALgABIAAAAmBg8AGgD/////AAAQAAAA8P///7f////QAAAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3ZR5mxQQAAAAtAQAACAAAADIK9ABKAAEAAAAxeQgAAAAyCgACOQABAAAAMHkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAAZR5mxQAACgAhAIoBAAAAAP////+88xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)n
5. Which of the following equations shows a fission reaction?
7. ![](data:None;base64,183GmgAAAAAAAOAAYAIDCQAAAACSXAEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYALgABIAAAAmBg8AGgD/////AAAQAAAA8P///7f////QAAAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3ZR5mxQQAAAAtAQAACAAAADIK9ABKAAEAAAAxeQgAAAAyCgACOQABAAAAMHkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAAZR5mxQAACgAhAIoBAAAAAP////+88xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)n + ![](data:None;base64,183GmgAAAAAAAMABYAICCQAAAACzXQEACQAAA6YAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYALAARIAAAAmBg8AGgD/////AAAQAAAA8P///7f///+wAQAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV38R5mlgQAAAAtAQAACQAAADIK9AA9AAMAAAAyMzVlCAAAADIKAAKqAAIAAAA5MgoAAAAmBg8ACgD/////AQAAAAAAHAAAAPsCEAAHAAAAAAC8AgAAAAABAgIiU3lzdGVtAADxHmaWAAAKACEAigEAAAAA/////7zzEgAEAAAALQEBAAQAAADwAQAAAwAAAAAA)U 🡪 + ![](data:None;base64,183GmgAAAAAAAGABYAIBCQAAAAAQXQEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYAJgARIAAAAmBg8AGgD/////AAAQAAAA8P///7f///9QAQAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3CB9mNgQAAAAtAQAACAAAADIK9AA9AAIAAAA5MwgAAAAyCgACNgACAAAAMzkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAACB9mNgAACgAhAIoBAAAAAP////+88xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)Y + 4 ![](data:None;base64,183GmgAAAAAAAOAAYAIDCQAAAACSXAEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCYALgABIAAAAmBg8AGgD/////AAAQAAAA8P///7f////QAAAAFwIAAAsAAAAmBg8ADABNYXRoVHlwZQAAYAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3ZR5mxQQAAAAtAQAACAAAADIK9ABKAAEAAAAxeQgAAAAyCgACOQABAAAAMHkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAAZR5mxQAACgAhAIoBAAAAAP////+88xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)n
9. ![](data:None;base64,183GmgAAAAAAAMAAQAICCQAAAACTXAEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCQALAABIAAAAmBg8AGgD/////AAAQAAAA8P///7f///+wAAAA9wEAAAsAAAAmBg8ADABNYXRoVHlwZQAAUAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3LhdmIgQAAAAtAQAACAAAADIK9AAkAAEAAAAxeQgAAAAyCgACJAABAAAAMXkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAALhdmIgAACgAhAIoBAAAAAP////9c8xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)H + ![](data:None;base64,183GmgAAAAAAAAABQAIBCQAAAABQXQEACQAAA6UAAAACABwAAAAAAAUAAAAJAgAAAAAFAAAAAgEBAAAABQAAAAEC////AAUAAAAuARgAAAAFAAAACwIAAAAABQAAAAwCQAIAARIAAAAmBg8AGgD/////AAAQAAAA8P///7f////wAAAA9wEAAAsAAAAmBg8ADABNYXRoVHlwZQAAUAAcAAAA+wIg/wAAAAAAAJABAAAAAAQCABBUaW1lcyBOZXcgUm9tYW4AIKnzdymp83cgMPV3LR9m3gQAAAAtAQAACAAAADIK9AA9AAEAAAAyeQgAAAAyCgACTgABAAAAMXkKAAAAJgYPAAoA/////wEAAAAAABwAAAD7AhAABwAAAAAAvAIAAAAAAQICIlN5c3RlbQAALR9m3gAACgAhAIoBAAAAAP////+88xIABAAAAC0BAQAEAAAA8AEAAAMAAAAAAA==)H 🡪 +
10. Which of the following best describes a common feature of nuclear fission and fusion reactions?
    1. Nuclei split during fission and fusion
    2. Fission and fusion both form heavier elements
    3. Fission and fusion both generate energy
    4. Nuclei gain electrons during fission and fusion
11. Which of the following statements applies to a nuclear fusion reaction?
    1. Nuclear fusion reactions have no commercial applications
    2. The reaction takes place when a nucleus is bombarded with neutrons
    3. The reaction releases large amounts of energy when nuclei are brought together
    4. A chain reaction is involved

Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Unit 6: Chemical Nomenclature**

**Chem.7A: Naming Compounds (ionic, covalent, acid)**

**Notes:**

* Every compound has a first and last name
  + First name comes from the first element, last name from the second (or polyatomic ion)
* Use your “Chemical Nomenclature Resources” to help with naming
* Ionic
  + Has a metal as the first element
  + Need parentheses if it is a Transition Metal
  + Do not need parentheses if it is a Main Group Metal
* Covalent
  + Does not have a metal
  + Named using covalent prefixes
  + *Do not use Mono- for the first element*
* Acid
  + First element is Hydrogen
  + Use the “rules for naming acids” to figure out how the name of the anion changes

**Write the name for each of the following compounds:**

|  |  |  |  |
| --- | --- | --- | --- |
| NO2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CaBr2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| NO3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | KClO3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| H2O | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | AgNO3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| CO | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Mg(OH)2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Ir(HCO3)7 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CoBr2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Al(MnO4)3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | HNO2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| P2Cl5 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | NaOH | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| H2SO3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | H3P | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| PCl3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | H2SO4 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Chem.7B: Writing Chemical Formulas (ionic, covalent, acid)**

**Notes:**

* Ionic
  + Find charge of cation and anion
  + Use the criss-cross rule to find the subscripts
* Covalent
  + Use covalent prefixes to find subscripts
* Acid
  + Use “rules for naming acids” in reverse to find anion, and then formula
  + All acids have H+  as the cation

**Write the formula for each of the compounds listed below:**

|  |  |  |  |
| --- | --- | --- | --- |
| Phosphoric Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Vanadium (III) Carbonate | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Sulfurous Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Dibromine Nonafluoride | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Hydronitric Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Perchloric Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Calcium Chlorite | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Hydrocyanic Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Iron (III) Iodide | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Nitrogen Monoxide | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Acetic Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Manganese (V) Dichromate | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Sulfur Hexafluoride | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Xenon Trifluoride | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Hypochlorous Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Hydrofluoric Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Hydroselenic Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Rhenium (III) Hypochlorite | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Carbonic Acid | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Arsenic Heptacarbide | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Chem.7C: Constructing electron dot formulas (Lewis Dot Structures)**

**Notes:**

* Steps for Success
  + Draw Lewis Dot Structures for all elements in the compound (use number of valence electrons)
  + Arrange atoms where bonds are formed between elements (single electrons)
  + Connect two single electrons with as line (the chemical bond)
    - One line = Two electrons
    - You may need to do this twice or even three times (double and triple bonds)
  + Count number of dots/lines to make sure you do not have more dots/lines than total valence electrons
* Exception! Hydrogen needs only two valence electrons to be happy (all other atoms need 8)

***Directions: Construct the Lewis Dot Structures for each of the following compounds***

1. NF3
2. OCl2
3. SiO2
4. SiCl4
5. HCN
6. N2
7. H2CO
8. C2H4
9. C2H2
10. O2

**Chem.7E: VSEPR Theory (Molecular Structures)**

**Notes:**

* Model used to predict shapes of molecules
* Need to draw the Lewis Dot Structure first
* When finding molecular structure, always look at the central atom
* If there are only two atoms, the structure is always linear

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **# of bonded atoms** | **# of lone pairs** | **Bonded atoms + lone pairs** | **Picture** | **Name** |
| 2 | 0 | 2 |  | Linear |
| 3 | 0 | 3 |  | Trigonal Planar |
| 2 | 1 | 3 |  | Bent |
| 4 | 0 | 4 |  | Tetrahedral |
| 3 | 1 | 4 |  | Trigonal Pyramidal |
| 2 | 2 | 4 |  | Bent |

***Directions: Predict the Molecular Structure for each of the following compounds***

1. Sb2
2. SiCl4
3. CN
4. SCl2
5. HCN
6. COCl2
7. PCl3
8. H2O
9. HI
10. NH3
11. CCl4
12. H2CS
13. CH4

**Chem.8A: The Mole**

**Notes:**

* 1 mole = 6.02 x 1023 particles
  + Types of particles:
    - Atoms: made of single element (Ex: Hg, Ag, Au)
    - Molecules: part of a covalent compound (Ex: H2, CO, CO2)
      * Molecules are divided into atoms
    - Formula Units: part of an ionic compound (Ex: NaF, BaSO4)
      * Formula units are divided into ions

***Directions: Classify the following particles as an atom, formula unit (F.U.), or molecule.***

|  |  |
| --- | --- |
| Particle | Atom, F.U., or Molecule?? |
| He |  |
| NaCl |  |
| CH4 |  |
| MgBr2 |  |
| CO2 |  |
| C12H22O11 |  |
| H |  |
| LiOH |  |
| H2O |  |
| Ba(CN)2 |  |

***Fill in the Blank***

1. 1 of Methane, CH4, has 6.02 x 1023 molecules.
2. 1 mole of Lithium Hydroxide has \_\_\_\_\_\_\_\_\_\_\_\_\_\_ formula units.
3. 1 mole of Barium Cyanide has 6.02x1023 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. 1 mole of Silver has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
5. 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Copper (II) Chloride has 6.02 x 1023 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

***True or False***

1. One mole of Gold atoms has the same quantity of molecules as 1 mole of Carbon Monoxide . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Three moles of Barium Cyanide formula units has the same number of atoms as four moles of carbon atoms. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Fifty moles of Fluorine (F2) have the same number of molecules as fifty moles of Potassium Chloride formula units. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chem.8B: Mole Calculations**

**Notes:**

* Requirements for mole calculations
  + Identify the given quantity, unit, and element (or compound)
  + Identify the unknown quantity, unit, and element (or compound)
  + Identify the relationship(s) between the given unit and compound

**Example 1: One Step Mole Calculation**

How many atoms does 12.0 moles of He represent?

**Example 2: Two Step Mole Calculation**

How many oxygen atoms are contained in 12.0 moles of Sulfur Dioxide (SO2)?

**Example 3: Two Step Mole Calculation**

How many hydroxide ions are contained in 5.1 moles of Calcium Hydroxide, Ca(OH)2?

***Directions: Complete the following mole calculation problems***

1. How many atoms are in 3.51 x 1017 moles of Nitrogen Trioxide, NO3?
2. How many molecules are in 4.42 moles of Sulfur Monoxide, SO?
3. How many moles are in 5.6 x 1023 formula units of Aluminum Chloride, AlCl3?
4. How many cadmium ions are in 7.2 moles of Cadmium (II) Hypochlorite, Cd(ClO)2?
5. How many moles are in 5.23 x 1033 molecules of Nitrogen Diselenide, NSe2?
6. How many atoms are in 3.17 moles of Sulfur?
7. How many moles are in 7.77 x 1022 formula units of Gallium Fluoride, GaF3?

**Chem.8C: Molar Mass, Percent Composition, Empirical/Molecular Formulas**

**Notes:**

* Molar mass (units of g/mol)
  + Mass of **1 mole** of a given compound
  + Used to convert from grams to moles (or reverse) for a given compound

For compound XaYbZc:

*Molar mass = a(Atomic MassX) + b(Atomic MassY) + c(Atomic MassZ)*

* Percent Composition
  + Percent by mass of each element in a compound

Mass of Part 🡪 Individual element’s contribution

Mass of Whole 🡪 Molar Mass

* Empirical Formula
  + Shows lowest number ratio of atoms in a compound
  + Steps to success
    - Convert percent composition to grams (i.e., 75% = 75g)
    - Convert grams to moles by dividing grams by the atomic mass of each element
    - Divide both molar quantities by the smallest mole quantity to determine the subscript for each element in the formula
    - If this still does not result in a value close to a whole number, multiple all ratios by a scalar:

|  |  |
| --- | --- |
| **Mole Ratio** | **Multiply all ratios by** |
| X.5 | 2 |
| X.33 | 3 |
| X.66 | 3 |
| X.75 | 4 |
| X.25 | 4 |

* Molecular Formula
  + Shows exactly how many of each atom is in a compound (unsimplified formula)
  + Steps to Success
    - Find the mass of the empirical formula
    - Divide the mass of the molecular formula by the mass of the empirical formula
    - Multiply all subscripts in the empirical formula by the answer to the previous step

***Directions: Calculate the Molar Mass for each of the following compounds***

1. Cl2
2. Potassium Hydroxide (KOH)
3. Beryllium Chloride (BeCl2)
4. FeCl3

***Percent Composition Calculations:***

1. 27.03g of Beryllium is combined with 28.01g of Nitrogen. What is the percent composition by mass of this compound?
2. What is the percent composition by mass of the elements in the compound, KCN?
3. 54.94g of Manganese is combined with 42g of Nitrogen and 144.0g of Oxygen. What is the percent composition by mass of Oxygen in this compound?
4. What is the percent composition by mass of the elements in Lithium Phosphide, Li3P?

***Empirical Formula Calculations:***

1. NutraSweet, an artificial sweetener, is 57.14% C, 6.16% H, 9.52% N, and 27.18% O. Calculate the empirical formula of NutraSweet.
2. Fat makes up a major portion of all soaps. A fat used in many soaps is 76.5% carbon, 12.2% hydrogen, and 11.3% oxygen. What is the empirical formula?
3. Strychnine, a deadly poison, has a percent composition of 75.42% carbon, 6.63% hydrogen, 8.38% nitrogen, and 9.57% oxygen. What is the empirical formula of strychnine?
4. A 10 gram sample of a compound contains 7.22 grams of magnesium and 2.78 grams of nitrogen. What is its empirical formula?

***Molecular Formula Calculations:***

1. An organic compound has an empirical formula of CH and a molar mass of 78 g/mol. What is the molecular formula of this compound?
2. A compound with an empirical formula of C2OH4 and a molar mass of 88 g/mol. What is the molecular formula of this compound?
3. A compound with an empirical formula of CFBrO and a molar mass of 254.7 g/mol. What is the molecular formula of this compound?
4. A 4.99 gram sample of a compound contains 1.52g Nitrogen and 3.47g Oxygen. The molar mass of the compound is between 90.0 g/mol and 95.0 g/mol. Determine the empirical and molecular formulas. What is the actual molar mass of the compound?

**Chem.8D: Law of Conservation of Mass, Balancing Equations, Types of Reactions**

**Notes:**

* Law of Conservation of Mass 🡪 Equations must be balanced, same number of atoms of same kind on both sides
* Balancing Equations
  + Steps for Success
    - List and count out number of atoms of each element on reactant and product sides
    - Pick an element that is not equal on both sides of the equation
    - Add a coefficient in front of the formula with that element and adjust the count
    - Continue adding coefficients to get the same number of atoms of each element on both sides
* Types of Reactions
  + Single Replacement 🡪 One element begins alone, replaces an element in a compound

*Example: A + BC 🡪 AC + B*

*2K + 2 HCl 🡪 2 KCl + H2*

* + Double Replacement 🡪 Two binary compounds start out, switch partners

*Example: AB + CD 🡪 AC + BD*

*2 KCl + BaSO4 🡪 K2SO4 + BaCl2*

* + Combustion 🡪 hydrocarbon and oxygen form water and carbon dioxide

*Example: CxHy + O2 🡪 CO2 + H2O*

*CH4 + 2 O2 🡪 CO2 + 2 H2O*

* + Synthesis 🡪 multiple compounds combine to form one

*Example: A + B 🡪 AB*

*2 Mg + O2 🡪 2 MgO*

* + Decomposition 🡪 One compound breaks into smaller ones

*Example: AB 🡪 A + B*

*CaCO3 🡪 CO2 + CaO*

***Directions: Balance and classify the following reactions***

1. \_\_\_\_Ca + \_\_\_\_HBr 🡪 \_\_\_\_CaBr2 + \_\_\_\_H2
2. \_\_\_Ba + \_\_\_HCl →\_\_\_BaCl2 +\_\_\_ H2
3. \_\_\_Cl2 + \_\_\_KI →\_\_\_KCl + \_\_\_I2
4. \_\_\_NaCl → \_\_\_ Na + \_\_\_ Cl2
5. \_\_\_Na + \_\_\_HCl → \_\_\_ H2 + \_\_\_NaCl
6. \_\_\_\_SO + \_\_\_\_O2 → \_\_\_\_SO2
7. \_\_\_\_ Na + \_\_\_\_H2O → \_\_\_\_NaOH + \_\_\_H2

1. \_\_\_\_SnO2 → \_\_\_\_ SnO + \_\_\_O2
2. \_\_\_\_Ca(OH)2 + \_\_\_\_ K3PO4 → \_\_\_\_ Ca3(PO4)2 + \_\_\_KOH

***Fill in the missing reactant/product in the following chemical reactions:***

1. Zn + 2 HCl → \_\_\_\_\_\_\_\_\_\_\_ + H2
2. CO2 + 2 NH3 → OC(NH2)2 + \_\_\_\_\_\_\_\_
3. 2 Al(OH)3 + 3 H2SO4 → \_\_\_\_\_\_\_\_\_\_\_\_ + 6 H2O
4. Fe2(SO4)3 + 6 \_\_\_\_\_\_\_\_ → 3 K2SO4 + 2 Fe(OH)3

**Chem.8E: Stoichiometry, Percent Yield**

**Notes:**

* Used to convert from one unit to another (moles, grams, liters, etc.)
* Flowchart at end of packet is helpful
* Common conversion factors
  + Moles A 🡪 Moles B (use mole ratio in chemical reaction)
  + Moles A 🡪 Grams A (use molar mass)
  + Liters A 🡪 Moles A (Use 22.4 L, assuming STP)
* Percent Yield
  + Theoretical Yield 🡪 How much should be formed
  + Actual Yield 🡪 How much is really formed

**All example problems use the following reaction:**

Na2SiO3 + 8 HF🡪 H2SiF6 + 2 NaF + 3 H2O

**Example 1: Moles to Moles**

How many moles of hydrofluoric acid are needed to react with 0.300 moles of Na2SiO3?

**Example 2: Moles to Grams**

How many grams of sodium fluoride are produced when 0.500 moles of hydrofluoric acid reacts with excess Na2SiO3?

**Example 3: Grams 🡪 Grams**

How many grams of Na2SiO3 are required to react with 80.4 grams of hydrofluoric acid?

**Example 4: Moles 🡪 Liters**

At STP, how many liters of water vapor are produced from the reaction of 5.77 moles of hydrofluoric acid?

1. When glucose (C6H12O6) is burned in oxygen, carbon dioxide and water are produced:

C6H12O6 + 9 O2 🡪 6 CO2 + 6 H2O

* 1. How many moles of water are produced when 0.450 moles of glucose are burned?
  2. If 284.7 grams of glucose are burned, how many moles of carbon dioxide are formed?
  3. How many grams of glucose are required to react with 43.8 grams of oxygen gas?
  4. If 124L of carbon dioxide are produced, how many moles of oxygen gas reacted?

1. Use the reaction below to answer the following questions:

Fe2O3 + 3 CO 🡪 2 Fe + 3 CO2

* 1. Calculate the number of moles of carbon monoxide required to produce 9.4 moles of iron.
  2. If 2.44 moles of carbon monoxide react, how many grams of carbon dioxide are produced?
  3. How many grams of iron (III) oxide are required to produce 72.1 grams of iron?
  4. If 15.22 moles of iron (III) oxide reacted, how many liters of carbon dioxide were produced? Assume STP.

***Percent Yield Problems:***

1. Use the equation below to answer the following question:

K2PtCl4 + 2 NH3 🡪 Pt(NH3)2Cl2 + 2 KCl

The theoretical yield of Pt(NH3)2Cl2 is 88.24 g. If 76.41 g of Pt(NH3)2Cl2 are produced from the reaction shown above, what is the percent yield of Pt(NH3)2Cl2?

1. In an experiment, 49.0 grams of potassium phosphate are formed when 0.500 moles of phosphoric acid reacts. If the theoretical yield is 106.1 grams, what is the percentage yield of potassium phosphate, to the nearest tenth of a percent?

H3PO4 + 3 KOH 🡪 K3PO4 + 3 H2O

1. Use the equation below to answer the following question:

Al(OH)3 + 3 HCl 🡪 AlCl3 + 3 H2O

The theoretical yield of AlCl3 is 46.4 g. If 39.5 g of AlCl3 are produced from the reaction shown above, what is the percent yield of AlCl3?

1. In an experiment, 213.7 grams of barium sulfate are formed when 0.999 moles of sulfuric acid reacts. If the theoretical yield is 233.4 grams, what is the percentage yield of barium sulfate, to the nearest tenth of a percent?

H2SO4 + Ba(OH)2 🡪 BaSO4 + H2O

**Chem.10A: Properties of Water**

**Notes:**

* All ionic compounds dissolve in water
* Some covalent compounds dissolve in water
  + Polar compound 🡪 contains a positive end (H) and a negative end (F, O, or N)
* Water is the universal solvent because of its **Polarity**

1. Which characteristic of a molecule most impacts whether it will dissolve in water?
2. Size
3. Polarity
4. Ionization energy
5. Shape
6. Which types of compounds dissolve in water? Why do they dissolve in water?
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Circle the compounds that will dissolve in water:

O2 C2H6 NH3 KCl

1. Circle the compounds that will dissolve in water:

Ca(OH)2 N2 CH3OH Oil

1. Why do so many substances dissolve in water?
2. There is an abundance of water on Earth.
3. The water molecule only contains two elements.
4. The water molecule has a polar structure.
5. Hydrogen and oxygen are very reactive when they are combined.

Explain your answer:

**Chem.10B: Solubility Rules**

**Notes:**

* Predict whether a compound will dissolve in water
* Steps to success
  + Find anion (negative) portion of compound on solubility chart
  + If under “soluble” category, then compound will dissolve
    - Exception: If the cation is listed under “exceptions”, compound flips to “insoluble”
  + If under “insoluble” category, then compound will not dissolve
    - Exception: if the cation is listed under “exceptions”, compound flips to “soluble”
* Precipitate 🡪 insoluble compound

***Direction: For each compound, classify it as being either soluble or insoluble in water. Also explain how you came to that conclusion.***

|  |  |  |
| --- | --- | --- |
| **Compound** | **Soluble or Insoluble?** | **Rationale** |
| FeCl3 |  |  |
| Potassium Hydroxide |  |  |
| BaCr2O7 |  |  |
| Iron (III) Hypochlorite |  |  |
| AgBr |  |  |

***Directions: For each problem, circle the compounds that are insoluble in water.***

AlC2H3O2 BaSO4 AgI Sr(OH)2

CaCO3 NH4ClO NaClO4 Mg(CN)2

***Directions: For each reaction, select which products, if any, would form a precipitate.***



BaCl2 + K2SO4 🡪 BaSO4 + 2 KCl

Precipitates:



2 AgNO3 + MgBr2 🡪 2 AgBr + Mg(NO3)2

Precipitates:



2 KCl + Pb(NO3)2 🡪 2 KNO3 + PbCl2

Precipitates:

**Chem.10D: Dilutions**

**Notes:**

* Dilute 🡪 to make less concentrated
* Dilution Formula:

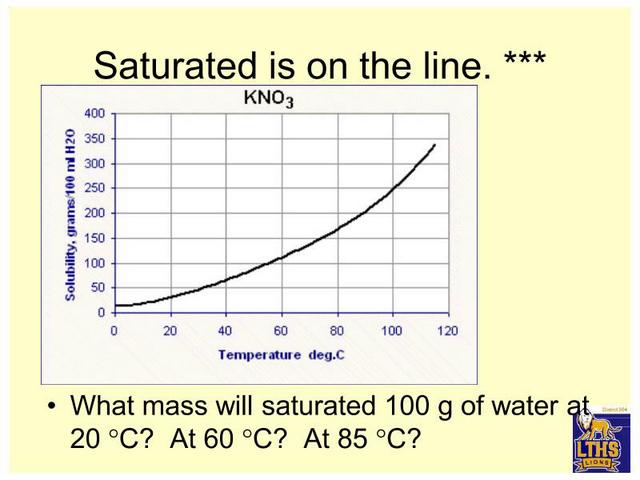
M1V1 = M2V2

1. Brenda has 0.125L of a 0.15 M NaOH solution. If she prepares 0.150L of a diluted solution, what is the new concentration?
2. What volume of 0.05 M HCl solution can Dulce make by diluting 0.250 L of 10.0M HCl?
3. How much water does Abdoulaye need to add in order to dilute 0.500 L of 2.4 M KCl solution to a concentration of 1.0 M?
4. Daniela has 2.5L of a 0.36 M Cesium Fluoride solution. If she prepares 1.4L of a diluted solution, what is the new concentration?
5. What volume of 2.44 M HCl solution can Luiz make by diluting 0.18 L of 12.0M HCl?

**Chem.10E: Types of Solutions, Solubility Curves**

**Notes:**

* Saturated 🡪 no more solute can be dissolved at a given temperature
* Supersaturated 🡪 more solute is dissolved than usually possible at the given temperature
* Unsaturated 🡪 more solute can be dissolved at the given temperature
* Electrolyte 🡪 ionic compound
* Nonelectrolyte 🡪 covalent compound

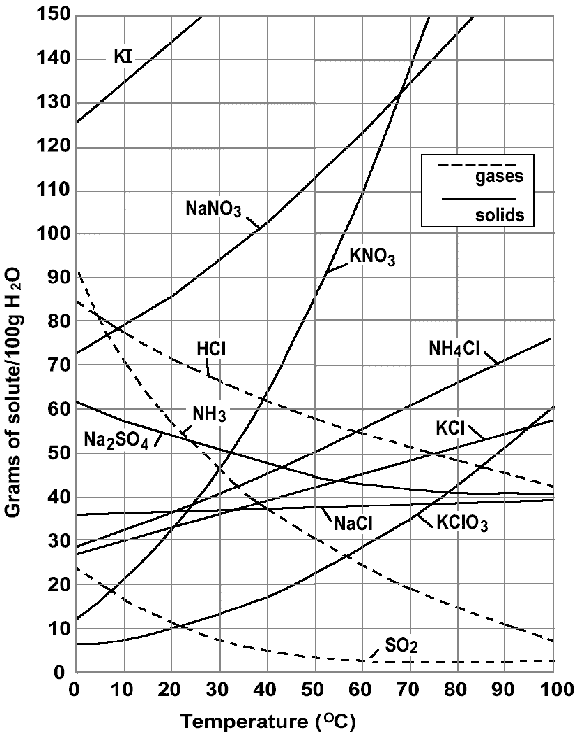


Unsaturated

Saturated

Supersaturated

***Use the solubility curves below to answer the following questions:***



1. Which substances’ solubility decreases as temperature increases?
2. Which substance is least affected by temperature changes?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. How many grams of NH4Cl are necessary to create a saturated solution at 50ºC?\_\_\_\_\_\_\_\_\_\_\_
4. If a saturated solution of KNO3 is made at 80ºC and rapidly cooled to 60ºC, how much solute is likely to precipitate?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Which compound is the least soluble in water at 10ºC?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have the same solubility at 78ºC
7. Are the following solutions unsaturated, saturated, or supersaturated?
   1. 45g NaNO3 in 100g H2O at 30ºC\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. 60g KClO3 in 100g H2O at 60ºC\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. If a saturated solution of NaNO3 is made at 70ºC and rapidly cooled to 40ºC, how much solute is likely to precipitate?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chem.10F: Factors Affecting Solubility**

**Notes:**

* To increase the rate of dissolution (dissolving):

|  |  |
| --- | --- |
| **Solids** | **Gases** |
| Increase Temperature | Decrease Temperature |
| Increase Movement | Decrease Movement |
| Increase Surface Area | Increase Pressure |

***For each action, write whether it would increase (I) or decrease (D) the solubility***

1. Stirring a solid into a liquid \_\_\_\_\_\_\_\_
2. Decreasing the pressure of a gas into a liquid \_\_\_\_\_\_\_\_
3. Putting a sugar and water solution into the refrigerator \_\_\_\_\_\_\_\_
4. Putting a soda into the refrigerator \_\_\_\_\_\_\_\_
5. Shaking up a soda \_\_\_\_\_\_\_
6. Using a packet of sugar instead of a sugar cube \_\_\_\_\_\_\_
7. Which will dissolve most slowly?
   1. Sugar cubes in cold water
   2. Sugar cubes in hot water
   3. Powdered sugar in cold water
   4. Powdered sugar in hot water
8. Which will dissolve most quickly?
9. Large salt crystals in stirred water
10. Large salt crystals in unstirred water
11. Small salt crystals in unstirred water
12. Small salt crystals in stirred water
13. Which of the following will increase the solubility of most solid solutes?
14. Decreasing the temperature
15. Decreasing the amount of solvent at constant temperature
16. Increasing the amount of solute at constant temperature
17. Increasing the temperature
18. Which of the following would most increase the rate of dissolution of a solid in a liquid?
19. Increase the temperature and increase the pressure
20. Increase the temperature and increase the surface area
21. Increase temperature, increase pressure, and shake the mixture
22. Increase the temperature, shake the mixture, and increase the surface area

**Chem.10H: Types of Reactions**

**Notes:**

* Acid-Base Reaction 🡪 Contains an acid and a base, forms water and a salt

Example: HCl (aq) + NaOH (aq) 🡪 H2O (l) + NaCl (aq)

* Precipitation Reaction 🡪 Two aqueous solutions react to form a solid

Example: Pb(NO3)2 (aq) + Na2SO4 (aq) 🡪 PbSO4 (s) + 2 NaNO3 (aq)

* Oxidation-Reduction Reaction 🡪 Involves transfer of electrons. Usually single replacement or synthesis reactions

Example: Mg (s) + O2 (g) 🡪 MgO (s)

***Classify each reaction as acid-base, precipitation, or oxidation-reduction:***

1. H2SO4  (aq) + Ca(OH)2 (aq) 🡪 CaSO4 (aq) + H2O (l)
2. K2CrO4 (aq) + 2AgNO3 (aq) 🡪 2KNO3  (aq) + Ag2CrO4 (s)
3. 3Mg (s) + N2 (g) 🡪 Mg3N2 (s)
4. Na2CO3 (aq) + MgSO4 (aq) → Na2SO4 (aq) + MgCO3 (s)
5. HBr (aq) + Ca(OH)2 (aq) → CaBr2 (aq) + H2O (l)
6. 2 Al(s) + 3 NiCl2 (aq) → 2 AlCl3 (aq) + 3 Ni (s)
7. Zn (s) + 2 HNO3 (aq) 🡪 Zn(NO3)2 (aq) + H2 (g)

**Chem.10I: pH Calculations**

**Notes:**

* pH scale is from 0-14
  + Acids are 0-6, Bases 8-14
  + pH of 7 is neutral
* pH formulas:

-log[H+] = pH

-log[OH-] = pOH

pH + pOH = 14

10-pH = [H+]

10-pOH = [OH-]

1. What is the pH of a solution of HCl with a hydrogen ion concentration of 5.3 x 10-2 M?
2. A student has 6.4L of HI solution. It contains 2.71 moles of H+. What is the pH of the solution?
3. A student has 3.1L of H2Cr2O7 solution. It contains 2.05 moles of H+. What is the pH of the solution?
4. What is the pH of a solution of Ca(OH)2 with a hydroxide ion concentration of 5.3 x 10-2 M?
5. A student has 6.4L of NaOH solution. It contains 2.71 moles of OH-. What is the pH of the solution?
6. What is the pH of a solution of NH3 with a hydroxide ion concentration of 2.67 x 10-4 M?

**Chem.9A: Gas Laws**

**Notes:**

* STP (standard temperature and pressure) = 1 atm, 0 ºC
* Temperatures must always be in K
  + ºC + 273 = K
* Changing Situations (use when there are two pressures, volumes, moles, temperatures)
  + Pressure and Volume have an inverse relationship
    - P ↑, V↓
    - P1V1 = P2V2 (Boyle’s Law)
  + Volume and Temperature have a direct relationship
    - V ↑, T↑
    - (Charles Law)
  + Pressure and Temperature have a direct relationship
    - P ↑, T↑
    - (G. Lussac’s Law)
  + Combined Gas Law shows relationship between P, V, n, and T
* Ideal Gas Law shows relationship between all variables (use when there is one of each variable)
  + PV = nRT
    - Value of R changes based on pressure units
      * R = 0.0821 (if pressure is in atm)
      * R = 8.31 (if pressure is in kPa)
      * R = 62.4 (if pressure is in mmHg)

1. In a thermonuclear device, the pressure of 0.050 liters of gas within the bomb casing reaches a pressure of 4.0 x 106 atm. When the bomb casing is destroyed by the explosion, the gas is released into the atmosphere, where it reaches a pressure of 1.00 atm. What is the volume of the gas after the explosion?
2. Synthetic diamonds can be manufactured at pressures of 6.00 x 104 atm. If we take 2.00 L of gas at 1.00 atm and compressed it to a pressure of 6.00 x 104 atm, what would the new volume of the gas be?
3. The temperature inside my refrigerator is about 4ºC. If I place a balloon in my fridge that initially has a temperature of 22 ºC and a volume of 0.5 L, what will the volume of the balloon be after it is fully cooled?
4. A soda bottle is flexible enough that the volume of the bottle can change even without opening it. If you have an empty soda bottle (volume of 2 L) at room temperature (25 ºC), what will the new volume be if the temperature is decreased to -4 ºC?
5. I have made a thermometer which measures temperature by the compression and expansion of a gas in a piston. I have measured that at 373 K, the volume of the piston is 20 L. What is the temperature outside in **Celsius** if the piston has a volume of 15 L?
6. A gas in a sealed container has a pressure of 125 kPa at a temperature of 30.0 ºC. If the pressure in the container is increased to 201 kPa, what is the new temperature?
7. The pressure in an automobile tire is 1.88 atm at 25 ºC. What will the pressure be if the temperature warms up to 37.0 ºC?
8. A gas initially has a pressure of 12 atm, a volume of 23 liters, and a temperature of 200K. If the pressure is raised to 14 atm and the temperature is increased to 27 ºC, what is the new volume of the gas?
9. A gas takes up a volume of 17 L, has a pressure of 2.3 atm, and a temperature of 299 K. If the temperature is raised to 350 K and the volume is lowered to 1.5 L, what is the new pressure of the gas?
10. A gas has a volume of 28 L, a temperature of 45 ºC, and an unknown pressure. When the volume is increased to 34 L and the temperature is decreased to 35 ºC, the resulting pressure is 2.0 atm. What was the initial pressure of the gas?
11. What pressure (in kPa) is exerted by 64.9g of Oxygen gas (O2) contained in a 4.03 L vessel at 17 ºC?
12. How many grams of Chlorine gas (Cl2) would occupy a 1.32 L flask at -19 ºC and 17.6 atm of pressure?
13. What volume is occupied by 0.579 moles of gas at 406 mmHg and 204 ºC?
14. At what pressure (in atm) is a gas if 17.96g Carbon Monoxide (CO) are contained in a 1.054 L container at 86 ºC?
15. At what temperature is a gas if 1.065 moles are in a 7.96 L vessel at 138.7 kPa? Give your answer in both K and ºC.

**Chem.9B: Gas Law Stoichiometry**

**Notes:**

* Used when looking for moles, volume, or temperature of a gas
* Same rules as normal stoichiometry, but may need to use Ideal Gas Law (PV=nRT) before or after stoichiometry processes

1. Carbon monoxide reacts with nitrogen monoxide to produce nitrogen gas and carbon dioxide.

2 CO + 2 NO 🡪 N2 + 2 CO2

If 3.55 moles NO is reacted completely with carbon monoxide at 17.5 kPa and 28 ºC, how many liters of nitrogen gas will be produced?

1. Ammonia is formed from the reaction of hydrogen and nitrogen.

3 H2 + N2 🡪 2 NH3

How many liters of H2 are required to produce 1.7 moles NH3 at -75oC and 20 atm?

1. When subjected to an electric current, water decomposes to hydrogen and oxygen gas.

2 H2O 🡪 2 H2 + O2

If 214.0 L of water are decomposed, how many grams of hydrogen gas are produced at 45°C and 196.7 kPa?

1. How many liters of carbon dioxide are formed from the reaction of 10.0 moles of hydrochloric acid (HCl) at 250°C and 4.33 atm?

HCl + NaHCO3 🡪 NaCl + H2O + CO2

**Chem.11A: Forms of Energy**

**Notes:**

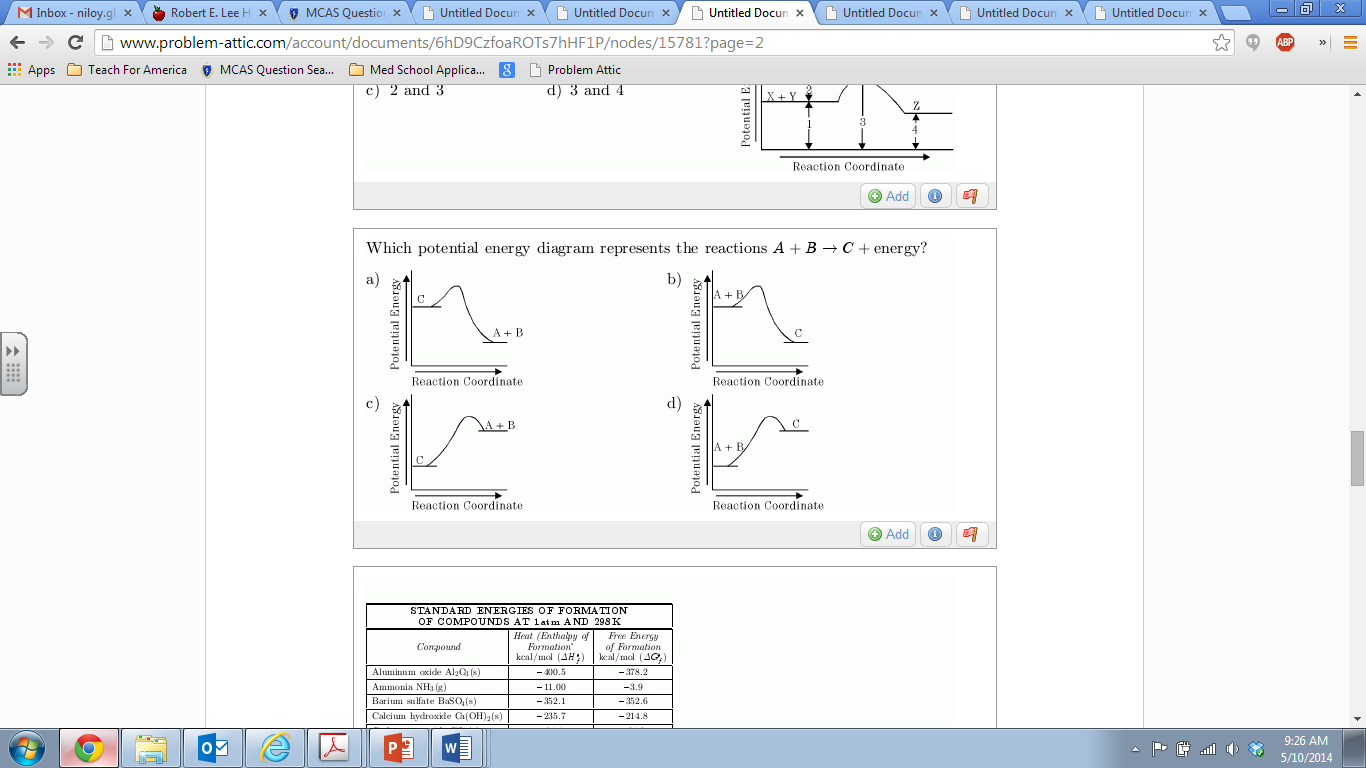
* Potential Energy 🡪 stored energy
* Kinetic Energy 🡪 Energy in motion
* Chemical Energy 🡪 Stored in chemical bonds and within molecules
* Thermal Energy 🡪 Heat, vibrations of atoms

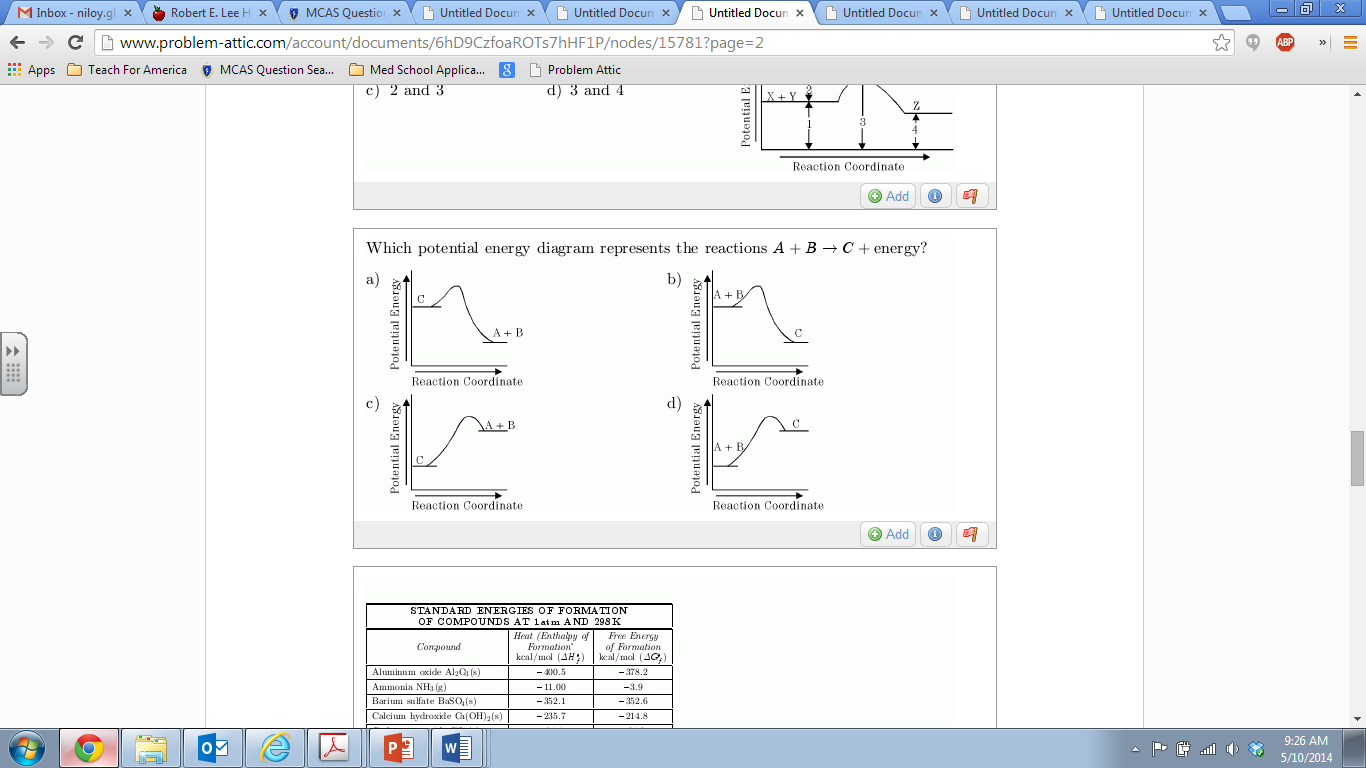
***Match each situation to the appropriate form of energy:***

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | 1. Stretched bow |
|  |  |  | 1. Ball moving through the air |
|  |  |  | 1. Ball resting on the table |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Potential Energy |  | 1. Stored in chemical bonds and molecules |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Kinetic Energy |  | 1. Energy of Motion |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Chemical Energy |  | 1. Stored Energy |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Thermal Energy |  | 1. Vibrating atoms |
|  |  |  | 1. Energy inside a battery |
|  |  |  | 1. Sound moving through air |
|  |  |  | 1. Heat from the sun |
|  |  |  | 1. Energy in food |

1. A runner eats a turkey sandwich before going out to exercise. He begins to run, and then starts to sweat. Which of the following best describes the movement of energy in this process?
   1. Potential 🡪 Thermal 🡪 Kinetic
   2. Kinetic 🡪 Potential 🡪 Thermal
   3. Potential 🡪 Kinetic 🡪 Thermal
   4. Thermal 🡪 Kinetic 🡪 Potential
2. Which of the following is an example of thermal energy?
   1. Standing on a chair
   2. Ice cream melting on a hot day
   3. A baseball thrown at 95 mph
   4. The energy stored in a sandwich
3. What type of energy is contained in a molecule of H2O?
4. Potential Energy
5. Kinetic Energy
6. Chemical Energy
7. Thermal Energy
8. When subjected to high pressure, carbon turns into a diamond. This pressure increases the temperature greatly, releasing a lot of heat. Which form of energy is responsible for the heat?
9. Potential Energy
10. Kinetic Energy
11. Chemical Energy
12. Thermal Energy

**Chem.11C: ΔHrxn, Exothermic vs. Endothermic**

**Notes:**

* Endothermic Reactions
  + Absorb heat
  + Surroundings get colder
  + ΔHrxn > 0
* ****Exothermic Reactions
  + Release heat
  + Surroundings get warmer
  + ΔHrxn < 0
* ΔHrxn

***Directions: Classify each reaction as exothermic or endothermic. Make sure to explain your reasoning.***

1. 2 H2O (l) + heat 🡪 2 H2 (g) + O2 (g)
2. Mg (s) + Cl2 (g) 🡪 MgCl2 (s) + heat
3. NH4NO3 (aq) + heat 🡪 NH4 + (aq) + NO3- (aq)
4. C6H12O6 (aq) + 6 O2 (g) 🡪 H2O (l) + 6 CO2 (g) + heat
5. When sodium hydroxide and hydrochloric acid are mixed together in solution, the temperature of the solution increases.
   1. Is this an endothermic or exothermic reaction?
   2. Is heat absorbed or released?
   3. Draw the reaction coordinate diagram for the reaction.
6. Cold packs are designed using an endothermic reaction. The reaction is shown below:

H2O + NH4Cl 🡪 NH3 + H3O+ + Cl-

* 1. Given that this is an endothermic reaction, which side (reactants or products) would heat be on? Explain your answer
  2. Is heat absorbed or released in this reaction?
  3. Would the temperature of the solution increase or decrease?
  4. Draw the general reaction coordinate diagram for an endothermic reaction

***Calculate the ΔHrxn for each of the following reactions:***

1. 3 H2 (g) + O3 (g) 🡪 3 H2O (g)
2. 2 NO (g)+ O2 (g) 🡪 2 NO2 (g)
3. CaC2 (s) + 2 H2O (l) 🡪 Ca(OH)2 (s) + C2H2 (g)
4. 2 C4H10 (l) + 13 O2 (g) 🡪 8 CO2 (g) + 10 H2O (l)

**Chem.11D: Q = mCpΔT**

**Notes:**

* Shows relationships between Q (total heat, in J), m (mass, in g), Cp (specific heat, in J/g·ºC), and ΔT (temperature change, in ºC)
  + ΔT = Tfinal - Tinitial
  + Cp for water is 4.184 J/g·ºC

1. A student must use 70g of hot water in a lab procedure. Calculate the amount of heat required (in J), to raise the temperature of the water from 46.0 ºC to 99.0 ºC.
2. A student heats 24g of an unknown metal from 40.0 ºC to 75.0 ºC. If the total heat required was 117.6 J, what was the specific heat of the unknown metal?
3. A 2950g sample of Sulfur is exposed to a total of -745,000 J of energy. If the specific heat of sulfur is 0.73 J/ g ·ºC, calculate the temperature change experienced by the sample.
4. Granite countertops have a specific heat of 0.790 J/ g ·ºC. If a piece of granite is exposed to -3081 J of energy and the temperature falls from 73 ºC to 21 ºC, what was the mass (in grams) of the granite?