Name: _____ Per ____

Partner Name: _____ Partner Cell #_____

COPPER ODYSSEY LAB

This is a multi-day lab! We will be working through each of these reactions. Don't be absent!

Purpose: To complete a series of experiments to convert copper from a solid state to a liquid state and back.

Copper Odyssey Conversion I

Conversion I (Day 1) - Changing elemental copper to copper (II) nitrate.

SAFETY: HNO_3 is a **VERY strong acid**, wear apron, and goggles at all times. NO_2 is a toxic gas, your reaction **must** be completed in the fume hood.

Procedure:

1) Complete the conversion I pre-lab questions below (A-B).
2) Obtain approximately 0.5g of copper wire and record the actual mass on your data table.
3) Use a marker and blue tape to label a 100mL Erlenmeyer flask with your names and period.
4) Place wire in bottle then go to fume hood and put flask in fume hood.
5) Make sure fume hood is on then add 20mL 6 M HNO_3 to the flask. Use a graduated cylinder to measure accurately.
6) Close fume hood glass door and observe the reaction for 5 minutes. Record your observations under Conversion I.
7) After 5 minutes place flask in the proper period tub and leave in hood overnight.
8) Answer Conversion I questions for homework.

Pre-lab:

A) Balance the following reaction.

____ $Cu_{(s)}$ + ____ $HNO_{3(aq)}$ ____ $Cu(NO_3)_{2(aq)}$ + ____ $NO_{2(g)}$ + ____ $H_2O_{(l)}$

B) Translate the above equation into names and states of matter

- use a periodic table & polyatomic ion sheet.
- Acid names on text book pages 468-469

___Solid copper reacts with_____

_____

Data and Observations:

Original mass of copper	_____g
Observations before reaction:	
Observations during reaction:	

Conversion I Questions

Directions: Answer the following questions in complete sentences.

1. What type of chemical reaction is Conversion I? **Explain your reasoning**: (synthesis, decomp., single displacement, double displacement, more than one?)

_____

_____

2. Fill in the chart below.

Reactant/product	**<u>Describe</u>: state of matter & color**	**<u>Bond type</u>: metallic, ionic, or covalent**
Cu		
HNO_3		
$Cu(NO_3)_2$		
NO_2		
H_2O		

3. Why does HNO_3 contain one nitrate and $Cu(NO_3)_2$ contain two nitrates? **Think charges**

_____

4. What does the 6M signify in the expression 6M HNO_3?

_____

5. Calculate the molar mass of each reactant. Be sure your work in clearly labeled!

Reactant/product	**<u>Molar mass</u>**
HNO_3	**Example:** HNO_3 = 1 + 14 + (16 x 3) = 63 g/mol
Cu	
$Cu(NO_3)_2$	
NO_2	
H_2O	

<u>Use your mole flow chart for the following problems; if you need one print it from my website under the Cu Odyssey folder.</u>

6. Using the initial mass of copper you obtained determine the number of moles of copper in your sample.

7. Calculate the number of atoms of copper in your sample.

8. Using the initial mass of copper you obtained determine the mass of NO_2 you expected to be produced. (**<u>Hint</u>**: find the mole ratio from your balanced equation in the pre-lab section)

Approx. 0.724g

9. Calculate the volume of NO_2 you expect to be produced at 27°C and 1.0 atm. (**<u>Hint</u>**: set up your solution using your answer from # 8, the molar mass of NO_2, (PV=nRT (R=0.08206 L atm/mol K)

Approx. 0.37 L NO_2

10. Calculate the number of moles of nitric acid used. (**<u>Hint</u>**: use balanced equation, a mole ratio & start with grams Cu)

Approx. 0.031 mol HNO_3

11. Calculate the mass of NO_2 produced from the amount of nitric acid used. (start with moles of nitric acid-from #10)

Approx. 0.713 g NO_3

12. Write the compound formula of the brown gas formed._____ (check the balanced equation in the pre-lab)

13. Write the compound formula of the blue product._____ (check the balanced equation)
14. The copper metal "disappeared" during this reaction. What really became of the copper atoms? (check the balanced equation)

_____

_____

15. Why did the bottle have to be put in the fume hood? (read safety section)

_____

16. Make a list of everything in the liquid in the bottle at the end of reaction one. (check the balanced equation)

_____

17. Why did we bother to mass the copper wire? **(Hint: what is the point of the lab?)**

_____

18. What would happen to the volume NO_2 as it moves higher in the atmosphere where the pressure drops to 0.07 atm and the temperature drops to 15°C?
a) Calculate the volume of NO_2 (use the data from #9 and $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$)

b) The volume of NO_2 would: **(increase/decrease/stay the same)** circle one
19. Why did we use nitric acid rather than some other acid, say hydrochloric acid? (read question 20 for a hint)

20. *Fill in the blanks:* In conversion one, elemental copper was changed to copper (II) _____by the action of _____acid. The roman number (II) stands for the _____ on the copper. In the process, water and a toxic gas, _____ were formed. This gas was brown in color and is the same gas that gives the brownish look to Los Angeles smog. Nitric acid is the only strong acid that will attack copper. The acid we used was not full strength, but had been diluted with water to a concentration of_____. In this reaction, four _____ of nitric acid were used for every one mole of copper. A single nitric acid formula unit has _____ atoms in it. The formula unit of copper (II) nitrate had _____atoms in it. While the nitrogen dioxide and the water molecules each have _____ atoms in them.

Copper Odyssey Conversion II

Conversion II (Day 2) - Changing copper (II) nitrate to copper (II) hydroxide.

SAFETY: NaOH is a VERY strong base and will burn skin & eyes upon contact. Wear apron and goggles at all times! Rinse with water if you come into contact with base.

1) Complete the conversion II pre-lab questions (A-B) and III pre-lab questions (A-B)
2) Find your sample from last class. Look at the sample and describe the material produced on the data table below.

3) The copper nitrate solution should still be acidic. To test this, get a piece of blue litmus paper and a stirring rod.
4) Dip the stirring rod in the solution, then touch it to blue litmus paper. Record the color in the data table below.

5) This reaction produces a lot of heat, so we will create a cooling bath. Put the flask with $Cu(NO_3)_2$ solution inside a 500mL beaker (or larger if needed) containing ~50mL ice cold water.
6) Measure out 20 mL of 6M NaOH in a graduated cylinder.
7) Slowly pour 20mL of 6M NaOH into the $Cu(NO_3)_2$ solution. Stir for 2 minutes.
8) Wash and dry your stirring rod and get a piece of red litmus paper.
9) Dip the stirring rod in the solution, then touch it to blue litmus paper. Record the color in the data table below.
10) Did the paper turn **DARK BLUE?** (not just the blue color of your solution- the litmus paper must turn **DARK BLUE**).
- If not dark blue then it is NOT a basic solution. Add 5mL more of NaOH and recheck with a clean stirring rod and new red litmus paper. Continue adding 5 ml of NAOH until solution is basic and appears **Dark blue** in color
- If dark blue Record your observations under Conversion II and go on to Conversion III

11) Describe the color and texture below.

Pre-lab:

A) Balance the following reaction.

____ $Cu(NO_3)_{2(aq)}$ + ____ $NaOH_{(aq)}$ ____ $Cu(OH)_{2(s)}$ + ____ $NaNO_{3(aq)}$

B) Translate the above equation into names and states of matter (use polyatomic ion sheet and periodic table)

_____

_____

Observations:

Get your sample and describe it here before starting:

Solution	Color of litmus paper	Acidic or basic
Copper Nitrate - $Cu(NO_3)_2$	Blue litmus paper turned = (**red/stays blue**) circle one ● If Blue litmus turns red= Acidic ● If Blue litmus stays blue = basic	**(Acid or base)** circle one
Copper Nitrate + Sodium Hydroxide $Cu(NO_3)_2$+ NaOH	Red litmus paper turned = **(Dark blue/stays red)** circle one ● If red litmus turns dark blue= Basic ● If red litmus stays red = acidic	**(Acid or base)** circle one

Observations:

Describe the color & texture of your sample after the NaOH was added:

Conversion II Questions

1. What type of chemical reaction is Conversion II? **Explain your reasoning**: (synthesis, decomp., single displacement, double displacement, more than one?)

_____

_____

2. Fill in the chart

compound	**Describe: state of matter & color**	**Bond type** ionic, nonpolar covalent, or polar covalent
$Cu(NO_3)_2$		
NaOH		
$Cu(OH)_2$		
$NaNO_3$		

3. Which of the substances in the reaction were a base? (look at the formulas)

_____

4. What does pH stand for? _____ What is the pH range of a base?_____

5. Describe what test can be done to quickly determine if a substance is an acid, a base or neutral?

_____

6. How did we determine whether or not we had added enough sodium hydroxide?

_____

7. What is the pH range of the solution at the end of conversion II?_____

8. Why did we use an ice bath? (Hint: Read procedure step 5)_____

9. Is the reaction exothermic or endothermic? Explain.

_____

10. The blue solid formed also had solid flecks of black. What are the solid black flecks? (look at the balanced equation)

_____

11. What is the mole ratio of $Cu(NO_3)_2$ to NaOH? (look at the balanced equation) _____

12. $Cu(NO_3)_2$, NaOH, and $NaNO_3$ are aqueous. What does aqueous mean? _____

13. Write a balanced equation of Hydrochloric acid with sodium hydroxide and predict the products.

14. The reaction from #13 of an acid plus a base is called a neutralization reaction. Neutralization reactions "neutralize" both the acid and the base so that they are no longer harmful. The reaction produces a "salt" and water.
Name the salt produced in #13: _____.

Copper Odyssey Conversion III

Conversion III (Day 2) - Changing copper (II) hydroxide to copper (II) oxide

SAFETY: $Cu(OH)_2$ is a strong base and will burn skin & eyes upon contact. Wear apron and goggles at all times! Rinse with water if you come into contact with base.

1) Make sure you have completed pre-lab questions (A-B) for conversion III.

Hot water bath

2) Place flask containing the $Cu(OH)_2$ into the warm water bath at (37°C)- Don't let it tip over!! The warm water will speed up the reaction.
3) Leave in hot water for 10 to 20 minutes.
3) Return to your desk and work on Conversion II questions until reaction is complete.
4) Check on your reaction and record your observations of the material produced under Conversion III

Filter paper separation

5) Fold and place filter paper into a large funnel and set on top of a 400 ml flask.
6) Get a distilled wash bottle.
7) Carefully pour the contents of the small flask into the filter lined funnel
8) Rinse the small flask with distilled a stream of distilled water from the wash bottle then pour into filter. Try and get all of the material out to the small flask and into the filter paper.
9) Rinse the CuO in the filter paper with a stream of distilled water. **USE Caution to not rip filter paper.**
10) Remove the label from your small flask and place on the large flask.
11) Place the funnel and large flask in the proper area and leave overnight.
12) Scrub out your small flask with a brush and soap. Put it on the drying rack.
13)clean up your area.
14) Answer Conversion II and III questions for homework.

Pre-lab:

A) Balance the following reaction.

____ $Cu(OH)_{2(s)}$ ____ $CuO_{(s)}$ + ____ $H_2O_{(l)}$

B) Translate the above equation into names and states of matter (use polyatomic ion sheet and periodic table)

_____

_____

Observations

After Hot water bath: (color/texture):

Conversion III Questions

1. What type of chemical reaction is Conversion III? **Explain your reasoning**: (synthesis, decomp., single displacement, double displacement, more than one?)

_____

_____

2. Fill in the chart:

compound	**<u>Describe</u>: state of matter & color**	**<u>Bond type</u>** ionic, covalent, or metallic
$Cu(OH)_2$		
CuO		
H_2O		

3. Why did we put the bottle in the hot water bath?

_____

4. What is the formula of copper (II) oxide?_____

5. What is the purpose of filter paper?

_____

_____

6. What is the charge of copper in CuO?_____How do you know?_____

_____

7. What is the charge of copper in copper (I) oxide? _____What is the formula of copper (I) oxide?_____

8. We used a water bath at 37°C. What is the temperature in Kelvin? (Show work; hint: C=K +273)

Copper Odyssey Conversion IV

<u>Conversion IV</u> (Day 3) Changing copper (II) oxide to copper (II) chloride

<u>SAFETY:</u> HCl is a VERY strong acid, wear apron, and goggles at all times. Rinse with water if you come into contact with acid.

1) Complete the conversion IV pre-lab questions (A-B)
2) Get your sample and record your observations below before starting.
3) Remove your funnel and place it on a **<u>NEW</u>** clean 125 ml flask.
4) **<u>Pour out the waste water</u>** from the large flask. Wash and dry the flask and return to dry rack.
5) Get a graduated cylinder and measure out 20 ml 6M HCl.
6) Pour the HCL directly onto the black/blue solid on the filter paper. Let solution flow through filter paper into the flask.
7) Use distilled water to rinse the remaining black solid from filter paper. Try to use a minimum amount of water.
8) Throw away filter paper.
9) When filtering is complete, wash, dry and put away funnel in the <u>correct cupboard</u>, look at labels on door.
10) Record observations below
11) Label the small flask with blue tape and place in correct area
12). Answer Conversion IV questions for homework.

Pre-lab:
A) Balance the following reaction.

____ $CuO_{(s)}$ + ____ $HCl_{(aq)}$ ____ $CuCl_{2(aq)}$ + ____ $H_2O_{(l)}$

B) Translate the above equation into names and states of matter (use polyatomic ion sheet and periodic table)

_____

_____

Observations:

Get your sample and describe it here **before** starting todays lab:

Observations:

Description **during and after** today's conversion:

Conversion IV Questions

1. **Explain your reasoning**: (synthesis, decomp., single displacement, double displacement, more than one?)

_____

_____

2. What were we trying to wash away from the black copper (II) oxide in step 7? _____

3. Is water polar or nonpolar? _____How do you know? _____

_____

4. How could you tell that Conversion IV is underway & then completed? _____

_____

5. Is HCl acidic or basic? _____How do you know?_____

6. Determine the number of moles of HCl in 20 mL of 6M HCl. (Hint: convert mL to L then use Molarity=number of moles/L)

7. Look at the following formulas: Which are acids, bases and neither? **Name each acid or base.**

Compound	**Acid or Base**	**Name the acid or base** ● if a base name like an ionic compound ● if an acid use text book p. book pages 468-469)
$Ca(OH)_2$		
H_3PO_4		
HCl		
$HC_2H_3O_2$		
NaOH		
NH_4OH		
HF		
LiOH		

Copper Odyssey Conversion V

Conversion V - (Day 4) Changing copper (II) chloride to elemental copper

Safety: The reaction must be completed under the fume-hood! It gives off considerable heat and gas.

1) Complete the conversion V pre-lab questions (A-B).
2) Get your sample and record your observations below before starting.
3) Take your flask and pour into 150 ml beaker.
4) Take beaker to fume hood and add small pieces of the Al foil one at a time. Wait until reaction has settled down before adding the next piece of foil. Be careful as the reaction give off considerable heat and gas.
5) When green color has gone and the Al no longer reacts, the reaction is then complete. If color does not disappear, add another piece of Al.
6) Record observations below.
7) Once the reaction is complete take beaker back to lab station and use forceps to remove any remaining aluminum.
8) Pour off liquid and dispose of down the sink. Be careful not to lose any solid material. The liquid may be copper colored, it is OK to pour this off.
9) Obtain 4 small test tubes and a test tube rack.
10) Put all 4 test tubes on the scale at the same time and record their total mass in the data table.
11) Use scoopula, pipette, or wash bottle to transfer copper to test tubes. Try to split your sample evenly.
12) Centrifuge for 4 minutes.
13) Remove test tubes and pour off supernatant (liquid on top).
14) Wash copper with distilled water. (Fill test tube 1/3 full) Agitate. Centrifuge. Remove supernatant.
15) Place test tubes in the test tube rack then put on cart to dry overnight.
16) Answer Conversion V for homework.
17) Next class mass all 4 test tubes together and calculate the mass of the copper recovered

Pre-lab:

A) Balance the following reaction.

B) Translate the above equation into names and states of matter (use polyatomic ion sheet and periodic table)

_____

_____

Observations:

Get your sample and describe it here **before** starting todays lab:

Observations:

Description during today's conversion: After being left overnight:

Data Table:

Total mass of 4 of empty test tubes (put all 4 on the scale)	_____g	
Mass of test tubes + copper (put all 4 on the scale)	_____g	
Mass of copper recovered ***(Mass of test tubes + copper - Total mass of 4 of empty test tubes)***	_____g	**This is the Actual yield**
Mass of copper you started with (Look on page 1 in data table)	_____g	**This is the Theoretical yield**

Conversion V Questions

1. The unreacted hydrochloric acid (HCl) from conversion IV was also reacting with the aluminum.
   - Write out the balanced reaction of aluminum plus HCl. Predict the products and label the reaction type.

_____

2. What were the fumes coming off of the mixture when it was reacting with the aluminum? (look at the balanced equation above) _____

3. The fumes from the reaction are a diatomic gas. List the seven diatomic gases. _____

_____

4. Look at the activity series page 286. Describe the placement of aluminum to copper. What does that mean? **You will need to read page 285 and 286!!! (please read before you ask me questions!)**

_____

_____

5. How is the aluminum able to replace the copper in this reaction? **You will need to read page 285 and 286!!!**

_____

_____

6. List 4 ways to speed up a reaction:

_____

9. If you produced 2.5 moles of H_2 gas, what volume would the gas to occupy if the room is 27°C and 1.0 atm?
Hint : **Ideal Gas Law**: PV = nRT (where R is 0.0820 (L•atm)/(K•mol). And temp. is in K.

10. How would the volume of the gas be affected if the temperature of the room was 30°C instead of 27°C? (show work)

11. What volume would the gas from #10 occupy if the conditions were changed to 270°C and 1.0 atm? (use info. From #14 for P_1, V_1 & T_1) **Hint** : use combined gas law and temp is in Kelvin.

$$\frac{P_1 \cdot V_1}{T_1} = \frac{P_2 \cdot V_2}{T_2}$$

12. Calculate the percent yield of your copper odyssey reaction. **FYI:** Your actual yield is the amount of Cu you were left with at the end of the experiment and the theoretical yield is the amount of Cu you started with at the beginning! (Data table P.10)

$$\text{Percent Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100\%$$

13. Was your percent yield over 100%, 100%, or under 100%?_____

14. Explain why your percent yield was over 100%, 100% or under 100%. *Be specific and clear!*

_____

_____

_____

15. Calculate your percent error. (Hint: the theoretical value is the amount of Cu you started with and the experimental value is the amount of Cu you were left with at the end of the experiment)

21. Explain your error. *Remember error should not be "I did the lab wrong or my partner is not very good at labs."*

_____

_____

_____

_____

_____

_____

Second Semester Final Exam Study Guide

UNIT 6 - STOICHIOMETRY

Know how to name compounds and write chemical formulas.

a) How do you determine if a compound is ionic or molecular?
b) What do you need to keep in mind when writing chemical formulas for ionic compounds?
c) What do you need to keep in mind when naming molecular compounds?
d) When a polyatomic ion is involved, what type of bond is occurring?
e) Write the chemical formulas for the following compounds.

You should identify if they are ionic or molecular first

copper (I) bromide	magnesium oxide
ammonium sulfate	diphosphorus trioxide
sulfur trichloride	manganese (III) cyanide

f) Write the names for the following compounds. *You should identify if they are ionic or molecular first*

AlF_3	$Fe(ClO_4)_3$
NO_3	$Li(OH)$
$Sr(NO_2)_2$	Cl_5

Know how to translate chemical reactions, balance equations, and predict chemical reactions.

Write the following chemical reactions into chemical formulas and a full chemical equation.

a) Sulfur burns in oxygen gas to produce sulfur dioxide.
b) Sulfuric acid (H_2SO_4) and sodium hydroxide reaction together for form sodium sulfate and water.
c) Sodium oxide reacts with water to produce sodium hydroxide.
d) Zinc sulfide reacts with oxygen gas to produce zinc oxide and sulfur dioxide.

Balance the following chemical equations:

e) ___N_2 + ___H_2 □ ___NH_3
f) ___Zn + ___MoO_3 □ ___Mo_2O_3 + ___ZnO
g) _____P_2O_5 + ____H_2O □ ____$P(OH)_3$
h) ____$Cd(NO_3)_2$ + ____Na_2S □ ___CdS + ____$NaNO_3$
i) _____Na_2O + ____H_2O □ NaOH

Identify the type of equation that will occur using the reactants. Then predict the products and balance the equation.

j) C_6H_{12} + O_2 →
k) $CuCl_2$ + H_2S →
l) $CaCl_2$ + K_2CO_3 →
m) Al + O_2 →
n) $Al_2(CO_3)_3$ →

Balance the equations and use your mole map to convert from one substance to another (stoichiometry).

$$Cr + CuSO_4 \square Cu + Cr_2(SO_4)_3$$

a) How many grams of copper would be produced from 49.48 grams of chromium?
b) How many grams of chromium are required to react with 125 mL of $CuSO_4$?

$$ZnS + O_2 \square ZnO + SO_2$$

c) How many liters of sulfur dioxide are created when 12.6 L of oxygen gas reacts with zinc sulfide?
d) If 3.45×10^{18} atoms of zinc sulfide react with oxygen gas, much many moles of zinc oxide are produced?
e) When 54 grams of oxygen gas react with zinc sulfide, how many atoms of sulfur dioxide are produced?

$$NaClO_3 \square NaCl + O_2$$

f) What is the mole ratio between $NaClO_3$ and NaCl?
g) 12 moles of $NaClO_3$ will produce how many grams of O_2?
h) If you have 24.7 grams $NaClO_3$ how many grams of NaCl will be produced?
i) If you have 10 grams $NaClO_3$, how many liters of oxygen gas will be produced?

Know how to determine limiting and excess reactants.

$$ZnS + O_2 \rightarrow ZnO + SO_2$$

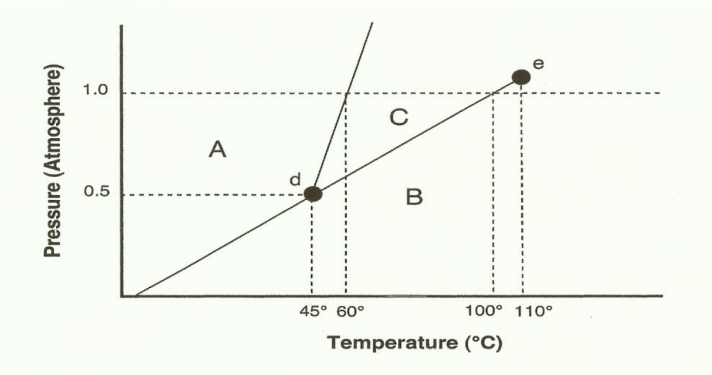
a) 6.45 grams of zinc sulfide reacts with 9.20 grams of oxygen gas to produce zinc oxide. How many grams of ZnO are formed?
b) What is the limiting and excess reactant?
c) The actual yield of this reaction is 12.5 grams. What is the percent yield of this reaction?

Know how to calculate the percentage composition of a substance.

a) What is the percentage composition of nitrogen in the compound HNO_3?
b) An 8.20 grams piece of Mg combines completely with 5.40 grams of O to form a compound. What is the percentage composition on Mg and O in this compound? **Hint: write out compound and find molar mass**
c) 9.03 grams of Mg combines completely with 3.48 grams of N to form a compound. What is the percentage composition of Mg and N in the compound? **Hint: write out compound and find molar mass**

UNIT 7 - GASES

Understand and be able to analyze the phase change diagram.



a) What phase change is happening when a substance goes from area A to C?
b) What state of matter is the substance in area A? Area B? Area C?
c) At standard pressure (1.0 atm) what temperature is need for the substance to vaporize?
d) At 100 °C and a pressure below standard, what phase is this substance in?
e) If that substance cooled from 100°C to 35°C, what phase change(s) would occur? Are these endothermic or exothermic?

Know how to convert between temperatures and pressures.

Convert the following pressures:

a) Convert 475 mm Hg into atm.
b) The pressure of a tire is measured as 29.4 psi. What is this pressure in torr?
c) How is 2 atm expressed in kPa?

Convert the following temperatures:

d) 48°C to Kelvin
e) 321.5 Kelvin to °C

Know the basics about gases.

a) What are the common characteristics of gases?
b) What is STP? What is the temperature and pressure?
c) Gases _____ to fill their containers.
d) Gases have greater/less density to their equivalent liquid or solid.
e) Gas particles, compared to liquid, are moving faster/slower.
f) A collision of gas particles with container walls is known as the _____ of the gas.
g) At the same temperature, small molecules move faster/slower than large molecules.

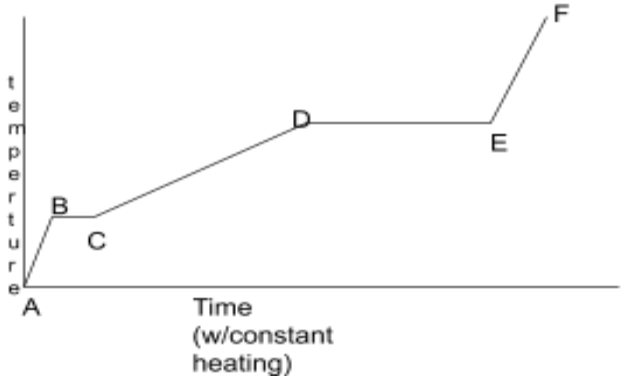
Know how to identify the gas law and solve the problem.

a) A sample of oxygen occupies a volume of 250.0 mL at 740.0 torr. What volume will it occupy at 2.4 atm?

b) A gas has a pressure of 6.58 kPa at 540 K. What will the pressure be at 210 K if the volume remains constant?
c) A gas with a volume of 4.0 L at 90.0 kPa expands until the pressure drops to 20.0 kPa. What is the new volume if the temperature remains constant?
d) A gas with a volume of 3.00×10^2 mL at 150°C and 1.7 atm is heated until its volume is 6.00×10^3 mL. What is the new temperature of the gas if the pressure decreased to 1.0 atm during the heating?
e) Calculate the quantity of gas, in moles, if 6.38 L is occupied at 35°C and 955 mm Hg.
f) What is the volume of a gas, in liters, if 2.95 moles is at 0.76 atm and 52°C?
g) Compare the rate of effusion of sulfur dioxide with that of chlorine gas at the same temperature and pressure.
h) What is the total pressure of a gas mixture if it contains 20 torr of HCl gas and 730 torr of Ne gas?

UNIT 8 - THERMOCHEMISTRY

Understand and be able to use a heating curve diagram.



a) Label the line with the following: solid, liquid, vapor, melting, freezing, condensation, vaporization
b) Why are the slopes in the graph different?
c) Why do the plateaus have different lengths?
d) When would you use a Q equation? What about a q equation?
e) How would you determine if a phase change is endothermic and exothermic?

Be able to identify when to use Q and q equations and how to calculate molar enthalpy, energy, and specific heat.

a) How much heat is lost when a 640 gram piece of copper cools from 375°C to 26°C? The specific heat of copper is 0.385 J/g°C.
b) 8750 J of heat are applied to a 170 grams sample of metal, causing a 56°C increase in its temperature. What is the specific heat of the metal?
c) How many kilojoules of heat energy are required to heat all the aluminum is a roll of aluminum foil, 500 grams, from room temperature, 22°C, to the temperature of a hot oven, 250°C. Aluminum has a specific heat of 0.902 J/g°C.
d) Calculate the quantity of heat gained or lost when 3.50 moles of water freezes at 0°C.
e) Calculate the energy gained or lost when 100 grams of water vaporizes from 35°C to 120°C.
f) Calculate the molar enthalpy of condensation for ammonia when 50.0 grams of NH_3 gas turns into a liquid at its boiling point when 68,500 Joules of energy are released in the process. Is this endothermic or exothermic?

$$CH_4(g) + 2\ O_2(g) \rightarrow 2\ H_2O(g) + CO_2(g) \qquad \Delta H = +802.7\ KJ$$

g) Using the above equation, calculate the heat evolved when 3.05 grams of water is produced in the reaction.

UNIT 9 - SOLUTIONS, ACIDS & BASES

Be able to identify and solve for molarity, molality, and dilution calculations.

a) How many grams of $AlCl_3$ are required to make a 2.25 m solution in 30.0 grams of water?
b) What volume of 12M HCl is needed to prepare 250 mL of 0.20 M HCl?
c) What is the molality of 18 g NaCl in 200 g of H_2O?
d) Calculate the molarity of a 15 g NaCl in 250 ml solution.

Know the fundamentals of acids and bases.

a) List properties of acids.
b) List properties of bases.
c) What ions do acids produce? What ions do bases produce?
d) What is the pH scale measuring?
e) What happens when an acid and base combine? What's produced?