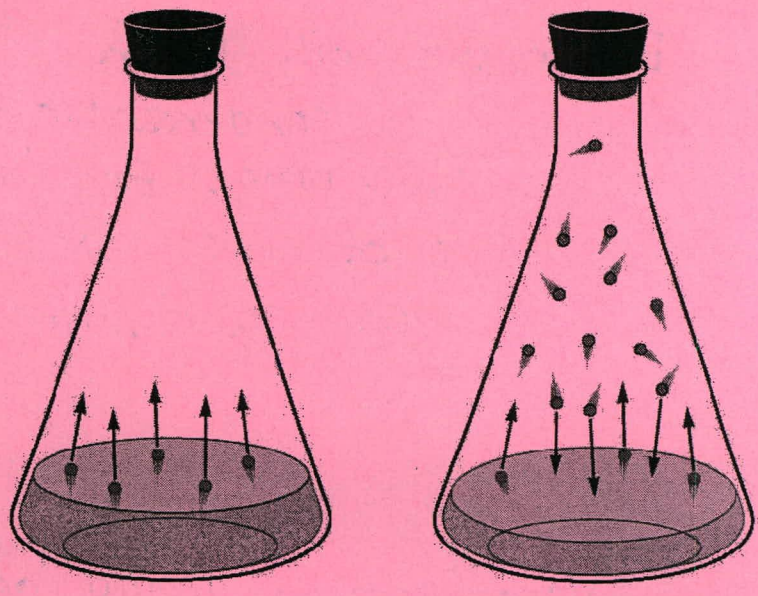
Name BETH "KEY"

Water Vapor Equilibrium Worksheet: Read **pages 433-459** in your textbook to assist you in answering the following questions.

Use the images at the right for questions 1-8.
Flask A & B both contain water.



A B

1. What process is taking place in flask A?

EVAPORATION

2. What is happening to the temperature of the liquid water remaining in flask A?

GOING DOWN

3. What two opposing processes are present in flask B at the right? Name these two processes and indicate if they are exothermic or endothermic processes.

EVAPORATION (ENDOTHERMIC) ⟷ CONDENSATION (EXOTHERMIC)

4. When you first stopper flask A, which process initially has the greatest rate?

EVAPORATION

5. Describe the changes that will take place in flask B as the system approaches equilibrium.

EVAPORATION RATE SLOWS AND CONDENSATION RATE INCREASES UNTIL BOTH ARE THE SAME.

6. Write an equation to represent the equilibrium in flask B.

$H_2O_{(l)} \longleftrightarrow H_2O_{(g)}$

7. If you remove some water from flask B, what will happen?

LIQUID

THE RATE OF CONDENSATION WILL INCREASE.

8. What is vapor pressure?

PARTIAL PRESSURE EXERTED BY THE VAPOR IN A DYNAMIC EQUILIBRIUM WITH THE LIQUID AT A CONSTANT TEMP.

9. What two measurements would you make of the system in Flask B to determine if an equilibrium has been reached between these two opposing processes?

VAPOR PRESSURE AND TEMPERATURE

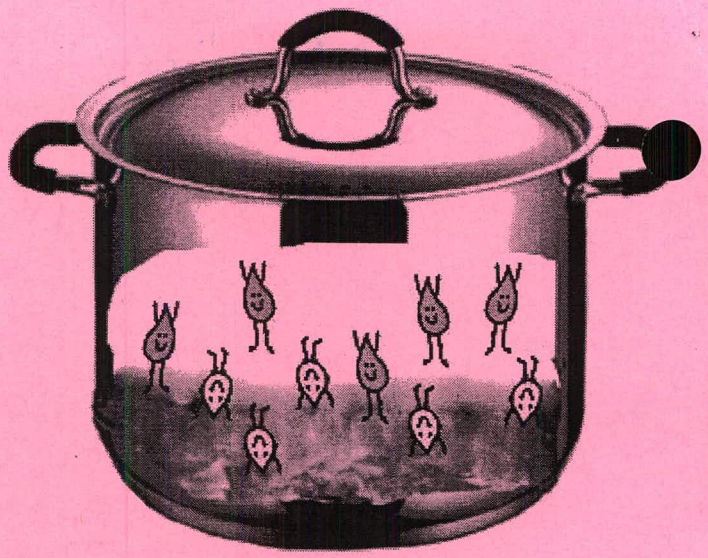
10. If the water temperature in flask B is 60°C, what is the vapor pressure? Vapor pressure at 100°C?

60°C = 149.4 torr (mm Hg) 100°C = 760.0 torr

11. What does volatile mean? Is vapor pressure high or low for a substance considered volatile? Give an example of a volatile substance.

Volatile indicates a liquid has a very high vapor pressure, because intermolecular attractive forces are weak.
Gasoline!

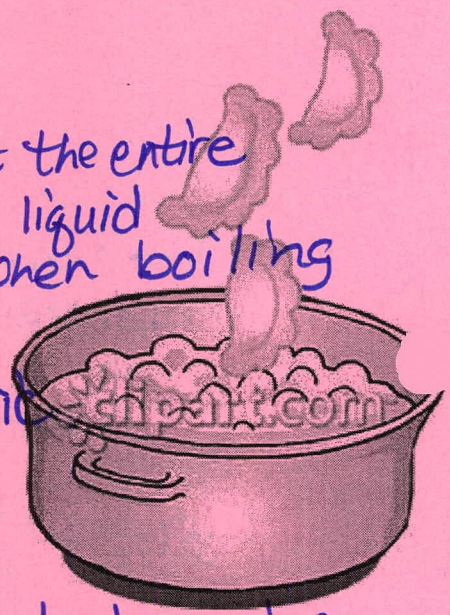
12. The kettle to the right is tightly sealed with its lid. Explain what will happen over time inside the kettle if it is left undisturbed sitting on the kitchen coutner.



Evaporation will begin leading to condensation also occurring. Eventually the rate of each will equal at equilibrium

13. If the kettle below were placed on the stove and the water heated until boiling occurred, what would be happening throughout the liquid?

Vaporization would occur throughout the entire liquid. Vapor pressure throughout the liquid will equal atmospheric pressure when boiling occurs.



14. Prior to boiling, the bubbles that initially form in the water collapse. Why?

Pressure in bubbles is < atmospheric pressure.

15. Once boiling begins, does the temperature of the liquid continue to rise? Why or why not?

No - all added energy goes into breaking intermolecular attractive forces changing liquid to gas.

16. What is the definition of normal boiling point?

The temperature at which the vapor pressure of a liquid = 1 atm.

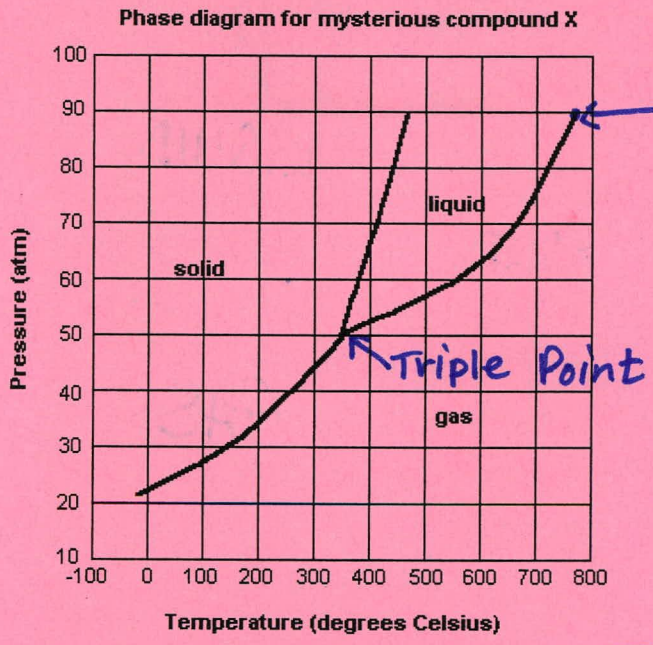
17. If you wanted to cook spaghetti dinner at the top of Mount Everest, would it take a longer period of time or shorter period of time to cook your noodles? Explain.

Lower pressure so H_2O will boil at a lower temp. so less kinetic energy to cook food so it will take longer!

To answer the questions on the following two pages, refer to pages 441-448 in your textbook.

Phase Diagram Worksheet

For each of the questions on this worksheet, refer to the phase diagram for mysterious compound X.



Densities of liquid & vapor become the same beyond this point so no liquid/vapor can exist beyond critical point.

1) What is the critical temperature of compound X? ~770°C

2) If you were to have a bottle containing compound X in your closet, what phase would it most likely be in?

GAS

3) At what temperature and pressure will all three phases coexist? TRIPLE POINT

~350°C, ~51 atm

4) If I have a bottle of compound X at a pressure of 45 atm and temperature of 100^0 C, what will happen if I raise the temperature to 400^0 C?

Sublime SOLID → GAS

5) Why can't compound X be boiled at a temperature of 200^0 C?

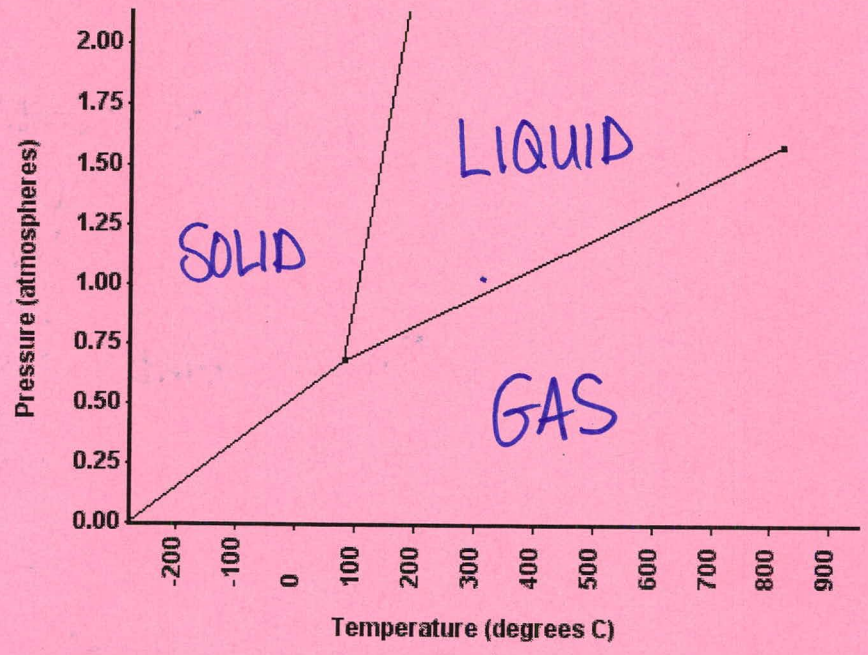
It is never in liquid state at 200°C. Temp has to be above 350°C to form liquid.

6) If I wanted to, could I drink compound X?

Temp. & pressure for liquid state too high – you'd be a dead duck!

Phase Diagram Worksheet

Refer to the phase diagram below when answering the questions on this worksheet:



1) What is the normal freezing point of this substance? 100°C

2) What is the normal boiling point of this substance? ~ 375°C

3) ~~What is the normal freezing point of this substance?~~

4) If I had a quantity of this substance at a pressure of 1.25 atm and a temperature of 300^0 C and lowered the pressure to 0.25 atm, what phase transition(s) would occur?

Vaporization
Liquid → GAS

5) At what temperature do the gas and liquid phases become indistinguishable from each other? 825°C

6) If I had a quantity of this substance at a pressure of 0.75 atm and a temperature of -100^0 C, what phase change(s) would occur if I increased the temperature to 600^0 C? At what temperature(s) would they occur?

At ~100°C it would melt.
At ~175°C it would boil.