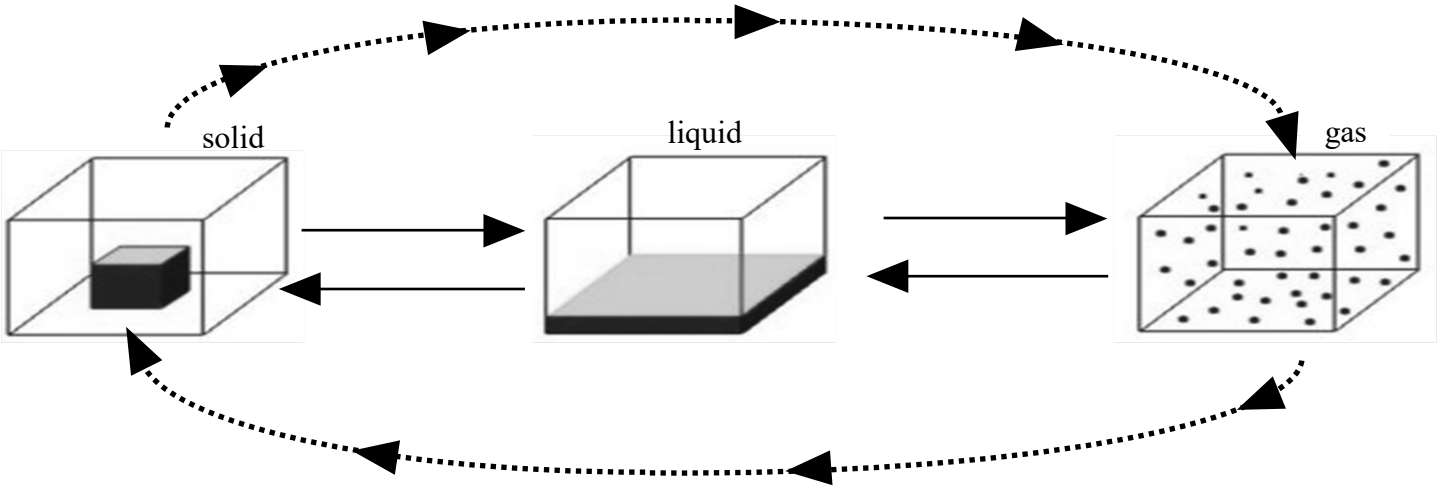
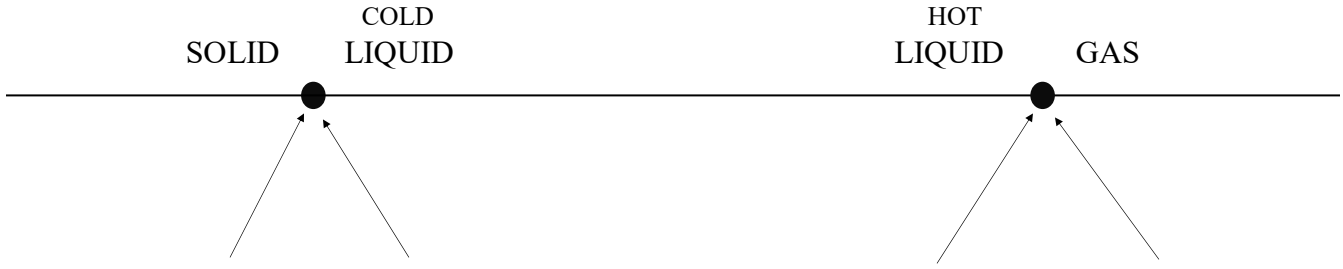
Phases Chemistry Notes

name _____

1. Fill in all six phases changes by their names, from solid ↔ liquid, liquid ↔ gas, and solid ↔ gas



2. Indicate the "important" temperatures for water (at standard pressure), and all three phases.



_____°C _____ K _____°C _____ K

3. A heating curve shows the specific _____ associated with the different

   _____ _____ for any substance, as heat is _____.

4. A cooling curve shows the specific _____ associated with the different

   _____ _____ for any substance, as heat is _____.

5. The necessary information for either a HEATING or COOLING curve includes the _____ point and the _____ point.

6. The melting point = the _____ point.

7. The boiling point = the _____ point.

8. We will draw the heating curve for water. Note: you can't start the graph at absolute zero! Start the graph above 0 Kelvin to start!

Think: Title, Y axis with units & numbers, X axis with words only, choose a point to start, draw line segments, the last segment gets an arrow head, Add "dots" at each segment end point, Label dots L→ R: A B C D E F.

9. Fill in this chart to describe what's happening at each line segment

SEGMENT	TEMPERATURE CHANGE	KINETIC ENERGY CHANGE	POTENTIAL ENERGY CHANGE	PHASE OR PHASES PRESENT
AB				
BC				
CD				
DE				
EF				

10. Temperature is deemed hotter when the particles are moving _____.

11. Colder temperatures indicate that the substance's particles are moving _____.

12. The "energy of motion" is called _____ energy.

13. Skip this one.

14. What ever the Temperature does, the Kinetic Energy _____.

15. If the temperature goes up, the kinetic energy _____.

16. If the temperature goes down, the kinetic energy _____.

17. If the temperature stays steady, the kinetic energy _____.

18. During a phase change on the heating curve, segment BC, heat energy is being added at a constant rate, but the temperature (and the Kinetic Energy) stay steady. The Law of Conservation of Energy says:

Energy cannot be created or destroyed in a chemical reaction, or during a physical change, but it can be transferred.

Potential Energy is the		Increasing PE
GAS	Highest POTENTIAL ENERGY	
LIQUID	Medium POTENTIAL ENERGY	
SOLID	Lowest POTENTIAL ENERGY	Decreasing PE

19. Which phase has the most potential energy? Solid Liquid Gas (circle)

20. Which phase has the LEAST potential energy? Solid Liquid Gas (circle)

21. During a phase change for H_2O, solid to liquid, energy is added, but the temperature remain at 273 Kelvin.

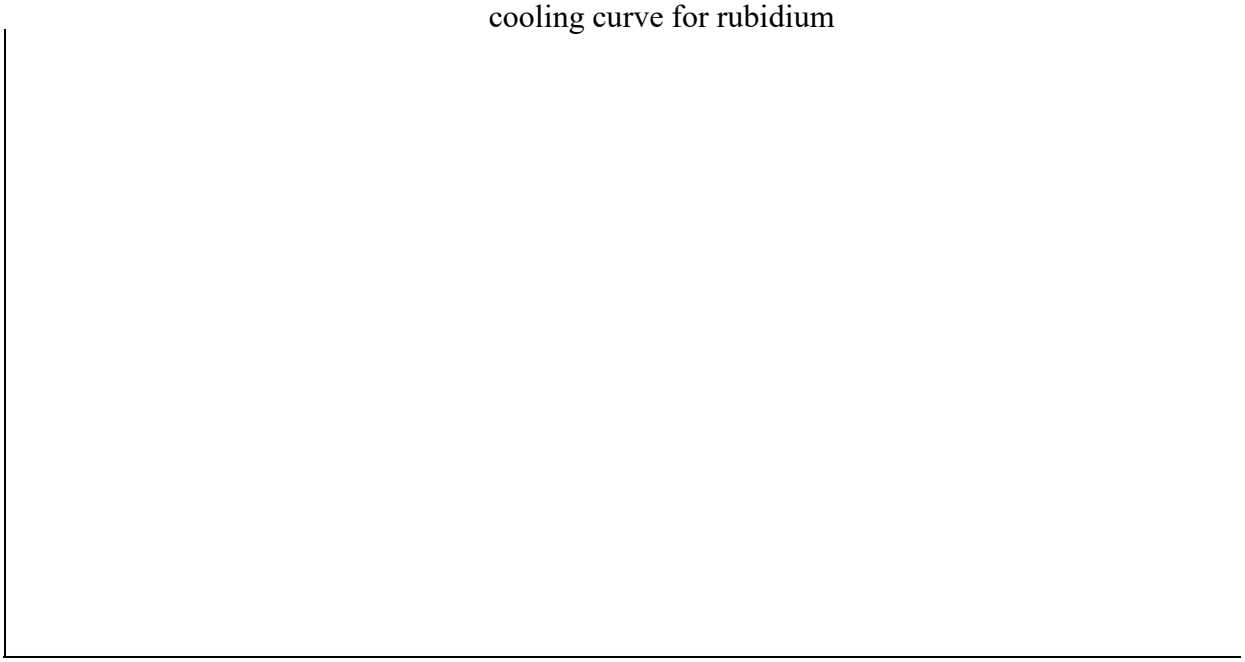
What energy increases during this phase change? _____

22. The ice has a _____ potential energy, while the liquid has a _____ PE.

23. Can both kinetic and potential energy change at the same time? _____

24. Draw the cooling curve for rubidium

cooling curve for rubidium



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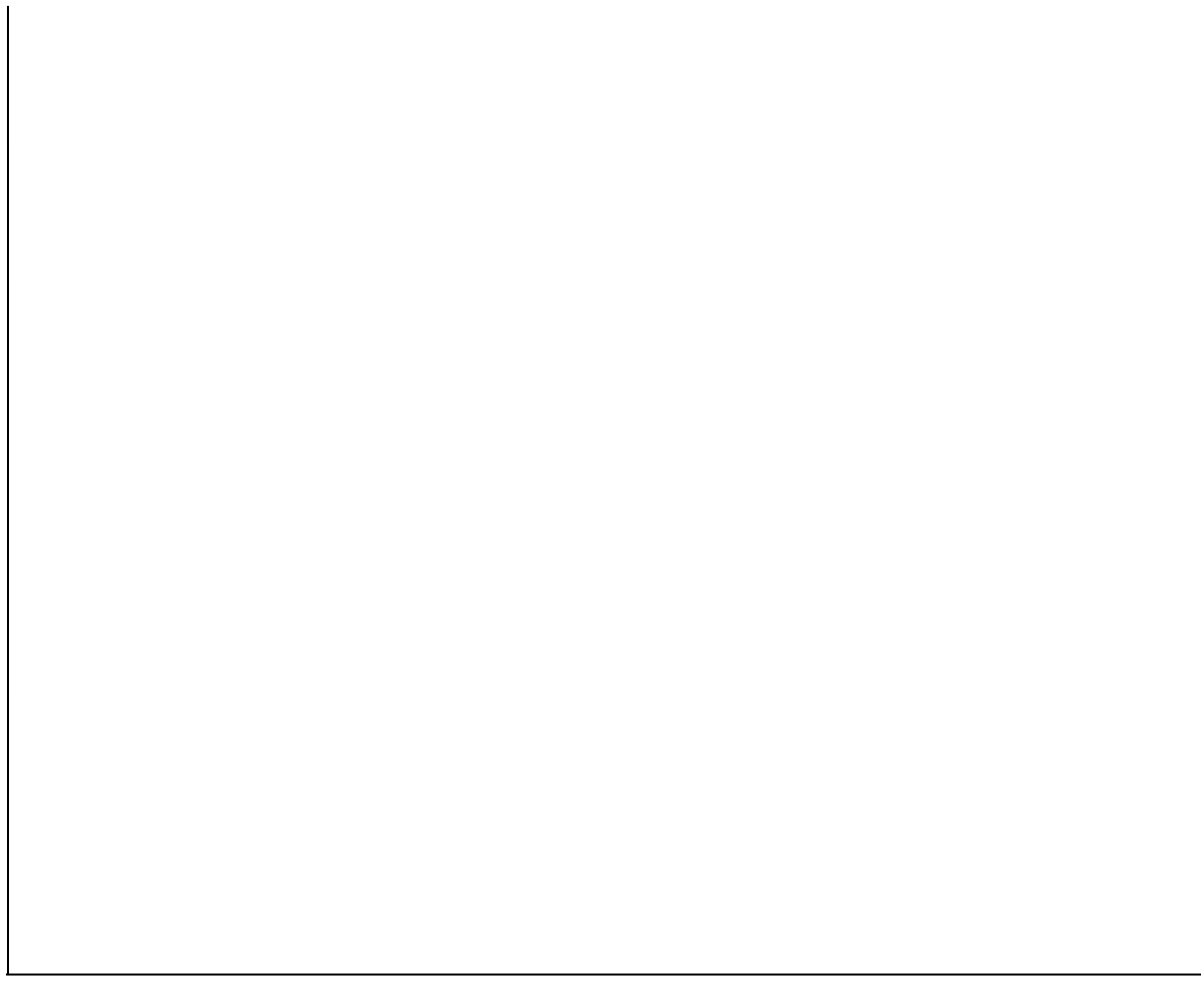
25. Fill in this chart to describe what's happening at each line segment

SEGMENT	TEMPERATURE CHANGE	KINETIC ENERGY CHANGE	POTENTIAL ENERGY CHANGE	PHASE OR PHASES PRESENT
AB				
BC				
CD				
DE				
EF				

Get this data before you begin, then put in temperature scale FIRST	Metal	Freezing/melting point	Boiling/condensation point
	LEAD		
	BISMUTH		

30. On one graph, draw both the heating curve for lead and the cooling curve for bismuth (!) Label both lines.



Important Graph Note: the "hot" phase change is always LONGER than the "cold" phase change.

What are the characteristics of solids, liquids and gases?

31. True or False, nearly every substance can be a solid, liquid or a gas? True or False

32. An exceptions is _____, which is a mixed solid, but combusts before it melts. All elements and *nearly* all compounds can be at any phase with proper temperature and pressure conditions.

33. Where do we find most element melting points and boiling points? _____

34. Where do we find the freezing points and the condensing points if we need to know them? _____

35	Particle Attraction	Particle Movement	Particles are...	Relative Density	Compressibility
Solid					
Liquid					
Gas					

36. Draw the particle diagrams of a solid, liquid and a gas in the boxes below.		
solid	liquid	gas

Gas or Air Pressure

37. Air and Gas Pressure is caused by the _____ of the particles.

38. The more collisions the _____ the pressure. If you put your balloon outside in the winter it shrinks. The cold atmosphere absorbs the energy out of the balloon gas, and the helium atoms slow down. Since they are slower, the collisions are both _____ and _____. This makes for _____ pressure, which makes good kids cry.

39. If you bring the balloon into a warm house, the heat "recharges" the energy in the helium, causing both _____ and more _____, which expands the balloons and the kids _____ again.

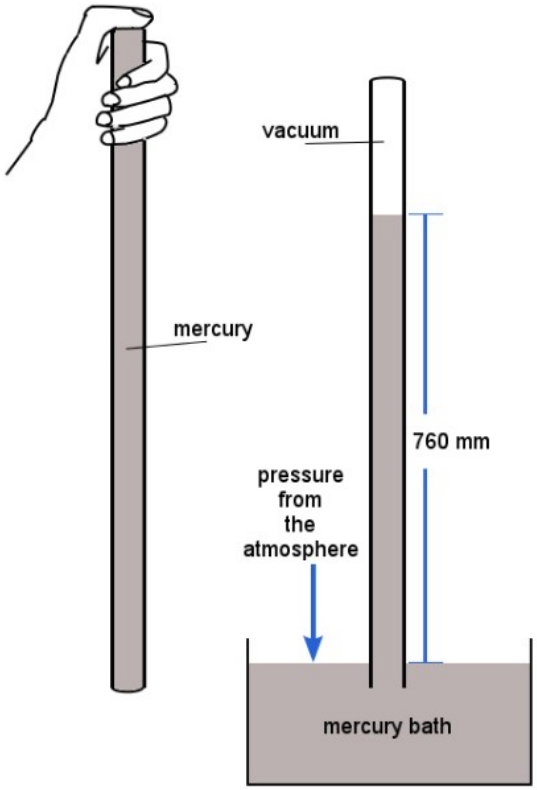
Gas (or air) pressure is measured in four units in chemistry. Most are weirdo, but you will learn them all. Take out table A. <u>Write ALL four units equal to each other under table A (as shown in slides).</u>

40. Normal or Standard Pressure is _____ atmosphere, which is shortened to _____.

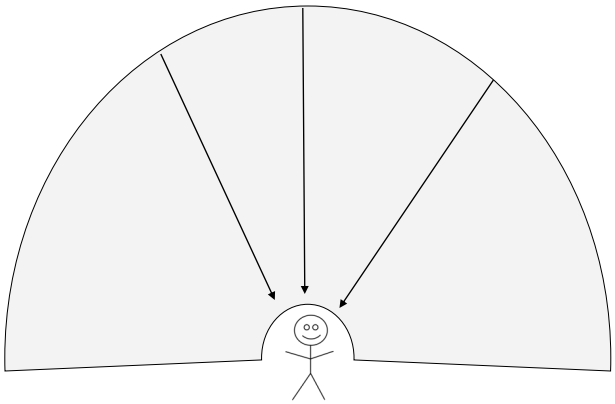
41. Or it's _____ kilopascals. Normal is abbreviated as _____.

42. In America we use pounds per square inch units. Normal is _____.

43. Pressure was originally measured by a device called a _____. Since they used mercury and a metric ruler, normal was originally determined to be _____ by a nice guy named _____.

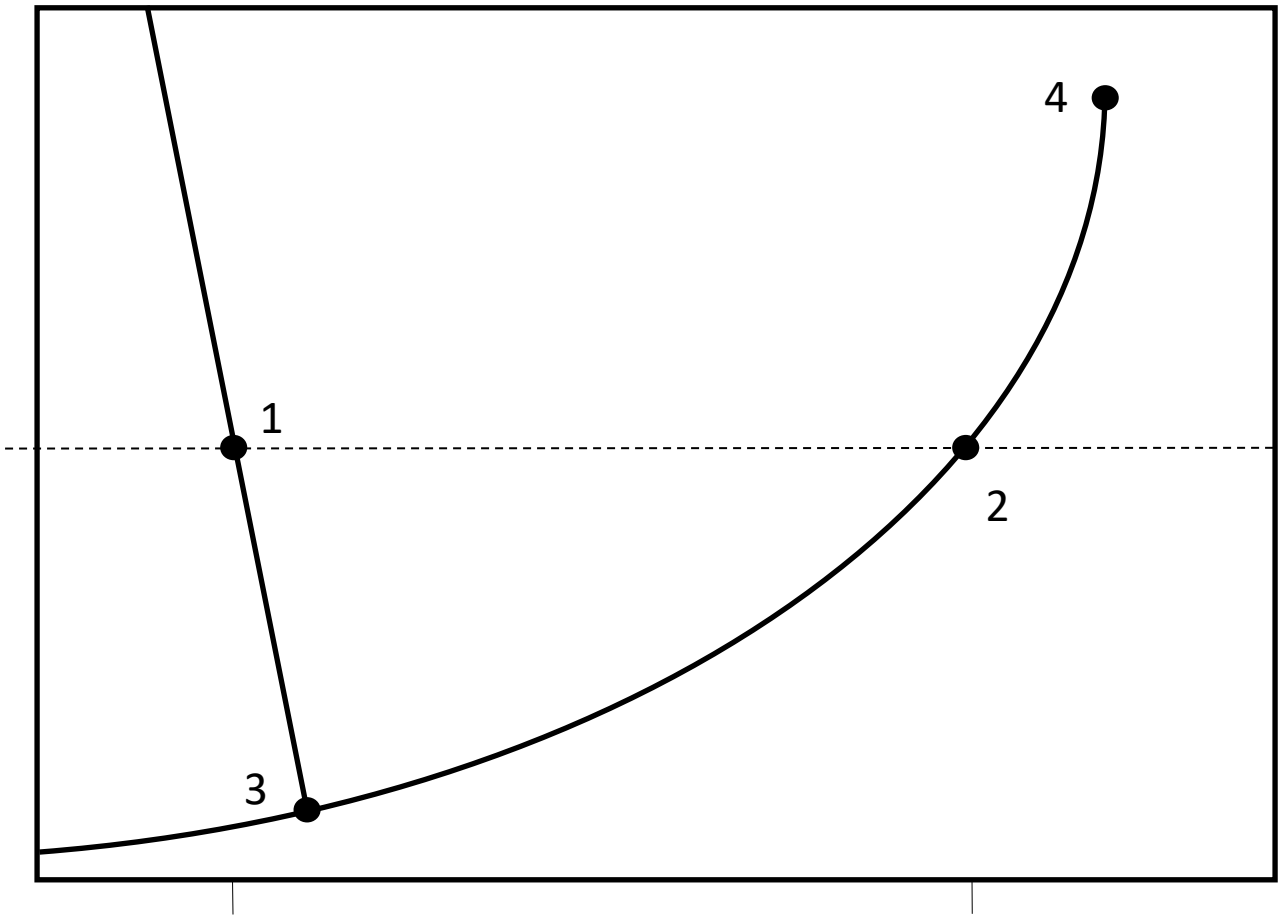


Air is always pressing on you, even if you don't feel it



A PHASE diagram will show the phase of a substance at a variety of temperatures and pressures.
Let's label this phase diagram for water while we discuss it.

TITLE:



44. Point 1 is called _____

45. Point 2 is called _____

46. Point 3 is called _____

47. Point 4 is called _____

48. The dotted line represents _____

49. Draw in the arrows and ALL six phase change names now.

Take out Table H (for Happy).

50. The title for Table H is _____

51. The liquids are: _____, _____ water, _____ acid

52. Another name for ethanoic acid is _____ or vinegar

53. Ethanol is _____

54. Propanone is a ketone. A similar, common, ketone is _____

55. Wata is _____

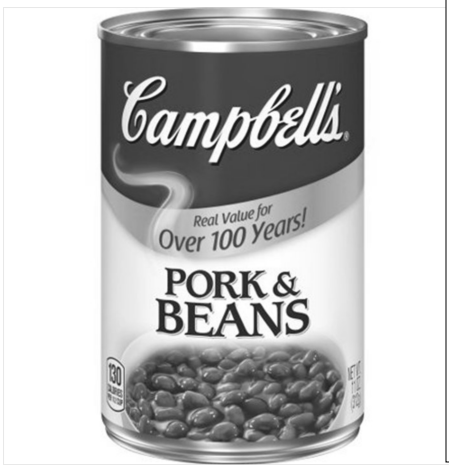
56. The Y axis scale in in _____, and each box is equal to _____

57. The X axis scale is in _____, and each box is equal to _____

58. There are 4 graphs on this table only to _____.

Promise to look at only _____ graph at a time.

59. Vapor Pressure is



60. The can and this bottle are both examples of

_____ systems.

Heating them up could cause an

_____

due to the increasing _____ pressure.
This pressure increases because heat turns the water into steam, with higher kinetic energy,
causing stronger and more

particle _____

Let's assume the air pressure in the room is normal (101.3 kPa). We open the bottle to drink, then reclose it to turn it into a closed system. At the top of the bottle is an air gap that ALSO now has normal pressure.

If you put the bottle down in lab and the room temperature is warmer than normal, say 25°C, what extra pressure in the top of the bottle, on top of the existing normal pressure?

Let's look at table H! (at the water curve!)

61. What is the vapor pressure for water at 20°C? _____

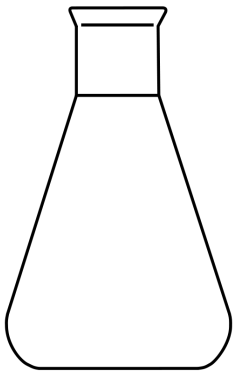
62. The pressure in this gap is now ~ _____

63. What is the vapor pressure if you raise the temp to 70°C? _____

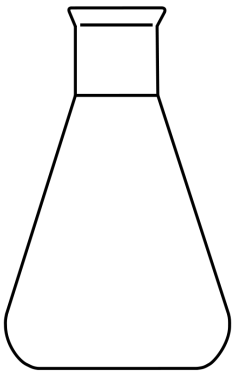
64. If the bottle is pressure rated to 165 kPa and you heat it up to 90°C, what happens?

_____

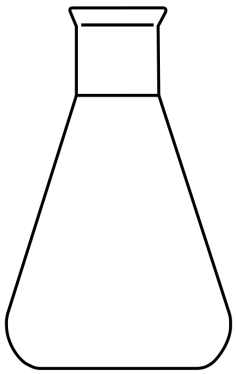
Let's look at these three SEALED bottles. Indicate the vapor pressures for each temperature.



Ethanol



Ethanoic Acid



Propanone

65. At 25°C	_____	_____	_____
66. At 45°C	_____	_____	_____
67. At 75°C	_____	_____	_____

68. Which bottle would burst first if they are all heated up together slowly? _____

69. Once more, vapor pressure is described as:

Some liquids evaporate easier (_____ VP) some liquids evaporate worse (_____ VP)

70. Point 1 is called

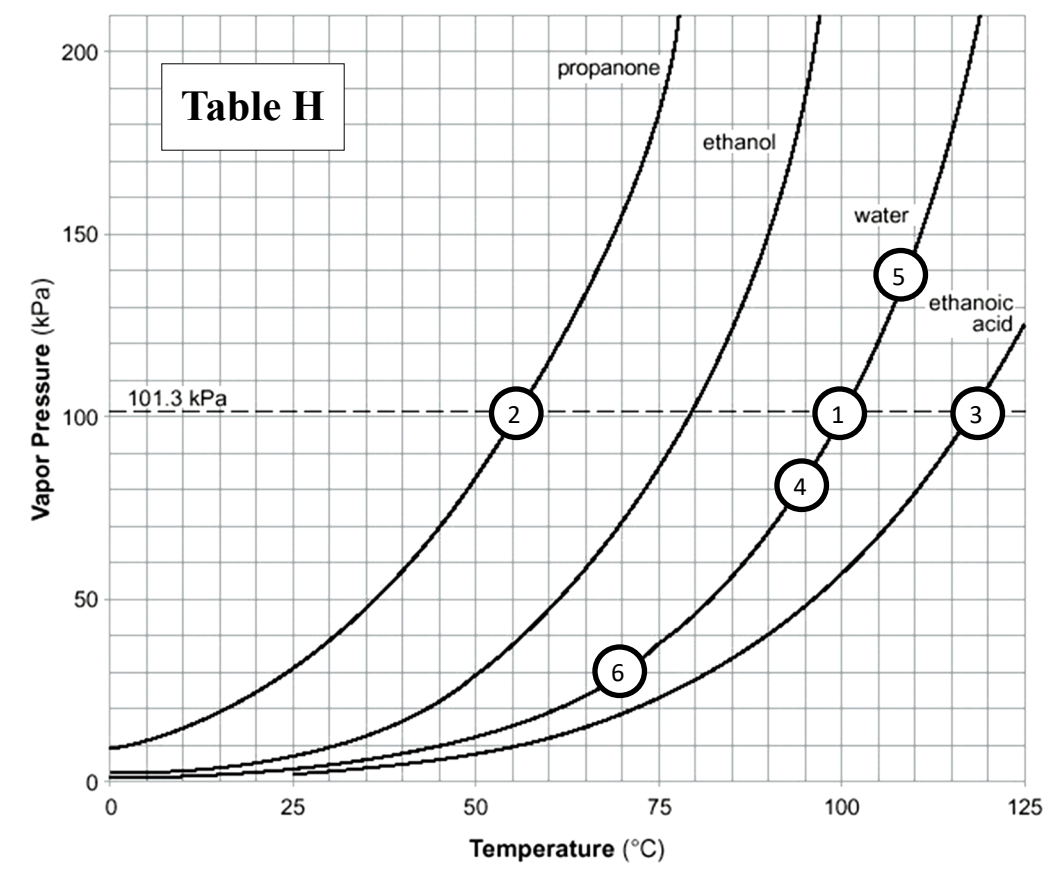
71. Point 2 is called the

72. Point 3 is called the

73. Point 4 is called the

74. Point 5 is called the

75. Point 6 is called the



76. In fact, the curve labeled water represents _____ the _____ of water at different pressures.

77. What is the boiling point of ethanol at 70 kPa? _____

Table H tells us the vapor pressure for these 4 liquids at different temperatures.
If you read the graph backwards. Table H also provides the boiling point of each liquid at any pressure you want it for.

78. ...What is the boiling point of ethanol at 60 kPa? _____°C

79. ……..…… What is the boiling point of propanone at 70 kPa? _____°C

80. …….……What is the boiling point of ethanol at 150 kPa? _____°C

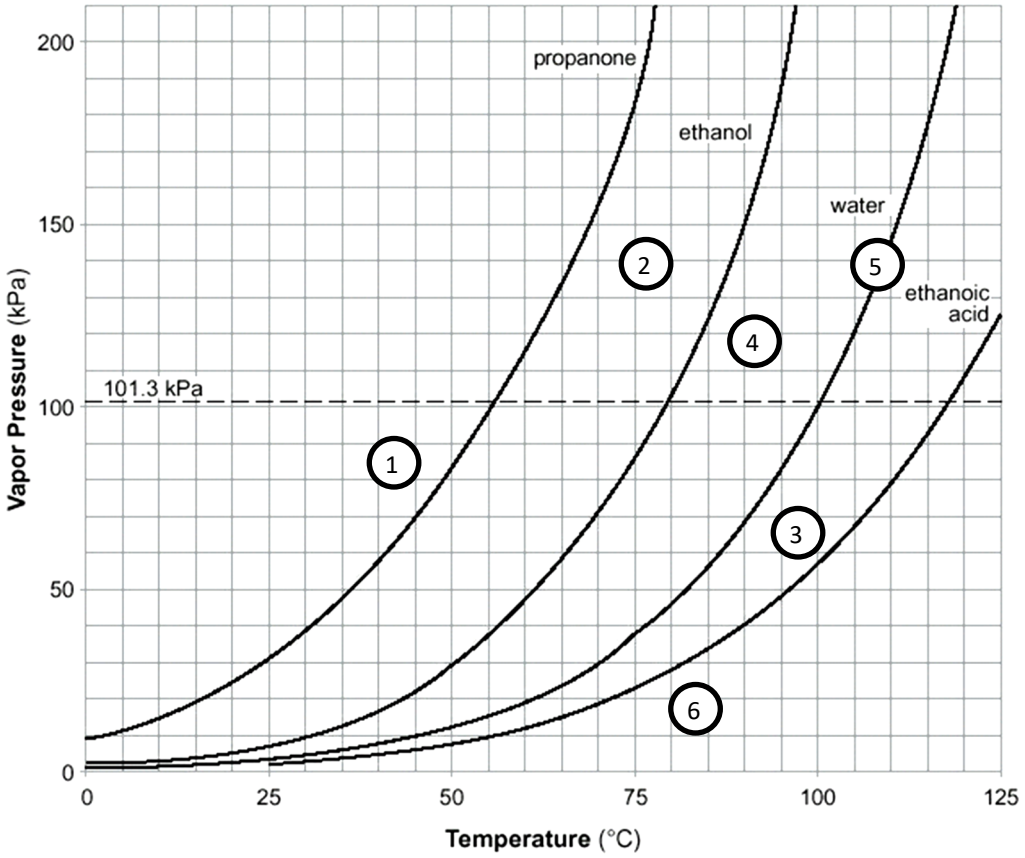
81. ……..……What is the boiling point of water at 180 kPa? _____°C

82. What is the boiling point of ethanol at 30 kPa? _____°C

Table H can also tell us what phase the liquids are at. Pick a point, and determine if you are in front of the curve (exceeded the BP so gas phase) or behind the curve (not at the BP so liquid phase).

83. Mark point "A" at Normal pressure and 115°C. What phase is water? SOLID LIQUID GAS

84. Mark point "B" at 90 kPa and 95°C, what phase is water? SOLID LIQUID GAS



85. At point 1, what phase is propanone? _____

86. At point 2, what phase is propanone? _____ What phase is ethanol? _____

87. At point 3, what phase is water? _____ What phase is ethanoic acid? _____

88. At point 4, what phase is ethanoic acid? _____ What phase is ethanol? _____

89. At point 5, what phase is ethanol? _____ What phase is water? _____

90. At point 6, what phase are all of these liquids? _____

Air and Gas Pressure Conversion Math *(take out table A)*

91. On a cold day the air pressure in Vestal is higher than normal (cold air is more dense and it "settles" onto the Earth a bit more than usual). The pressure registers at 1.20 atm. Convert 1.20 atm into kilopascals.

92. Convert 145 kPa into atmospheres.

93. Convert 905 mm Hg into kPa.

94. Convert 31.0 kPa (pressure atop Mr. Everest) into atmospheres.

95. Convert the high pressure of 2.68 atm into pounds per square inch.

96. The maximum pressure inside an official NBA basketball is 8.50 psi, convert that to mm of Hg.

97. The Kinetic Molecular Theory of Gases (KMT)

What are gases, how do they stay gases, how do we understand gases?

A	
B	
C	
D	
E	
F	
G	