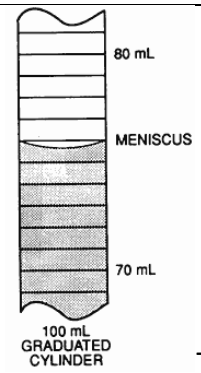
Unit 1: Getting Ready for Chemistry

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.

_____1. I can list five important lab safety rules.	5 important lab safety rules are: **1. wear appropriate personal protection equipment (PPE)** **2. follow directions** **3. no food or drink in the lab** **4. no non-experiment related electronics in the lab** **5. no horseplay**
_____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)	Draw and label as many of the common laboratory tools as you can!
_____3. I can determine the independent and dependent variable in a lab experiment.	A farmer wants to know what the effect the amount of fertilizer has on the amount of fruit an apple tree produces. What is the independent variable? **amount of fertilizer** What is the dependent variable? **amount of fruit apple tree produces**
_____4. I can determine the number of significant figures in a measurement.	How many significant figures are there in 30.50 cm? **4** How many significant figures are there in 400.0 sec? **4**
_____5. I can determine the answer to a math problem to the correct number of significant figures.	To the correct number of significant figures, what is the answer to 5.93 mL + 4.6 mL? **10.5 mL** To the correct number of significant figures, what is the answer to 5.93 cm * 4.6 cm? **27 cm^2**

_____6. I can read the meniscus on a graduated cylinder to the correct number of significant figures.	 The volume is_____**75.7**_____ mL.
_____7. I can use dimensional analysis to solve math problems.	To the correct number of significant figures, determine how many meters there are in 15.4 ft. **4.69 m** To the correct number of significant figures, determine how many minutes there are in 2.7 years. **1.4×10^6 min**
_____8. I can convert numbers into scientific notation from standard notation.	Convert 87,394,000,000,000 to scientific notation. **8.7394×10^{13}** Convert 0.0000040934 to scientific notation. **4.0934×10^{-6}**
_____9. I can convert numbers into standard notation from scientific notation.	Convert 5.8×10^9 to standard notation. **5,800,000,000** Convert 4.3×10^{-5} to standard notation. **0.000 043**
_____10. I can use my calculator to input numbers in scientific notation using the "2nd function & EE keys.	Enter the number 5.67×10^{52} on your calculator and show Mrs. S. She'll initial this box, if you've done it correctly! **calculator display should read 5.67E52**
_____11. I can convert between different metric units by using "King Henry died by drinking chocolate milk".	9.3 km = ? m **9300 m** 39,983 mL = ?kL **0.39983 kL**
_____12. I can convert between different metric units by using Reference Table C and dimensional analysis.	1.5×10^{-3} km = ? μm **1.5×10^6 μm** 4.67×10^{13} pm = ?dm **467 dm**

_____13. I can determine which equation to use from Reference Table T by looking at the given information.	**Which equation** would you use to solve the following problem? (Don't solve it. Just tell me WHICH equation to use.) *Problem:* How many grams of LiBr (gram-formula mass = 87 g/mol) would 3.5 moles of LiBr be? **moles = given mass/gfm**
_____14. I can solve for "x" when it's in the denominator of a fraction.	What is the volume, in cm^3, of 54.6 g of beryllium (density = 1.85 g/cm^3) **29.5 cm^3**
_____15. I can convert ^oC to degrees kelvin and degrees kelvin to ^oC.	What kelvin temperature is equal to 200^oC? **473K** What Celsius temperature is equal to 200K? **-73^oC**
_____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.	Al_____aluminum_____ Ca_____calcium_____ Ne_____neon_____ N_____nitrogen_____ Na_____sodium_____ S_____sulfur_____ Br_____bromine_____ Ge_____germanium_____
_____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.	Al_____Group 13_____ Ca_____Group 2_____ Ne_____Group 18_____ N_____Group 15_____ Na_____Group 1_____ S_____Group 16_____ Br_____Group 17_____ Ge_____Group 14_____
_____18. I can define gram-formula mass (AKA molar mass).	**Definition:** **gram formula mass is the mass of one mole of substance**

_____19.Given the chemical symbol/formula, I can determine how many atoms are present.	How many moles of atoms are in N_2? **2** What is the total # of moles of atoms in $Pb(C_2H_3O_2)_2$? **15** How many moles of C atoms are in $Pb(C_2H_3O_2)_2$? **4**
_____20. I can determine the gram-formula mass for any element or compound.	What is the gfm for N_2? **28 g/mol** What is the gfm for $Pb(C_2H_3O_2)_2$? **325 g/mol**
_____21. I can define a mole as it pertains to chemistry.	**<u>Definition:</u>** **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 6.02 x 10_{23} particles. If the substance is a gas at STP, one mole will occupy 22.4 L of volume.**
_____22. I can find the number of moles of substance if I am given the mass and formula for the substance.	94.3 g is how many moles of $NaCl$? **1.61 moles**
_____23. I can determine the percent composition of an element in a compound.	What is the percent by mass of Mg in $Mg(NO_3)_2$? **18.8%**
_____24. I can convert between moles and numbers of particles using Avogadro's number?	How many moles of carbon atoms are there in 4.8×10^{24} atoms of C?
_____25. I can convert between moles and L (assuming STP).	How many L does 4.60 moles of O_2 occupy (assuming STP)? **103 L**

Unit 2: Introduction to Matter

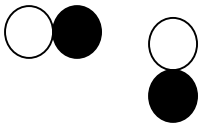
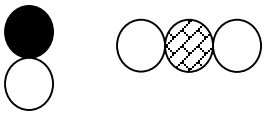
If you can do all the things listed below, you are ready for the Unit 2 test.

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

<table>
<tr><td>_____1. I can still do everything from Unit 1.</td><td colspan="2"></td></tr>
<tr><td>_____2. I can define the following: atom, element, compound, mixture</td><td colspan="2"><u>Definitions:</u>
atom – smallest particle of matter that retains the properties of an element

element –a substance that cannot be broken down into a simpler substance

compound – two or more elements chemically combined in a fixed ratio

mixture – two or more substances physically combined in a variable ratio</td></tr>
<tr><td rowspan="3">_____3. I can draw particle diagrams to represent an atom, an element, a molecule, a compound, a mixture</td><td>2 Atoms of 1 Element
  </td><td>2 Molecules of 1 Compound
  </td></tr>
<tr><td>Mixture of 2 elements
  </td><td>Mixture of 2 compounds
  </td></tr>
<tr><td colspan="2">Mixture of an element and a compound
  </td></tr>
</table>

_____4. I can classify substances as a pure substance (element or compound) or as a mixture.

Put each of the following examples into the correct column.

Examples: $C_{12}H_{22}O_{11}$, NaCl, Fe, salt water, air, CO_2, H_2, Ar, soda

Element	*Compound*	*Mixture*
Fe	**$C_{12}H_{22}O_{11}$**	**salt water**
H_2	**NaCl**	**air**
Ar	**CO_2**	**soda**

_____5. I can define homogeneous mixture and heterogeneous mixture in terms of particle distribution.

Definitions:

homogeneous mixture **– two or more substances physically combined with a uniform distribution of particles**

heterogeneous mixture**– two or more substances physically combined with a non-uniform (clumpy) distribution of particles**

_____6. I can give an example of homogeneous and heterogeneous mixtures.

Two examples of homogeneous mixtures:

a. **brass**

b. **a pitcher of Kool-Aid**

Two examples of heterogeneous mixtures:

a. **snickers bar**

b. **soil**

_____7. I can classify a property as physical or chemical.

Write "P" for physical or "C" for chemical on the line provided.

___P__copper (II) sulfate is blue.

___C__copper reacts with oxygen.

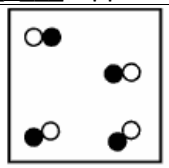
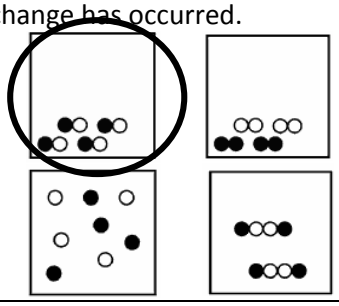
___P__copper can be made into wire.

___P__copper has a density of 8.96 g/cm^3.

___P_ copper melts at 1358K.

__C__copper reacts with nitric acid.

___P__copper doesn't dissolve in water.

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

_____12. I can describe the trend in solubility for gases as the temperature changes.	As the temperature increases, the solubility of a gas ___decreases_____.
_____13. I can use Reference Table F to determine if a substance will be soluble in water.	Write "S" for **soluble** and "NS" for **not soluble**. Use Reference Table F to determine the solubility of the following compounds: ___S__potassium chlorate ___NS__silver bromide __S___lithium carbonate __NS__calcium carbonate
_____14. I can use Table G to determine how much solute to add at a given temperature to make a saturated solution.	How many grams of $KClO_3$ must be dissolved in 100 grams of water at 20^{o}C to make a saturated solution? **56 g**
_____15. I can use Table G to determine if a solution is saturated, unsaturated, or supersatured.	If 20.0 g of $NaNO_3$ are dissolved in 100.0 g of water at 25.0^{o}C, will the resulting solution be saturated, unsaturated, or supersaturated? **unsaturated**
_____16. I can define: dilute, concentrated, concentration, and electrolyte.	**Definitions:** dilute – **a solution in which a small quantity of solute is dissolved in a large quantity of solvent** concentrated – **a solution in which a large quantity of solute is dissolved in a small quantity of solvent** concentration – **the amount of solute dissolved in a given amount of solvent** electrolyte – **a substance that can conduct electricity when dissolved in water**
_____17. I can interpret Table G to determine which solution is the most concentrated or the most dilute.	Which solution is most concentrated? A) 125.0 g of KI dissolved in 100.0 g of water at 10^{o}C B) 70.0 g of NH_4Cl dissolved in 100.0 g of water at 70^{o}C C) 120.0 g of KNO_3 dissolved in 100.0 g of water at 70^{o}C D) 30.0 g of SO_2 dissolved in 100.0 g of water at 90^{o}C
_____18. I can use Reference Table T to calculate the concentration of a solution in ppm.	What is the concentration, in ppm, of a 2600 g of solution containing 0.015 g of CO_2? **5.7 ppm**
_____19. I can use Reference Table T to calculate the concentration of a solution in molarity.	What is the molarity of 3.5 moles of $NaBr$ dissolved in 500 mL of water? **7M**

_____20. I can determine how matter will be separated using filtration.	When a mixture of sand, salt, sugar, and water is filtered, what passes through the filter? **salt, sugar, and water**
_____21. I can describe how matter can be separated using distillation.	Which physical property makes it possible to separate the components of crude oil by means of distillation? **difference in boiling points**
_____23. I can state which separation process (decanting, filtering, distilling, chromatography, or evaporating) is best for a given situation.	To separate a mixture of salt and water, the best method of separation would be_evaporation_. To separate a mixture of ethanol and water, the best method of separation would be ___distillation____. To separate a mixture of food coloring dyes, the best method of separation would be _____chromatography____. To separate a mixture of oil and water, the best method of separation would be_____decanting____.
_____24. I can define allotrope.	**Defintion:** allotrope – **different forms of the same element that possess different molecular structures**
_____25. I can state the differences between two allotropes of the same element.	Two allotropes of the same element have different molecular structures and therefore have different _physical___ and ___chemical_____ properties.

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.

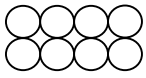
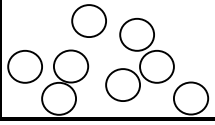
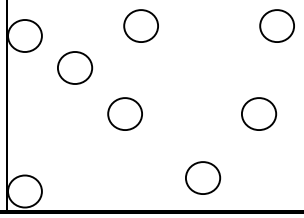
<table>
<tr><td>_____1. I can still do everything from Unit 1.</td><td></td></tr>
<tr><td>_____2. I can still do everything from Unit 2.</td><td></td></tr>
<tr><td>_____3. I can define kinetic energy, potential energy, temperature, heat, endothermic, and exothermic.</td><td><u>Defintions:</u>
kinetic energy – energy a substance has due to its motion

potential energy – energy a substance has that is stored in chemical bonds and static interactions

temperature – a measure of the average kinetic energy of a substance

heat – energy the moves between two substances due to differences in temperature between the substances

endothermic – chemical reaction or physical change that requires the input of energy to occur

exothermic – chemical reaction of physical change that releases energy as it occurs</td></tr>
<tr><td>____4. I can use particle diagrams to show the arrangement and spacing of atoms/molecules in different phases.</td><td>Draw a particle diagram to represent atoms of Li in each phase.
<table><tr><th>Solid</th><th>Liquid</th><th>Gas</th></tr><tr><td>  </td><td>  </td><td>  </td></tr></table></td></tr>
</table>

_____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.

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

_____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_____

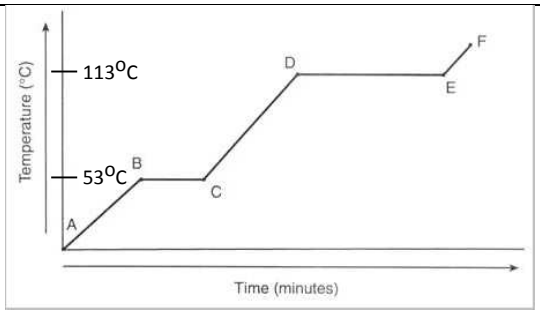
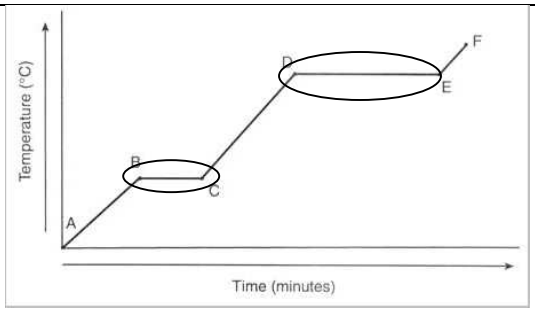
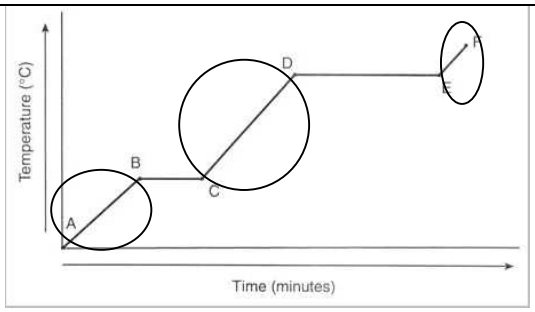
solidification/freezing_____EXO_____

condensation_____EXO_____

vaporization/boiling_____ENDO_____

sublimation_____ENDO_____

deposition_____EXO_____

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

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

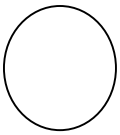
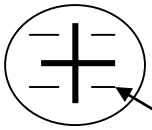
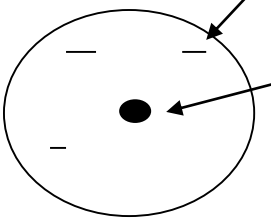
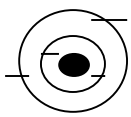
_____19. I can define an ideal gas.	**Definition:** ideal gas –**any gas that conforms to all of the parts of the KMT. Ideal gases are theoretical although some gases are close. Hydrogen and helium are the closest to ideal gases at all temperatures and pressures.**
_____20. I can state the conditions of pressure and temperature under which a gas will act "ideally".	A gas will act most "ideally" under the conditions of __low___ pressure and ___high_____ temperature.
_____21. I can state the two elements that act ideally most of the time.	The two elements that act ideally most of the time are ___hydrogen_____ & _____helium_____.
_____22. I can explain how pressure is created by a gas.	What causes gas molecules to create pressure? **Collisions with the walls of the container.**
_____23. I can state the relationship between pressure and volume for gases (assuming constant temperature).	At constant temperature, as the pressure on a gas increases, the volume ____decreases_____.
_____24. I can state the relationship between temperature and volume for gases (assuming constant pressure).	At constant pressure, as the temperature on a gas increases, the volume _____increases_____.
_____25. I can state the relationship between temperature and pressure for gases (assuming constant volume).	In a fixed container (AKA "has constant volume), as the temperature on a gas increases, the pressure____increases_____.
_____26. I can state Avogadro's Hypothesis.	Avogadro's Hypothesis says two samples of an ideal gas, if they have the same temperature, pressure, and volume, will contain the same number of molecules.
_____27. I can remember to convert ^{O}C to K when using the Combined Gas Law to determine changes in V, P, or T of a gas.	A gas originally occupies 2.3L at 56^{O}C and 101.3 kPa. What will its volume be at 100^{O}C and 105.7 kPa? **2.5 L**

_____28. I can define boiling point and vapor pressure.	**<u>Definition:</u>** boiling point – **the temperature at which the vapor pressure of a liquid equals the pressure surrounding the liquid** 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**
_____29. I can state the condition of pressure that is used for "normal" boiling points.	The normal boiling point of a substance occurs at a pressure of ___1_____atm/_____101.3_____kPa.
_____30. I can state the relationship between atmospheric pressure and boiling point.	As the atmospheric pressure increases, the boiling point ___increases_____.

Unit 4: Atomic Theory

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

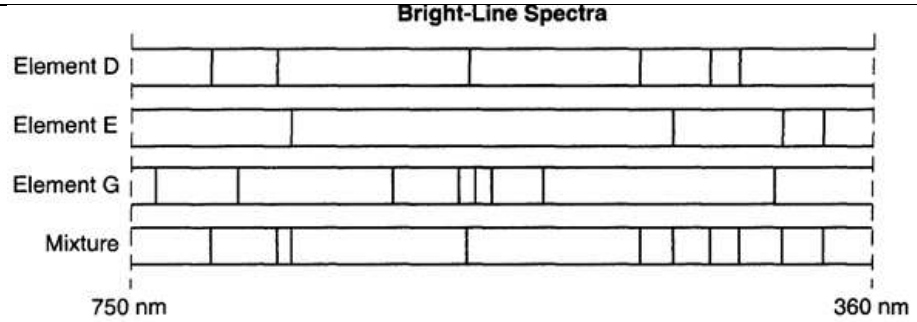
Place a checkmark next to each item that you can do! If a sample problem is given, complete it as evidence.

_____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 describe John Dalton's contribution to our understanding of the atom.	Dalton's Model: **hard sphere model** What it looked like: 
_____5. I can describe JJ Thomson's contribution to our understanding of the atom.	Thomson's Experiment: **cathode ray experiment** Thomson's Model: **plum pudding model** What it looked like: 
_____6. I can describe Ernest Rutherford's contribution to our understanding of the atom.	Rutherford's Experiment: **gold foil experiment** Rutherford's Model: **nuclear model; empty space model** What it looked like:  electrons small, positively charged nucleus
_____7. I can describe Niels Bohr's contribution to our understanding of the atom.	Bohr's Model: **planetary model; electron shell model** What it looked like: 

_____8. I can describe James Chadwick's contribution to our understanding of the atom.	What subatomic particle did Chadwick discover? **neutron**
_____9. I can describe how Schrodinger, Heisenberg, Pauli, Dirac, and others contributed to our understanding of the atom.	What does the modern model of the atom look like?  Where, in an atom, are electrons likely to be found according to the modern model? **orbitals**
_____10. I can state the chronological order of atomic models.	From oldest to newest, list the models that we have used to describe an atom. hard sphere ---> plum pudding ---> empty space ---> electron shell ---> modern model
_____11. I can state the three subatomic particles, their location in an atom, their charges, and their masses (in amu).	<table><tr><th></th><th>Particle #1</th><th>Particle #2</th><th>Particle #3</th></tr><tr><td>**Name**</td><td>***proton***</td><td>***neutron***</td><td>***electron***</td></tr><tr><td>**Charge**</td><td>***+1***</td><td>***0***</td><td>***-1***</td></tr><tr><td>**Mass**</td><td>***1 amu***</td><td>***1 amu***</td><td>***0.0005 amu***</td></tr><tr><td>**Location in Atom**</td><td>***nucleus***</td><td>***nucleus***</td><td>***orbital***</td></tr></table>
_____12. I can explain why atoms are electrically neutral.	Atoms are electrically neutral because the number of __protons___ is equal to the number of ____electrons_____.
_____13. I can define mass number and atomic number.	**Definitions:** mass number – **the total number of protons and neutrons in an atoms** atomic number – **the number of protons in an atom; defines which element the atom is**
_____14. Given the mass number, I can determine the number of protons, neutron, and electrons in an atom.	In an atom of $^{212}_{84}Po$, how many protons are present? **84** In an atom of $^{212}_{84}Po$, how many electrons are present? **84** In an atom of $^{212}_{84}Po$, how many neutrons are present? **128**

_____15. I can use the Periodic Table to determine the atomic number of an element.	How many protons are in an atom of selenium? **34** How many protons are in an atom of silicon? **14**
_____16. I can define isotope.	**Definition:** 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**
_____17. I can represent an atom in any of the four methods of isotopic notation.	Write the four different methods of isotopic notation for an atom of bromine that has 45 neutrons. Method 1 **Br-80** Method 2 **bromine-80** Method 3 **^{80}Br** Method 4 **$^{80}_{35}Br$**
_____18. I can calculate average atomic mass given the masses of the naturally occurring isotopes and the percent abundances.	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? **84.998 amu**
_____19. I can define ion, cation, and anion.	**Definitions:** ion – **an atom that has lost or gained electrons** cation **– a positively charged ion that results from the loss of electrons** anion – **a negatively charged ion that results from the gaining of electrons**
_____20. Given the mass number and the charge, I can determine the number of protons, neutrons, and electrons in an ion.	How many protons are in $^{19}_{9}F^{1-}$? **9** How many neutrons are in $^{19}_{9}F^{1-}$? **10** How many electrons are in $^{19}_{9}F^{1-}$? **10**

_____21. I can define principal energy level, orbital, ground state, excited state, electron configuration, and bright line spectrum.	**Definitions:** principal energy level (PEL)– **main energy level or shell of an atom** orbital – **most probable electron location in the modern mechanical model** ground state – **lowest energy state of an electron; electron configurations on the PT are shown in the ground state** excited state – **any energy state of an electron that is higher than ground state** electron configuration –**the ground state arrangement of electrons in PEL** bright line spectrum – **characteristic colors of light that are given off by an atom when an excited electron releases energy and returns to the ground state**
_____22. I can state the maximum number of electrons that will fit into each of the first four principal energy levels.	PEL1 holds a maximum of ____2_____ electrons. PEL2 holds a maximum of _____8_____ electrons. PEL3 holds a maximum of ____18_____ electrons. PEL4 holds a maximum of ____32_____ electrons.
_____23. I can state the relationship between distance from the nucleus and energy of an electron.	As the distance between the nucleus and the electron increases, the energy of the electron _____increases_____.
_____24. I can state the relationship between the number of the principal energy level and the distance to the atom's nucleus.	As the number of the PEL increases, the distance to the nucleus _increases__.
_____25. I can explain, in terms of subatomic particles and energy states, how a bright line spectrum is created.	A brightline spectrum is created when **electrons in a high energy state release energy and return to a lower energy state**

_____26. I can identify the elements shown in a bright line spectrum.	 Which element(s) is/are present in the mixture? **D & E**
_____27. I can define valence electrons.	**Definition:** valence electron – **the electrons in the outermost s & p suborbitals; the farthest number to the right on the electron configuration on the PT**
_____28. I can locate and interpret an element's electron configuration on the Periodic Table.	How many valence electrons does an atom of rubidium have in the ground state? **1** How many principal energy levels contain electrons in an atom of iodine in the ground state? **6**
_____29. I can identify an electron configuration that shows an atom in the excited state.	Which electron configuration represents an atom of potassium in the excited state? A) 2-8-7-1 B) 2-8-8-1 C) 2-8-7-2 D) 2-8-8-2
_____30. I can draw Lewis electron dot diagrams for a given element.	Draw the Lewis electron dot diagram for the following atoms: Li Be B C N O F Ne
_____31. I can define and state the importance of "octet of valence electrons."	**Definition:** octet of valence electrons – **having 8 valence electrons; a full valence shell** The importance of having a complete"octet of valence electrons" is **it makes the element "stable" and unreactive**

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.

_____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 compare types of radiation in terms of symbol, mass number, charge, penetrating power, shielding required, and biological hazard.

Type	Symbol	Mass #	Charge	Penetrating Power	Shielding Required	Bio Hazard
alpha	α	***4***	***2***	***very low***	***paper, clothing***	***none unless inhaled***
beta	β^-	***0***	***-1***	***low***	***metal foil***	***eyes & skin***
gamma	γ	***0***	***0***	***very high***	***concrete & lead***	***whole body***
neutron	^1_0n	***1***	***0***	***very high***	***water; lead***	***whole body***
positron	β^+	***0***	***+1***	***low***	***metal foil***	***eyes & skin***

_____6. I can identify the three types of nuclear reactions.

The three types of nuclear reactions are:

a. **fission**

b. **fusion**

c. **transmutation**

_____7. I can define transmutation, fission, and fusion.

Definitions:

transmutation **– process of changing one element into another; may be natural or artificial**

fission – **process of splitting apart a large atom (usually U of Pu) into two roughly equal size pieces by hitting it with a neutron**

fusion – **process of putting small nuclei (usually H) together to form a larger nucleus (He)**

_____8. I can state two synonyms for spontaneous decay.	Two synonyms for spontaneous decay are:____natural decay_____ and __natural transmutation__.
_____9. I can show how mass number and electrical charge must be conserved in any nuclear reaction.	Complete the following nuclear equation: $^{42}_{19}\mathrm{K} \rightarrow {}^{42}_{20}\mathrm{Ca} + {}^{0}_{-1}\beta$
_____10. I can explain what makes a nucleus stable or unstable.	The stability of the nucleus is dependent on the ___proton___ to _____neutron_____ ratio.
_____11. I can explain the difference between natural transmutation and artificial transmutation.	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).
_____12. I can identify a natural decay reaction from a list of reactions.	Which equation represents a natural decay? A) $^{9}_{4}\mathrm{Be} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{6}_{3}\mathrm{Li} + {}^{4}_{2}\mathrm{He}$ B) $^{27}_{13}\mathrm{Al} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{30}_{15}\mathrm{P} + {}^{1}_{0}\mathrm{n}$ C) $^{14}_{7}\mathrm{N} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{17}_{8}\mathrm{O} + {}^{1}_{1}\mathrm{H}$ D) $^{235}_{92}\mathrm{U} \rightarrow {}^{231}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He}$
_____13. I can identify an artificial transmutation reaction from a list of reactions.	Which equation represents artificial transmutation? A) $^{16}_{7}\mathrm{N} \rightarrow {}^{16}_{8}\mathrm{O} + {}^{0}_{-1}\mathrm{e}$ B) $^{14}_{7}\mathrm{N} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{17}_{8}\mathrm{O} + {}^{1}_{1}\mathrm{H}$ C) $^{37}_{19}\mathrm{K} \rightarrow {}^{37}_{18}\mathrm{Ar} + {}^{0}_{+1}\mathrm{e}$ D) $^{42}_{19}\mathrm{K} \rightarrow {}^{42}_{20}\mathrm{Ca} + {}^{0}_{+1}\mathrm{e}$
_____14. I can identify a fission reaction from a list of reactions.	Which equation represents fission? A) $^{1}_{0}\mathrm{n} + {}^{235}_{92}\mathrm{U} \rightarrow {}^{142}_{56}\mathrm{Ba} + {}^{91}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n}$ B) $^{226}_{88}\mathrm{Ra} \rightarrow {}^{222}_{86}\mathrm{Rn} + {}^{4}_{2}\mathrm{He}$ C) $^{6}_{3}\mathrm{Li} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{3}_{1}\mathrm{H} + {}^{4}_{2}\mathrm{He}$ D) $^{2}_{1}\mathrm{H} + {}^{3}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n}$
_____15. I can identify a fusion reaction from a list of reactions.	Which equation represents fusion? A) $^{1}_{0}\mathrm{n} + {}^{235}_{92}\mathrm{U} \rightarrow {}^{142}_{56}\mathrm{Ba} + {}^{91}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n}$ B) $^{226}_{88}\mathrm{Ra} \rightarrow {}^{222}_{86}\mathrm{Rn} + {}^{4}_{2}\mathrm{He}$ C) $^{6}_{3}\mathrm{Li} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{3}_{1}\mathrm{H} + {}^{4}_{2}\mathrm{He}$ D) $^{2}_{1}\mathrm{H} + {}^{3}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n}$

_____16. I can state the conditions of temperature and pressure that are needed for a fusion reaction to happen.	The temperature and pressure conditions needed for fusion to happen are: _____high_____ temperature and _____high_____ pressure
_____17. I can explain why all nuclear reactions release LOTS more energy than chemical reactions do.	Nuclear reactions release LOTS more energy than chemical reactions do because **some of the mass is converted to energy**
_____18. Given a list of reactions, I can differentiate a "nuclear" reaction from a "chemical" reaction.	Which of the following equations represent NUCLEAR reactions? A) $H_2O(g) \rightarrow H_2O(\ell)$ B) $C(s) + O_2(g) \rightarrow CO_2(g)$ C) $^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + ^{1}_{0}n$ D) $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{142}_{56}Ba + ^{91}_{36}Kr + 3\ ^{1}_{0}n$
_____19. I can define half-life.	**Definition:** half-life – **the amount of time required for one-half of a radioactive isotope to decay**
_____20. Given the length of the half-life and the amount of time that has passed, I can determine the amount of radioactive sample.	Based on Reference Table N, what fraction of a radioactive sample of Au-198 will remain unchanged after 10.78 days? **1/16** 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) **400 g**
_____21. Given the length of the half-life and the amount of radioactive sample, I can determine the amount of time that has passed.	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? **15.813 years**
_____22. Given the amount of time that has passed and the amount of radioactive sample, I can determine the length of the half-life.	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? **3.82 days**
_____23. Using Table N, I can determine the length of half-life and/or decay mode for a specific radioactive isotope.	Compared to K-37, the isotope K-42 has 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

_____24. I can state 5 beneficial uses for radioactive isotopes.	Five beneficial uses for radioactive isotopes are: **a. radioactive dating** **b. tracing chemical and biological processes** **c. industrial measurement** **d. nuclear power** **e. detection and treatment of disease**
_____25. I can state the scientific use of 4 specific radioactive isotopes.	C-14 is used for _____dating previously living organisms_____ I-131 is used for_____treating thyroid disorders_____ U-238 is used for ____dating geologic formations_____ Co-60 is used for_____treating cancerous tumors_____
_____26. I can state three risks associated with radioactivity and radioactive isotopes.	Three risks associated with radioactivity and radioactive isotopes are: **a. biological exposure** **b. long-term storage and disposal** **c. nuclear accidents**

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.

_____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 classify elements as metals, nonmetals, or metalloids based on their placement on the Periodic Table.	Classify each of the following elements as metals (M), nonmetals (NM), or metalloids (MTLD). __NM___B _____M___K _____M__Li __NM____C __NM___Ar _MTLD__Sb __NM____H ____M___Fe __M_____Au _NM____S _NM____F MTLD____Si ___M____Fr ____NM___He NM_____Rn MTLD___Ge ____M___Al MTLD____As ___M____Bi _NM____I
_____7. I can state the group names for elements in groups 1, 2, 17, and 18.	Group 1 is called the ____alkali metals_____. Group 2 is called the _____alkaline earth metals_____. Group 17 is called the _____halogens_____. Group 18 is called the _____noble gases_____.
_____8. I can explain why elements in the same group have similar chemical properties.	Elements in the same group have similar chemical properties because **they have similar electron configurations; same number of valence electrons**
_____9. I can explain why the elements in Group 18 don't usually react with other elements.	Elements in Group 18 don't usually react with other elements because **they have a stable octet of valence electrons**
_____10. I can state the meaning of "STP" and the Reference Table on which it can be found.	STP stands for _standard temperature and pressure_____. The values can be found on Reference Table____B_____.
_____11. I can state the names/symbols for the two elements on the Periodic Table that are liquids at STP.	The two elements that are liquids at STP are: ____mercury_____ and _____bromine_____

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

_____16. I can state the periodic trend for electronegativity and explain why it occurs.	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._____. 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_____.
_____17. I can state the periodic trend for first ionization energy and explain why it occurs.	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._____. 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_____.
_____18. I can state the periodic trend for atomic radius and explain why it occurs.	As one reads down a group from top to bottom, atomic radius ____increases_____ because __there are more PEL._____ _____. 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>
_____19. I can state the periodic trend for metallic character and explain why it occurs.	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._____. 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. _____.
_____20. I can state the trend for melting points and boiling point for METALS as one reads down a group.	As one reads down a group from top to bottom, the melting points and boiling points for METALS __decreases_____.
_____21. I can state the trend for melting points and boiling point for NONMETALS as one reads down a group.	As one reads down a group from top to bottom, the melting points and boiling points for NONMETALS ___increases_____.

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

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.

<table>
<tr><td>_____1. I can still do everything from Unit 1.</td><td></td></tr>
<tr><td>_____2. I can still do everything from Unit 2.</td><td></td></tr>
<tr><td>_____3. I can still do everything from Unit 3.</td><td></td></tr>
<tr><td>_____4. I can still do everything from Unit 4.</td><td></td></tr>
<tr><td>_____5. I can still do everything from Unit 5.</td><td></td></tr>
<tr><td>_____6. I can still do everything from Unit 6.</td><td></td></tr>
<tr><td>_____7. I can use two different systems to define acids and bases.</td><td>
<table>
<tr><th></th><th>Arrhenius</th><th>“Alternate Method” (AKA Bronsted-Lowry)</th></tr>
<tr><td>acid</td><td>any substance that yields H_3O^+ ions as the only positive ion in solution</td><td>any substance that donates protons</td></tr>
<tr><td>base</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>
</table>
</td></tr>
<tr><td>_____8. I can define pH, [ ], hydronium ion, hydroxide ion, and electrolyte.</td><td>Definitions:
pH – measure of the acidity or alkalinity of a solution

[ ] - concentration

hydronium ion – H_3O^+ AKA hydrogen ion, H^+; found in higher concentrations in acids

hydroxide ion – OH^- ion; found in higher concentration in bases

electrolyte – any substance that conducts electricity when dissolved in water</td></tr>
</table>

<table>
<tr><td>_____9. I can state another name for the hydronium ion.</td><td>The hydronium ion is also known as the _____hydrogen ion, H^+.</td></tr>
<tr><td>_____10. Given the hydronium ion concentration, I can determine the pH.</td><td>If the $[H_3O^+]$ is 1 x 10^{-8}, the pH of the solution will be___8____.

If the $[H_3O^+]$ is 1 x 10^{-1}, the pH of the solution will be____1___.

If the $[H_3O^+]$ is 1 x 10^{-14}, the pH of the solution will be__14____.

If the $[H_3O^+]$ is 1 x 10^{-7}, the pH of the solution will be___7____.</td></tr>
<tr><td>_____11. Based on pH, I can determine if a solution is acidic, basic, or neutral.</td><td>If the pH of a solution is 4.5, the solution is _____acidic_____.

If the pH of a solution is 7.0, the solution is _____neutral_____.

If the pH of a solution is 11, the solution is _____basic_____.

If the pH of a solution is 5.7, the solution is _____acidic_____.</td></tr>
<tr><td>_____13. I can state the relationship between H^+ concentration and pH.</td><td>As the H^+ concentration decreases , the pH _____increases_____.

As the H^+ concentration increases, the pH _____decreases_____.</td></tr>
<tr><td>_____14. I can determine the change in pH when the H^+ concentration of a solution is changed.</td><td>If the H^+ concentration is increased by a factor of 10,

the pH will decrease by ____1_____.

If the H^+ concentration is increased by a factor of 100,

the pH will decrease by _____2_____.

If the H^+ concentration is decreased by a factor of 1000,

the pH will increase by _____3_____.</td></tr>
<tr><td>_____15. I can give examples of the chemical names of common acids and bases.</td><td>List the chemical names of three common acids and three common bases.
<table>
<tr><th>Acids</th><th>Bases</th></tr>
<tr><td>hydrochloric acid</td><td>sodium hydroxide</td></tr>
<tr><td>phosphoric acid</td><td>potassium hydroxide</td></tr>
<tr><td>sulfuric acid</td><td>ammonia</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>_____16. I can give examples of chemical formulas of common acids and bases.</td><td>List the chemical formulas of three common acids and three common bases.<table><tr><th>Acids</th><th>Bases</th></tr><tr><td>HCl</td><td>NaOH</td></tr><tr><td>H_2SO_4</td><td>KOH</td></tr><tr><td>H_3PO_4</td><td>NH_3</td></tr></table></td></tr>
<tr><td>_____17. I can define neutralization.</td><td><u>Definition:</u>
neutralization – double replacement reaction between an acid and a base producing water and a salt</td></tr>
<tr><td>_____18. I can identify a neutralization reaction from a list of reactions.</td><td>Which of the following equations is a neutralization reaction?

A) $6Na + B_2O_3$ -----> $3Na_2O + 2B$
B) $Mg(OH)_2 + 2HBr$ -----> $MgBr_2 + 2HOH$
C) $2H_2 + O_2$ -----> $2H_2O$
D) $2KClO_3$ -----> $2KCl + 3O_2$</td></tr>
<tr><td>_____19. I can state the name of the laboratory equipment that is used to carry out a titration.</td><td>Which piece of laboratory equipment is used to carry out a titration?
burette</td></tr>
<tr><td>_____20. I can state the purpose of titration.</td><td>Why do scientists do titrations?

To determine the concentration of an unknown acid or base</td></tr>
<tr><td>_____21. I can solve for any variable in the titration equation from Reference Table T.</td><td>If it requires 56.95 mL of 0.0043 M HNO_3 to neutralize 34.56 mL of LiOH, what is the concentration of the LiOH?

0.00071 M</td></tr>
<tr><td>_____22. I can state the three types of substances that are electrolytes.</td><td><u>Acids</u>, <u>bases</u>, and <u>salts</u> are three classes of compounds that are electrolytes.</td></tr>
<tr><td>_____23. Given the pH, I can determine the color of acid-base indicators.</td><td>Which indicator is red in a solution that has a pH of 3.6?

A) bromcresol green
B) bromthymol blue
C) litmus
D) thymol blue</td></tr>
</table>

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	**Definitions:** oxidation – **loss of electrons** reduction – **gain of electrons** oxidation number – **the oxidation state; an indicator of the oxidation of an element** redox reaction – **any reaction in which a reduction and oxidation occurs**
_____9. I can assign oxidation numbers to any element.	Assign oxidation number to each of the elements below. O_2_____0_____ Li_____0_____ Si_____0_____
_____10. I can assign oxidation numbers to the elements in a compound.	Assign oxidation numbers to each element in the compounds below. $MnCl_3$: Mn_____+3_____ Cl_____-1_____ H_2SO_4: H_____+1_____ S_____+6_____ O_____-2_____
_____11. I can assign oxidation numbers to the elements in a polyatomic ion.	Assign oxidation numbers to each element in the polyatomic ions below. PO_4^{3-}: P_____+5_____O_____-2_____ ClO_3^-: Cl_____+5_____O_____-2_____

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

_____15. I can balance a redox reaction.	Given the reaction: _____$Cl_2(g)$ + _____$Fe^{2+}(aq)$ -----> _____$Fe(s)$ + _____$Cl^-(aq)$ When the equation is correctly balanced using smallest whole numbers, the coefficient of Cl^- will be A) 1 B) 2 C) 6 D) 7 ..... Which simple oxidation-reduction reaction is *not* correctly balanced? A) $Sn(s) + Cu^{2+}(aq) \rightarrow Cu(s) + Sn^{2+}(aq)$ B) $Ni(s) + Sn^{2+}(aq) \rightarrow Sn(s) + Ni^{2+}(aq)$ C) $2\ I^-(aq) + Fe^{3+}(aq) \rightarrow Fe^{2+}(aq) + I_2(s)$ D) $2\ I^-(aq) + Hg^{2+}(aq) \rightarrow Hg(\ell) + I_2(s)$ ..... Given the balanced equation: $3\ Fe^{3+}(aq) + Al(s) \rightarrow 3\ Fe^{2+}(aq) + Al^{3+}(aq)$ What is the total number of moles of electrons lost by 2 moles of Al(s)? A) 1 mole B) 6 moles C) 3 moles D) 9 moles
_____16. I can identify a redox reaction from a list of chemical reactions.	Which balanced equation represents a redox reaction? A) $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$ B) $H_2CO_3(aq) \rightarrow H_2O(\ell) + CO_2(g)$ C) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(\ell)$ D) $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ ..... Which balanced equation represents a redox reaction? A) $PCl_5 \rightarrow PCl_3 + Cl_2$ B) $KOH + HCl \rightarrow KCl + H_2O$ C) $LiBr \rightarrow Li^+ + Br^-$ D) $Ca^{2+} + SO_4{}^{2-} \rightarrow CaSO_4$
_____17. From a list of given list of elements, I can determine which element is most active.	Which of the following elements is most likely to react? A) Cu B) Al C) Li D) Mg

_____18. I can state the two types of electrochemical cells.

The two types of electrochemical cells are:

___voltaic_____ and _____electrolytic_____

_____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.

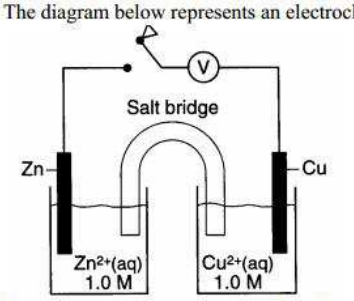
	Voltaic	**Electrolytic**
Components	salt bridge anode cathode electrolyte	power supply anode cathode electrolyte
Oxidation occurs at the	anode	anode
Reduction occurs at the	cathode	cathode
Electrons flow from	anode to cathode	anode to cathode
Energy conversion that occurs in this cell	chemical energy is converted to electrical energy	electrical energy is converted to chemical energy
Is this reaction spontaneous or does it require an outside power source to happen?	spontaneous	requires and outside power source

_____20. I can state the purpose of the salt bridge in a voltaic cell.

The purpose of the salt bridge is **to allow for the migration/movement of ions**

_____21. Given an electrochemical cell, I can predict the direction of electron flow.

The diagram below represents an electrochemical cell.



What occurs when the switch is closed?

A) Zn is reduced.
B) Cu is oxidized.
C) Electrons flow from Cu to Zn.
D) Electrons flow from Zn to Cu.

_____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.

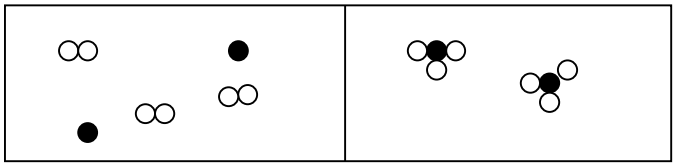
Explain, in terms of atoms and ions, why the mass of the cathode increases during the operation of an electrochemical cell.
The mass of the cathode increases because ions from the solution get reduced to atoms and become part of the cathode.
Explain, in terms of atoms and ions, why the mass of the anode decreases during the operation of an electrochemical cell.
The mass of the anode decreases because atoms from the cathode get oxidized into ions and become part of the solution.

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.	Write the chemical formula for the following compounds: sodium bromide____NaBr_____ lithium selenide_____Li_2Se_____ iron (III) fluoride_____FeF_3_____ vanadium (V) oxide_____V_2O_5_____
_____10. Given the chemical formula, I can write the IUPAC name for binary compounds.	Write the IUPAC name for the following compounds: CrO_____chromium (II) oxide_____ MgI_2_____magnesium iodide_____
_____11. Given the IUPAC name, I can write the chemical formula for ternary compounds.	Write the chemical formula for the following compounds: calcium oxalate_____CaC_2O_4_____ nickel (II) thiosulfate_____NiS_2O_3_____
_____12. Given the chemical formula, I can write the IUPAC name for ternary compounds.	Write the IUPAC name for the following compounds: $Sn(C_2H_3O_2)_2$_____tin (II) acetate_____ $(NH_4)_3PO_4$_____ammonium phosphate_____
_____13. I can state the three types of chemical formulas.	The three types of chemical formulas are: ____empirical_____, _____molecular_____, & _____structural_____

_____14. I can define empirical formula, molecular formula, and hydrate.	**Definitions:** empirical formula – **lowest whole number ratio between the elements in a compound** molecular formula – **the actual ratio of elements in a compound; the true formula** hydrate – **a compound that has one of more molecules of water associated with it**
_____15. Given the empirical formula and the molar mass, I can determine the molecular formula of a compound.	What is the molecular formula of a compound that has the empirical formula of CH and a molar mass of 78 g/mol. **C_6H_6**
_____16. I can use particle diagrams to show conservation of mass in a chemical equation.	Using the symbols shown below, complete the equation below to illustrate conservation of mass. ● = Al ○ = Br $2Al + 3Br_2 \text{ -----> } 2AlBr_3$ 
_____17. I can balance a chemical equation showing conservation of mass using the lowest whole number coefficients.	Balance the following chemical equation using the lowest whole number coefficients. _____$Al_2(SO_4)_3$ + __3__$Ca(OH)_2$ -----> __2__$Al(OH)_3$ + __3__$CaSO_4$
_____18. Given a partially balanced equation, I can predict the missing reactant or product.	Use the law of conservation of mass to predict the missing product. $2NH_4Cl + CaO \text{ -----> } 2NH_3 +$ ____H_2O_____ $+ CaCl_2$
_____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.	Classify the following reactions as synthesis, decomposition, single replacement, or double replacement. A) $Mg + 2AgNO_3 \rightarrow Mg(NO_3)_2 + 2Ag$ ____SR____ B) $2Mg + O_2 \rightarrow 2MgO$ _____ C) $MgCO_3 \rightarrow MgO + CO_2$ ____S____ D) $MgCl_2 + 2AgNO_3 \rightarrow 2AgCl + Mg(NO_3)_2$ ____D____

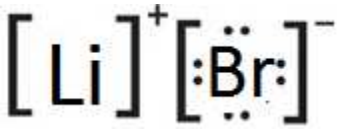
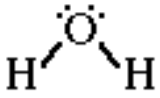
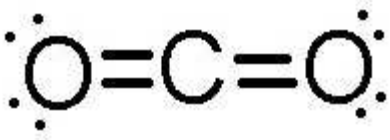
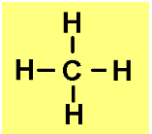
_____20. Given a balanced equation, I can state the mole ratios between any of the reactants and/or products.	Given the following balanced equation, state the mole ratios between the requested substances. $C_3H_8(g) + 5O_2(g) \text{ -----> } 3CO_2(g) + 4H_2O(l)$ The mole ratio between C_3H_8 and O_2 is __1____C_3H_8:____5__O_2. The mole ratio between C_3H_8 and CO_2 is ___1___C_3H_8:__3____CO_2. The mole ratio between C_3H_8 and H_2O is ___1___C_3H_8:___4___H_2O. The mole ratio between CO_2 and O_2 is __3____CO_2:__5____O_2. The mole ratio between H_2O and CO_2 is __4____H_2O:___3___CO_2.
_____21. I can define stoichiometry.	**Definition:** stoichiometry – **the calculations of the quantities in chemical reactions**
_____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.	Using the equation from question #20, determine how many moles of O_2 are needed to completely react with 7.0 moles of C_3H_8. **35 moles** Using the equation from question #20, determine how many moles of CO_2 are produced when 7.0 moles of C_3H_8 completely react. **21 moles**
_____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.	Using the equation from question #20, determine how many liters of O_2 at STP are needed to react completely with 88.0 g of C_3H_8. **224 L** Using the equation from question #20, determine how many grams of H_2O are produced when 88.0 g of C_3H_8 completely react. **72 g**

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.	**Definition:** ionic bond covalent bond metallic bond

_____14. I can define ionic and covalent bonds based on what happens to the valence electrons.	**Definition:** In an ionic bond, the valence electrons of the ___metal_____are __transferred_____ to the __nonmetal_____ so that each atom attains a stable octet (like noble gases). In a covalent bond, the valence electrons of the two ___nonmetals_____ are ____shared_____ so that each atom attains a stable octet (like noble gases).
_____15. I can explain TICS as it relates to chemical bonding.	TICS stands for __transferred ionic, covalent shared___. It helps me remember what happens to the electrons in each type of bond.
_____16. In terms of valence electrons, I can find similarities and differences between the bonding in several substances.	Explain, in terms of valence electrons, why the bonding in methane (CH_4) is similar to the bonding in water (H_2O). **In both CH_4 & H_2O the valence electrons are shared to form covalent bonds.** Explain, in terms of valence electrons, why the bonding in HCl is different than that bonding in NaCl. **In HCl the valence electrons are shared to form a covalent bond. In NaCl, the valence electrons are transferred from the Na to the Cl to form an ionic bond.**
_____17. I can draw a Lewis dot diagram to represent an ionic compound.	Draw Lewis dot diagrams for the following ionic compounds. LiBr  $CaCl_2$ 
_____18. I can draw a Lewis dot diagram to represent a molecular (covalently bonded) compound.	Draw Lewis dot diagrams for the following molecular substances. H_2O  CO_2  I_2  CH_4 

_____ 19. I can state the number of electrons that are shared in single and multiple covalent bonds.	In a single covalent bond, _____2_____ electrons are shared. In a double covalent bond, ___4_____ electrons are shared. In a triple covalent bond, ___6_____ electrons are shared.6
_____20. I can explain why the Lewis dot diagrams of ionic compounds have brackets and the Lewis dot diagrams of molecular compounds do not.	Lewis dot diagrams for ionic compounds have brackets because the elements involved in the bond have charges_____. Lewis dot diagrams for molecular compounds do NOT have brackets because _the electrons are shared and there are no charges_____.
_____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.	Polyatomic ions have ___covalent_____ bonding because ____nonmetals are sharing valence electrons_____.
_____22. Given the chemical formula for a compound, I can determine the type(s) of bonding in the compound.	State the type(s) of bonding in the following compounds: NaCl_ionic_____ CO____covalent_____ Hg____metallic_____ Na_3PO_4____ionic_____&____covalent_____
_____ 23. I can explain and apply the meaning of BARF as is applies to chemical bonding.	BARF stands for "broken absorbed, released formed" This means that when a bond is FORMED, energy is __released_____ and when a bond is BROKEN, energy is ___absorbed_____. Given the balanced equation: $N + N \text{ -----> } N_2$ Which statement describes the process represented by this equation? A) A bond is formed as energy is absorbed. 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.
_____24. I can explain the difference between a polar covalent bond and a nonpolar covalent bond in terms of the types of nonmetals involved.	Polar covalent bonds are formed when __two different_____ nonmetals share electrons unevenly. Nonpolar covalent bonds form when ____two of the same_____ nonmetals share electrons evenly.
_____25. I can explain how to determine the degree of polarity of a covalent bond.	The degree of polarity of a covalent bond is determined by the _electronegativity difference_____ between the elements. .

_____26. I can explain why one covalent bond is more or less polar than another covalent bond, based on electronegativity difference.	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. **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.**
_____27. I can define symmetrical and asymmetrical.	**Definition:** symmetrical – **molecule that has the at least two lines of symmetry** asymmetrical – **molecule that does not have lines of symmetry**
_____28. I can state, in order, the three questions that are asked to determine if a MOLECULE is polar or nonpolar.	When determining if a MOLECULE is polar or non-polar, the first question to ask is___"Is there more than one polar bond?"_____ When determining if a MOLECULE is polar or non-polar, the second question to ask is___"Does the central atom have unshared pairs of electrons?"_____ When determining if a MOLECULE is polar or non-polar, the third question to ask is____"Is the molecule symmetrical?"_____
_____29. I can explain and apply the meaning of SNAP as it applies to determining molecule polarity.	SNAP means__"symmetrical nonpolar, asymmetrical polar"_____ Why is a molecule of CH_4 nonpolar even though the bonds between the carbon and hydrogen are polar? A) The shape of the CH_4 molecule is symmetrical. B) The shape of the CH_4 molecule is asymmetrical. C) The CH_4 molecule has an excess of electrons. D) The CH_4 molecule has a deficiency of electrons. Explain, in terms of charge distribution, why a molecule of water (H_2O) is polar. **A water molecule has asymmetrical distribution of charge.**

_____30. I can determine if a molecular is polar or nonpolar.	Determine which molecules are polar and which are nonpolar. Justify your answer. H_2O — polar; central atom has unshared electrons CO_2 — nonpolar; symmetrical I_2 — nonpolar; no polar bonds CH_4 — nonpolar; symmetrical
_____31. I can explain and apply the expression "like dissolves like" and give an example.	"Like dissolves like" means **if two substances have the same polarity (polar or nonpolar), they will dissolve in one another** An example of "like dissolving like" is ___ammonia dissolving in water___ _____ Explain, in terms of molecular polarity, why ammonia is more soluble than methane in water at 20^oC at standard pressure. **Both ammonia and water are polar so ammonia dissolves in water. Methane is nonpolar and therefore will not dissolve well in polar water.**
_____32. I can define intramolecular forces and intermolecular forces and give examples of each.	**Definition:** Intramolecular forces – **forces of attraction within a molecule** Examples: **ionic bonds and covalent bonds** Intermolecular forces – **forces of attraction between molecules** Examples: dipole-dipole, London dispersion forces (van der waals), hydrogen bonds
_____33. I can list the intramolecular forces from STRONGEST to WEAKEST.	**Strongest**____covalent___bonds>_____ionic____bonds **Weakest**

_____34. I can list the intermolecular forces from STRONGEST to WEAKEST.	**Strongest**____hydrogen bonds_____> _____dipole-dipole_____> _____London dispersion forces (van der waals)_____ **Weakest**
_____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.	Eight physical properties that are dependent on the type of bonding and the strength of the IMF are: 1._physical state_____ _ 2.__melting point_____ 3._boiling point_____ 4.___conductivity_____ 5._vapor pressure_____ 6.___malleability_____ 7.__solubility_____ 8.___hardness_____
_____36. I can state the relationship between polarity and IMF strength.	As the polarity of the molecule ___increases_____, the strength of the IMF _____increases_____.
_____37. I can state the relationship between size of the molecule and IMF strength.	As the size of the molecule_____increases_____, the strength of the IMF _____increases_____.
_____38. Given the physical state of some substances, I can compare the relative strength of the IMF.	At STP, iodine (I_2) is a crystal and fluorine (F_2) is a gas. Compare the strength of the IMF in a sample of I_2 at STP to the strength of the IMF in a sample of F_2 at STP. **F_2 has weaker IMF than I_2.**
_____39. Given the boiling points (or freezing points) of some substances, I can compare the relative strength of the IMF.	At STP, CF_4 boils at -127.8^{o}C and NH_3 boils at -33.3^{o}C. Which substance has stronger IMF? Justify your answer. **NH_3 has stronger IMF because NH_3 has a higher boiling point.**
_____40. I can explain and apply the meaning of "Hydrogen bonding is FON".	"Hydrogen bonding is FON" means__Hydrogen bonding occurs when the__ _molecule contains fluorine, oxygen, or nitrogen._____ Which compound has hydrogen bonding between its molecules? A) CH_4 B) CaH_2 C) KNO_3 D) H_2O

_____41. I can define normal boiling point, vapor pressure, volatile, and nonvolatile.	**Definition:** normal boiling point – **the temperature at which a substance boils at 1 atm pressure** 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** volatile – **easily evaporated at normal temperatures** nonvolatile – **not easily evaporated at normal temperatures**
_____42. I can determine the vapor pressure of ethanol, ethanoic acid, propane, or water at a given temperature.	What is the vapor pressure of ethanol at 56^{O}C? **49 kPa**
_____43. I can state the relationship between the strength of IMF and vapor pressure.	As the strength of IMF ___increases_____, vapor pressure _____increases_____.
_____44. I can explain the how adding a nonvolatile solute to a pure solvent affects the freezing point of the solvent.	When a nonvolatile solute is added to a solvent, the freezing point of the solvent ___is lowered_____ because the solute ___disrupts_____ _crystal formation_____ The more solute that is added, the ___lower_____ the feeezing point gets.
____45. I can explain the how adding a nonvolatile solute to a pure solvent affects the boiling point of the solvent.	When a nonvolatile solute is added to a solvent, the boiling point of the solvent _____is raised_____ because the solute __increases_____ _attractions between solute and solvent particles_____ The more solute that is added, the ___higher_____ the boiling point gets.

_____46. I can state 5 physical properties of ionic substances.	Five physical properties of ionic substances are: 1.__have ionic bonding _____ 2.__have high mp_____ 3. __have high bp_____ 4.__low vapor pressure_____ 5.___conduct electricity as liquids or aqueous_____
_____47. I can identify a substance as "ionic" based on its properties.	A solid substance was tested in the laboratory. The results are shown below. *dissolves in water *is an electrolyte * has a high melting point Based on these results, the solid substance could be A) Hg (B) AuCl C) CH_4 D) $C_{12}H_{22}O_{11}$ Based on bond type, which compound has the highest melting point? A) CH_4 B) $C_{12}H_{22}O_{11}$ (C) NaCl D) C_5H_{12}
_____48. I can state 5 physical properties of molecular substances.	Five physical properties of molecular substances are: 1.__have covalent bonding _____ 2.__have low mp_____ 3. __have low bp_____ 4.__high vapor pressure_____ 5.___do NOT conduct electricity _____

_____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_2O (grams per 100.0 g H_2O 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

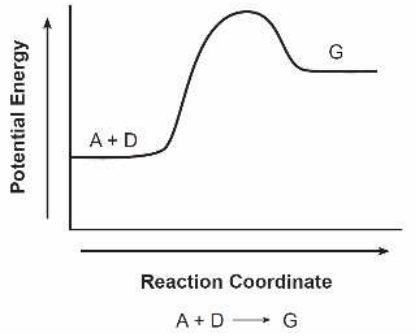
Unit 12: Reaction Rates & Equilibrium

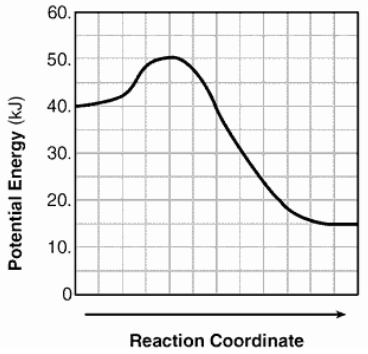
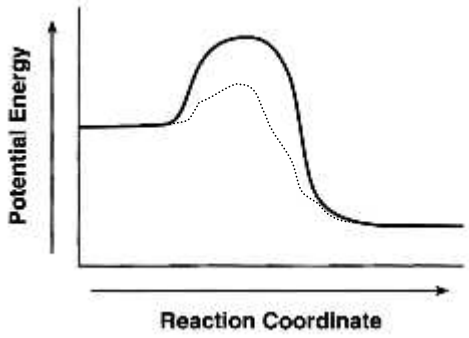
If you can do all the things listed below, you are ready for the Unit 12 test.

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

_____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 define effective collision and collision theory	**Definition:** effective collision – **a collision between two reactants that have the proper orientation and sufficient energy to overcome the activation energy barrier** collision theory – **substances must sustain effective collisions in order for chemical reactions to occur**
_____12. I can state and apply the relationship between temperature and reaction rate in terms of collision theory.	As the temperature ____increases________, the reaction rate for most chemical reactions _____increases__________ because there are __more_ effective collisions between particles. - Given the reaction: $2Mg(s) + O_2(g)$ -----> $2MgO(s)$ At which temperature would the reaction occur at the greatest rate? A) 0^oC B) 15^oC (C) 95^oC D) 273K

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

_____19. I can define potential energy diagram, reaction coordinate, $PE_{reactant}$, $PE_{product}$, heat of reaction (ΔH), 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** $PE_{reactant}$ **– potential energy of the reactant** $PE_{product}$ **– potential energy of the product** heat of reaction (ΔH) – **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.**

_____21. Given a potential energy diagram, I can determine the $PE_{reactant}$, $PE_{product}$, ΔH, and activation energy.	Given the potential energy diagram below, determine the $PE_{reactant}$, $PE_{product}$, ΔH, and the activation energy.  $PE_{reactant}$ = **40 kJ** $PE_{product}$ = **15 kJ** ΔH = **-25kJ** activation energy = **10 kJ**
_____22. Given a potential energy diagram for an uncatalyzed reaction diagram, I can how the diagram will change when a catalyst is been added.	Draw a dotted line on the potential energy diagram shown below to indicate how it will change if a catalyst is added. 
_____23. I can rank the three phases of matter from least entropy to most entropy.	Least entropy Most entropy ___solids_____<_____liquids_____<_____gases_____
_____24. I can state the trends in nature for entropy and energy.	In nature most systems in nature tend to undergo reactions that have a(n) _____increase_____ in entropy and a(n) ____decrease_____ in energy. As Mrs. S says, nature is like a teenager ---- lazy and messy!

_____25. Given a balanced equation, I can determine if the reaction results in an overall increase or decrease in entropy.	Which reaction results in an increase in entropy? A) $CO_2(g) \rightarrow CO_2(s)$ B) $H_2O(\ell) \rightarrow H_2O(s)$ C) $Ca(s) + 2\ H_2O(\ell) \rightarrow Ca(OH)_2(aq) + H_2(g)$ D) $NaCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NaNO_3(aq)$ --- Which equation shows an increase in entropy? A) $CO_2(g) \rightarrow CO_2(s)$ B) $CO_2(\ell) \rightarrow CO_2(g)$ C) $CH_3OH(\ell) \rightarrow CH_3OH(s)$ D) $CH_3OH(g) \rightarrow CH_3OH(\ell)$ --- Which reaction has the greatest increase in entropy? A) $2\ H_2O(\ell) \rightarrow 2\ H_2(g) + O_2(g)$ B) $2\ H_2O(g) \rightarrow 2\ H_2(g) + O_2(g)$ C) $H_2O(g) \rightarrow H_2O(\ell)$ D) $H_2O(\ell) \rightarrow H_2O(s)$
_____26. I can define forward reaction, reverse reaction, reversible reaction, and closed system	**Definitions:** forward reaction – **the chemical reaction read from left to right** reverse reaction – **the chemical reaction read from right to left** reversible reaction – **a chemical reaction that can proceed from both left to right and right to left** closed system – **a system in which reactants and products are trapped and may not enter or leave**
_____27. I can state the three types of equilibrium.	The three types of equilibrium are: ___Phase_____ equilibrium ____Chemical/reaction_____ equilibrium and ____Solution_____ equilibrium

_____28. I can state two conditions that apply to all systems at equilibrium.

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_____.

_____29. Given a list of reactions, I can identify reactions that show equilibrium (chemical, phase, or solution).

Which balanced equation represents phase equilibrium?

A) $H_2(g) + I_2(s) \text{ <-----> } 2HI(g)$

B) $I_2(s) \text{ <-----> } I_2(g)$

C) $KCl(s) \xleftrightarrow{H_2O} KCl(aq)$

D) $2KCl(s) + 3O_2(g) \text{ -----> } 2KClO_3$

Which balanced equation represents solution equilibrium?

A) $H_2(g) + I_2(s) \text{ <-----> } 2HI(g)$

B) $I_2(s) \text{ <-----> } I_2(g)$

C) $KCl(s) \xleftrightarrow{H_2O} KCl(aq)$

D) $2KCl(s) + 3O_2(g) \text{ -----> } 2KClO_3$

Which balanced equation represents chemical equilibrium?

A) $H_2(g) + I_2(s) \text{ <-----> } 2HI(g)$

B) $I_2(s) \text{ <-----> } I_2(g)$

C) $KCl(s) \xleftrightarrow{H_2O} KCl(aq)$

D) $2KCl(s) + 3O_2(g) \text{ -----> } 2KClO_3$

_____30. In terms of saturation, I can describe a solution that is at equilibrium.

In terms of saturation, a solution that is at equilibrium must be ____saturated_____.

_____31. I can state LeChatelier's Principle.

LeChatelier's Principle states **when subjected to a stress, systems at equilibrium will shift to relieve the stress**

_____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.

Given the reaction at equilibrium:

$2SO_2(g) + O_2(g) \text{ <-----> } 2SO_3(g) + 392kJ$

Predict the direction of shift in the equilibrium (right, left, no shift) when the following changes are made to the system.

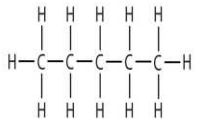
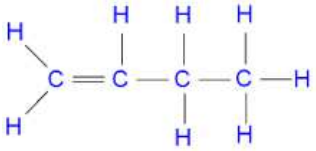
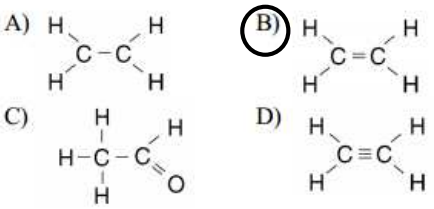
Change	Direction of Shift
Increase concentration of SO_2	**right**
Increase concentration of SO_3	left
Increase temperature	left
Increase pressure	right
Add a catalyst	no shift

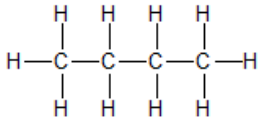
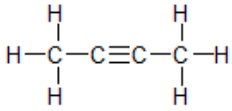
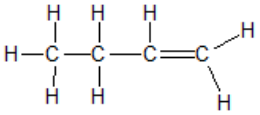
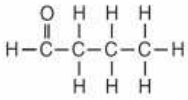
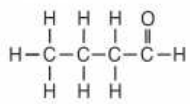
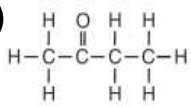
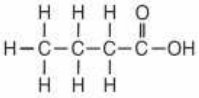
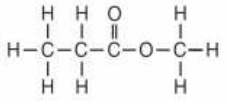
Unit 13: Organic Chemistry

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.

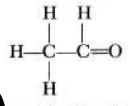
_____1. I can still do everything from Unit 1.	
_____2. I can still do everything from Unit 2.	
_____3. I can still do everything from Unit 3.	
_____4. I can still do everything from Unit 4.	
_____5. I can still do everything from Unit 5.	
_____6. I can still do everything from Unit 6.	
_____7. I can 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.	**Definitions:** organic compound **– all carbonate containing compounds except CO, CO_2, and carbonates** saturated hydrocarbon – **a compound containing only C and H in which each carbon atom has 4 single bonds** unsaturated hydrocarbon - **a compound containing only C and H in which there is at least one double bond (possibly triple) between C atoms** isomer –**two organic compounds that have the same molecular formula, but different structural formula and therefore different physical and chemical properties**

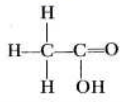
_____13. I can expand a condensed structural formula to show the structural formula of an organic compound.	Draw the complete structural formula for $CH_3CH_2CH_2CH_2CH_3$.  Draw the complete structural formula for $CH_3CHCHCH_3$. 
_____14. I can state the name and symbol of the element that is capable of forming rings, chains, and networks.	The element that is capable of forming rings, chains, and networks is _____carbon_____. Its symbol is_____C_____.
_____15. I can explain the meaning of and apply HONC1234.	HONC1234 tells me that **Hydrogen forms 1 bond. Oxygen forms 2 bonds. Nitrogen forms 3 bonds. Carbon forms 4 bonds.** Which structural formula *correctly* represents a hydrocarbon molecule? 
_____16. Given the formula, I can determine if a compound is a hydrocarbon or not.	Which formula represents a hydrocarbon? A) $CH_3CH_2CH_2CHO$ B) $CH_3CH_2CH_2CH_3$ C) $CH_3CH_2CH_2COOH$ D) $CH_3CH_2COOCH_3$
_____17. Given the name, I can use Reference Table P to determine how many carbons atoms are in a compound.	Determine how many carbon atoms are in each of the following compounds: decane_____10_____ ethene_____2_____ 3-nonene_____9_____ 1-pentyne_____5_____
_____18. Given the name, I can use Reference Table Q to determine to which class of hydrocarbons a compound belongs.	Determine the homologous series of hydrocarbons to which each of the following belongs: decane____alkane_____ 2-decene_____alkene_____ 3-nonene___alkene_____ 1-pentyne_____alkyne_____
_____19. Given the name, I can determine if the hydrocarbon is saturated or unsaturated.	Determine if each of the following is a saturated or unsaturated hydrocarbon. decane_____sat_____ ethene_____unsat_____ 3-nonene_____unsat_____ 1-pentyne_____unsat_____

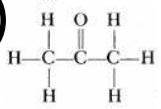
_____20. Given the formula, I can determine to which homologous series a hydrocarbon belongs.	Determine the homologous series of hydrocarbons to which each of the following belongs:  belongs to the ____alkane_____ series.  belongs to the _____alkyne_____ series.  belongs to the _____alkene_____ series.
_____21. Given the formula, I can determine if a hydrocarbon is saturated or unsaturated.	Determine if each of the following is a saturated or unsaturated hydrocarbon. $CH_3CH_2CH_2CH_3$_____sat_____ $CH_3CHCHCH_3$_____nsat_____
_____22.Given the name, I can use Reference Table Q to determine how many hydrogen atoms the hydrocarbon contains.	Determine the number of hydrogen atoms in each of the following. decane_____22_____ 1-butene_____8_____ 3-nonene___18_____ 1-pentyne_____18_____
_____23. Given a list of compounds, I can determine which ones are isomers.	Given a formula representing a compound:  Which formula represents an isomer of this compound? A)  B)  C)  D) 

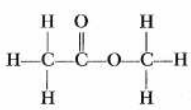
_____24. Given a structural formula, I can use Reference Table R to identify to which class of organic compounds a substance belongs.

Which structural formula represents a ketone?

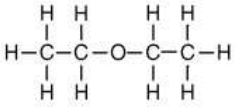
A) 

B) 

C) 

D) 

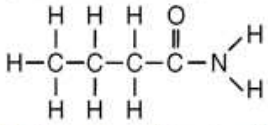
Given the structural formula:



The compound represented by this formula can be classified as an

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

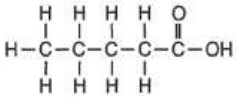
Given the formula:



This compound is classified as

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

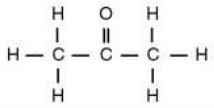
Given the formula for an organic compound:

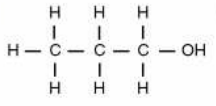


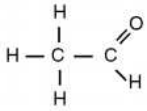
This compound is classified as an

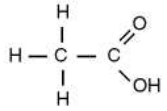
A) aldehyde B) amine
C) ester D) organic acid

Which structural formula represents an alcohol?

A) 

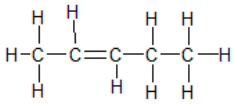
B) 

C) 

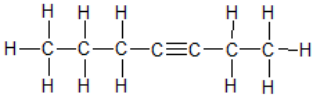
D) 

_____25. I can use Reference Tables P & Q and IUPAC nomenclature to name simple hydrocarbons.

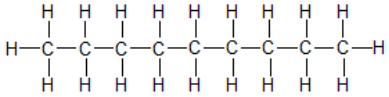
Name the following hydrocarbons.



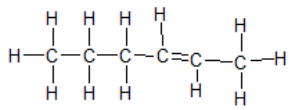
2-pentene



3-heptyne



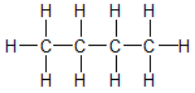
nonane



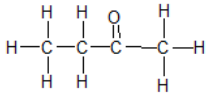
2-hexene

_____26. I can use Reference Tables P & R and IUPAC nomenclature to name simple compounds in any of the classes of organic compounds.

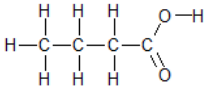
Name the following organic compounds.



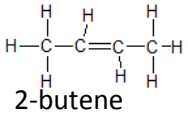
butane



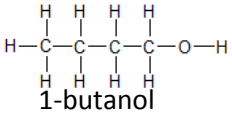
butanone



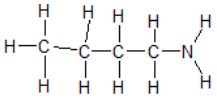
butanoic acid



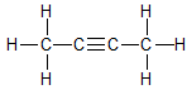
2-butene



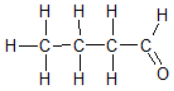
1-butanol



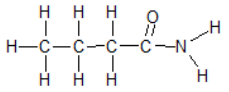
1-butanamine



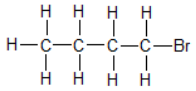
2-butyne



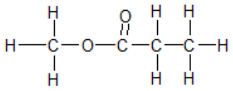
butanal



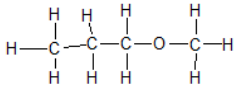
butanamide



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).

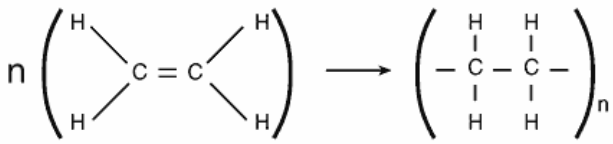
C stands for _____combustion_____. In this type of organic reaction a _____hydrocarbon_____ reacts with ___oxygen_____ to form ___carbon dioxide_____ and _____water_____. It is an exothermic reaction.

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.

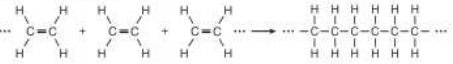
Given the balanced equation for an organic reaction:

$C_2H_2 + 2Cl_2 \rightarrow C_2H_2Cl_4$

This reaction is best classified as

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

Given the equation:



Which type of reaction is represented by this equation?

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

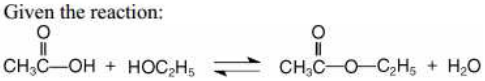
Given the equation:

$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$

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

Given the reaction:



This reaction is an example of

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

Which equation represents fermentation?

A) $C_2H_6 + Cl_2 \rightarrow C_2H_6Cl + HCl$
B) $C_6H_{12}O_6 \rightarrow 2\,C_2H_5OH + 2\,CO_2$
C) $CH_3COOH + CH_3OH \rightarrow CH_3COOCH_3 + H_2O$
D) $nC_2H_4 \rightarrow (C_2H_4)n$

Which reaction best represents the complete combustion of ethene?

A) $C_2H_4 + HCl \rightarrow C_2H_5Cl$
B) $C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$
C) $C_2H_4 + 3\,O_2 \rightarrow 2\,CO_2 + 2\,H_2O$
D) $C_2H_4 + H_2O \rightarrow C_2H_5OH$