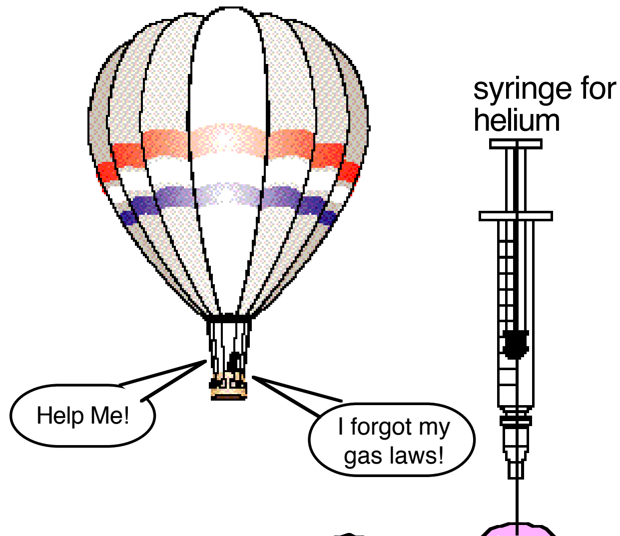
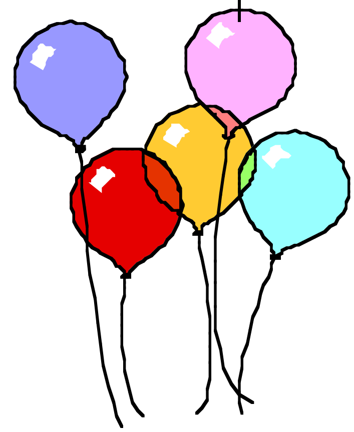
Daily Assignment Sheet '19

(check them off as you complete them)

Name ________________________________ Per ____

packet 6:
The Gas Laws





Due Date	Assignment
Mon 1/7	___ Do WS 6.1 (visit website!) ___ Do WS 6.2
Tue 1/8	___ Read *Abs 0 Lab*
Wed 1/9	___ turn-in *Abs 0 Lab* ___ Read *Boyle's Law Lab*
Thur 1/10	___ turn-in *Boyle's Law Lab* ___ Do WS 6.3
Fri 1/11	___ Do WS 6.4 **(#1 - 10)**
Mon 1/14	___ Do WS 6.4 **(#11-16)**
Tues 1/15	(mini-quiz today)
Wed 1/16	___ Finish WS 6.4
Thur 1/17	___ Do WS 6.5
Fri 1/18	___ Do WS 6.6 **(#1-8)** ___ Last Day for *Bonus* Soda Bottles
Tues 1/22	___ Finish WS 6.6 ___ bring *optional* supplies for cartesian diver lab **2-L Soda Bottle Due Today**
Wed 1/23	___ turn-in *Soda Bottle Pressure Lab Write-Up*
Thur 1/24	___ turn-in *Cartesian Diver Lab*
Fri 1/25	___ Read *Wet Dry Ice Lab*
Mon 1/28	___ Do WS 6.7 ___ turn-in *Wet Dry Ice Lab*
Tues 1/29	___ Read "boiling" from class web-site ___ turn-in Home Lab: *Watched Pot Never Boils*
Wed 1/30	___ Do WS 6.8 •• Student Presentations Today ••
Thur 1/31	(-)(-) Mustard Day (-)(-) •• Student Presentations Today •• **I RECOMMEND YOU GET A HEAD START ON REVIEW SHEET**
Fri 2/1	___ Do WS 6.11 (Student Presentations) ___ Do WS 6.10 (Demo Log) ___ Do WS 6.9 (Review Sheet) •• QUIZ TODAY •• / •• PACKETS DUE TODAY ••

Packets are to be turned in today. Assignment sheet in front, then WS 6.1 - WS 6.11 (in that order). Packets should be in a folder, with no other papers inside.

Please Read This Statement:

If you are not here on the day of the quiz, you will need to take the more challenging make-up quiz, unless you've made arrangements with me.

penalties:

no name on top: **-1/2**
wrong order: **-1/2**
turning in non pertinent material: **-1/2**
turning in graded labs: **-1/2**
no folder or wrong type of folder: **-1/2**
(use pocket-type folder, not a plain, 3-ring, or homemade folder)

WS 6.1 Kinetic-Molecular Theory of Gases / Pressure

1. Visit the pack 6 website & click on "kinetic molecular theory".
   Read & summarize the 5 points of the *kinetic-molecular theory* - in your own words:

1)

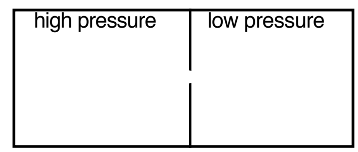
2)

3)

4)

5)

2. What is pressure? Which of the 2 points above accounts for pressure? __________
   How exactly does a gas sample exert a pressure? Use diagrams, as was shown in class:



3. Use diagrams, as was shown in class, to illustrate how an inflated balloon stays stretched. (What are the gas particles inside doing to keep it inflated?) Also, explain what happened to the balloon in the vacuum chamber:

4. How does a suction cup work? Use diagrams:

5. How does a drinking straw work? Use diagrams:

6. How does a barometer work? Use diagrams. Why is mercury used instead of a cheaper liquid like water?

WS 6.2 Kinetic Theory - Temperature & Volume

1. What is kinetic energy? ___________________________________

   What is the equation for calculating it? ____________________________

2. What is temperature, as defined in class? ____

3. If the kinetic energy of a gas is increased, which variable in the equation for K.E. is also increased? ___________

4. Explain how a gas may react in response to being heated up! _______________________________________

5. What temperature units best represent the average kinetic energy of a gas? ___________________________

6. Convert the following temperatures into Kelvin:

   a) 125˚C --->   b) 15.5˚C --->   c) -108˚C --->

7. Convert the following temperatures into Celsius:

   a) 0 K --->   b) 422 K --->   c) 215.5 K --->

8. What is the freezing point of water in K? _________   The boiling point? _________

9. Explain why it is not possible to have a temperature of 0 K, in terms of kinetic energy.

10. Which 2 of the 5 postulates from **WS 6.1** accounts for motion & temperature of gases? _______
    Combine these 2 postulates together & restate them in your own sentence:

11. When the **kinetic energy** of a gas is increased, its _____________________ will increase.
    - If the gas is inside a solid, rigid container, what ALSO will increase? _____________________
    - If the gas is inside a flexible container, what ALSO will increase? _____________________

12. When the **kinetic energy** of a gas in increased, its _____________________ will *never* change.

13. What is STP? What's so special about the volume of a gas at STP?

14. Calculate the volume of each gas sample at STP conditions:

    a) 2 moles of He

    b) 0.75 moles of O_2

    c) 68.0 grams of CO_2

    d) 114 grams of SO_3

Ans (IRO+2): -273 -57.5 16.8 31.9 34.6 44.8 106 149 165 218 273 288.5 373 398

WS 6.3.1 Combined Gas Law - *must show work & units*!

STP: 0˚C 1 atm (1 mole = 22.4 L)	$\frac{P_i V_i}{T_i} = \frac{P_f V_f}{T_f}$
1 atm = 760 mmHg = 14.7 psi	

1. A 1.30 L balloon is taken from room temperature (25.0˚C) and placed into a freezer at -11.5˚C. What is its new volume? (*isobaric change*)

Ans: __________

2. A container of oxygen gas is at STP. If this sample is put into an oven at 280˚C, what would its pressure be, in atmospheres? (*isovolumetric change*)

Ans: __________

3. You have a 2.40 L container of air at STP. From out of nowhere, Bigfoot stomps on it, decreasing the container's volume down to 0.500 L and increasing the pressure to 8.00 atmospheres. How hot, in **˚C**, is the air in the container now?

Ans: __________

4. You're at the zoo and have a big red 1.80 L helium balloon. The barometric pressure today is 785 mmHg. Then you hear the roar of a lion. Startled, you accidentally release the balloon. It flies away. By the time it reaches the clouds, the atmospheric pressure that high is only 0.300 atmospheres. What would be the volume of the balloon up there? (*isothermal change*)

(answer bank on next page)

Ans: __________

WS 6.3.2 Combined Gas Law - *must show work & units*!

5. **a)** You fill your car's tires to 35 psi when they were cold (12˚C). After driving for 3 hours, your car's tires warm up to 38˚C. What would be the pressure inside your tires now, in psi? (*isovolumetric change*)

   b) What is this pressure in atmospheres?

Ans: **a)** ________ **b)** ________

6. A 12.0 L sample of NO_2 gas is at STP. What would be its new volume if its pressure was decreased to 575 mmHg and its temperature was doubled? *(isothermal change)*

Ans: __________

7. A 5.75 gram sample of nitrogen gas is at STP. What would be its volume if its temperature was increased to 317˚C? (*isobaric change*) **hint**- remember nitrogen is *diatomic!*

Ans: __________

8. **a)** A sample of Cl_2 gas occupies a volume of 11.4 L at 3.50 atmospheres. When the Cl_2 is changed to STP conditions, what will be its volume?

   b) How many molecules of Cl_2 are there?

Ans: **a)** ________ **b)** ________

Ans (IRO+2): 1.14 1.95 2.03 2.60 6.20 9.94 31.7 38.2 39.9 182 1.07E24 2.71E24
Units (IRO): L L L L L atm atm psi ˚C molecules

WS 6.4.1 Ideal Gas Law - All Work Must Be Shown...

PV=nRT $R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

1. What volume would 3.00 moles of neon gas have at 295 K and 645 mmHg?

Ans: ________

2. What volume would 4.3 moles of hydrogen gas occupy at 45˚C and 3.22 atm?

Ans: ________

3. How much pressure would 4.85 moles of He gas exert in a 4.50 L tank at 55˚C?

Ans: ________

4. How many moles of CO_2 could fit in a 475 mL bag at -22˚C and 855 mmHg?

Ans: ________

5. How many grams of oxygen gas are there in a 2.3 L tank at 7.5 atm and 24˚C?

Ans: ________

(answers on page 6.4.4)

WS 6.4.2 Ideal Gas Law - All Work Must Be Shown...

6. How many molecules of N_2 could fit in a 2.00 L soda bottle at 23˚C and 755 mmHg?

Ans: ________

7. What pressure would be needed to fit 35.0 g of N_2 gas into a 195 mL flask at 0˚C?

Ans: ________

8. In order to have 1.00 mole of gas fit in a box that measures 1.30 dm x 2.40 dm x 5.83 dm at 1.00 atm, what must the temperature be (in ˚C)? (*1 L = 1 dm^3*)

Ans: ________

9. A cube-shaped box is to be made that can hold precisely 40.0 grams of He at 1.05 atm and 55˚C. How long would the box have to be? (*remember it's a cube so take the cube root of the volume*)

Ans: ________

10. What volume would be occupied by 16.0 g of CH_4 at 0˚C and 760 mmHg?
    (notice it's at STP?)

(answers on page 6.4.4)

Ans: ________

WS 6.4.3 Ideal Gas Law: Density Problems - All Work Must Be Shown...

11. **a)** What is the mass of 1.00 mole of Ne?
    b) What would be the volume of 1.00 mole of Ne at 34˚C and 0.862 atm?
    c) What would be the density of 1.00 mole of Ne at 34˚C and 0.862 atm?

a: ________ **b**: ________ **c**: ________

12. What is the density of helium at 2.15 atm and -45˚C?

Ans: ________

13. Determine the density of fluorine gas at 595 mmHg and 423 K.

Ans: ________

14. What is the density of helium at STP?

Ans: ________

(answers on page 6.4.4)

WS 6.4.4 Ideal Gas Law: Molecular Weight & Stoichiometry Problems -
All Work Must Be Shown...

15. 2.58 g of a gas has a volume of 3.97 L at 745 mmHg and 21˚C.
Determine the molecular weight of the gas. What gas might it be?? ***(see choices in ans. bank)***

Ans: ________ ________

16. 2.58 g of a different gas has a volume of 31.8 L at 745 mmHg and 21˚C.
Determine the molecular weight of the gas. What gas might it be?? ***(see choices in ans. bank)***

Ans: ________ ________

17. How many moles of sodium will react with 2.6 L of Cl_2 gas at 1.15 atm and 39˚C?
Hint: use the balanced equation... **2 Na + Cl_2 ---> 2 NaCl**

Ans: ________

18. How many grams of propane (C_3H_8) will react with 3.29 L of O_2 at 1.05 atm and -34˚C?
Hint: balance & use this equation... **___ C_3H_8 + ___ O_2 ---> ___ CO_2 + ___ H_2O**

Ans: ________

Ans (IRO+3): -51 0.0259 0.179 0.23 0.459 0.691 0.857 1.55 2.00 6.35 16 20.2 22.4 22.6 26.9 29.0 29.2 35 85.6 144 20,500 2.3E22 4.9E22 CH_4 H_2 g/mol g/mol

Units (IRO+3): L L L L L g/L g/L g/L g/L g g g g mmHg mmHg atm atm mol mol molecule ˚C dm

WS 6.5 Partial Pressures (Dalton's Law) don't forget units ***p*** **= (mol frac) x (P)**

1. A flask contains Ne at 542 mmHg together with Ar at 234 mmHg. What will the total pressure be? (use Dalton's law)

Ans ________

2. A tank is filled with oxygen and nitrogen. The total pressure of the tank is 6.45 atm, and the partial pressure of the nitrogen is 2.07 atm. What is the partial pressure of the oxygen? (use Dalton's law)

Ans ________

3. **a)** A mixture contains 1.00 moles of CO_2, 2.00 moles He, and 3.00 moles of CH_4. Which gas has the highest partial pressure? ______ Which gas has the lowest partial pressure? ______

b) If the total pressure of the mixture above is 12.0 atm, what is the P_{CO_2}? ____________

P_{He}? ____________ P_{CH_4}? ____________

4. **a)** 1.25 moles of N_2 and 6.41 moles of F_2 are placed together in a 128 L tank at 755 mmHg. What is N_2's mole fraction in the mixture? What is the partial pressure of the N_2?

a) Ans: _________ _________

b) What is F_2's mole fraction, and what is the partial pressure of the F_2?

b) Ans: _________ _________

c) What must the temperature (˚C) of the mixture be?

Ans ________

5. **a)** 3.23 g of Ne and 4.19 g of CH_4 are placed together in a tank at 5.34 atm and 23˚C. What is Ne's mole fraction, **and** what is the partial pressure of the Ne?

a) Ans: _________ _________

b) What must the volume of the tank be? (use ideal gas law)

Ans ________

6. A tank contains 5.86 g of Ar and 5.77 g of Ne. The partial pressure of the Ar is 237 mmHg. What is Ar's mole fraction and what is the <u>total</u> pressure of the tank?

Ans: __________ __________

7. A flask contains 2.34 x 10^{22} atoms of He, 0.1972 moles of CO_2, and 2.45 g of N_2. The partial pressure of the N_2 is 2.33 atm. **a)** What is N_2's mole fraction? **b)** What is the total pressure of the mixture?

* Cross off answers as you find them. Circle the left over answer! *

Ans: **a)** _________ **b)** _________

Ans(IRO+1): -71 0.163 0.270 0.339 0.379 0.837 1.34 1.92 2.00 2.02 4.00 4.38 6.00 8.63 123 632 699 776

Units(IRO+1): atm atm atm atm atm atm mmHg mmHg mmHg mmHg CO2 CH4 L g ˚C **(more on page 2)--->**

8. Two gases **A** & **B** are placed together in a container. **A**'s partial pressure is greater than **B**'s.

a) One reason one gas sample might have a higher pressure than another is because it is at a higher temperature. Why could this <u>not</u> be used to explain why **A** has a higher pressure than **B**?

b) One reason one gas sample might have a higher pressure than other is because it is confined to a smaller volume. Why could this <u>not</u> be used to explain why **A** has a higher pressure than **B**?

c) So, if it's not temperature or volume, what explanation can you offer why **A** has a higher pressure than **B**?

d) Again, regarding the sample described above, label the following as <u>DT</u> (definitely true), <u>PT</u> (possibly true), or <u>DF</u> (definitely false): **ans bank: DT** (4) **PT** (3) **DF** (3)

1. ____ There is a greater mass of **A** present (compared to **B**) in the mixture.
2. ____ There is a greater number of moles of **A** (compared to **B**) in the mixture.
3. ____ There is a greater number of particles of **A** (compared to **B**) in the mixture.
4. ____ **A** is at a higher temperature than **B** in the mixture.
5. ____ **A**-particles are hitting the inside walls of the container harder on average than **B**-particles.
6. ____ **A**-particles are hitting the inside walls more often on average than **B**-particles.
7. ____ **A**-particles are more concentrated in the container than **B**-particles.
8. ____ **A**-particles don't have as much room to move around as **B**-particles.
9. ____ **A**-particles are heavier on average than **B**-particles.
10. ____ **A**-particles are moving faster on average than **B**-particles.

9. Equal masses of **P** gas and **Q** gas are present in a container, yet **P** has a greater partial pressure than **Q**. Is this possible? Explain.

10. Equal number of moles of **X** gas and **Y** gas are present in a container, yet **X** has a greater partial pressure than **Y**. Is this possible? Explain.

WS 6.6 Graham's Law

1. What exactly is temperature a measurement of? ________________________________

2. Why is it important to include the word "*average*" in your answer? ____________________

3. What two factors does an object's kinetic energy depend on? __________ and __________

4. What specifically is the equation for kinetic energy? ____________________

5. Which would increase the kinetic energy of an object more: doubling the object's <u>*mass*</u> or doubling the objects <u>*velocity*</u>? _________ Explain: ________________________________

6. State Graham's Law as an equation for two gases (A and B) at the same temp: ____________

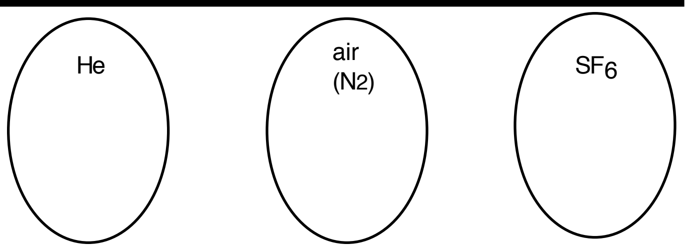
7. ***Consider two gases, He and O_2, at the same temperature...*** (√ answer bank below)
   Which particles would have greater average kinetic energy? _______ Which particles are heavier? ______
   Which particles would have greater velocity? ______ Which gas would diffuse across the room faster? ______

8. ***Two gas samples, one H_2 and one CO_2, are such that their particles have the same velocity...***
   Which gas molecules have the greater average kinetic energy? _______
   Which gas is at the higher temperature? ________ Explain: ________________________________

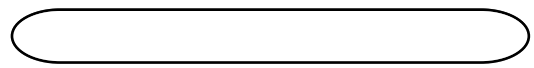
9. Explain the following two demos using **<u>words</u>** and **<u>diagrams</u>**:

<u>The He/SF_6 balloon demo:</u>

	<u>He</u>	***<u>air</u> (N_2)***	***<u>SF_6</u>***
initial size:			
prediction:			
final size:			



<u>The NH_3/HCl racing demo:</u>



<u>For the following questions, use the Graham's Law equation. Show all work.</u>

10. At a certain temperature, O_2 molecules move with an average velocity of 345 mph. At that same temperature, what would be the average velocity of **a)** He atoms? **b)** CO_2 molecules?

Ans: **a)** ________ **b)** ________

11. At a certain temperature, CH_4 molecules move with an average velocity of 187 m/sec. At that same temp, gas X particles have an average velocity of 141 m/sec. **a)** Is gas X heavier or lighter than CH_4? **b)** What is the molecular weight of gas X? **c)** What is a possible identity of gas X? (see choices in ans. bank)

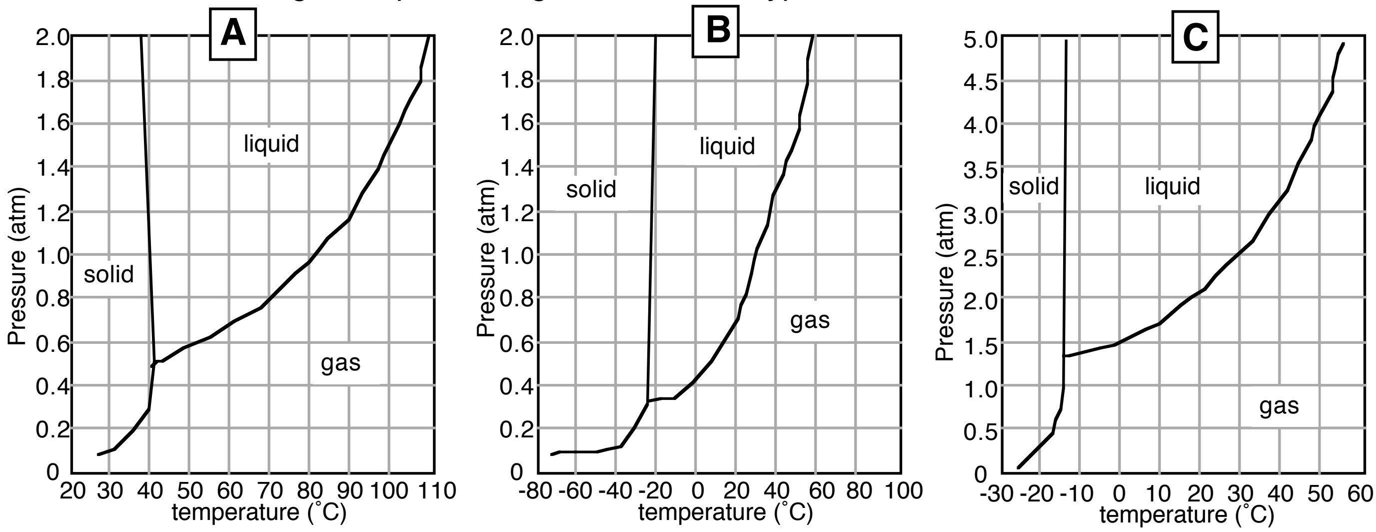
Ans: **a)** ________ **b)** ________ **c)** ________

<u>*BONUS*</u> A sample of gas is at room temp (22˚C). to what temp (˚C) would it have to be taken to cause the average velocity of the particles to double? ______ ...triple? ______ (*Hint*: look back at your answers for #1 and 4)

Ans #7-8 (IRO): CO2 CO2 He He neither O2
Ans #10-11 (IRO+5): 28.1 32.3 294 469 976 CO2 He N2 F2 **Units (IRO)**: mph mph g/mol

WS 6.7 Phase Diagrams

Consider the following three phase diagrams for three hypothetical substances: A, B, and C.



1. What is the stable state(s) (s,l, or g) for substance **A** at room conditions (1.0 atm & 25˚C)? _____
2. What is the stable state(s) for substance **B** at room conditions? _____ ...for substance **C**? _____
3. At 1.6 atm and 50˚C, what is/are the stable state(s) for **A**? ____ ...for **B**? _____ ...for **C**? _____
4. At 1.0 atm what are the melting point (**mp**) boiling point (**bp**) and sublimation point (**sp**) for each of the three substances? (use "**NA**" for not applicable)

A: mp=___ bp=___ sp=___ **B**: mp=___ bp=___ sp=___ **C**: mp=___ bp=___ sp=___

5. At 0.4 atm what are the melting point (**mp**) boiling point (**bp**) and sublimation point (**sp**) for each of the three substances? (use "**NA**" for not applicable)

A: mp=___ bp=___ sp=___ **B**: mp=___ bp=___ sp=___ **C**: mp=___ bp=___ sp=___

6. As pressure increases, what happens (↑ ,↓ , or ---) to the <u>bp</u> of **A**? ___ ...of **B**? ___ ...of **C**? ___
7. As pressure increases, what happens (↑ ,↓ , or ---) to the <u>mp</u> of **A**? ___ ...of **B**? ___ ...of **C**? ___
8. At 50˚C, what pressure is required to condense gaseous **A** into a liquid?____ **B**?____ **C**?___
9. What is the significance of the triple point of a substance? ______________________________
10. What is the triple point (P & T) for **A**? ____ / ____ ... for **B**? ____ / ____ ...for **C**? ____ / ____
11. Some solid **A** is at 0.6 atm & 40˚C. What would happen (melt, boil, freeze???) if the pressure were increased? ____________ ...if the pressure were decreased? _____________
12. Some liquid **B** is at 0.4 atm & -20˚C. What would happen (melt, boil, freeze???) if the pressure were increased? ____________ ...if the pressure were decreased? _____________
13. When you heat up a sample of iodine at room conditions, it changes directly from a solid to a gas. What does this imply about iodine's triple point pressure? ____________ temp? ___________
14. When a sample of methane gas is cooled, it condenses to a liquid and then freezes to a solid. What does this imply about methane's triple point pressure? ____________ temp? __________
15. How is a phase diagram like a map? ____

Ans- IRO: s l l l/g g g -25 -25 -21 -17 -14 -14 -4 0 0.3 0.5 0.6 1.3 1.5 4.1 30 40 41 41 81 NA NA NA NA NA NA NA NA NA melt sublime freeze boil ↑↑↑↑↓—

WS 6.8 Boiling *<u>I recommend you do this worksheet</u>* **in pencil!** (visit pack 5 website for help)

Use class notes & direct observations of the boiling process to fill out the following explanation sheet. Also, fill in the figures at right showing a liquid & its vapor in a closed container.

<u>Evaporation and vapor pressure:</u>

In a liquid, some of the ___________ moving near the surface have enough energy to escape into the ___________ state. This process is known as ___________. If this takes place in a(n) ________ container, the liquid will eventually all evaporate away. But if it takes place in a _______ container (with a lid), then the vapor molecules will start to accumulate over the liquid's surface as shown in **Fig 1** at right. These vapor molecules might bounce back into the liquid and get "re-captured". This is known as __________. As more evaporation takes place, the concentration of vapor molecules ___________, which in turn increases the rate of ___________. In a relatively short time, the ___________ rate will increase to the point where it equals the ___________ rate, and the system will be at a state of ___________ as shown in **Fig 2** at right. This vapor exerts a ___________ against the inside walls of the container. This is known as the ________ ________ of the liquid. If the <u>temperature</u> of the system were increased, it would cause the ___________ rate to increase (as shown in **Fig 3**), which would in turn cause the concentration of ________ molecules to increase. This would cause the ___________ rate to increase, and the system would reach a new ___________ as shown in **Fig 4**. Since there are more vapor ___________ bouncing around at higher ___________, the ________ ________ would also be higher. In general, as ___________ increases, ________ ________ also increases. The chart at right below shows the ________ ________ (in mmHg) of various ________ at a range of different ________ (in ˚C). Note that at 20˚C, water has a vapor pressure of ____ mmHg, whereas liquid A has a vapor pressure of _____ mmHg. This higher vapor pressure is caused by liquid A evaporating at a ________ rate than water, which is a result of its molecules having a weaker attraction for one another. Something that evaporates quickly is said to be ________. Note that liquid B has a much _________ vapor pressure than water at any given ___________. This would imply that it is less _________ than water and thus the attractive forces between its molecules are _________.

Fig 1

Fig 2

Fig 3

Fig 4

<u>temp</u> (˚C)	<u>vapor pressure</u> (mmHg)		
	<u>water</u>	<u>liquid A</u>	<u>liquid B</u>
0	5	25	2
20	18	108	4
40	55	303	9
60	149	701	27
80	355	1420	75
100	760	2514	178
120	1520	4276	380
140	2710	7278	748
160	4515	11051	1321
180	7600	16728	2219

<u>Boiling</u>:

When water is heated (from beneath) in an open container, some of the ___________ at the bottom might absorb sufficient _________ to cause them to fly apart and form a small ________ of water vapor. If the temperature of the surrounding water is only 60˚C, then the ________ ________ pushing outward on the walls of that bubble will only be ____ mmHg. The atmospheric pressure pushing downward on the water's surface (assuming standard pressure) will be ____ mmHg. This greater pressure from the outside causes the bubble to collapse back into a _______ state. If one watches a pot of water on the stove, one can easily observe these _______ form and then _______ long before the water comes to a true ________.

Ans for side 1 (IAO+3): boil bubble bubbles closed collapse condensation condensation condensation condensation energy equilibrium equilibrium evaporation evaporation evaporation greater high increases liquid liquids lower mmHg molecules molecules molecules open pressure pressure pressure pressure pressure pressure pressure stronger temp. temp. temps. temps. vapor vapor vapor vapor vapor vapor vapor volatile volatile 18 108 149 760

(WS 6.8 side 2)

When the temperature is increased further, up to 80˚C, the bubbles that form will have vapor molecules pushing outward with a ________ of 355 mmHg. Still, this pressure will not be great enough to withstand the ________ ________ of 760 ______ pushing downward from the outside of the container, thus the bubble will again ________. At 99˚C, the ________ ________ of water is 733 mmHg, still not enough... and then finally at ____ ˚C, the vapor pressure of water reaches _____ _____, where it can finally match the outside pressure of __________ __________. This allows the bubble to persist, so that more molecules can vaporize into it. As the bubble grows, it quickly breaks lose from the bottom and floats upwards. If on the way up it encounters water that has not quite reached ____ ˚C, the bubble will again collapse. It is not until the entire container of water has reached ____˚C that the water will be at a full ______.

Now... if you were trying to boil water at high _________, like Denver, where the surrounding atmospheric pressure is a lot ________ than the standard ____ mmHg, then the water would _____ at a somewhat ______ _________. If you had water in a bell jar and brought the _________ down to 55 mmHg, then the water would _____ at only ____˚C. By the same token, if you put water in a ______ pressure environment, such as a _________ cooker or an auto-_______, where the pressure is taken way up to _____ mmHg, then the water needs to be 160˚C before it could _____.

Looking back at the table on side #1, we can see that liquid A, which was ______ volatile than water would have its ______ pressure reach standard pressure (______ mmHg) at a much ______ temperature. This means that liquid A would _____ at a much ________ ________ than water. In fact, it would boil around ____˚C (estimating from the table). Similarly, liquid B which was _____ _________ than water, would have to be taken to a ________ ________ for its ________ ________ to reach 760 mmHg. Thus it would have a much _________ boiling point (around _____˚C, estimated from the table).

In general then, it can be said that a _________ will always ________ when its _______ __________ matches the __________ __________ pushing down on the liquid's _________. To say that the boiling point of water is ____˚C is a bit misleading. One should say that the _________ ________ depends on the ___________ ___________, and that it just *happens* to be ____˚C at standard pressure!!!

Ans for side 2(IAO+4): altitudes atmospheric-**(x 4)** boil boil boil boil boil boil boiling clave collapse evaporation high higher higher less liquid low lower lower lower lower mmHg mmHg molecules more point pressure pressure pressure pressure pressure pressure pressure pressure pressure pressure surface temp. temp. temp. vapor vapor vapor vapor volatile 40 62 80 100 100 100 100 100 141 760 760 760 4515

Follow-up questions:

Identical eggs are placed in identical pots of water on identical stoves, one here in St. Louis, and one in Denver. The stoves are turned on at the same time.

1) Which water will heat up faster **(St. Louis, Denver, neither, both)** and *why*?

2) Which water will boil sooner **(St. Louis, Denver, neither, both)** and *why*?

3) Which water will boil at a higher temperature **(St. Louis, Denver, neither, both)** and *why*?

4) Which water will boil when its vapor pressure matches atmospheric pressure, and *why*?

5) Which egg will get done first **(St. Louis, Denver, neither, both)** and *why*?

WS 6.9   Review Sheet pg 1

1. To what temperature (˚C) would 12.3 g of He have to be cooled to fit in a 34.0 L tank at 1.17 atm?

Ans: _______

2. What would be the density of CH_4 at 132˚C and 725 mmHg?

Ans: _______

3. A gas sample occupies a volume of 34.8 L at 2.56 atm. What volume would it occupy at 3.47 atm?

Ans: _______

4. A 2.79 g sample of gas occupies a space of 735 mL at 1.78 atm and -21˚C. What is the molecular weight of the gas? What gas might it be: H_2, Ne, or CO_2?

Ans: _______ Ans: _______

5. If Ne particles are moving with an average velocity of 17.4 m/sec, how fast would the CH_4 particles be moving? How about the CO_2? *(all gases are in the same container & therefore the same temp!)*

Ans: ______ Ans: ______

6. **<u>The gas laws & relationships among the variables</u>**
   - Boyle's Law states that ____________ and volume are inversely related to each other. This is why a balloon expands in a _____________.
   - Charles's Law states that volume and temperature are _____________ related to each other. This is why a balloon shrinks when liquid ______________ is poured on it.
   - Gay-Lussac's Law states that pressure varies directly with temperature. This is why areosol cans become ______________ when the pressure is ________________.

Ans #6: colder directly nitrogen pressure released vacuum

Ans (IRO) #1-5: -115, 0.458, 11.8, 19.6, 25.7, 44.0, 52.4 ***UNITS***: ˚C g/L L g/mol m/sec

WS 6.9 review sheet page 2

7. In the “wet dry ice lab”, we placed a sample of ________ ________ (which is actually solid ________, not water) in a plastic ________ and placed a metal ________around the stem, then squeezed down on this with a pair of ________. This helped keep the ________ in the pipet as the dry ice ________, thus building up the ________ and taking the sample to the ________ ________, that unique ________ and ________ on the ________ diagram where all three phases (________, ________ and ________) can exist together and where all three processes (________, ________ and ________) can occur at the same time.

8. Bobby wanted to boil some acetone (a liquid which is somewhat ________ volatile than water, meaning it evaporates more ________). Remembering what he learned in ________ class, that a ________ will always ________ when its ________ ________ matches ________ ________, Bobby decides there are two ways he can boil the liquid: he can ________ the ________ to ______˚C, at which point its ________ ________ would equal the standard ______ psi, or he could ________ the ________ to around _____ psi, at which point the liquid would ________.

temp (˚C)	v.p. of acetone (psi)
25	4.8
50	7.4
75	14.7
100	27.9

9. Suzi does the “Boyle’s Law lab” and collects the data at right. Use any two data lines to determine what value she gets for atmospheric pressure.
(any 2 data lines will work)

gauge press. (psi)	vol. (mL)
42.1	2.9
31.5	3.6
22.7	4.5
17.9	5.2

Ans: ________

10. 13.5 g of CO_2, 13.5 g of Ne and 13.5 g of CH_4 are all placed together in a tank at 762 mmHg. What is the partial pressure of the CO_2, the Ne, and the CH_4?

Ans: ________ Ans: _______ Ans: _______

11. Which gas in the tank above is moving the fastest?? _____________

Ans (IRO+3): 4.8 12.6 14.7 15.7 75 129 216 280 354 atmospheric boil boil boiling chemistry clamp CH4 CO2 decrease dry force gas gas ice increase liquid liquid melting more O2 phase pipet pliers point pressure pressure pressure pressure pressure quickly solid sublimed subliming temp. temp. triple vapor vapor

Units (IRO): atm psi mmHg mmHg mmHg

WS 6.10 Gas Laws Demos

Throughout this packet, you will be seeing various gas-related demos.
Keep track of some by taking notes and/or making diagrams here.

Methane Mamba

The Vapor Ramp

Hot Air Balloon

Pouring CO_2

Whistling Gases

Explain why the gases each produced a different pitch...

Shaving in a Vacuum

Aluminum Recycling

Boiling with Ice

Water Barometer

Test Tube Bunsen Burner

What states of matter did you witness?

What phase changes did you witness?

WS 6.11.1 - Student Presentations page 1

The Bends

1) What gas causes the bends? _____ When pressure increases, so does gas solubility. Whose gas law is this ?

2) What are some of the symptoms of the bends?

3) What gas to divers breath in order to avoid the bends?

4) What is a dive chart?

5) How are the bends treated?

CO Poisoning

1) How is CO produced?

2) Why is it so dangerous? How does its reaction with hemoglobin compare to oxygen's?

3) How do people avoid CO poisoning?

4) How is CO poisoning treated?

WS 6.11.2 - Student Presentations page 2

Ozone Depletion

1) What is the formula for ozone? ______ How is it produced?

2) Up there ozone is our friend, down here it's our enemy! Explain this!

3) What is depleting our ozone layer?

4) Where is this reported hole in the ozone layer and why is it there? What are the long term consequences of a widening hole in the layer?

5) What are people doing to stop ozone depletion?

The Greenhouse Effect

1) What causes the greenhouse effect? Why is a little greenhouse effect good?

2) What are the long term consequences of the greenhouse effect?

3) Some experts say the greenhouse effect will lead to terrible flooding of our coastal cities & turn the midwest into a desert. Explain this.

4) What is being done to deal with the problem?

5) How does this tie in with the whole nuclear vs. coal burning power plant issue?