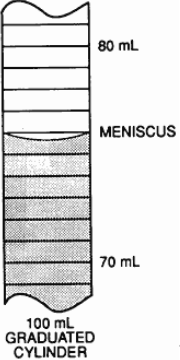


# Unit 1: Getting Ready for Chemistry

If you can do all the things listed below, you are ready for the Unit 1 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<p>_____ 1. I can list five important lab safety rules.</p>	<p>5 important lab safety rules are:</p> <ol style="list-style-type: none"> <li>1. wear appropriate personal protection equipment (PPE)</li> <li>2. follow directions</li> <li>3. no food or drink in the lab</li> <li>4. no non-experiment related electronics in the lab</li> <li>5. no horseplay</li> </ol>
<p>_____ 2. I can identify the most common laboratory tools such as: beaker, graduated cylinder, Erlenmeyer flask, scoop, beaker tongs, test tube, test tube rack, test tube holder, crucible tongs, Bunsen burner, striker, stirring rod, funnel, dropper pipette (aka eye dropper)</p>	<p>Draw and label as many of the common laboratory tools as you can!</p>
<p>_____ 3. I can determine the independent and dependent variable in a lab experiment.</p>	<p>A farmer wants to know what the effect the amount of fertilizer has on the amount of fruit an apple tree produces.</p> <p>What is the independent variable? <b>amount of fertilizer</b></p> <p>What is the dependent variable? <b>amount of fruit apple tree produces</b></p>
<p>_____ 4. I can determine the number of significant figures in a measurement.</p>	<p>How many significant figures are there in 30.50 cm? <b>4</b></p> <p>How many significant figures are there in 400.0 sec? <b>4</b></p>
<p>_____ 5. I can determine the answer to a math problem to the correct number of significant figures.</p>	<p>To the correct number of significant figures, what is the answer to 5.93 mL + 4.6 mL? <b>10.5 mL</b></p> <p>To the correct number of significant figures, what is the answer to 5.93 cm * 4.6 cm? <b>27 cm<sup>2</sup></b></p>

<p>_____ 6. I can read the meniscus on a graduated cylinder to the correct number of significant figures.</p>	 <p>The volume is <u>75.7</u> mL.</p>
<p>_____ 7. I can use dimensional analysis to solve math problems.</p>	<p>To the correct number of significant figures, determine how many meters there are in 15.4 ft.</p> <p style="text-align: center;"><b>4.69 m</b></p> <p>To the correct number of significant figures, determine how many minutes there are in 2.7 years.</p> <p style="text-align: center;"><b><math>1.4 \times 10^6</math> min</b></p>
<p>_____ 8. I can convert numbers into scientific notation from standard notation.</p>	<p>Convert 87,394,000,000,000 to scientific notation.</p> <p style="text-align: center;"><b><math>8.7394 \times 10^{13}</math></b></p> <p>Convert 0.0000040934 to scientific notation.</p> <p style="text-align: center;"><b><math>4.0934 \times 10^{-6}</math></b></p>
<p>_____ 9. I can convert numbers into standard notation from scientific notation.</p>	<p>Convert <math>5.8 \times 10^9</math> to standard notation.</p> <p style="text-align: center;"><b>5,800,000,000</b></p> <p>Convert <math>4.3 \times 10^{-5}</math> to standard notation.</p> <p style="text-align: center;"><b>0.000 043</b></p>
<p>_____ 10. I can use my calculator to input numbers in scientific notation using the "2<sup>nd</sup> function &amp; EE keys.</p>	<p>Enter the number <math>5.67 \times 10^{52}</math> on your calculator and show Mrs. S. She'll initial this box, if you've done it correctly!</p> <p style="text-align: center;"><b>calculator display should read 5.67E52</b></p>
<p>_____ 11. I can convert between different metric units by using "King Henry died by drinking chocolate milk".</p>	<p>9.3 km = ? m</p> <p style="text-align: center;"><b>9300 m</b></p> <p>39,983 mL = ?kL</p> <p style="text-align: center;"><b>0.39983 kL</b></p>
<p>_____ 12. I can convert between different metric units by using Reference Table C and dimensional analysis.</p>	<p><math>1.5 \times 10^{-3}</math> km = ? <math>\mu</math>m</p> <p style="text-align: center;"><b><math>1.5 \times 10^6 \mu</math>m</b></p> <p><math>4.67 \times 10^{13}</math> pm = ?dm</p> <p style="text-align: center;"><b>467 dm</b></p>


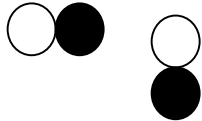

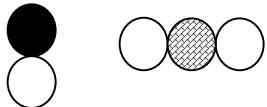

<p>_____13. I can determine which equation to use from Reference Table T by looking at the given information.</p>	<p><b>Which equation</b> would you use to solve the following problem? (Don't solve it. Just tell me WHICH equation to use.)</p> <p><i>Problem:</i> How many grams of LiBr (gram-formula mass = 87 g/mol) would 3.5 moles of LiBr be?</p> <p style="text-align: center;"><b>moles = given mass/gfm</b></p>
<p>_____14. I can solve for "x" when it's in the denominator of a fraction.</p>	<p>What is the volume, in cm<sup>3</sup>, of 54.6 g of beryllium (density = 1.85 g/cm<sup>3</sup>)</p> <p style="text-align: center;"><b>29.5 cm<sup>3</sup></b></p>
<p>_____15. I can convert °C to degrees kelvin and degrees kelvin to °C.</p>	<p>What kelvin temperature is equal to 200°C? <span style="float: right;"><b>473K</b></span></p> <p>What Celsius temperature is equal to 200K? <span style="float: right;"><b>-73°C</b></span></p>
<p>_____16. Given the symbol I can write the name for any element in Group 1, Group 2, Group 13, Group 14, Group 15, Group 16, Group 17 or Group 18 without using a Periodic Table.</p>	<p>Al <u>aluminum</u></p> <p>Ca <u>calcium</u></p> <p>Ne <u>neon</u></p> <p>N <u>nitrogen</u></p> <p>Na <u>sodium</u></p> <p>S <u>sulfur</u></p> <p>Br <u>bromine</u></p> <p>Ge <u>germanium</u></p>
<p>_____17. Given the symbol or the name, I can determine the Group for any element in Group 1, Group 2, Group 13, Group 14, Group 15, Group 16, Group 17 or Group 18 without using a Periodic Table.</p>	<p>Al <u>Group 13</u></p> <p>Ca <u>Group 2</u></p> <p>Ne <u>Group 18</u></p> <p>N <u>Group 15</u></p> <p>Na <u>Group 1</u></p> <p>S <u>Group 16</u></p> <p>Br <u>Group 17</u></p> <p>Ge <u>Group 14</u></p>
<p>_____18. I can define gram-formula mass (AKA molar mass).</p>	<p><b>Definition:</b> gram formula mass is the mass of one mole of substance</p>

<p>____ 19. Given the chemical symbol/formula, I can determine how many atoms are present.</p>	<p>How many moles of atoms are in <math>N_2</math>?  <b>2</b></p> <p>What is the total # of moles of atoms in <math>Pb(C_2H_3O_2)_2</math>?  <b>15</b></p> <p>How many moles of C atoms are in <math>Pb(C_2H_3O_2)_2</math>?  <b>4</b></p>
<p>____ 20. I can determine the gram-formula mass for any element or compound.</p>	<p>What is the gfm for <math>N_2</math>?  <b>28 g/mol</b></p> <p>What is the gfm for <math>Pb(C_2H_3O_2)_2</math>?  <b>325 g/mol</b></p>
<p>____ 21. I can define a mole as it pertains to chemistry.</p>	<p><b>Definition:</b>  <b>A mole is a unit to measure the amount of substance. One mole of substance is equal to its gfm. It is also equal to <math>6.02 \times 10^{23}</math> particles. If the substance is a gas at STP, one mole will occupy 22.4 L of volume.</b></p>
<p>____ 22. I can find the number of moles of substance if I am given the mass and formula for the substance.</p>	<p>94.3 g is how many moles of NaCl?  <b>1.61 moles</b></p>
<p>____ 23. I can determine the percent composition of an element in a compound.</p>	<p>What is the percent by mass of Mg in <math>Mg(NO_3)_2</math>?  <b>18.8%</b></p>
<p>____ 24. I can convert between moles and numbers of particles using Avogadro's number?</p>	<p>How many moles of carbon atoms are there in <math>4.8 \times 10^{24}</math> atoms of C?</p>
<p>____ 25. I can convert between moles and L (assuming STP).</p>	<p>How many L does 4.60 moles of <math>O_2</math> occupy (assuming STP)?  <b>103 L</b></p>

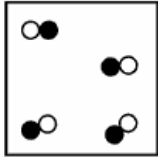
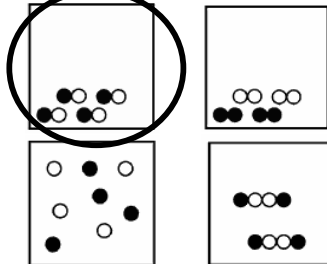
## Unit 2: Introduction to Matter

If you can do all the things listed below, you are ready for the Unit 2 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<p>____ 1. I can still do everything from Unit 1.</p>	<p><b>Definitions:</b>  atom – <b>smallest particle of matter that retains the properties of an element</b></p> <p>element – <b>a substance that cannot be broken down into a simpler substance</b></p> <p>compound – <b>two or more elements chemically combined in a fixed ratio</b></p> <p>mixture – <b>two or more substances physically combined in a variable ratio</b></p>	
<p>____ 2. I can define the following: atom, element, compound, mixture</p>		
<p>____ 3. I can draw particle diagrams to represent an atom, an element, a molecule, a compound, a mixture</p>	<p>2 Atoms of 1 Element</p> 	<p>2 Molecules of 1 Compound</p> 
	<p>Mixture of 2 elements</p> 	<p>Mixture of 2 compounds</p> 
	<p>Mixture of an element and a compound</p> 	

<p>_____4. I can classify substances as a pure substance (element or compound) or as a mixture.</p>	<p>Put each of the following examples into the correct column.</p> <p>Examples: <math>C_{12}H_{22}O_{11}</math>, NaCl, Fe, salt water, air, <math>CO_2</math>, <math>H_2</math>, Ar, soda</p>														
<p>_____5. I can define homogeneous mixture and heterogeneous mixture in terms of particle distribution.</p>	<table border="1" data-bbox="535 210 1502 504"> <thead> <tr> <th data-bbox="535 210 836 241"><u>Element</u></th> <th data-bbox="836 210 1161 241"><u>Compound</u></th> <th data-bbox="1161 210 1502 241"><u>Mixture</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="535 241 836 273">Fe</td> <td data-bbox="836 241 1161 273"><math>C_{12}H_{22}O_{11}</math></td> <td data-bbox="1161 241 1502 273">salt water</td> </tr> <tr> <td data-bbox="535 273 836 304"><math>H_2</math></td> <td data-bbox="836 273 1161 304">NaCl</td> <td data-bbox="1161 273 1502 304">air</td> </tr> <tr> <td data-bbox="535 304 836 336">Ar</td> <td data-bbox="836 304 1161 336"><math>CO_2</math></td> <td data-bbox="1161 304 1502 336">soda</td> </tr> </tbody> </table> <p><b>Definitions:</b>  homogeneous mixture – <b>two or more substances physically combined with a uniform distribution of particles</b></p> <p>heterogeneous mixture– <b>two or more substances physically combined with a non-uniform (clumpy) distribution of particles</b></p>			<u>Element</u>	<u>Compound</u>	<u>Mixture</u>	Fe	$C_{12}H_{22}O_{11}$	salt water	$H_2$	NaCl	air	Ar	$CO_2$	soda
<u>Element</u>	<u>Compound</u>	<u>Mixture</u>													
Fe	$C_{12}H_{22}O_{11}$	salt water													
$H_2$	NaCl	air													
Ar	$CO_2$	soda													
<p>_____6. I can give an example of homogeneous and heterogeneous mixtures.</p>	<p>Two examples of homogeneous mixtures:</p> <p>a. <b>brass</b></p> <p>b. <b>a pitcher of Kool-Aid</b></p> <p>Two examples of heterogeneous mixtures:</p> <p>a. <b>snickers bar</b></p> <p>b. <b>soil</b></p>														
<p>_____7. I can classify a property as physical or chemical.</p>	<p>Write “P” for physical or “C” for chemical on the line provided.</p> <p>___ P ___ copper (II) sulfate is blue.</p> <p>___ C ___ copper reacts with oxygen.</p> <p>___ P ___ copper can be made into wire.</p> <p>___ P ___ copper has a density of <math>8.96 \text{ g/cm}^3</math>.</p> <p>___ P ___ copper melts at 1358K.</p> <p>___ C ___ copper reacts with nitric acid.</p> <p>___ P ___ copper doesn’t dissolve in water.</p>														

<p>_____8. I can classify a change as physical or chemical.</p>	<p>Write "P" for <b>physical</b> or "C" for <b>chemical</b> on the line provided.</p> <p>___P___ copper (II) sulfate dissolves in water.</p> <p>___C___ copper reacts with oxygen to form solid copper (I) oxide.</p> <p>___P___ solid copper is melted.</p> <p>___P___ a chunk of copper is pounded flat.</p> <p>___P___ copper and zinc are mixed to form brass.</p> <p>___P___ a large piece of copper is chopped in half.</p> <p>___C___ copper reacts with bromine to form copper (II) bromide.</p>
<p>_____9. In a particle diagram, I can distinguish between a physical change and a chemical change.</p>	<p></p> <p><b>Substance A</b></p> <p>Circle the particle diagram that best represents Substance A after a physical change has occurred.</p> <p></p>
<p>_____10. I can define: solute, solvent, solution, and solubility.</p>	<p><b>Definitions:</b></p> <p>solute – <b>the substance in a mixture that gets dissolved</b></p> <p>solvent – <b>the substance in a mixture that does the dissolving</b></p> <p>solution – <b>a homogenous mixture</b></p> <p>solubility – <b>the amount of solute that will dissolve in a given amount of solvent at a given temperature</b></p>
<p>_____11. I can describe the trend in solubility for solids as the temperature changes.</p>	<p>As the temperature increases, the solubility of a solid _____increases_____.</p>

<p>_____12. I can describe the trend in solubility for gases as the temperature changes.</p>	<p>As the temperature increases, the solubility of a gas <u>decreases</u>.</p>
<p>_____13. I can use Reference Table F to determine if a substance will be soluble in water.</p>	<p>Write "S" for <b>soluble</b> and "NS" for <b>not soluble</b>. Use Reference Table F to determine the solubility of the following compounds:</p> <p><u>S</u> potassium chlorate</p> <p><u>NS</u> silver bromide</p> <p><u>S</u> lithium carbonate</p> <p><u>NS</u> calcium carbonate</p>
<p>_____14. I can use Table G to determine how much solute to add at a given temperature to make a saturated solution.</p>	<p>How many grams of <math>\text{KClO}_3</math> must be dissolved in 100 grams of water at <math>20^\circ\text{C}</math> to make a saturated solution?</p> <p style="text-align: right;"><b>56 g</b></p>
<p>_____15. I can use Table G to determine if a solution is saturated, unsaturated, or supersaturated.</p>	<p>If 20.0 g of <math>\text{NaNO}_3</math> are dissolved in 100.0 g of water at <math>25.0^\circ\text{C}</math>, will the resulting solution be saturated, unsaturated, or supersaturated?</p> <p style="text-align: right;"><b>unsaturated</b></p>
<p>_____16. I can define: dilute, concentrated, concentration, and electrolyte.</p>	<p><b>Definitions:</b></p> <p>dilute – a solution in which a small quantity of solute is dissolved in a large quantity of solvent</p> <p>concentrated – a solution in which a large quantity of solute is dissolved in a small quantity of solvent</p> <p>concentration – the amount of solute dissolved in a given amount of solvent</p> <p>electrolyte – a substance that can conduct electricity when dissolved in water</p>
<p>_____17. I can interpret Table G to determine which solution is the most concentrated or the most dilute.</p>	<p>Which solution is most concentrated?</p> <p><b>A)</b> 125.0 g of <math>\text{KI}</math> dissolved in 100.0 g of water at <math>10^\circ\text{C}</math></p> <p>B) 70.0 g of <math>\text{NH}_4\text{Cl}</math> dissolved in 100.0 g of water at <math>70^\circ\text{C}</math></p> <p>C) 120.0 g of <math>\text{KNO}_3</math> dissolved in 100.0 g of water at <math>70^\circ\text{C}</math></p> <p>D) 30.0 g of <math>\text{SO}_2</math> dissolved in 100.0 g of water at <math>90^\circ\text{C}</math></p>
<p>_____18. I can use Reference Table T to calculate the concentration of a solution in ppm.</p>	<p>What is the concentration, in ppm, of a 2600 g of solution containing 0.015 g of <math>\text{CO}_2</math>?</p> <p style="text-align: center;"><b>5.7 ppm</b></p>
<p>_____19. I can use Reference Table T to calculate the concentration of a solution in molarity.</p>	<p>What is the molarity of 3.5 moles of <math>\text{NaBr}</math> dissolved in 500 mL of water?</p> <p style="text-align: right;"><b>7M</b></p>

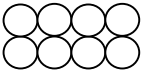
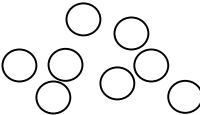
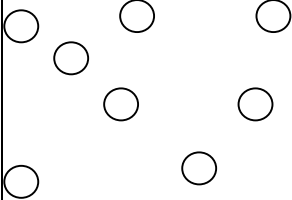
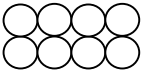
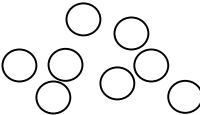
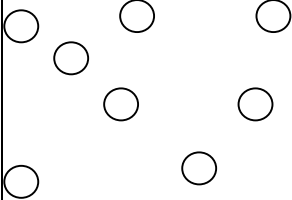
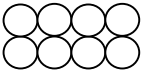
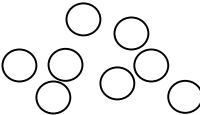
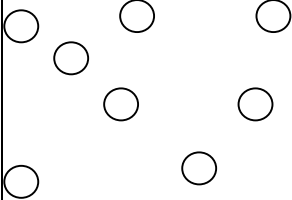


<p>____ 20. I can determine how matter will be separated using filtration.</p>	<p>When a mixture of sand, salt, sugar, and water is filtered, what passes through the filter?</p> <p style="text-align: center;"><b>salt, sugar, and water</b></p>
<p>____ 21. I can describe how matter can be separated using distillation.</p>	<p>Which physical property makes it possible to separate the components of crude oil by means of distillation?</p> <p style="text-align: center;"><b>difference in boiling points</b></p>
<p>____ 23. I can state which separation process (decanting, filtering, distilling, chromatography, or evaporating) is best for a given situation.</p>	<p>To separate a mixture of salt and water, the best method of separation would be <u>evaporation</u>.</p> <p>To separate a mixture of ethanol and water, the best method of separation would be <u>distillation</u>.</p> <p>To separate a mixture of food coloring dyes, the best method of separation would be <u>chromatography</u>.</p> <p>To separate a mixture of oil and water, the best method of separation would be <u>decanting</u>.</p>
<p>____ 24. I can define allotrope.</p>	<p><b>Defintion:</b> allotrope – <b>different forms of the same element that possess different molecular structures</b></p>
<p>____ 25. I can state the differences between two allotropes of the same element.</p>	<p>Two allotropes of the same element have different molecular structures and therefore have different <u>physical</u> and <u>chemical</u> properties.</p>

## Unit 3: Matter & Energy

If you can do all the things listed below, you are ready for the Unit 3 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<p>____1. I can still do everything from Unit 1.</p>							
<p>____2. I can still do everything from Unit 2.</p>							
<p>____3. I can define kinetic energy, potential energy, temperature, heat, endothermic, and exothermic.</p>	<p><b>Defintions:</b>  kinetic energy – <b>energy a substance has due to its motion</b></p> <p>potential energy – <b>energy a substance has that is stored in chemical bonds and static interactions</b></p> <p>temperature – <b>a measure of the average kinetic energy of a substance</b></p> <p>heat – <b>energy the moves between two substances due to differences in temperature between the substances</b></p> <p>endothermic – <b>chemical reaction or physical change that requires the input of energy to occur</b></p> <p>exothermic – <b>chemical reaction of physical change that releases energy as it occurs</b></p>						
<p>____4. I can use particle diagrams to show the arrangement and spacing of atoms/molecules in different phases.</p>	<p>Draw a particle diagram to represent atoms of Li in each phase.</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Solid</th> <th style="width: 33%;">Liquid</th> <th style="width: 33%;">Gas</th> </tr> </thead> <tbody> <tr> <td style="text-align: left; padding: 10px;">  </td> <td style="text-align: left; padding: 10px;">  </td> <td style="text-align: left; padding: 10px;">  </td> </tr> </tbody> </table>	Solid	Liquid	Gas			
Solid	Liquid	Gas					
							

	Solid	Liquid	Gas
<b>Relative Kinetic Energy</b>	<i>low</i>	<i>moderate</i>	<i>high</i>
<b>Type of Molecular Motion</b>	<i>vibrations, only</i>	<i>vibration and rotation</i>	<i>vibration, rotation, and translation</i>
<b>Ability to Completely Fill Any Container</b>	<i>no</i>	<i>no</i>	<i>yes</i>
<b>Ability to Change Shape</b>	<i>no</i>	<i>yes</i>	<i>yes</i>

\_\_\_\_ 5. I can compare solids, liquids, and gases in terms of their relative kinetic energy, type of molecular motion, ability to completely fill a container, ability to change shape.

\_\_\_\_ 6. I can state the change of phase occurring in fusion, solidification, condensation, vaporization, melting, boiling, sublimation, deposition, and freezing.

During fusion a substance changes from solid to liquid.

During solidification a substance changes from liquid to solid.

During condensation a substance changes from gas to liquid.

During vaporization a substance changes from liquid to gas.

During melting a substance changes from solid to liquid.

During boiling a substance changes from liquid to gas.

During sublimation a substance changes from solid to gas.

During deposition a substance changes from gas to solid.

During freezing a substance changes from liquid to solid.

\_\_\_\_ 7. I can indicate if a phase change is exothermic or endothermic.

For each phase change listed, indicate whether the change is exothermic or endothermic.

fusion/melting ENDO

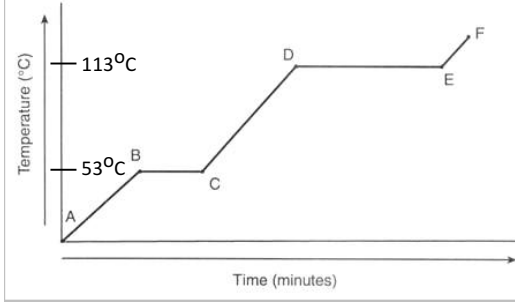
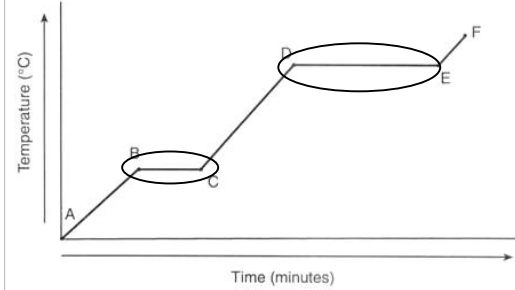
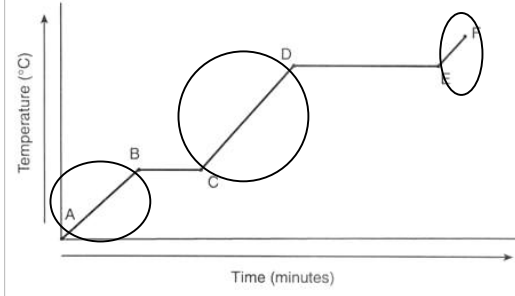
solidification/freezing EXO

condensation EXO

vaporization/boiling ENDO

sublimation ENDO

deposition EXO

<p>_____8. Given a heating/cooling curve, I can determine the temperature at which a substance freezes/melts or condenses/vaporizes.</p>	 <p>What is the freezing point of this substance?      53°C</p> <p>What is the boiling point of this substance?      113°C</p>	
<p>_____9. Given a heating/cooling curve, I can determine which sections of the curve show changes in potential energy.</p>	 <p>On the graph, circle the sections that show a change in potential energy.</p>	
<p>_____10. Given a heating/cooling curve, I can determine which sections of the curve show changes in kinetic energy.</p>	 <p>On the graph, circle the sections that show a change in kinetic energy.</p>	
<p>_____11. I can state the temperature at which water freezes in °C and K.</p>	<p>What is the freezing point of water in °C and K?</p> <p><b>0°C and 273K</b></p>	
<p>_____12. I can state the temperature at which water melts in °C and K.</p>	<p>What is the melting point of water in °C and K?</p> <p><b>0°C and 273K</b></p>	
<p>_____13. I can state the temperature at which water vaporizes/boils in °C and K.</p>	<p>What is the boiling point of water in °C and K?</p> <p><b>100°C and 373K</b></p>	
<p>_____14. I can state the temperature at which water condenses in °C and K.</p>	<p>What is the condensing point of water in °C and K?</p> <p><b>100°C and 373K</b></p>	

<p>_____15. I can use Reference Table T to determine which “heat” equation is needed for a given problem.</p>	<p>Which heat equation should be used in each of the following:</p> <p>a. How much heat is needed to vaporize 100.0 g of water at 100°C?  <math>Q = mH_v</math></p> <p>b. How much heat is needed to raise the temperature of 100.0 g of water by 35°C?  <math>Q = mC\Delta T</math></p> <p>c. How much heat is needed to melt 100.0 g of ice at 0°C?  <math>Q = mH_f</math></p>
<p>_____16. I can define specific heat capacity, heat of fusion, heat of vaporization.</p>	<p><b>Definitions:</b>  specific heat capacity – <b>the amount of heat required to increase the temperature of one gram of substance by 1°C (or K)</b></p> <p>heat of fusion - <b>the amount of heat required to melt one gram of substance at its melting point</b></p> <p>heat of vaporization - <b>the amount of heat required to vaporize one gram of substance at its boiling point</b></p>
<p>_____17. I can use the “heat” equations to solve for any variable, if I am given the other variables.</p>	<p>How many grams of water can be heated by 15.0°C using 13,500 J of heat?    <b>215 g</b></p> <p>It takes 5210 J of heat to melt 50.0 g of ethanol at its melting point. What is the heat of fusion of ethanol?    <b>104 J/g</b></p>
<p>_____18. I can state the 5 parts of the Kinetic Molecular Theory.</p>	<p>The five parts of the Kinetic Molecular Theory are:</p> <p>a. <b>Gases consist of tiny particles.</b></p> <p>b. <b>The size of the particles is so small compared to the space between the particles that the volume of the actual gas particles is negligible.</b></p> <p>c. <b>Gas particles are in constant, random, straight-line motion, colliding with the walls of the container. These collisions create pressure.</b></p> <p>d. <b>Gas particles have no intermolecular forces (IMF).</b></p> <p>e. <b>The average kinetic energy of gas particles is directly proportional to their Kelvin temperature.</b></p>

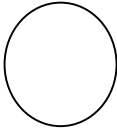
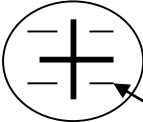
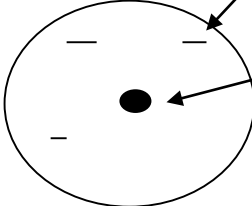
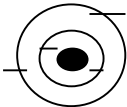
<p>_____ 19. I can define an ideal gas.</p>	<p><b>Definition:</b> ideal gas –any gas that conforms to all of the parts of the KMT. Ideal gases are theoretical although some gases are close. Hydrogen and helium are the closest to ideal gases at all temperatures and pressures.</p>
<p>_____ 20. I can state the conditions of pressure and temperature under which a gas will act “ideally”.</p>	<p>A gas will act most “ideally” under the conditions of <u>low</u> pressure and <u>high</u> temperature.</p>
<p>_____ 21. I can state the two elements that act ideally most of the time.</p>	<p>The two elements that act ideally most of the time are <u>hydrogen</u> &amp; <u>helium</u>.</p>
<p>_____ 22. I can explain how pressure is created by a gas.</p>	<p>What causes gas molecules to create pressure? <b>Collisions with the walls of the container.</b></p>
<p>_____ 23. I can state the relationship between pressure and volume for gases (assuming constant temperature).</p>	<p>At constant temperature, as the pressure on a gas increases, the volume <u>decreases</u>.</p>
<p>_____ 24. I can state the relationship between temperature and volume for gases (assuming constant pressure).</p>	<p>At constant pressure, as the temperature on a gas increases, the volume <u>increases</u>.</p>
<p>_____ 25. I can state the relationship between temperature and pressure for gases (assuming constant volume).</p>	<p>In a fixed container (AKA “has constant volume), as the temperature on a gas increases, the pressure <u>increases</u>.</p>
<p>_____ 26. I can state Avogadro’s Hypothesis.</p>	<p>Avogadro’s Hypothesis says <u>two samples of an ideal gas, if they have the same temperature, pressure, and volume, will contain the same number of molecules.</u></p>
<p>_____ 27. I can remember to convert °C to K when using the Combined Gas Law to determine changes in V, P, or T of a gas.</p>	<p>A gas originally occupies 2.3L at 56°C and 101.3 kPa. What will its volume be at 100°C and 105.7 kPa?  <b>2.5 L</b></p>

<p>_____ 28. I can define boiling point and vapor pressure.</p>	<p><b>Definition:</b>  boiling point – the temperature at which the vapor pressure of a liquid equals the pressure surrounding the liquid</p> <p>vapor pressure – the pressure exerted by a vapor in equilibrium with its condensed phases (solid or liquid) at a given temperature in a closed system</p>
<p>_____ 29. I can state the condition of pressure that is used for “normal” boiling points.</p>	<p>The normal boiling point of a substance occurs at a pressure of _____ 1 _____ atm/ _____ 101.3 _____ kPa.</p>
<p>_____ 30. I can state the relationship between atmospheric pressure and boiling point.</p>	<p>As the atmospheric pressure increases, the boiling point _____ increases _____.</p>


# Unit 4: Atomic Theory

If you can do all the things listed below, you are ready for the Unit 4 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<p>____1. I can still do everything from Unit 1.</p>	
<p>____2. I can still do everything from Unit 2.</p>	
<p>____3. I can still do everything from Unit 3.</p>	
<p>____4. I can describe John Dalton's contribution to our understanding of the atom.</p>	<p>Dalton's Model: <b>hard sphere model</b></p> <p>What it looked like:</p> 
<p>____5. I can describe JJ Thomson's contribution to our understanding of the atom.</p>	<p>Thomson's Experiment: <b>cathode ray experiment</b></p> <p>Thomson's Model: <b>plum pudding model</b></p> <p>What it looked like:</p> 
<p>____6. I can describe Ernest Rutherford's contribution to our understanding of the atom.</p>	<p>Rutherford's Experiment: <b>gold foil experiment</b></p> <p>Rutherford's Model: <b>nuclear model; empty space model</b></p> <p>What it looked like:</p>  <p>electrons</p> <p>small, positively charged nucleus</p>
<p>____7. I can describe Niels Bohr's contribution to our understanding of the atom.</p>	<p>Bohr's Model: <b>planetary model; electron shell model</b></p> <p>What it looked like:</p> 



<p>_____8. I can describe James Chadwick's contribution to our understanding of the atom.</p>	<p>What subatomic particle did Chadwick discover? <b>neutron</b></p>																							
<p>_____9. I can describe how Schrodinger, Heisenberg, Pauli, Dirac, and others contributed to our understanding of the atom.</p>	<p>What does the modern model of the atom look like?</p>  <p>Where, in an atom, are electrons likely to be found according to the modern model?</p> <p style="text-align: center;"><b>orbitals</b></p>																							
<p>_____10. I can state the chronological order of atomic models.</p>	<p>From oldest to newest, list the models that we have used to describe an atom.</p> <p>hard sphere ---&gt; plum pudding ---&gt; empty space ---&gt; electron shell ---&gt; modern model</p>																							
<p>_____11. I can state the three subatomic particles, their location in an atom, their charges, and their masses (in amu).</p>	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>Particle #1</th> <th>Particle #2</th> <th>Particle #3</th> </tr> </thead> <tbody> <tr> <td><b>Name</b></td> <td><i>proton</i></td> <td><i>neutron</i></td> <td><i>electron</i></td> </tr> <tr> <td><b>Charge</b></td> <td><i>+1</i></td> <td><i>0</i></td> <td><i>-1</i></td> </tr> <tr> <td><b>Mass</b></td> <td><i>1 amu</i></td> <td><i>1 amu</i></td> <td><i>0.0005 amu</i></td> </tr> <tr> <td><b>Location in Atom</b></td> <td><i>nucleus</i></td> <td><i>nucleus</i></td> <td><i>orbital</i></td> </tr> </tbody> </table>					Particle #1	Particle #2	Particle #3	<b>Name</b>	<i>proton</i>	<i>neutron</i>	<i>electron</i>	<b>Charge</b>	<i>+1</i>	<i>0</i>	<i>-1</i>	<b>Mass</b>	<i>1 amu</i>	<i>1 amu</i>	<i>0.0005 amu</i>	<b>Location in Atom</b>	<i>nucleus</i>	<i>nucleus</i>	<i>orbital</i>
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<p>_____12. I can explain why atoms are electrically neutral.</p>	<p>Atoms are electrically neutral because the number of <u>  protons  </u> is equal to the number of <u>  electrons  </u>.</p>																							
<p>_____13. I can define mass number and atomic number.</p>	<p><b>Definitions:</b>  mass number – <b>the total number of protons and neutrons in an atoms</b>   atomic number – <b>the number of protons in an atom; defines which element the atom is</b></p>																							
<p>_____14. Given the mass number, I can determine the number of protons, neutron, and electrons in an atom.</p>	<table style="width: 100%;"> <tr> <td style="width: 80%;">In an atom of <math>^{212}\text{Po}</math>, how many protons are present?</td> <td style="text-align: right;"><b>84</b></td> </tr> <tr> <td style="text-align: center;">84</td> <td></td> </tr> <tr> <td>In an atom of <math>^{212}\text{Po}</math>, how many electrons are present?</td> <td style="text-align: right;"><b>84</b></td> </tr> <tr> <td style="text-align: center;">84</td> <td></td> </tr> <tr> <td>In an atom of <math>^{212}\text{Po}</math>, how many neutrons are present?</td> <td style="text-align: right;"><b>128</b></td> </tr> <tr> <td style="text-align: center;">84</td> <td></td> </tr> </table>				In an atom of $^{212}\text{Po}$ , how many protons are present?	<b>84</b>	84		In an atom of $^{212}\text{Po}$ , how many electrons are present?	<b>84</b>	84		In an atom of $^{212}\text{Po}$ , how many neutrons are present?	<b>128</b>	84									
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<p>____15. I can use the Periodic Table to determine the atomic number of an element.</p>	<p>How many protons are in an atom of selenium?     <b>34</b></p> <p>How many protons are in an atom of silicon?     <b>14</b></p>												
<p>____16. I can define isotope.</p>	<p><b>Definition:</b> isotope – each of two or more forms of an element that have the same number of protons, but a different number of neutrons giving each different form a different mass</p>												
<p>____17. I can represent an atom in any of the four methods of isotopic notation.</p>	<p>Write the four different methods of isotopic notation for an atom of bromine that has 45 neutrons.</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">Method 1</td> <td style="text-align: center;">Method 2</td> <td style="text-align: center;">Method 3</td> <td style="text-align: center;">Method 4</td> </tr> <tr> <td style="text-align: center;"><b>Br-80</b></td> <td style="text-align: center;"><b>bromine-80</b></td> <td style="text-align: center;"><b>80Br</b></td> <td style="text-align: center;"><b>80Br</b></td> </tr> <tr> <td></td> <td></td> <td></td> <td style="text-align: center;"><b>35</b></td> </tr> </table>	Method 1	Method 2	Method 3	Method 4	<b>Br-80</b>	<b>bromine-80</b>	<b>80Br</b>	<b>80Br</b>				<b>35</b>
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			<b>35</b>										
<p>____18. I can calculate average atomic mass given the masses of the naturally occurring isotopes and the percent abundances.</p>	<p>Element Q has two isotopes. If 77% of the element has an isotopic mass of 83.7 amu and 23% of the element has an isotopic mass of 89.3 amu, what is the average atomic mass of the element?</p> <p><b>84.998 amu</b></p>												
<p>____19. I can define ion, cation, and anion.</p>	<p><b>Definitions:</b> ion – an atom that has lost or gained electrons</p> <p>cation – a positively charged ion that results from the loss of electrons</p> <p>anion – a negatively charged ion that results from the gaining of electrons</p>												
<p>____20. Given the mass number and the charge, I can determine the number of protons, neutrons, and electrons in an ion.</p>	<p>How many protons are in <math>{}^{19}_{9}\text{F}^{1-}</math>?     <b>9</b></p> <p>How many neutrons are in <math>{}^{19}_{9}\text{F}^{1-}</math>?     <b>10</b></p> <p>How many electrons are in <math>{}^{19}_{9}\text{F}^{1-}</math>?     <b>10</b></p>												

<p>_____ 21. I can define principal energy level, orbital, ground state, excited state, electron configuration, and bright line spectrum.</p>	<p><b>Definitions:</b> principal energy level (PEL)– <b>main energy level or shell of an atom</b></p> <p>orbital – <b>most probable electron location in the modern mechanical model</b></p> <p>ground state – <b>lowest energy state of an electron; electron configurations on the PT are shown in the ground state</b></p> <p>excited state – <b>any energy state of an electron that is higher than ground state</b></p> <p>electron configuration –<b>the ground state arrangement of electrons in PEL</b></p> <p>bright line spectrum – <b>characteristic colors of light that are given off by an atom when an excited electron releases energy and returns to the ground state</b></p>
<p>_____ 22. I can state the maximum number of electrons that will fit into each of the first four principal energy levels.</p>	<p>PEL1 holds a maximum of <u>  2  </u> electrons.</p> <p>PEL2 holds a maximum of <u>  8  </u> electrons.</p> <p>PEL3 holds a maximum of <u> 18 </u> electrons.</p> <p>PEL4 holds a maximum of <u> 32 </u> electrons.</p>
<p>_____ 23. I can state the relationship between distance from the nucleus and energy of an electron.</p>	<p>As the distance between the nucleus and the electron increases, the energy of the electron <u>  increases  </u>.</p>
<p>_____ 24. I can state the relationship between the number of the principal energy level and the distance to the atom's nucleus.</p>	<p>As the number of the PEL increases, the distance to the nucleus <u>  increases  </u>.</p>
<p>_____ 25. I can explain, in terms of subatomic particles and energy states, how a bright line spectrum is created.</p>	<p>A brightline spectrum is created when <b>electrons in a high energy state release energy and return to a lower energy state</b></p>

<p>____26. I can identify the elements shown in a bright line spectrum.</p>	<p style="text-align: center;"><b>Bright-Line Spectra</b></p> <p>Which element(s) is/are present in the mixture?</p> <p style="text-align: center;"><b>D &amp; E</b></p>
<p>____27. I can define valence electrons.</p>	<p><b>Definition:</b> valence electron – <b>the electrons in the outermost s &amp; p suborbitals; the farthest number to the right on the electron configuration on the PT</b></p>
<p>____28. I can locate and interpret an element's electron configuration on the Periodic Table.</p>	<p>How many valence electrons does an atom of rubidium have in the ground state?</p> <p style="text-align: center;"><b>1</b></p> <p>How many principal energy levels contain electrons in an atom of iodine in the ground state?</p> <p style="text-align: center;"><b>6</b></p>
<p>____29. I can identify an electron configuration that shows an atom in the excited state.</p>	<p>Which electron configuration represents an atom of potassium in the excited state?</p> <p>A) 2-8-7-1 B) 2-8-8-1 <b>C) 2-8-7-2</b> D) 2-8-8-2</p>
<p>____30. I can draw Lewis electron dot diagrams for a given element.</p>	<p>Draw the Lewis electron dot diagram for the following atoms:</p> <p style="text-align: center;"> <math>\cdot</math>Li    <math>\cdot\cdot</math>Be<math>\cdot</math>    <math>\cdot\cdot</math>B<math>\cdot</math>    <math>\cdot\cdot</math>C<math>\cdot</math>    <math>\cdot\cdot</math>N<math>\cdot</math>    <math>\cdot\cdot</math>O:<math>\cdot</math>    <math>\cdot</math>F:<math>\cdot</math>    :Ne:<math>\cdot\cdot</math> </p>
<p>____31. I can define and state the importance of "octet of valence electrons."</p>	<p><b>Definition:</b> octet of valence electrons – <b>having 8 valence electrons; a full valence shell</b></p> <p>The importance of having a complete "octet of valence electrons" is <b>it makes the element "stable" and unreactive</b></p>

## Unit 5: Nuclear Chemistry

If you can do all the things listed below, you are ready for the Unit 5 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<p>____1. I can still do everything from Unit 1.</p>																																											
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<p>____3. I can still do everything from Unit 3.</p>																																											
<p>____4. I can still do everything from Unit 4.</p>																																											
<p>____5. I can compare types of radiation in terms of symbol, mass number, charge, penetrating power, shielding required, and biological hazard.</p>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Type</th> <th style="padding: 5px;">Symbol</th> <th style="padding: 5px;">Mass #</th> <th style="padding: 5px;">Charge</th> <th style="padding: 5px;">Penetrating Power</th> <th style="padding: 5px;">Shielding Required</th> <th style="padding: 5px;">Bio Hazard</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">alpha</td> <td style="padding: 5px;"><math>\alpha</math></td> <td style="padding: 5px;">4</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">very low</td> <td style="padding: 5px;"><i>paper, clothing</i></td> <td style="padding: 5px;"><i>none unless inhaled</i></td> </tr> <tr> <td style="padding: 5px;">beta</td> <td style="padding: 5px;"><math>\beta^-</math></td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">-1</td> <td style="padding: 5px;">low</td> <td style="padding: 5px;"><i>metal foil</i></td> <td style="padding: 5px;"><i>eyes &amp; skin</i></td> </tr> <tr> <td style="padding: 5px;">gamma</td> <td style="padding: 5px;"><math>\gamma</math></td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">very high</td> <td style="padding: 5px;"><i>concrete &amp; lead</i></td> <td style="padding: 5px;"><i>whole body</i></td> </tr> <tr> <td style="padding: 5px;">neutron</td> <td style="padding: 5px;"><math>^1_0n</math></td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">very high</td> <td style="padding: 5px;"><i>water; lead</i></td> <td style="padding: 5px;"><i>whole body</i></td> </tr> <tr> <td style="padding: 5px;">positron</td> <td style="padding: 5px;"><math>\beta^+</math></td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">+1</td> <td style="padding: 5px;">low</td> <td style="padding: 5px;"><i>metal foil</i></td> <td style="padding: 5px;"><i>eyes &amp; skin</i></td> </tr> </tbody> </table>	Type	Symbol	Mass #	Charge	Penetrating Power	Shielding Required	Bio Hazard	alpha	$\alpha$	4	2	very low	<i>paper, clothing</i>	<i>none unless inhaled</i>	beta	$\beta^-$	0	-1	low	<i>metal foil</i>	<i>eyes &amp; skin</i>	gamma	$\gamma$	0	0	very high	<i>concrete &amp; lead</i>	<i>whole body</i>	neutron	$^1_0n$	1	0	very high	<i>water; lead</i>	<i>whole body</i>	positron	$\beta^+$	0	+1	low	<i>metal foil</i>	<i>eyes &amp; skin</i>
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<p>____6. I can identify the three types of nuclear reactions.</p>	<p>The three types of nuclear reactions are:</p> <ul style="list-style-type: none"> <li>a. fission</li> <li>b. fusion</li> <li>c. transmutation</li> </ul>																																										
<p>____7. I can define transmutation, fission, and fusion.</p>	<p><b>Definitions:</b></p> <p>transmutation – <b>process of changing one element into another; may be natural or artificial</b></p> <p>fission – <b>process of splitting apart a large atom (usually U or Pu) into two roughly equal size pieces by hitting it with a neutron</b></p> <p>fusion – <b>process of putting small nuclei (usually H) together to form a larger nucleus (He)</b></p>																																										

<p>_____8. I can state two synonyms for spontaneous decay.</p>	<p>Two synonyms for spontaneous decay are: _____ natural decay _____ and _____ natural transmutation _____.</p>
<p>_____9. I can show how mass number and electrical charge must be conserved in any nuclear reaction.</p>	<p>Complete the following nuclear equation:</p> ${}_{19}^{42}\text{K} \rightarrow {}_{20}^{42}\text{Ca} + \underline{\quad\quad\quad}^{\quad\quad\quad}_0$
<p>_____10. I can explain what makes a nucleus stable or unstable.</p>	<p>The stability of the nucleus is dependent on the _____ proton _____ to _____ neutron _____ ratio.</p>
<p>_____11. I can explain the difference between natural transmutation and artificial transmutation.</p>	<p>The difference between natural transmutation and artificial transmutation is that in natural transmutation an _____ unstable _____ nucleus _____ breaks apart on its own and in artificial transmutation a _____ stable _____ nucleus _____ is made _____ unstable _____ by hitting it with a high energy particle (such as a proton, neutron, or gamma radiation).</p>
<p>_____12. I can identify a natural decay reaction from a list of reactions.</p>	<p>Which equation represents a natural decay?</p> <p>A) <math>{}^9_4\text{Be} + {}^1_1\text{H} \rightarrow {}^6_3\text{Li} + {}^4_2\text{He}</math>  B) <math>{}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow {}^{30}_{15}\text{P} + {}^1_0\text{n}</math>  C) <math>{}^{14}_7\text{N} + {}^4_2\text{He} \rightarrow {}^{17}_8\text{O} + {}^1_1\text{H}</math>  D) <math>{}^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + {}^4_2\text{He}</math></p>
<p>_____13. I can identify an artificial transmutation reaction from a list of reactions.</p>	<p>Which equation represents artificial transmutation?</p> <p>A) <math>{}^{16}_7\text{N} \rightarrow {}^{16}_8\text{O} + {}^0_{-1}\text{e}</math>  B) <math>{}^{14}_7\text{N} + {}^4_2\text{He} \rightarrow {}^{17}_8\text{O} + {}^1_1\text{H}</math>  C) <math>{}^{37}_{19}\text{K} \rightarrow {}^{37}_{18}\text{Ar} + {}^0_{+1}\text{e}</math>  D) <math>{}^{42}_{19}\text{K} \rightarrow {}^{42}_{20}\text{Ca} + {}^0_{+1}\text{e}</math></p>
<p>_____14. I can identify a fission reaction from a list of reactions.</p>	<p>Which equation represents fission?</p> <p>A) <math>{}^1_0\text{n} + {}^{235}_{92}\text{U} \rightarrow {}^{142}_{56}\text{Ba} + {}^{91}_{36}\text{Kr} + 3{}^1_0\text{n}</math>  B) <math>{}^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + {}^4_2\text{He}</math>  C) <math>{}^6_3\text{Li} + {}^1_0\text{n} \rightarrow {}^3_1\text{H} + {}^4_2\text{He}</math>  D) <math>{}^2_1\text{H} + {}^3_1\text{H} \rightarrow {}^4_2\text{He} + {}^1_0\text{n}</math></p>
<p>_____15. I can identify a fusion reaction from a list of reactions.</p>	<p>Which equation represents fusion?</p> <p>A) <math>{}^1_0\text{n} + {}^{235}_{92}\text{U} \rightarrow {}^{142}_{56}\text{Ba} + {}^{91}_{36}\text{Kr} + 3{}^1_0\text{n}</math>  B) <math>{}^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + {}^4_2\text{He}</math>  C) <math>{}^6_3\text{Li} + {}^1_0\text{n} \rightarrow {}^3_1\text{H} + {}^4_2\text{He}</math>  D) <math>{}^2_1\text{H} + {}^3_1\text{H} \rightarrow {}^4_2\text{He} + {}^1_0\text{n}</math></p>

<p>____16. I can state the conditions of temperature and pressure that are needed for a fusion reaction to happen.</p>	<p>The temperature and pressure conditions needed for fusion to happen are:          ____high____ temperature and ____high____ pressure</p>
<p>____17. I can explain why all nuclear reactions release LOTS more energy than chemical reactions do.</p>	<p>Nuclear reactions release LOTS more energy than chemical reactions do because <b>some of the mass is converted to energy</b></p>
<p>____18. Given a list of reactions, I can differentiate a “nuclear” reaction from a “chemical” reaction.</p>	<p>Which of the following equations represent NUCLEAR reactions?</p> <p>A) <math>\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\ell)</math>          B) <math>\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})</math>          C) <math>{}^2_1\text{H} + {}^3_1\text{H} \rightarrow {}^4_2\text{He} + {}^1_0\text{n}</math>          D) <math>{}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{142}_{56}\text{Ba} + {}^{91}_{36}\text{Kr} + 3 {}^1_0\text{n}</math></p>
<p>____19. I can define half-life.</p>	<p><b>Definition:</b>          half-life – <b>the amount of time required for one-half of a radioactive isotope to decay</b></p>
<p>____20. Given the length of the half-life and the amount of time that has passed, I can determine the amount of radioactive sample.</p>	<p>Based on Reference Table N, what fraction of a radioactive sample of Au-198 will remain unchanged after 10.78 days?</p> <p style="text-align: center;"><b>1/16</b></p> <p>What was the original mass of a radioactive sample of K-37 if the sample decayed to 25.0 g after 4.92 seconds? The half-life of K-37 is 1.23 seconds)</p> <p style="text-align: center;"><b>400 g</b></p>
<p>____21. Given the length of the half-life and the amount of radioactive sample, I can determine the amount of time that has passed.</p>	<p>A 100.0 g sample of Co-60 decays until only 12.5 g of it remains. Given that the half-life of Co-60 is 5.271 years, how long did the decay take?</p> <p style="text-align: center;"><b>15.813 years</b></p>
<p>____22. Given the amount of time that has passed and the amount of radioactive sample, I can determine the length of the half-life.</p>	<p>What is the half-life of a radioisotope if 25.0 g of an original 200.0 g sample remains unchanged after 11.46 days?</p> <p style="text-align: center;"><b>3.82 days</b></p>
<p>____23. Using Table N, I can determine the length of half-life and/or decay mode for a specific radioactive isotope.</p>	<p>Compared to K-37, the isotope K-42 has</p> <p>A) shorter half-life and the same decay mode          B) shorter half-life and a different decay mode          C) longer half-life and the same decay mode          D) longer half-life and a different decay mode</p>

<p>_____ 24. I can state 5 beneficial uses for radioactive isotopes.</p>	<p>Five beneficial uses for radioactive isotopes are:</p> <ul style="list-style-type: none"> <li>a. radioactive dating</li> <li>b. tracing chemical and biological processes</li> <li>c. industrial measurement</li> <li>d. nuclear power</li> <li>e. detection and treatment of disease</li> </ul>
<p>_____ 25. I can state the scientific use of 4 specific radioactive isotopes.</p>	<p>C-14 is used for _____ dating previously living organisms _____</p> <p>I-131 is used for _____ treating thyroid disorders _____</p> <p>U-238 is used for _____ dating geologic formations _____</p> <p>Co-60 is used for _____ treating cancerous tumors _____</p>
<p>_____ 26. I can state three risks associated with radioactivity and radioactive isotopes.</p>	<p>Three risks associated with radioactivity and radioactive isotopes are:</p> <ul style="list-style-type: none"> <li>a. biological exposure</li> <li>b. long-term storage and disposal</li> <li>c. nuclear accidents</li> </ul>



## Unit 6: Periodic Table

If you can do all the things listed below, you are ready for the Unit 6 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<p>____1. I can still do everything from Unit 1.</p>	
<p>____2. I can still do everything from Unit 2.</p>	
<p>____3. I can still do everything from Unit 3.</p>	
<p>____4. I can still do everything from Unit 4.</p>	
<p>____5. I can still do everything from Unit 5.</p>	
<p>____6. I can classify elements as metals, nonmetals, or metalloids based on their placement on the Periodic Table.</p>	<p>Classify each of the following elements as metals (M), nonmetals (NM), or metalloids (MTLD).</p> <p> <u>  NM  </u> B    <u>  M  </u> K    <u>  M  </u> Li    <u>  NM  </u> C    <u>  NM  </u> Ar  <u>  MTLD  </u> Sb    <u>  NM  </u> H    <u>  M  </u> Fe    <u>  M  </u> Au    <u>  NM  </u> S  <u>  NM  </u> F    <u>  MTLD  </u> Si    <u>  M  </u> Fr    <u>  NM  </u> He    <u>  NM  </u> Rn  <u>  MTLD  </u> Ge    <u>  M  </u> Al    <u>  MTLD  </u> As    <u>  M  </u> Bi    <u>  NM  </u> I </p>
<p>____7. I can state the group names for elements in groups 1, 2, 17, and 18.</p>	<p>Group 1 is called the <u>  alkali metals  </u>.</p> <p>Group 2 is called the <u>  alkaline earth metals  </u>.</p> <p>Group 17 is called the <u>  halogens  </u>.</p> <p>Group 18 is called the <u>  noble gases  </u>.</p>
<p>____8. I can explain why elements in the same group have similar chemical properties.</p>	<p>Elements in the same group have similar chemical properties because <b>they have similar electron configurations; same number of valence electrons</b></p>
<p>____9. I can explain why the elements in Group 18 don't usually react with other elements.</p>	<p>Elements in Group 18 don't usually react with other elements because <b>they have a stable octet of valence electrons</b></p>
<p>____10. I can state the meaning of "STP" and the Reference Table on which it can be found.</p>	<p>STP stands for <u>  standard temperature and pressure  </u>.</p> <p>The values can be found on Reference Table <u>  B  </u>.</p>
<p>____11. I can state the names/symbols for the two elements on the Periodic Table that are liquids at STP.</p>	<p>The two elements that are liquids at STP are:</p> <p><u>  mercury  </u> and <u>  bromine  </u></p>

<p>_____12. I can state the names/symbols of the 11 elements that are gases at STP.</p>	<p>The 11 elements that are gases at STP are:</p> <p>_____hydrogen_____, _____helium_____,</p> <p>_____fluorine_____, _____chlorine_____,</p> <p>_____nitrogen_____, _____oxygen_____,</p> <p>_____radon_____, _____xenon_____,</p> <p>_____krypton_____, _____argon_____,</p> <p>and _____neon_____.</p>
<p>_____13. I can state how the elements on the Periodic Table are arranged.</p>	<p>The elements on the Periodic Table are arranged by increasing _____atomic_____ _____number_____.</p>
<p>_____14. I can list the 7 diatomic elements.</p>	<p>The seven diatomic elements are:</p> <p><i>BrINClHO<del>F</del></i></p>
<p>_____15. I can define electronegativity, first ionization energy, atomic radius, ionic radius, metallic character, and activity/reactivity.</p>	<p><b>Definitions:</b></p> <p>electronegativity – <b>the tendency of an element to attract electrons towards itself in a chemical bond</b></p> <p>first ionization energy – <b>the amount of energy required to remove the most loosely held electron from an atom in the gaseous state</b></p> <p>atomic radius – <b>1/2 the internuclear distance between two of the same atom</b></p> <p>ionic radius – <b>radius of an ion</b> (sorry, I just don't want to make it more complicated than it needs to be 😊)</p> <p>metallic character – <b>how easy it is for an element to lose its valence electrons</b></p> <p>activity/reactivity – <b>how likely it is that an element will lose/gain electrons</b></p>

<p>_____16. I can state the periodic trend for electronegativity and explain why it occurs.</p>	<p>As one reads down a group from top to bottom, electronegativity _____decreases_____ because _____the valence electrons are farther_____ _____from the nucleus and are less tightly held._____.</p> <p>As one reads across a period from left to right, electronegativity _____increases_____ because _____each element is getting closer to_____ _____having a stable octet of valence electrons_____.</p>
<p>_____17. I can state the periodic trend for first ionization energy and explain why it occurs.</p>	<p>As one reads down a group from top to bottom, first ionization energy _____decreases_____ because _____the valence electrons are farther_____ _____from the nucleus and are less tightly held._____.</p> <p>As one reads across a period from left to right, , first ionization energy _____increases_____ because _____each element is getting closer to_____ _____having a stable octet of valence electrons_____.</p>
<p>_____18. I can state the periodic trend for atomic radius and explain why it occurs.</p>	<p>As one reads down a group from top to bottom, atomic radius _____increases_____ because _____there are more PEL._____.</p> <p>As one reads across a period from left to right, atomic radius _____decreases_____ because _____the valence electrons are added to the _____same shell and there is increased nuclear charge attracting the electrons&gt;_____.</p>
<p>_____19. I can state the periodic trend for metallic character and explain why it occurs.</p>	<p>As one reads down a group from top to bottom, metallic character _____increases_____ because _____the valence electrons are farther_____ _____from the nucleus and are less tightly held._____.</p> <p>As one reads across a period from left to right, metallic character _____decreases_____ because _____elements become less likely_____ _____to lose valence electrons and more likely to gain them. _____.</p>
<p>_____20. I can state the trend for melting points and boiling point for METALS as one reads down a group.</p>	<p>As one reads down a group from top to bottom, the melting points and boiling points for METALS _____decreases_____.</p>
<p>_____21. I can state the trend for melting points and boiling point for NONMETALS as one reads down a group.</p>	<p>As one reads down a group from top to bottom, the melting points and boiling points for NONMETALS _____increases_____.</p>

<p>_____22. I can state the trend for activity/reactivity for METALS as one reads down a group.</p>	<p>As one reads down a group from top to bottom, the activity/reactivity of METALS <u>increases</u>.</p>										
<p>_____23. I can state the trend for activity/reactivity for NONMETALS as one reads down a group.</p>	<p>As one reads down a group from top to bottom, the activity/reactivity of NONMETALS <u>decreases</u>.</p>										
<p>_____24. I can explain how loss or gaining of electrons affects the radius of an element.</p>	<p>Metals tend to lose electrons (get oxidized). This loss of electrons causes cations to be <u>smaller</u> than the original atom.</p> <p>Nonmetals tend to gain electrons (get reduced). This gain of electrons causes anions to be <u>larger</u> than the original atom.</p>										
<p>_____25. I can list 10 properties of metals.</p>	<p>Ten properties of metals are:</p> <table border="0"> <tr> <td><b>a. tend to lose electrons</b></td> <td><b>b. form positively charged ions</b></td> </tr> <tr> <td><b>c. shiny</b></td> <td><b>d. conduct heat</b></td> </tr> <tr> <td><b>e. conduct electricity</b></td> <td><b>f. malleable</b></td> </tr> <tr> <td><b>g. ductile</b></td> <td><b>h. high tensile strength</b></td> </tr> <tr> <td><b>i. high density</b></td> <td><b>j. high mp and bp</b></td> </tr> </table>	<b>a. tend to lose electrons</b>	<b>b. form positively charged ions</b>	<b>c. shiny</b>	<b>d. conduct heat</b>	<b>e. conduct electricity</b>	<b>f. malleable</b>	<b>g. ductile</b>	<b>h. high tensile strength</b>	<b>i. high density</b>	<b>j. high mp and bp</b>
<b>a. tend to lose electrons</b>	<b>b. form positively charged ions</b>										
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<b>e. conduct electricity</b>	<b>f. malleable</b>										
<b>g. ductile</b>	<b>h. high tensile strength</b>										
<b>i. high density</b>	<b>j. high mp and bp</b>										
<p>_____26. I can list 8 properties of nonmetals.</p>	<p>Eight properties of non metals are:</p> <table border="0"> <tr> <td><b>a. tend to gain electrons</b></td> <td><b>b. form negatively charged ions</b></td> </tr> <tr> <td><b>c. dull</b></td> <td><b>d. nonconductors of heat &amp; electricity</b></td> </tr> <tr> <td><b>e. low densities</b></td> <td><b>f. brittle</b></td> </tr> <tr> <td><b>g. low tensile strength</b></td> <td><b>h. low mp and bp</b></td> </tr> </table>	<b>a. tend to gain electrons</b>	<b>b. form negatively charged ions</b>	<b>c. dull</b>	<b>d. nonconductors of heat &amp; electricity</b>	<b>e. low densities</b>	<b>f. brittle</b>	<b>g. low tensile strength</b>	<b>h. low mp and bp</b>		
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<b>e. low densities</b>	<b>f. brittle</b>										
<b>g. low tensile strength</b>	<b>h. low mp and bp</b>										

## Unit 7: Acids & Bases

If you can do all the things listed below, you are ready for the Unit 7 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<b>_____1. I can still do everything from Unit 1.</b>										
<b>_____2. I can still do everything from Unit 2.</b>										
<b>_____3. I can still do everything from Unit 3.</b>										
<b>_____4. I can still do everything from Unit 4.</b>										
<b>_____5. I can still do everything from Unit 5.</b>										
<b>_____6. I can still do everything from Unit 6.</b>										
<b>_____7. I can use two different systems to define acids and bases.</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 50%;">Arrhenius</th> <th style="width: 40%;">“Alternate Method” (AKA Bronsted-Lowry)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: middle;"><b>acid</b></td> <td>any substance that yields <math>\text{H}_3\text{O}^+</math> ions as the only positive ion in solution</td> <td>any substance that donates protons</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;"><b>base</b></td> <td>any substance that yields hydroxide as the only negative ion in solution</td> <td>any substance that can accept a proton</td> </tr> </tbody> </table>		Arrhenius	“Alternate Method” (AKA Bronsted-Lowry)	<b>acid</b>	any substance that yields $\text{H}_3\text{O}^+$ ions as the only positive ion in solution	any substance that donates protons	<b>base</b>	any substance that yields hydroxide as the only negative ion in solution	any substance that can accept a proton
		Arrhenius	“Alternate Method” (AKA Bronsted-Lowry)							
	<b>acid</b>	any substance that yields $\text{H}_3\text{O}^+$ ions as the only positive ion in solution	any substance that donates protons							
<b>base</b>	any substance that yields hydroxide as the only negative ion in solution	any substance that can accept a proton								
<b>_____8. I can define pH, [ ], hydronium ion, hydroxide ion, and electrolyte.</b>	<p><b>Definitions:</b>  pH – <b>measure of the acidity or alkalinity of a solution</b></p> <p>[ ] - <b>concentration</b></p> <p>hydronium ion – <math>\text{H}_3\text{O}^+</math> AKA <b>hydrogen ion, <math>\text{H}^+</math></b>; found in higher concentrations in <b>acids</b></p> <p>hydroxide ion – <math>\text{OH}^-</math> ion; found in higher concentration in <b>bases</b></p> <p>electrolyte – <b>any substance that conducts electricity when dissolved in water</b></p>									

<p>_____9. I can state another name for the hydronium ion.</p>	<p>The hydronium ion is also known as the _____ hydrogen ion, <math>H^+</math>.</p>								
<p>_____10. Given the hydronium ion concentration, I can determine the pH.</p>	<p>If the <math>[H_3O^+]</math> is <math>1 \times 10^{-8}</math>, the pH of the solution will be _____8_____.</p> <p>If the <math>[H_3O^+]</math> is <math>1 \times 10^{-1}</math>, the pH of the solution will be _____1_____.</p> <p>If the <math>[H_3O^+]</math> is <math>1 \times 10^{-14}</math>, the pH of the solution will be _____14_____.</p> <p>If the <math>[H_3O^+]</math> is <math>1 \times 10^{-7}</math>, the pH of the solution will be _____7_____.</p>								
<p>_____11. Based on pH, I can determine if a solution is acidic, basic, or neutral.</p>	<p>If the pH of a solution is 4.5, the solution is _____acidic_____.</p> <p>If the pH of a solution is 7.0, the solution is _____neutral_____.</p> <p>If the pH of a solution is 11, the solution is _____basic_____.</p> <p>If the pH of a solution is 5.7, the solution is _____acidic_____.</p>								
<p>_____13. I can state the relationship between <math>H^+</math> concentration and pH.</p>	<p>As the <math>H^+</math> concentration decreases, the pH _____increases_____.</p> <p>As the <math>H^+</math> concentration increases, the pH _____decreases_____.</p>								
<p>_____14. I can determine the change in pH when the <math>H^+</math> concentration of a solution is changed.</p>	<p>If the <math>H^+</math> concentration is increased by a factor of 10, the pH will decrease by _____1_____.</p> <p>-----</p> <p>If the <math>H^+</math> concentration is increased by a factor of 100, the pH will decrease by _____2_____.</p> <p>-----</p> <p>If the <math>H^+</math> concentration is decreased by a factor of 1000, the pH will increase by _____3_____.</p> <p>-----</p>								
<p>_____15. I can give examples of the chemical names of common acids and bases.</p>	<p>List the chemical names of three common acids and three common bases.</p> <table border="1" data-bbox="548 1430 1479 1690"> <thead> <tr> <th data-bbox="548 1430 1019 1465">Acids</th> <th data-bbox="1019 1430 1479 1465">Bases</th> </tr> </thead> <tbody> <tr> <td data-bbox="548 1465 1019 1543">hydrochloric acid</td> <td data-bbox="1019 1465 1479 1543">sodium hydroxide</td> </tr> <tr> <td data-bbox="548 1543 1019 1621">phosphoric acid</td> <td data-bbox="1019 1543 1479 1621">potassium hydroxide</td> </tr> <tr> <td data-bbox="548 1621 1019 1690">sulfuric acid</td> <td data-bbox="1019 1621 1479 1690">ammonia</td> </tr> </tbody> </table>	Acids	Bases	hydrochloric acid	sodium hydroxide	phosphoric acid	potassium hydroxide	sulfuric acid	ammonia
Acids	Bases								
hydrochloric acid	sodium hydroxide								
phosphoric acid	potassium hydroxide								
sulfuric acid	ammonia								

<p>_____16. I can give examples of chemical formulas of common acids and bases.</p>	List the chemical formulas of three common acids and three common bases.	
	<b>Acids</b>	<b>Bases</b>
	HCl	NaOH
	H <sub>2</sub> SO <sub>4</sub>	KOH
	H <sub>3</sub> PO <sub>4</sub>	NH <sub>3</sub>
<p>_____17. I can define neutralization.</p>	<p><b>Definition:</b> neutralization – <b>double replacement reaction between an acid and a base producing water and a salt</b></p>	
<p>_____18. I can identify a neutralization reaction from a list of reactions.</p>	<p>Which of the following equations is a neutralization reaction?</p> <p>A) <math>6\text{Na} + \text{B}_2\text{O}_3 \rightarrow 3\text{Na}_2\text{O} + 2\text{B}</math></p> <p><b>B) <math>\text{Mg}(\text{OH})_2 + 2\text{HBr} \rightarrow \text{MgBr}_2 + 2\text{HOH}</math></b></p> <p>C) <math>2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}</math></p> <p>D) <math>2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2</math></p>	
<p>_____19. I can state the name of the laboratory equipment that is used to carry out a titration.</p>	<p>Which piece of laboratory equipment is used to carry out a titration? <b>burette</b></p>	
<p>_____20. I can state the purpose of titration.</p>	<p>Why do scientists do titrations? <b>To determine the concentration of an unknown acid or base</b></p>	
<p>_____21. I can solve for any variable in the titration equation from Reference Table T.</p>	<p>If it requires 56.95 mL of 0.0043 M HNO<sub>3</sub> to neutralize 34.56 mL of LiOH, what is the concentration of the LiOH? <b>0.00071 M</b></p>	
<p>_____22. I can state the three types of substances that are electrolytes.</p>	<p><u>Acids</u>, <u>bases</u>, and <u>salts</u> are three classes of compounds that are electrolytes.</p>	
<p>_____23. Given the pH, I can determine the color of acid-base indicators.</p>	<p>Which indicator is red in a solution that has a pH of 3.6?</p> <p>A) bromcresol green</p> <p>B) bromthymol blue</p> <p><b>C) litmus</b></p> <p>D) thymol blue</p>	

## Unit 8: Redox & Electrochemistry

If you can do all the things listed below, you are ready for the Unit 8 test.

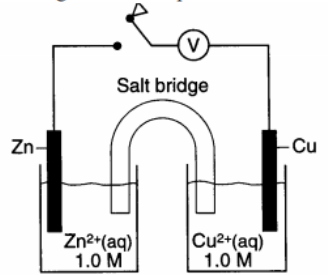
Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

____1. I can still do everything from Unit 1.	
____2. I can still do everything from Unit 2.	
____3. I can still do everything from Unit 3.	
____4. I can still do everything from Unit 4.	
____5. I can still do everything from Unit 5.	
____6. I can still do everything from Unit 6.	
____7. I can still do everything from Unit 7.	
____8. I can define oxidation, reduction, oxidation number, and redox reaction	<p><b>Definitions:</b>  oxidation – <b>loss of electrons</b></p> <p>reduction – <b>gain of electrons</b></p> <p>oxidation number – <b>the oxidation state; an indicator of the oxidation of an element</b></p> <p>redox reaction – <b>any reaction in which a reduction and oxidation occurs</b></p>
____9. I can assign oxidation numbers to any element.	<p>Assign oxidation number to each of the elements below.</p> <p>O<sub>2</sub> _____ 0 _____ Li _____ 0 _____ Si _____ 0 _____</p>
____10. I can assign oxidation numbers to the elements in a compound.	<p>Assign oxidation numbers to each element in the compounds below.</p> <p>MnCl<sub>3</sub>: Mn _____ +3 _____ Cl _____ -1 _____</p> <p>H<sub>2</sub>SO<sub>4</sub>: H _____ +1 _____ S _____ +6 _____ O _____ -2 _____</p>
____11. I can assign oxidation numbers to the elements in a polyatomic ion.	<p>Assign oxidation numbers to each element in the polyatomic ions below.</p> <p>PO<sub>4</sub><sup>3-</sup>: P _____ +5 _____ O _____ -2 _____</p> <p>ClO<sub>3</sub><sup>-</sup>: Cl _____ +5 _____ O _____ -2 _____</p>



<p>_____12. I can distinguish between an oxidation half-reaction and a reduction half-reaction.</p>	<p>Which half-reaction equation represents the reduction of a potassium ion?</p> <p><input checked="" type="radio"/> A) <math>K^+ + e^- \rightarrow K</math>  <input type="radio"/> B) <math>K + e^- \rightarrow K^+</math>  <input type="radio"/> C) <math>K^+ \rightarrow K + e^-</math>  <input type="radio"/> D) <math>K \rightarrow K^+ + e^-</math></p> <p>Given the reaction:</p> $Fe(s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu(s)$ <p>Which half-reaction correctly shows the oxidation that occurs?</p> <p><input checked="" type="radio"/> A) <math>Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-</math>  <input type="radio"/> B) <math>Fe(s) + 2e^- \rightarrow Fe^{2+}(aq)</math>  <input type="radio"/> C) <math>Cu^{2+}(aq) \rightarrow Cu(s) + 2e^-</math>  <input type="radio"/> D) <math>Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)</math></p>
<p>_____13. I can state the Law of Conservation of Charge.</p>	<p>The law of Conservation of Charge states <b>in any chemical reaction charge must be conserved</b></p>
<p>_____14. I can break a redox reaction into its two half-reactions.</p>	<p>The two half-reactions that come from the following equation are:</p> $Li(s) + Ag^+(aq) \rightarrow Li^+(aq) + Ag(s)$ <p>oxidation half-reaction</p> $Li(s) \rightarrow Li^+(aq) + e^-$ <p>reduction half-reaction</p> $Ag^+(aq) + e^- \rightarrow Ag$

<p>_____15. I can balance a redox reaction.</p>	<p>Given the reaction:</p> $\text{_____ Cl}_2(\text{g}) + \text{_____ Fe}^{2+}(\text{aq}) \text{ ----> } \text{_____ Fe}(\text{s}) + \text{_____ Cl}^{-}(\text{aq})$ <p>When the equation is correctly balanced using smallest whole numbers, the coefficient of <math>\text{Cl}^{-}</math> will be</p> <p>A) 1    <b>(B) 2</b>    C) 6    D) 7</p> <hr/> <p>Which simple oxidation-reduction reaction is <i>not</i> correctly balanced?</p> <p>A) <math>\text{Sn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Cu}(\text{s}) + \text{Sn}^{2+}(\text{aq})</math>  B) <math>\text{Ni}(\text{s}) + \text{Sn}^{2+}(\text{aq}) \rightarrow \text{Sn}(\text{s}) + \text{Ni}^{2+}(\text{aq})</math>  <b>(C) <math>2 \text{I}^{-}(\text{aq}) + \text{Fe}^{3+}(\text{aq}) \rightarrow \text{Fe}^{2+}(\text{aq}) + \text{I}_2(\text{s})</math></b>  D) <math>2 \text{I}^{-}(\text{aq}) + \text{Hg}^{2+}(\text{aq}) \rightarrow \text{Hg}(\ell) + \text{I}_2(\text{s})</math></p> <hr/> <p>Given the balanced equation:</p> $3 \text{Fe}^{3+}(\text{aq}) + \text{Al}(\text{s}) \rightarrow 3 \text{Fe}^{2+}(\text{aq}) + \text{Al}^{3+}(\text{aq})$ <p>What is the total number of moles of electrons lost by 2 moles of <math>\text{Al}(\text{s})</math>?</p> <p>A) 1 mole                      <b>(B) 6 moles</b>  C) 3 moles                      D) 9 moles</p>
<p>_____16. I can identify a redox reaction from a list of chemical reactions.</p>	<p>Which balanced equation represents a redox reaction?</p> <p>A) <math>\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})</math>  B) <math>\text{H}_2\text{CO}_3(\text{aq}) \rightarrow \text{H}_2\text{O}(\ell) + \text{CO}_2(\text{g})</math>  C) <math>\text{NaOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\ell)</math>  <b>(D) <math>\text{Mg}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})</math></b></p> <hr/> <p>Which balanced equation represents a redox reaction?</p> <p><b>(A) <math>\text{PCl}_5 \rightarrow \text{PCl}_3 + \text{Cl}_2</math></b>  B) <math>\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}</math>  C) <math>\text{LiBr} \rightarrow \text{Li}^{+} + \text{Br}^{-}</math>  D) <math>\text{Ca}^{2+} + \text{SO}_4^{2-} \rightarrow \text{CaSO}_4</math></p>
<p>_____17. From a list of given list of elements, I can determine which element is most active.</p>	<p>Which of the following elements is most likely to react?</p> <p>A) Cu  B) Al  <b>(C) Li</b>  D) Mg</p>

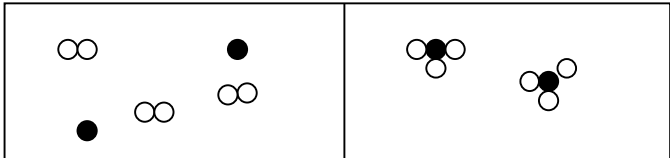
<p>____18. I can state the two types of electrochemical cells.</p>	<p>The two types of electrochemical cells are:  <u>      voltaic      </u> and <u>      electrolytic      </u></p>																						
<p>____19. I can compare the two types of electrochemical cells in terms of: components, location of oxidation, location of reduction, direction of electron flow, conversion between electrical and chemical energy, and spontaneity of reaction.</p>	<table border="1"> <thead> <tr> <th></th> <th>Voltaic</th> <th>Electrolytic</th> </tr> </thead> <tbody> <tr> <td><b>Components</b></td> <td>salt bridge anode cathode electrolyte</td> <td>power supply anode cathode electrolyte</td> </tr> <tr> <td><b>Oxidation occurs at the</b></td> <td>anode</td> <td>anode</td> </tr> <tr> <td><b>Reduction occurs at the</b></td> <td>cathode</td> <td>cathode</td> </tr> <tr> <td><b>Electrons flow from</b></td> <td>anode to cathode</td> <td>anode to cathode</td> </tr> <tr> <td><b>Energy conversion that occurs in this cell</b></td> <td>chemical energy is converted to electrical energy</td> <td>electrical energy is converted to chemical energy</td> </tr> <tr> <td><b>Is this reaction spontaneous or does it require an outside power source to happen?</b></td> <td>spontaneous</td> <td>requires an outside power source</td> </tr> </tbody> </table>			Voltaic	Electrolytic	<b>Components</b>	salt bridge anode cathode electrolyte	power supply anode cathode electrolyte	<b>Oxidation occurs at the</b>	anode	anode	<b>Reduction occurs at the</b>	cathode	cathode	<b>Electrons flow from</b>	anode to cathode	anode to cathode	<b>Energy conversion that occurs in this cell</b>	chemical energy is converted to electrical energy	electrical energy is converted to chemical energy	<b>Is this reaction spontaneous or does it require an outside power source to happen?</b>	spontaneous	requires an outside power source
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<p>____20. I can state the purpose of the salt bridge in a voltaic cell.</p>	<p>The purpose of the salt bridge is <b>to allow for the migration/movement of ions</b></p>																						
<p>____21. Given an electrochemical cell, I can predict the direction of electron flow.</p>	<p>The diagram below represents an electrochemical cell.</p>  <p>What occurs when the switch is closed?</p> <p>A) Zn is reduced.  B) Cu is oxidized.  C) Electrons flow from Cu to Zn.  <input checked="" type="radio"/> D) Electrons flow from Zn to Cu.</p>																						
<p>____22. I can explain, in terms of atoms and ions, the changes in mass that take place at the anode and cathode of an electrochemical cell.</p>	<p>Explain, in terms of atoms and ions, why the mass of the cathode increases during the operation of an electrochemical cell.  <b>The mass of the cathode increases because ions from the solution get reduced to atoms and become part of the cathode.</b></p> <p>Explain, in terms of atoms and ions, why the mass of the anode decreases during the operation of an electrochemical cell.  <b>The mass of the anode decreases because atoms from the cathode get oxidized into ions and become part of the solution.</b></p>																						

## Unit 10: Chemical Reactions

If you can do all the things listed below, you are ready for the Unit 10 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

_____1. I can still do everything from Unit 1.	
_____2. I can still do everything from Unit 2.	
_____3. I can still do everything from Unit 3.	
_____4. I can still do everything from Unit 4.	
_____5. I can still do everything from Unit 5.	
_____6. I can still do everything from Unit 6.	
_____7. I can still do everything from Unit 7.	
_____8. I can still do everything from Unit 8.	
_____9. Given the IUPAC name, I can write the chemical formula for binary compounds.	<p>Write the chemical formula for the following compounds:</p> <p>sodium bromide _____ NaBr _____ lithium selenide _____ Li<sub>2</sub>Se _____</p> <p>iron (III) fluoride _____ FeF<sub>3</sub> _____ vanadium (V) oxide _____ V<sub>2</sub>O<sub>5</sub> _____</p>
_____10. Given the chemical formula, I can write the IUPAC name for binary compounds.	<p>Write the IUPAC name for the following compounds:</p> <p>CrO _____ chromium (II) oxide _____</p> <p>MgI<sub>2</sub> _____ magnesium iodide _____</p>
_____11. Given the IUPAC name, I can write the chemical formula for ternary compounds.	<p>Write the chemical formula for the following compounds:</p> <p>calcium oxalate _____ CaC<sub>2</sub>O<sub>4</sub> _____</p> <p>nickel (II) thiosulfate _____ NiS<sub>2</sub>O<sub>3</sub> _____</p>
_____12. Given the chemical formula, I can write the IUPAC name for ternary compounds.	<p>Write the IUPAC name for the following compounds:</p> <p>Sn(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub> _____ tin (II) acetate _____</p> <p>(NH<sub>4</sub>)<sub>3</sub>PO<sub>4</sub> _____ ammonium phosphate _____</p>
_____13. I can state the three types of chemical formulas.	<p>The three types of chemical formulas are:</p> <p>_____ empirical _____, _____ molecular _____, &amp;</p> <p>_____ structural _____</p>

<p>____14. I can define empirical formula, molecular formula, and hydrate.</p>	<p><b>Definitions:</b>  empirical formula – <b>lowest whole number ratio between the elements in a compound</b></p> <p>molecular formula – <b>the actual ratio of elements in a compound; the true formula</b></p> <p>hydrate – <b>a compound that has one or more molecules of water associated with it</b></p>
<p>____15. Given the empirical formula and the molar mass, I can determine the molecular formula of a compound.</p>	<p>What is the molecular formula of a compound that has the empirical formula of CH and a molar mass of 78 g/mol.</p> <p><b>C<sub>6</sub>H<sub>6</sub></b></p>
<p>____16. I can use particle diagrams to show conservation of mass in a chemical equation.</p>	<p>Using the symbols shown below, complete the equation below to illustrate conservation of mass.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>● = Al  ○ = Br</p> </div> <p style="text-align: center;">2Al + 3Br<sub>2</sub> -----&gt; 2AlBr<sub>3</sub></p> 
<p>____17. I can balance a chemical equation showing conservation of mass using the lowest whole number coefficients.</p>	<p>Balance the following chemical equation using the lowest whole number coefficients.</p> <p style="text-align: center;">____ Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> + ____ Ca(OH)<sub>2</sub> -----&gt; ____ Al(OH)<sub>3</sub> + ____ CaSO<sub>4</sub></p>
<p>____18. Given a partially balanced equation, I can predict the missing reactant or product.</p>	<p>Use the law of conservation of mass to predict the missing product.</p> <p style="text-align: center;">2NH<sub>4</sub>Cl + CaO -----&gt; 2NH<sub>3</sub> + ____ H<sub>2</sub>O ____ + CaCl<sub>2</sub></p>
<p>____19. Given a list of chemical reactions, I can classify them as being a synthesis reaction, decomposition reaction, single replacement reaction, or double replacement reaction.</p>	<p>Classify the following reactions as synthesis, decomposition, single replacement, or double replacement.</p> <p>A) Mg + 2AgNO<sub>3</sub> → Mg(NO<sub>3</sub>)<sub>2</sub> + 2Ag _____ SR</p> <p>B) 2Mg + O<sub>2</sub> → 2MgO _____ S</p> <p>C) MgCO<sub>3</sub> → MgO + CO<sub>2</sub> _____ D</p> <p>D) MgCl<sub>2</sub> + 2AgNO<sub>3</sub> → 2AgCl + Mg(NO<sub>3</sub>)<sub>2</sub> _____</p>

<p>_____20. Given a balanced equation, I can state the mole ratios between any of the reactants and/or products.</p>	<p>Given the following balanced equation, state the mole ratios between the requested substances.</p> $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$ <p>The mole ratio between <math>\text{C}_3\text{H}_8</math> and <math>\text{O}_2</math> is <u>  1  </u> <math>\text{C}_3\text{H}_8</math>: <u>  5  </u> <math>\text{O}_2</math>.</p> <p>The mole ratio between <math>\text{C}_3\text{H}_8</math> and <math>\text{CO}_2</math> is <u>  1  </u> <math>\text{C}_3\text{H}_8</math>: <u>  3  </u> <math>\text{CO}_2</math>.</p> <p>The mole ratio between <math>\text{C}_3\text{H}_8</math> and <math>\text{H}_2\text{O}</math> is <u>  1  </u> <math>\text{C}_3\text{H}_8</math>: <u>  4  </u> <math>\text{H}_2\text{O}</math>.</p> <p>The mole ratio between <math>\text{CO}_2</math> and <math>\text{O}_2</math> is <u>  3  </u> <math>\text{CO}_2</math>: <u>  5  </u> <math>\text{O}_2</math>.</p> <p>The mole ratio between <math>\text{H}_2\text{O}</math> and <math>\text{CO}_2</math> is <u>  4  </u> <math>\text{H}_2\text{O}</math>: <u>  3  </u> <math>\text{CO}_2</math>.</p>
<p>_____21. I can define stoichiometry.</p>	<p><b>Definition:</b> stoichiometry – the calculations of the quantities in chemical reactions</p>
<p>_____22. Given the number of moles of one of the reactants or products, I can determine the number of moles of another reactant or product that is needed to completely use up the given reactant/product.</p>	<p>Using the equation from question #20, determine how many moles of <math>\text{O}_2</math> are needed to completely react with 7.0 moles of <math>\text{C}_3\text{H}_8</math>.</p> <p><b>35 moles</b></p> <p>Using the equation from question #20, determine how many moles of <math>\text{CO}_2</math> are produced when 7.0 moles of <math>\text{C}_3\text{H}_8</math> completely react.</p> <p><b>21 moles</b></p>
<p>_____23. Given the mass or volume of one of the reactants or products, I can determine the mass or volume of another reactant or product that is needed to completely use up the given reactant/product.</p>	<p>Using the equation from question #20, determine how many liters of <math>\text{O}_2</math> at STP are needed to react completely with 88.0 g of <math>\text{C}_3\text{H}_8</math>.</p> <p><b>224 L</b></p> <p>Using the equation from question #20, determine how many grams of <math>\text{H}_2\text{O}</math> are produced when 88.0 g of <math>\text{C}_3\text{H}_8</math> completely react.</p> <p><b>72 g</b></p>

## Unit 11: Bonding & IMF

If you can do all the things listed below, you are ready for the Unit 11 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

____ 1. I can still do everything from Unit 1.	
____ 2. I can still do everything from Unit 2.	
____ 3. I can still do everything from Unit 3.	
____ 4. I can still do everything from Unit 4.	
____ 5. I can still do everything from Unit 5.	
____ 6. I can still do everything from Unit 6.	
____ 7. I can still do everything from Unit 7.	
____ 8. I can still do everything from Unit 8.	
____ 9. I can still do everything from Unit 10.	
____ 10. I can state the three types of chemical bonds.	The three types of chemical bonds are: ____ ionic _____, _____ covalent _____, and ____ metallic _____.
____ 11. I can state the number of valence electrons that an atom attains to be most stable.	Atoms are most stable when they have ____ 8 ____ valence electrons.
____ 12. I can state the two types of compounds.	The two types of compounds are ____ ionic _____ and ____ molecular _____.
____ 13. I can define ionic bond, covalent bond, and metallic bond in terms of the types of elements (metals, nonmetals) from which they are formed.	<b>Definition:</b> ionic bond  covalent bond  metallic bond





<p>____ 19. I can state the number of electrons that are shared in single and multiple covalent bonds.</p>	<p>In a single covalent bond, <u>  2  </u> electrons are shared.</p> <p>In a double covalent bond, <u>  4  </u> electrons are shared.</p> <p>In a triple covalent bond, <u>  6  </u> electrons are shared.6</p>
<p>____ 20. I can explain why the Lewis dot diagrams of ionic compounds have brackets and the Lewis dot diagrams of molecular compounds do not.</p>	<p>Lewis dot diagrams for ionic compounds have brackets because the elements involved in the bond have charges _____.</p> <p>Lewis dot diagrams for molecular compounds do NOT have brackets because <u>  the electrons are shared and there are no charges  </u>.</p>
<p>____ 21. I can state the type of bonding that occurs in the polyatomic ions (Reference Table E) and explain why they have that type of bonding.</p>	<p>Polyatomic ions have <u>  covalent  </u> bonding because <u>  nonmetals are sharing valence electrons  </u>.</p>
<p>____ 22. Given the chemical formula for a compound, I can determine the type(s) of bonding in the compound.</p>	<p>State the type(s) of bonding in the following compounds:</p> <p>NaCl <u>  ionic  </u>      CO <u>  covalent  </u></p> <p>Hg <u>  metallic  </u>      Na<sub>3</sub>PO<sub>4</sub> <u>  ionic  </u> &amp; <u>  covalent  </u></p>
<p>____ 23. I can explain and apply the meaning of BARF as it applies to chemical bonding.</p>	<p>BARF stands for "<u>broken absorbed, released formed</u>"</p> <p>This means that when a bond is FORMED, energy is <u>  released  </u> and when a bond is BROKEN, energy is <u>  absorbed  </u>.</p> <p>-----</p> <p>Given the balanced equation:</p> $N + N \text{ -----> } N_2$ <p>Which statement describes the process represented by this equation?</p> <p>A) A bond is formed as energy is absorbed.  <input checked="" type="radio"/> B) A bond is formed as energy is released.  C) A bond is broken as energy is absorbed.  D) A bond is broken as energy is released.</p>
<p>____ 24. I can explain the difference between a polar covalent bond and a nonpolar covalent bond in terms of the types of nonmetals involved.</p>	<p>Polar covalent bonds are formed when <u>  two different  </u> nonmetals share electrons unevenly.</p> <p>Nonpolar covalent bonds form when <u>  two of the same  </u> nonmetals share electrons evenly.</p>
<p>____ 25. I can explain how to determine the degree of polarity of a covalent bond.</p>	<p>The degree of polarity of a covalent bond is determined by the <u>  electronegativity difference  </u> between the elements. .</p>

<p>____ 26. I can explain why one covalent bond is more or less polar than another covalent bond, based on electronegativity difference.</p>	<p>Explain, in terms of electronegativity difference, why the bond between carbon and oxygen in a carbon dioxide molecule is less polar than the bond between hydrogen and oxygen in a water molecule.</p> <p><b>The difference in electronegativity between carbon and oxygen is less than the difference in electronegativity between hydrogen and oxygen so the CO bond is less polar.</b></p>
<p>____ 27. I can define symmetrical and asymmetrical.</p>	<p><b>Definition:</b>  symmetrical – <b>molecule that has the at least two lines of symmetry</b></p> <p>asymmetrical – <b>molecule that does not have lines of symmetry</b></p>
<p>____ 28. I can state, in order, the three questions that are asked to determine if a MOLECULE is polar or nonpolar.</p>	<p>When determining if a MOLECULE is polar or non-polar, the first question to ask is <u>“Is there more than one polar bond?”</u></p> <p>When determining if a MOLECULE is polar or non-polar, the second question to ask is <u>“Does the central atom have unshared pairs of electrons?”</u></p> <p>When determining if a MOLECULE is polar or non-polar, the third question to ask is <u>“Is the molecule symmetrical?”</u></p>
<p>____ 29. I can explain and apply the meaning of SNAP as it applies to determining molecule polarity.</p>	<p>SNAP means <u>“symmetrical nonpolar, asymmetrical polar”</u></p> <p>-----</p> <p>Why is a molecule of CH<sub>4</sub> nonpolar even though the bonds between the carbon and hydrogen are polar?</p> <p><input checked="" type="radio"/> A) The shape of the CH<sub>4</sub> molecule is symmetrical.  <input type="radio"/> B) The shape of the CH<sub>4</sub> molecule is asymmetrical.  <input type="radio"/> C) The CH<sub>4</sub> molecule has an excess of electrons.  <input type="radio"/> D) The CH<sub>4</sub> molecule has a deficiency of electrons.</p> <p>-----</p> <p>Explain, in terms of charge distribution, why a molecule of water (H<sub>2</sub>O) is polar.</p> <p><b>A water molecule has asymmetrical distribution of charge.</b></p>

<p>____ 30. I can determine if a molecular is polar or nonpolar.</p>	<p>Determine which molecules are polar and which are nonpolar. Justify your answer.</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>H<sub>2</sub>O</p> <p>polar; central atom has unshared electrons</p> </td> <td style="width: 50%; vertical-align: top;"> <p>CO<sub>2</sub></p> <p>nonpolar; symmetrical</p> </td> </tr> <tr> <td style="vertical-align: top;"> <p>I<sub>2</sub></p> <p>nonpolar; no polar bonds</p> </td> <td style="vertical-align: top;"> <p>CH<sub>4</sub></p> <p>nonpolar; symmetrical</p> </td> </tr> </table>	<p>H<sub>2</sub>O</p> <p>polar; central atom has unshared electrons</p>	<p>CO<sub>2</sub></p> <p>nonpolar; symmetrical</p>	<p>I<sub>2</sub></p> <p>nonpolar; no polar bonds</p>	<p>CH<sub>4</sub></p> <p>nonpolar; symmetrical</p>
<p>H<sub>2</sub>O</p> <p>polar; central atom has unshared electrons</p>	<p>CO<sub>2</sub></p> <p>nonpolar; symmetrical</p>				
<p>I<sub>2</sub></p> <p>nonpolar; no polar bonds</p>	<p>CH<sub>4</sub></p> <p>nonpolar; symmetrical</p>				
<p>____ 31. I can explain and apply the expression "like dissolves like" and give an example.</p>	<p>"Like dissolves like" means</p> <p><b>if two substances have the same polarity (polar or nonpolar), they will dissolve in one another</b></p> <p>An example of "like dissolving like" is <u>ammonia dissolving in water</u></p> <hr style="border-top: 1px dashed black;"/> <p>Explain, in terms of molecular polarity, why ammonia is more soluble than methane in water at 20°C at standard pressure.</p> <p><b>Both ammonia and water are polar so ammonia dissolves in water. Methane is nonpolar and therefore will not dissolve well in polar water.</b></p>				
<p>____ 32. I can define intramolecular forces and intermolecular forces and give examples of each.</p>	<p><b>Definition:</b>  Intramolecular forces – <b>forces of attraction within a molecule</b></p> <p>Examples: <b>ionic bonds and covalent bonds</b></p> <p>Intermolecular forces – <b>forces of attraction between molecules</b></p> <p>Examples: dipole-dipole, London dispersion forces, hydrogen bonds</p>				
<p>____ 33. I can list the intramolecular forces from STRONGEST to WEAKEST.</p>	<p><b>Strongest</b> <u>covalent</u> <b>bonds</b> &gt; <u>ionic</u> <b>bonds</b> <b>Weakest</b></p>				
<p>____ 34. I can list the</p>					

<p>intermolecular forces from <b>STRONGEST to WEAKEST</b>.</p>	<p><b>Strongest</b> _____ hydrogen bonds _____ &gt; _____ dipole-dipole _____ &gt; _____ London dispersion forces _____ <b>Weakest</b></p>
<p>_____ <b>35. I can state 8 physical properties of substances that are dependent on the type of bonding in the substance and the strength of the IMF.</b></p>	<p>Eight physical properties that are dependent on the type of bonding and the strength of the IMF are:</p> <p>1. <u>physical state</u> _____ 2. <u>melting point</u> _____</p> <p>3. <u>boiling point</u> _____ 4. <u>conductivity</u> _____</p> <p>5. <u>vapor pressure</u> _____ 6. <u>malleability</u> _____</p> <p>7. <u>solubility</u> _____ 8. <u>hardness</u> _____</p>
<p>_____ <b>36. I can state the relationship between polarity and IMF strength.</b></p>	<p>As the polarity of the molecule _____ increases _____, the strength of the IMF _____ increases _____.</p>
<p>_____ <b>37. I can state the relationship between size of the molecule and IMF strength.</b></p>	<p>As the size of the molecule _____ increases _____, the strength of the IMF _____ increases _____.</p>
<p>_____ <b>38. Given the physical state of some substances, I can compare the relative strength of the IMF.</b></p>	<p>At STP, iodine (<math>I_2</math>) is a crystal and fluorine (<math>F_2</math>) is a gas. Compare the strength of the IMF in a sample of <math>I_2</math> at STP to the strength of the IMF in a sample of <math>F_2</math> at STP.</p> <p><b><math>F_2</math> has weaker IMF than <math>I_2</math>.</b></p>
<p>_____ <b>39. Given the boiling points (or freezing points) of some substances, I can compare the relative strength of the IMF.</b></p>	<p>At STP, <math>CF_4</math> boils at <math>-127.8^\circ C</math> and <math>NH_3</math> boils at <math>-33.3^\circ C</math>. Which substance has stronger IMF? Justify your answer.</p> <p><b><math>NH_3</math> has stronger IMF because <math>NH_3</math> has a higher boiling point.</b></p>
<p>_____ <b>40. I can explain and apply the meaning of "Hydrogen bonding is FON".</b></p>	<p>"Hydrogen bonding is FON" means _____ Hydrogen bonding occurs when the _____ molecule contains fluorine, oxygen, or nitrogen. _____</p> <p>Which compound has hydrogen bonding between its molecules?</p> <p>A) <math>CH_4</math>      B) <math>CaH_2</math>      C) <math>KNO_3</math>      <b>D) <math>H_2O</math></b></p>

<p>_____ 41. I can define normal boiling point, vapor pressure, volatile, and nonvolatile.</p>	<p><b>Definition:</b>  normal boiling point – <b>the temperature at which a substance boils at 1 atm pressure</b></p> <p>vapor pressure - <b>the pressure exerted by a vapor in equilibrium with its condensed phases (solid or liquid) at a given temperature in a closed system</b></p> <p>volatile – <b>easily evaporated at normal temperatures</b></p> <p>nonvolatile – <b>not easily evaporated at normal temperatures</b></p>
<p>_____ 42. I can determine the vapor pressure of ethanol, ethanoic acid, propane, or water at a given temperature.</p>	<p>What is the vapor pressure of ethanol at 56°C?</p> <p><b>49 kPa</b></p>
<p>_____ 43. I can state the relationship between the strength of IMF and vapor pressure.</p>	<p>As the strength of IMF <u>increases</u>, vapor pressure <u>increases</u>.</p>
<p>_____ 44. I can explain the how adding a nonvolatile solute to a pure solvent affects the freezing point of the solvent.</p>	<p>When a nonvolatile solute is added to a solvent, the freezing point of the solvent <u>is lowered</u> because the solute <u>disrupts</u> <u>crystal formation</u></p> <p>The more solute that is added, the <u>lower</u> the freezing point gets.</p>
<p>_____ 45. I can explain the how adding a nonvolatile solute to a pure solvent affects the boiling point of the solvent.</p>	<p>When a nonvolatile solute is added to a solvent, the boiling point of the solvent <u>is raised</u> because the solute <u>increases</u> <u>attractions between solute and solvent particles</u></p> <p>The more solute that is added, the <u>higher</u> the boiling point gets.</p>

<p>_____ <b>46. I can state 5 physical properties of ionic substances.</b></p>	<p>Five physical properties of ionic substances are:</p> <ol style="list-style-type: none"> <li>1. <u>  </u> have ionic bonding _____</li> <li>2. <u>  </u> have high mp _____</li> <li>3. <u>  </u> have high bp _____</li> <li>4. <u>  </u> low vapor pressure _____</li> <li>5. <u>  </u> conduct electricity as liquids or aqueous _____</li> </ol>
<p>_____ <b>47. I can identify a substance as "ionic" based on its properties.</b></p>	<p>A solid substance was tested in the laboratory. The results are shown below.</p> <ul style="list-style-type: none"> <li>*dissolves in water</li> <li>*is an electrolyte</li> <li>* has a high melting point</li> </ul> <p>Based on these results, the solid substance could be</p> <p>A) Hg  <input checked="" type="radio"/> B) AuCl  C) CH<sub>4</sub>  D) C<sub>12</sub>H<sub>22</sub>O<sub>11</sub></p> <p>-----</p> <p>Based on bond type, which compound has the highest melting point?</p> <p>A) CH<sub>4</sub>    B) C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>    <input checked="" type="radio"/> C) NaCl    D) C<sub>5</sub>H<sub>12</sub></p>
<p>_____ <b>48. I can state 5 physical properties of molecular substances.</b></p>	<p>Five physical properties of molecular substances are:</p> <ol style="list-style-type: none"> <li>1. <u>  </u> have covalent bonding _____</li> <li>2. <u>  </u> have low mp _____</li> <li>3. <u>  </u> have low bp _____</li> <li>4. <u>  </u> high vapor pressure _____</li> <li>5. <u>  </u> do NOT conduct electricity _____</li> </ol>

\_\_\_\_\_49. I can identify a substance as “molecular” based on its properties.

A chemist performs the same tests on two homogeneous white crystalline solids, *A* and *B*. The results are shown in the table below.

	Solid A	Solid B
Melting Point	High, 801°C	Low, decomposes at 186°C
Solubility in H <sub>2</sub> O (grams per 100.0 g H <sub>2</sub> O at 0°C)	35.7	3.2
Electrical Conductivity (in aqueous solution)	Good conductor	Nonconductor

The results of these tests suggest that

- A) both solids contain only ionic bonds
- B) both solids contain only covalent bonds
- C) solid *A* contains only covalent bonds and solid *B* contains only ionic bonds
- D) solid *A* contains only ionic bonds and solid *B* contains only covalent bonds

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Which terms describe a substance that has a low melting point and poor electrical conductivity?

- A) covalent and metallic
- B) covalent and molecular
- C) ionic and molecular
- D) ionic and metallic

## Unit 12: Reaction Rates & Equilibrium

If you can do all the things listed below, you are ready for the Unit 12 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

<b>_____1. I can still do everything from Unit 1.</b>	
<b>_____2. I can still do everything from Unit 2.</b>	
<b>_____3. I can still do everything from Unit 3.</b>	
<b>_____4. I can still do everything from Unit 4.</b>	
<b>_____5. I can still do everything from Unit 5.</b>	
<b>_____6. I can still do everything from Unit 6.</b>	
<b>_____7. I can still do everything from Unit 7.</b>	
<b>_____8. I can still do everything from Unit 8.</b>	
<b>_____9. I can still do everything from Unit 10.</b>	
<b>_____10. I can still do everything from Unit 11.</b>	
<b>_____11. I can define effective collision and collision theory</b>	<p><b>Definition:</b> effective collision – <b>a collision between two reactants that have the proper orientation and sufficient energy to overcome the activation energy barrier</b></p> <p>collision theory – <b>substances must sustain effective collisions in order for chemical reactions to occur</b></p>
<b>_____12. I can state and apply the relationship between temperature and reaction rate in terms of collision theory.</b>	<p>As the temperature _____increases_____, the reaction rate for most chemical reactions _____increases_____ because there are <u>more</u> effective collisions between particles.</p> <p>.....</p> <p>Given the reaction:</p> $2\text{Mg}(s) + \text{O}_2(g) \text{ ----> } 2\text{MgO}(s)$ <p>At which temperature would the reaction occur at the greatest rate?</p> <p>A) 0°C      B) 15°C      <b>C) 95°C</b>      D) 273K</p>



<p>_____13. I can state and apply the relationship between surface area and reaction rate in terms of collision theory.</p>	<p>As the surface area _____ increases _____, the reaction rate _____ increases _____ because there are _____ more _____ effective collisions between particles.</p> <p>-----</p> <p>At STP, which 4.0 g sample of Zn(s) will react most quickly with dilute hydrochloric acid?</p> <p>A) lump      B) bar      <b>C) powdered</b>      D) sheet metal</p>
<p>_____14. I can state and apply the relationship between concentration and reaction rate in terms of collision theory.</p>	<p>As the concentration _____ increases _____, the reaction rate _____ increases _____ because there are _____ more _____ effective collisions between particles.</p> <p>-----</p> <p>At 20°C, a reaction between powdered Zn(s) and hydrochloric acid will occur most quickly if the concentration of the HCl is</p> <p>A) 1.0 M      B) 1.5 M      C) 2.5 M      <b>D) 2.8 M</b></p>
<p>_____15. I can state the unit used to measure energy.</p>	<p>Energy is measured in _____ joules _____.</p>
<p>_____16. Based on the location of the energy term, I can determine if the reaction is exothermic or endothermic.</p>	<p>Given the following balanced equation:</p> $I + I \rightarrow I_2 + 146.3 \text{ kJ}$ <p>Is this reaction exothermic or endothermic? Justify your answer.</p> <p><b>Exo. Energy is a product.</b></p>
<p>_____17. I can use Table I to determine if a reaction is exothermic or endothermic.</p>	<p>Which balanced equation represents an endothermic reaction?</p> <p>A) <math>C(s) + O_2(g) \rightarrow CO_2(g)</math></p> <p>B) <math>CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)</math></p> <p>C) <math>N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)</math></p> <p><b>D) <math>N_2(g) + O_2(g) \rightarrow 2NO(g)</math></b></p>

\_\_\_\_ 19. I can define potential energy diagram, reaction coordinate,  $PE_{\text{reactant}}$ ,  $PE_{\text{product}}$ , heat of reaction ( $\Delta H$ ), activation energy, catalyst.

**Definitions:**

potential energy diagram – a graph that shows the changes in potential energy over the course of a chemical reaction.

reaction coordinate – shown on the X-axis of a potential energy diagram, it indicates the reaction pathway

$PE_{\text{reactant}}$  – potential energy of the reactant

$PE_{\text{product}}$  – potential energy of the product

heat of reaction ( $\Delta H$ ) – potential energy of the products minus the potential energy of the reactants

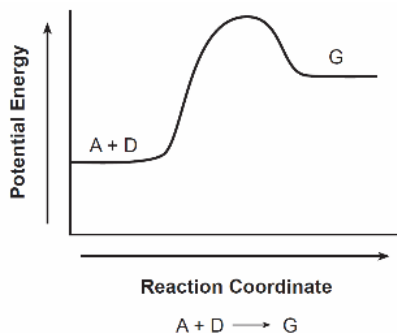
activation energy – the amount of energy that must be added to the reactants to overcome the energy barrier so the reaction will happen

catalyst – a substance that speeds up the rate of a chemical reaction by allowing it to occur via an alternate pathway that requires less energy

entropy – a measure of the system's disorder

\_\_\_\_ 20. Given a potential energy diagram, I can determine if the reaction is exothermic or endothermic.

Give the potential energy diagram below, determine if the reaction is exothermic or endothermic. Justify your answer.



**Endo.** The products have more energy than the reactants.



<p>_____25. Given a balanced equation, I can determine if the reaction results in an overall increase or decrease in entropy.</p>	<p>Which reaction results in an increase in entropy?</p> <p>A) <math>\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{s})</math>  <input checked="" type="radio"/> B) <math>\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})</math>  C) <math>\text{Ca}(\text{s}) + 2 \text{H}_2\text{O}(\ell) \rightarrow \text{Ca}(\text{OH})_2(\text{aq}) + \text{H}_2(\text{g})</math>  D) <math>\text{NaCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})</math></p> <hr/> <p>Which equation shows an increase in entropy?</p> <p>A) <math>\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{s})</math>  <input checked="" type="radio"/> B) <math>\text{CO}_2(\ell) \rightarrow \text{CO}_2(\text{g})</math>  C) <math>\text{CH}_3\text{OH}(\ell) \rightarrow \text{CH}_3\text{OH}(\text{s})</math>  D) <math>\text{CH}_3\text{OH}(\text{g}) \rightarrow \text{CH}_3\text{OH}(\ell)</math></p> <hr/> <p>Which reaction has the greatest increase in entropy?</p> <p><input checked="" type="radio"/> A) <math>2 \text{H}_2\text{O}(\ell) \rightarrow 2 \text{H}_2(\text{g}) + \text{O}_2(\text{g})</math>  B) <math>2 \text{H}_2\text{O}(\text{g}) \rightarrow 2 \text{H}_2(\text{g}) + \text{O}_2(\text{g})</math>  C) <math>\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\ell)</math>  D) <math>\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})</math></p>
<p>_____26. I can define forward reaction, reverse reaction, reversible reaction, and closed system</p>	<p><b>Definitions:</b>  forward reaction – <b>the chemical reaction read from left to right</b></p> <p>reverse reaction – <b>the chemical reaction read from right to left</b></p> <p>reversible reaction – <b>a chemical reaction that can proceed from both left to right and right to left</b></p> <p>closed system – <b>a system in which reactants and products are trapped and may not enter or leave</b></p>
<p>_____27. I can state the three types of equilibrium.</p>	<p>The three types of equilibrium are:</p> <p>_____ Phase _____ equilibrium</p> <p>_____ Chemical/reaction _____ equilibrium and</p> <p>_____ Solution _____ equilibrium</p>

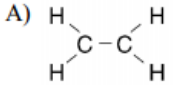
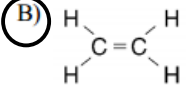
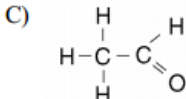
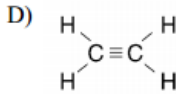
<p>____ 28. I can state two conditions that apply to all systems at equilibrium.</p>	<p>In a system at equilibrium the ____ rate ____ of the forward and reverse reaction must be ____ equal ____ and the ____ concentrations ____ of the reactants and products must be ____ constant ____.</p>												
<p>____ 29. Given a list of reactions, I can identify reactions that show equilibrium (chemical, phase, or solution).</p>	<p>Which balanced equation represents phase equilibrium?  A) <math>\text{H}_2(\text{g}) + \text{I}_2(\text{s}) \rightleftharpoons 2\text{HI}(\text{g})</math>  <input checked="" type="radio"/> B) <math>\text{I}_2(\text{s}) \rightleftharpoons \text{I}_2(\text{g})</math>  C) <math>\text{KCl}(\text{s}) \xrightarrow{\text{H}_2\text{O}} \text{KCl}(\text{aq})</math>  D) <math>2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g}) \rightleftharpoons 2\text{KClO}_3</math></p> <hr/> <p>Which balanced equation represents solution equilibrium?  A) <math>\text{H}_2(\text{g}) + \text{I}_2(\text{s}) \rightleftharpoons 2\text{HI}(\text{g})</math>  B) <math>\text{I}_2(\text{s}) \rightleftharpoons \text{I}_2(\text{g})</math>  <input checked="" type="radio"/> C) <math>\text{KCl}(\text{s}) \xrightarrow{\text{H}_2\text{O}} \text{KCl}(\text{aq})</math>  D) <math>2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g}) \rightleftharpoons 2\text{KClO}_3</math></p> <hr/> <p>Which balanced equation represents chemical equilibrium?  <input checked="" type="radio"/> A) <math>\text{H}_2(\text{g}) + \text{I}_2(\text{s}) \rightleftharpoons 2\text{HI}(\text{g})</math>  B) <math>\text{I}_2(\text{s}) \rightleftharpoons \text{I}_2(\text{g})</math>  C) <math>\text{KCl}(\text{s}) \xrightarrow{\text{H}_2\text{O}} \text{KCl}(\text{aq})</math>  D) <math>2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g}) \rightleftharpoons 2\text{KClO}_3</math></p>												
<p>____ 30. In terms of saturation, I can describe a solution that is at equilibrium.</p>	<p>In terms of saturation, a solution that is at equilibrium must be ____ saturated ____.</p>												
<p>____ 31. I can state LeChatelier's Principle.</p>	<p>LeChatelier's Principle states <b>when subjected to a stress, systems at equilibrium will shift to relieve the stress</b></p>												
<p>____ 32. Given a balanced equation at equilibrium, I can predict the direction of shift in the equilibrium when the temperature, concentration, or pressure is changed or if a catalyst is added.</p>	<p>Given the reaction at equilibrium:  <math>2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g}) + 392\text{kJ}</math></p> <p>Predict the direction of shift in the equilibrium (right, left, no shift) when the following changes are made to the system.</p> <table border="1" data-bbox="548 1688 1490 1967"> <thead> <tr> <th>Change</th> <th>Direction of Shift</th> </tr> </thead> <tbody> <tr> <td>Increase concentration of <math>\text{SO}_2</math></td> <td>right</td> </tr> <tr> <td>Increase concentration of <math>\text{SO}_3</math></td> <td>left</td> </tr> <tr> <td>Increase temperature</td> <td>left</td> </tr> <tr> <td>Increase pressure</td> <td>right</td> </tr> <tr> <td>Add a catalyst</td> <td>no shift</td> </tr> </tbody> </table>	Change	Direction of Shift	Increase concentration of $\text{SO}_2$	right	Increase concentration of $\text{SO}_3$	left	Increase temperature	left	Increase pressure	right	Add a catalyst	no shift
Change	Direction of Shift												
Increase concentration of $\text{SO}_2$	right												
Increase concentration of $\text{SO}_3$	left												
Increase temperature	left												
Increase pressure	right												
Add a catalyst	no shift												

## Unit 13: Organic Chemistry

If you can do all the things listed below, you are ready for the Unit 13 test.

Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

____1. I can still do everything from Unit 1.	
____2. I can still do everything from Unit 2.	
____3. I can still do everything from Unit 3.	
____4. I can still do everything from Unit 4.	
____5. I can still do everything from Unit 5.	
____6. I can still do everything from Unit 6.	
____7. I can still do everything from Unit 7.	
____8. I can still do everything from Unit 8.	
____9. I can still do everything from Unit 10.	
____10. I can still do everything from Unit 11.	
____11. I can still do everything from Unit 12.	
____12. I can define organic compound, saturated hydrocarbon, unsaturated hydrocarbon, and isomer.	<p><b>Definitions:</b> organic compound – all carbonate containing compounds except CO, CO<sub>2</sub>, and carbonates</p> <p>saturated hydrocarbon – a compound containing only C and H in which each carbon atom has 4 single bonds</p> <p>unsaturated hydrocarbon - a compound containing only C and H in which there is at least one double bond (possibly triple) between C atoms</p> <p>isomer –two organic compounds that have the same molecular formula, but different structural formula and therefore different physical and chemical properties</p>

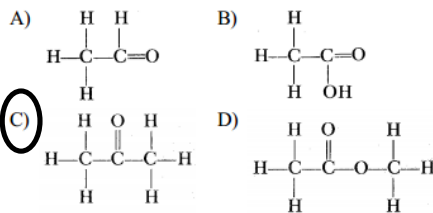
<p>_____13. I can expand a condensed structural formula to show the structural formula of an organic compound.</p>	<p>Draw the complete structural formula for <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3</math>.</p> <p>(Sorry. This will take WAAY too long on the computer.)</p> <p>Draw the complete structural formula for <math>\text{CH}_3\text{CHCHCH}_3</math>.</p> <p>(This one too.)</p>
<p>_____14. I can state the name and symbol of the element that is capable of forming rings, chains, and networks.</p>	<p>The element that is capable of forming rings, chains, and networks is _____carbon_____. Its symbol is _____C_____.</p>
<p>_____15. I can explain the meaning of and apply HONC1234.</p>	<p>HONC1234 tells me that</p> <p><b>Hydrogen forms 1 bond. Oxygen forms 2 bonds. Nitrogen forms 3 bonds. Carbon forms 4 bonds.</b></p> <hr/> <p>Which structural formula <i>correctly</i> represents a hydrocarbon molecule?</p> <p>A) </p> <p>B) </p> <p>C) </p> <p>D) </p>
<p>_____16. Given the formula, I can determine if a compound is a hydrocarbon or not.</p>	<p>Which formula represents a hydrocarbon?</p> <p>A) <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}</math> B) <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3</math> C) <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}</math> D) <math>\text{CH}_3\text{CH}_2\text{COOCH}_3</math></p>
<p>_____17. Given the name, I can use Reference Table P to determine how many carbon atoms are in a compound.</p>	<p>Determine how many carbon atoms are in each of the following compounds:</p> <p>decane _____10_____ ethene _____2_____</p> <p>3-nonene _____9_____ 1-pentyne _____5_____</p>
<p>_____18. Given the name, I can use Reference Table Q to determine to which class of hydrocarbons a compound belongs.</p>	<p>Determine the homologous series of hydrocarbons to which each of the following belongs:</p> <p>decane _____alkane_____ 2-decene _____alkene_____</p> <p>3-nonene _____alkene_____ 1-pentyne _____alkyne_____</p>
<p>_____19. Given the name, I can determine if the hydrocarbon is saturated or unsaturated.</p>	<p>Determine if each of the following is a saturated or unsaturated hydrocarbon.</p> <p>decane _____sat_____ ethene _____unsat_____</p> <p>3-nonene _____unsat_____ 1-pentyne _____unsat_____</p>

<p>_____ 20. Given the formula, I can determine to which homologous series a hydrocarbon belongs.</p>	<p>Determine the homologous series of hydrocarbons to which each of the following belongs:</p> $  \begin{array}{cccc}  & \text{H} & \text{H} & \text{H} & \text{H} \\  &   &   &   &   \\  \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\  &   &   &   &   \\  & \text{H} & \text{H} & \text{H} & \text{H}  \end{array}  $ <p>belongs to the <u>alkane</u> series.</p> <hr/> $  \begin{array}{cccc}  & \text{H} & & \text{H} \\  &   & &   \\  \text{H} & -\text{C} & -\text{C}\equiv\text{C} & -\text{C}-\text{H} \\  &   & &   \\  & \text{H} & & \text{H}  \end{array}  $ <p>belongs to the <u>alkyne</u> series.</p> <hr/> $  \begin{array}{cccc}  & \text{H} & \text{H} & \text{H} & & \text{H} \\  &   &   &   & &   \\  \text{H} & -\text{C} & -\text{C} & -\text{C} & =\text{C} & -\text{H} \\  &   &   & & &   \\  & \text{H} & \text{H} & & & \text{H}  \end{array}  $ <p>belongs to the <u>alkene</u> series.</p>
<p>_____ 21. Given the formula, I can determine if a hydrocarbon is saturated or unsaturated.</p>	<p>Determine if each of the following is a saturated or unsaturated hydrocarbon.</p> <p><math>\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3</math> <u>sat</u></p> <p><math>\text{CH}_3\text{CHCHCH}_3</math> <u>nsat</u></p>
<p>_____ 22. Given the name, I can use Reference Table Q to determine how many hydrogen atoms the hydrocarbon contains.</p>	<p>Determine the number of hydrogen atoms in each of the following.</p> <p>decane <u>22</u>    1-butene <u>8</u></p> <p>3-nonene <u>18</u>    1-pentyne <u>18</u></p>
<p>_____ 23. Given a list of compounds, I can determine which ones are isomers.</p>	<p>Given a formula representing a compound:</p> $  \begin{array}{cccc}  & \text{O} & \text{H} & \text{H} & \text{H} \\  &    &   &   &   \\  \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\  & &   &   &   \\  & & \text{H} & \text{H} & \text{H}  \end{array}  $ <p>Which formula represents an isomer of this compound?</p> <p>A) <math display="block">  \begin{array}{cccc}  &amp; \text{H} &amp; \text{H} &amp; \text{H} &amp; \text{O} \\  &amp;   &amp;   &amp;   &amp;    \\  \text{H} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C}-\text{H} \\  &amp;   &amp;   &amp;   &amp; \\  &amp; \text{H} &amp; \text{H} &amp; \text{H} &amp;   \end{array}  </math></p> <p><b>B)</b> <math display="block">  \begin{array}{cccc}  &amp; \text{H} &amp; \text{O} &amp; \text{H} &amp; \text{H} \\  &amp;   &amp;    &amp;   &amp;   \\  \text{H} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C}-\text{H} \\  &amp;   &amp; &amp;   &amp;   \\  &amp; \text{H} &amp; &amp; \text{H} &amp; \text{H}  \end{array}  </math></p> <p>C) <math display="block">  \begin{array}{cccc}  &amp; \text{H} &amp; \text{H} &amp; \text{H} &amp; \text{O} \\  &amp;   &amp;   &amp;   &amp;    \\  \text{H} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C}-\text{OH} \\  &amp;   &amp;   &amp;   &amp; \\  &amp; \text{H} &amp; \text{H} &amp; \text{H} &amp;   \end{array}  </math></p> <p>D) <math display="block">  \begin{array}{cccc}  &amp; \text{H} &amp; \text{H} &amp; \text{O} &amp; &amp; \text{H} \\  &amp;   &amp;   &amp;    &amp; &amp;   \\  \text{H} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C} &amp; -\text{O} &amp; -\text{C}-\text{H} \\  &amp;   &amp;   &amp; &amp; &amp;   \\  &amp; \text{H} &amp; \text{H} &amp; &amp; &amp; \text{H}  \end{array}  </math></p>

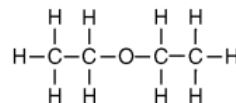


\_\_\_\_\_ 24. Given a structural formula, I can use Reference Table R to identify to which class of organic compounds a substance belongs.

Which structural formula represents a ketone?



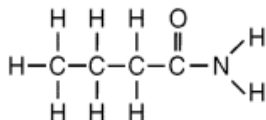
Given the structural formula:



The compound represented by this formula can be classified as an

- A) organic acid      **B) ether**  
C) ester      D) aldehyde

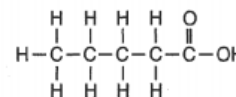
Given the formula:



This compound is classified as

- A) an aldehyde      **B) an amide**  
C) an amine      D) a ketone

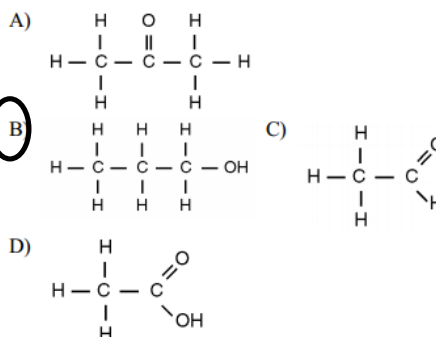
Given the formula for an organic compound:



This compound is classified as an

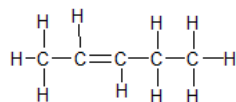
- A) aldehyde      **B) amine**  
C) ester      **D) organic acid**

Which structural formula represents an alcohol?

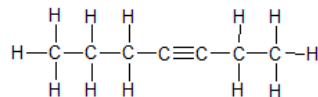


\_\_\_\_\_ 25. I can use Reference Tables P & Q and IUPAC nomenclature to name simple hydrocarbons.

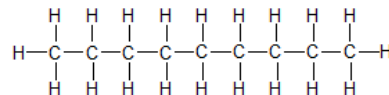
Name the following hydrocarbons.



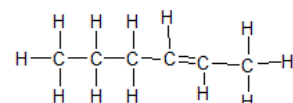
2-pentene



3-heptyne



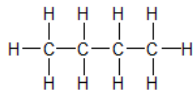
nonane



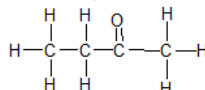
2-hexene

\_\_\_\_\_26. I can use Reference Tables P & R and IUPAC nomenclature to name simple compounds in any of the classes of organic compounds.

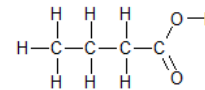
Name the following organic compounds.



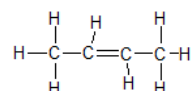
butane



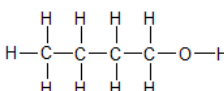
butanone



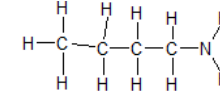
butanoic acid



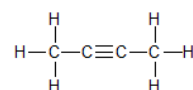
2-butene



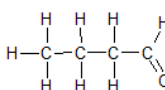
1-butanol



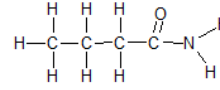
1-butanamine



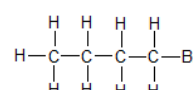
2-butyne



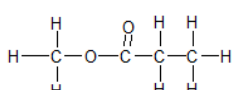
butanal



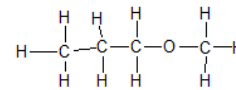
butanamide



1bromobutane



methylpropanoate



methylpropyl ether

\_\_\_\_\_27. I can use F-SCAPES to list and describe the 7 types of organic reactions.

**F** stands for fermentation. This type of organic reaction results from a reaction of a sugar to form carbon dioxide and ethanol. It typically requires a catalyst, in the form of an enzyme to occur.

**S** stands for substitution. This type of organic reaction happens when saturated hydrocarbons replace one of the hydrogens for some other element (often a halide).

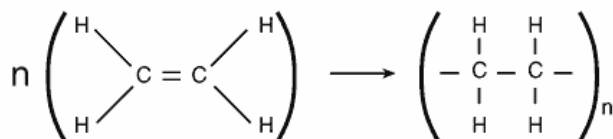
**C** stands for combustion. In this type of organic reaction a hydrocarbon reacts with oxygen to form carbon dioxide and water. It is an exothermic reaction.

**A** stands for addition. In this type of organic reaction an unsaturated hydrocarbon becomes a saturated when the double bond breaks and two atoms of another element (often a halide) are added.

\_\_\_\_\_27. I can use F-SCAPES to list and describe the 7 types of organic reactions. (continued)

**P** stands for polymerization. In this type of organic reaction many monomers are linked together to form a polymer. A generalized form of this reaction looks like this.....

**Note:**  $n$  and  $n$  are very large numbers equal to about 2000.

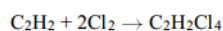


**E** stands for esterification. In this type of organic reaction an alcohol reacts with a organic acid to form an ester and water. The products of this reaction are typically fragrant.

**S** stands for saponification. In this type of organic reaction a fat reacts with a base to form soap. You can really “clean up” if you remember this organic reaction.

\_\_\_\_\_28. Given an equation, I can identify the type of organic reaction that is occurring.

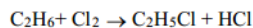
Given the balanced equation for an organic reaction:



This reaction is best classified as

- A) addition                      B) esterification  
 C) fermentation                D) substitution

Given the equation:



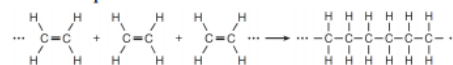
This reaction is best described as

- A) addition involving a saturated hydrocarbon  
 B) addition involving an unsaturated hydrocarbon  
 C) substitution involving a saturated hydrocarbon  
 D) substitution involving an unsaturated hydrocarbon

Which equation represents fermentation?

- A)  $\text{C}_2\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_6\text{Cl} + \text{HCl}$   
 B)  $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2 \text{C}_2\text{H}_5\text{OH} + 2 \text{CO}_2$   
 C)  $\text{CH}_3\text{COOH} + \text{CH}_3\text{OH} \rightarrow \text{CH}_3\text{COOCH}_3 + \text{H}_2\text{O}$   
 D)  $n\text{C}_2\text{H}_4 \rightarrow (\text{C}_2\text{H}_4)_n$

Given the equation:



Which type of reaction is represented by this equation?

- A) combustion                      B) esterification  
 C) polymerization                D) substitution

Given the reaction:



This reaction is an example of

- A) fermentation                      B) saponification  
 C) hydrogenation                      D) esterification

Which reaction best represents the complete combustion of ethene?

- A)  $\text{C}_2\text{H}_4 + \text{HCl} \rightarrow \text{C}_2\text{H}_5\text{Cl}$   
 B)  $\text{C}_2\text{H}_4 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_4\text{Cl}_2$   
 C)  $\text{C}_2\text{H}_4 + 3 \text{O}_2 \rightarrow 2 \text{CO}_2 + 2 \text{H}_2\text{O}$   
 D)  $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$