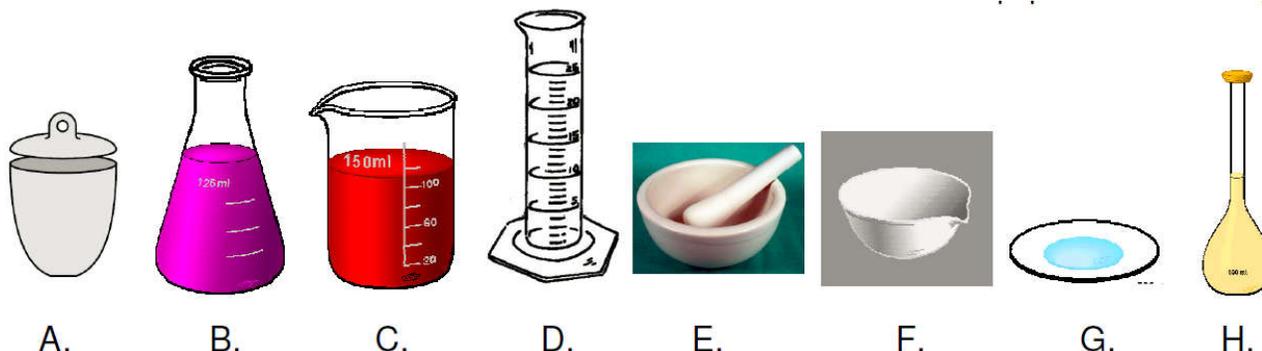


1. Match the following **lab equipment** with its name:



___ beaker ___ evaporating dish ___ Erlenmeyer flask ___ watch glass
 ___ volumetric flask ___ graduated cylinder ___ mortar & pestle ___ crucible

2. Put the following values into correct **scientific notation** and indicate the number of **significant figures** in each measurement.

Measurement	# of significant figures	Scientific Notation
0.00005607 m		
205.00 mL		
345000 J		
0.00300 kg		
250. g		
		$3.159 \times 10^{-3} \text{ L}$
		$2.14 \times 10^4 \text{ mg}$

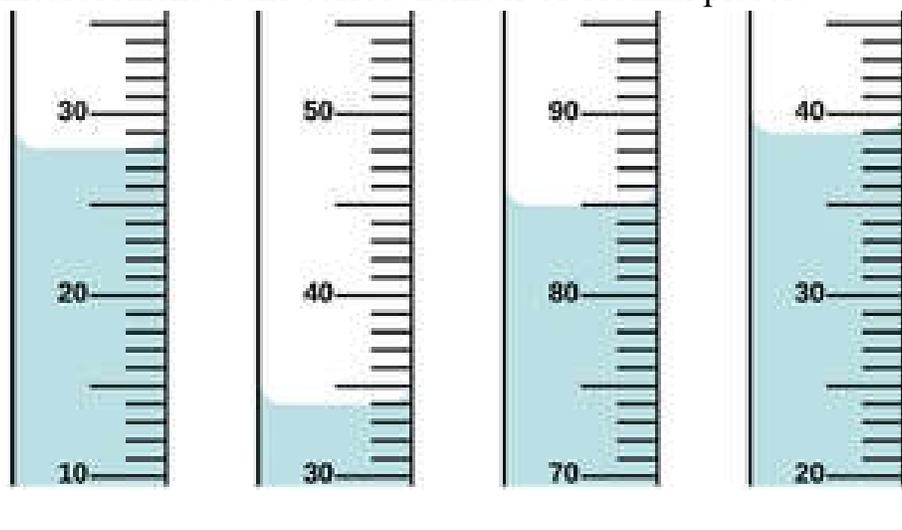
3. Perform the calculations & **round** your answer to the **correct number of significant figures**

Problem	Raw Answer	Rounded Answer
1.35×2.467		
$12.01 + 35.2 + 6$		
$55.46 - 28.9$		
$0.021 \times 3.2 \times 100.1$		

4. The boiling point of water is 100.0°C. Give an example of data for the boiling point (BP) of water that is **PRECISE BUT NOT ACCURATE**:

Trial 1: _____ Trial 2: _____ Trial 3: _____ Trial 4: _____

5. What is the measurement in the graduated cylinder? Make sure you estimate each measurement to the correct number of decimal places!



6. Complete the table below about **separation techniques** and the physical property the mixtures are separated by.

Separation Techniques: distillation, filtration, chromatography

Physical Properties: size/state of matter, boiling point, polarity

Image of separation technique			
Name of technique			
Separated by this differing physical property			

7. What is the difference between an element and a compound? A homogeneous and heterogeneous mixture?

Empirical/Molecular Formula, Molar Mass, Percent Composition

Empirical Formula	Molecular Formula	Molar Mass of MF	% comp	WORK HERE
CH_2	C_2H_4	26.06 g/mol	%C: 85.6% %H: 14.4%	
	N_2O_5		%N: %O:	
CH_3		30.07 g/mol	%C: %H:	
		220 g/mol	%P: 56.3% %O: 43.7%	

Molar Conversions

Problem	Work – Circle final answer with correct sig figs and unit
How many <i>moles</i> are present in a 100.0 g sample of C_2H_6O ?	
What is the <i>mass</i> of 9.25×10^{22} molecules of water?	
What is the volume of a 3.56g of O_2 at STP?	
What is the volume of 3.01×10^{23} atoms of He gas at STP?	

Molarity & Dilutions

Problem	Work – Circle final answer with correct sig figs and unit
What is the molarity of a 3.89g sample of CaCl ₂ dissolved in 500.mL?	
How many grams of KCl are required to prepare 500 mL of a 0.125 M solution?	
A 35.0 mL 5.0M solution is diluted to 1.67M. What is the volume of the new solution?	
A 12.3M solution is diluted to a volume of 990.0mL. If the new molarity is 3.0M, what is the initial volume of solution needed?	

Chemical vs. Physical Changes, Reactions, Balancing Equations, Stoichiometry

1. Balance and identify the type of reaction represented by the chemical equations below (synthesis, decomposition, single replacement, double replacement, combustion, neutralization):

Chemical Equation	Type of Reaction
___ H ₂ + ___ O ₂ → ___ H ₂ O	
___ LiCl + ___ MgBr ₂ → ___ LiBr + ___ MgCl ₂	
___ C ₆ H ₁₂ O ₆ → ___ C + ___ O ₂ + ___ H ₂	
___ C ₄ H ₈ + ___ O ₂ → ___ H ₂ O + ___ CO ₂	
___ Cu + ___ H ₃ PO ₄ → ___ H ₂ + ___ CuPO ₄	

2. What is the difference between a chemical and a physical change? Chemical and physical property?

Stoichiometry:

Problem	Work – Circle final answer with correct sig figs and unit
$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ What is the mass of water produced from 9.67g of hydrogen gas?	
$2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$ If 5.2 moles of ethane (C_2H_6) is burned, how many moles of O_2 are required?	
$\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$ If 5.00 grams of potassium iodide reacts according to the equation above, how many grams of lead iodide will be produced?	

• Gas Laws

1. A 5.67L sample of a gas has a pressure of 1.45atm. What is the new volume of the gas at 2.00atm?

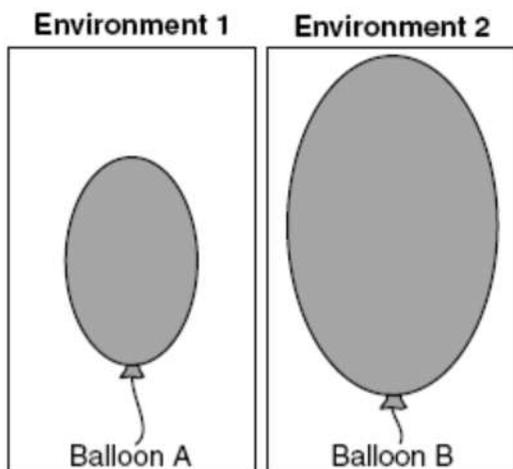
2. A 120.0mL sample of gas has a temperature of 256K and a pressure of 600.torr. What is the new pressure if the volume is decreased to 55.0mL at a temperature of 301K?

3. What is the temperature of a 5.00 mole gas sample with a pressure of 1.57kPa and a volume of 3.56L?

$$R = \frac{8.31 \text{ kPa} \cdot \text{dm}^3}{\text{moles} \cdot \text{K}}$$

4. What is the partial pressure of oxygen gas if it is mixed with 0.50atm of nitrogen gas? The total pressure of the mixture is 1.30atm?

5.



Each balloon was filled with an identical number of moles of gas. Which of the following *best* explains why balloon B is larger than balloon A?

- A The gas in balloon A is under less pressure.
- B The gas in balloon A is warmer.
- C The gas in balloon B is under more pressure.
- D The gas in balloon B is warmer.

• **Physical Behavior of Matter, Interpreting Graphs**

6. What is the relationship between strength of intermolecular forces and boiling point?

These three phase changes are all ENDOTHERMIC:					
Solid → Liquid		Liquid → Gas		Solid → Gas	

These three phase changes are all EXOTHERMIC:					
Gas → Liquid		Liquid → Solid		Gas → Solid	

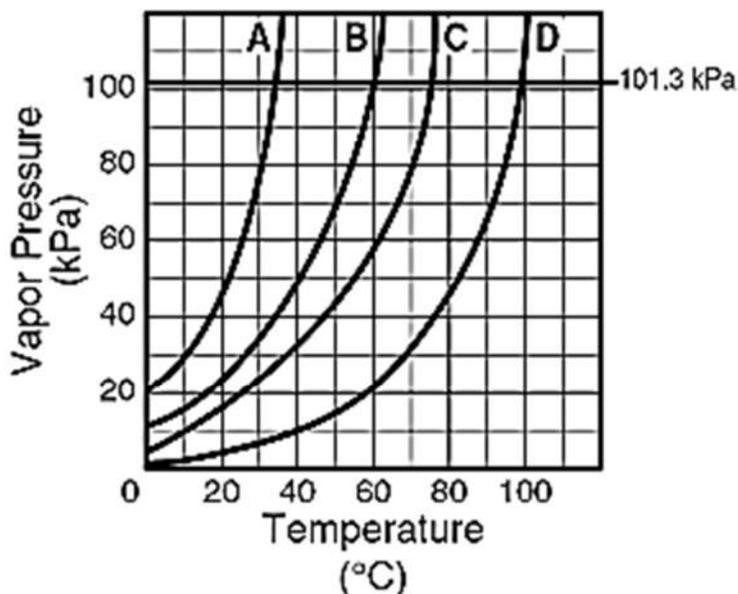
Another word for melting is FUSION. Another word for evaporation is VAPORIZATION.

If you see a diagram with a sealed liquid in a jar or flask, you should know that there is an equilibrium happening in there. The rate of evaporation is equal to the rate of condensation.



Vapor pressure is defined as the pressure exerted by the gas above a liquid. Here is an example of some vapor pressure curves:

Vapor pressure is defined as the pressure exerted by the gas above a liquid. Here is an example of some vapor pressure curves:



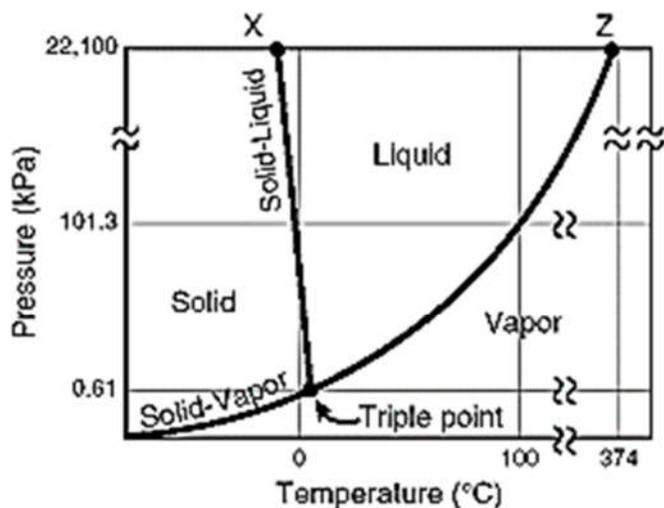
6. From this graph we can get certain information.

- The normal boiling point of liquid A is _____
- If the external pressure is reduced to 60 kPa, then Liquid C would boil at _____
- The liquid with the strongest intermolecular forces is most likely _____

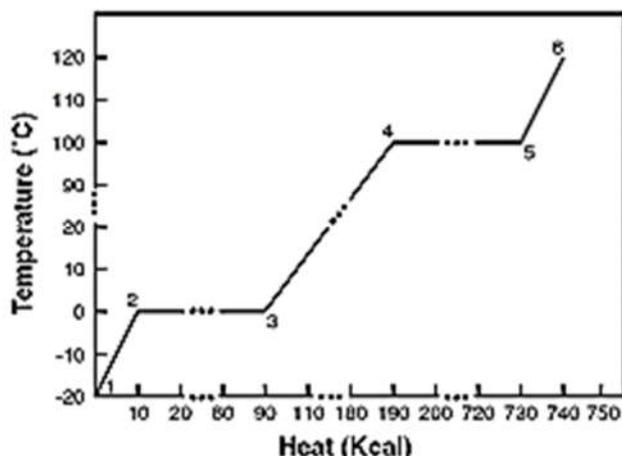
Liquid	Boiling Point (°C)
ether	35
ethyl alcohol	78
water	100
glycerine	290

7. Which of the liquids in the table above would have the *highest vapor pressure* at room temperature? Explain

- If you want to get water to boil BELOW 100°C, you can _____ the air pressure.
If you want to get water to boil ABOVE 100°C, you can _____ the air pressure.
- If you add salt to water, this will _____ the freezing point and _____ the boiling point.



10. The diagram above is called a phase diagram. All along the boundary between two phases there is an equilibrium between those phases. What can we say about the triple point?



11. The diagram above is called a heating curve. Match the descriptions of what is happening with the various line segments

- | | |
|-----------------------|--------------------------------|
| _____ Between 1 and 2 | A. ice is melting |
| _____ Between 2 and 3 | B. liquid water is evaporating |
| _____ Between 3 and 4 | C. ice is being heated |
| _____ Between 4 and 5 | D. liquid is being heated |
| _____ Between 5 and 6 | E. gas is being heated |

8. What is the energy needed to heat 5.55g of water to boiling? ($H_{\text{vap}}=51.5\text{cal/g}$)

9. What is the energy needed to heat 30.7g of water from 55°C to 85°C? ($C_p=4.186\text{kJ/gC}$)

• Atomic Theory

1. Complete the following table with element symbol, # of protons, neutrons, electrons, valence electrons, electron configuration, and valence electrons

Element Symbol	Mass Number	p ⁺	e ⁻	n ⁰	Long form E.C.	# of valence electrons
⁵² ₂₄ Cr +3	52			28	1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d <input type="checkbox"/> 4p <input type="checkbox"/>	
	35	16	18		1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d <input type="checkbox"/> 4p <input type="checkbox"/>	
	50	22	20		1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d <input type="checkbox"/> 4p <input type="checkbox"/>	
		33	33	45	1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d <input type="checkbox"/> 4p <input type="checkbox"/>	
C-13					1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d <input type="checkbox"/> 4p <input type="checkbox"/>	
Mg-24					1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d <input type="checkbox"/> 4p <input type="checkbox"/>	

2. What is different between ions of the same element? What is the same?

3. What is the difference between isotopes of the same element? What is the same?

4. The natural abundances of all of nitrogen's isotopes are: 70.% N-14, 15% N-15, and 15% N-16? Calculate the average atomic mass of nitrogen.

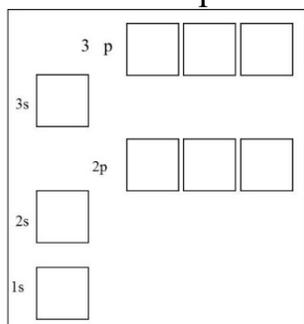
5. Fill in the blanks about the history of the atom:

- The _____ model says the electrons orbit the nucleus
- The _____ model says the electrons can be found in clouds around the nucleus
- Thomson discovered the _____ during the cathode ray tube experiment.
- The gold foil experiment, performed by _____, which allowed him to conclude the atom was mostly _____ with a dense, positive central core

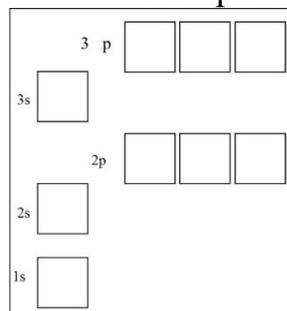
6. What is the ion formed for Magnesium? Oxygen?

7. Complete the following orbital diagrams and electron configurations:

Ground state Phosphorus



Excited State Phosphorus



• **Periodic Table and Trends**

1. Complete the table below.

Group #	Group/Family Name	Valence Configuration	# of Valence Electrons
1		ns^1	
2		ns^2	
3-12		It varies	It varies
13	The Boron Family	ns^2np^1	
14	The Carbon Family		
15	The Nitrogen Family		
16	The Oxygen Family		
17			
18		ns^2np^6	

2. Complete the following sentences with the words *increase* or *decrease*.

- A. As you move from *left to right* across a period on the periodic table, the number of protons will ____
- B. As you move from *left to right* across a period on the periodic table, the *atomic radius* will ____
- C. As you move from *left to right* across a period on the periodic table, the *1st ionization energy* will ____
- D. As you move from *left to right* across a period on the periodic table, the *electronegativity* will ____
- E. As you move from *top to bottom* down a group on the periodic table, the *atomic radius* will ____
- F. As you move from *top to bottom* down a group on the periodic table, the *1st ionization energy* will ____
- G. As you move from *top to bottom* down a group on the periodic table, the *electronegativity* will ____

3. In Group 1, the most reactive element would be _____. This can be explained because metals need to _____ electrons when they undergo chemical reactions, and so the _____ the atom, the more reactive it will be.

4. In Group 17, the most reactive element would be _____. This can be explained because nonmetals need to _____ electrons when they undergo chemical reactions, and so the _____ the atom, the more reactive it will be.

• **Bonding and Nomenclature**

1. Complete the table below by finding the term that fills in the blank correctly

Ionic	Covalent	Metallic
<ul style="list-style-type: none"> • _____ electrons • Composed of _____ and _____ • To name ionic compounds that have transition metals, use Roman numerals to indicate the _____ 	<ul style="list-style-type: none"> • _____ electrons • Composed of only _____ • To name covalent molecules, use prefixes to indicate the number of _____ for each element. 	<ul style="list-style-type: none"> • _____ electrons • Composed of only _____ • To name metallic compounds, it is the name of the _____.

2. Write the name or formula for the following polyatomic ions.

Name	Formula	Name	Formula	Name	Formula
Ammonium		Carbonate		Nitrate	
	OH ¹⁻		SO ₄ ²⁻		PO ₄ ⁻³

3. Complete the table below. Correctly write the name or formula for each and indicate whether it is ionic (I) or covalent (C).

Name	Formula	Type
magnesium chloride		
sulfur trioxide		
iron (III) iodide		
	CaBr ₂	
	N ₂ O ₃	
	CrSO ₄	

Complete the following table:

	Essential Information:	Structure:	Essential Questions:	Additional Information:
CCl₄	Total valence electrons:		VSEPR Formula	Polar or Nonpolar Molecule:
	Electrons in Bonds:		Shape:	Major intermolecular force:
	Electrons in Lone Pairs:		Hybridization	Oxidation Number: C: Cl:
H₂O	Total valence electrons:		VSEPR Formula	Polar or Nonpolar Molecule:
	Electrons in Bonds:		Shape:	Major intermolecular force:
	Electrons in Lone Pairs:		Hybridization	Oxidation Number: H: O:
CO₂	Total valence electrons:		VSEPR Formula	Polar or Nonpolar Molecule:
	Electrons in Bonds:		Shape:	Major intermolecular force:
	Electrons in Lone Pairs:		Hybridization	Oxidation Number: C: O: