

"Gas Pains"

Name \_\_\_\_\_

1 to 5: Base your answers on table H, the vapor pressure curves.

  D   1. At 25 °C which of these liquids evaporates most **slowly**?

A) propanone B) ethanol C) water D) ethanoic acid

  A   2. Which of these liquids has the weakest intermolecular attractions?

A) propanone B) ethanol C) water D) ethanoic acid

  A   3. Which of these liquids has a normal boiling point of 57°C?

A) propanone B) ethanol C) water D) ethanoic acid

  A   4. What is the vapor pressure of water at a temperature of 333 **Kelvin**?

A) 19 kPa B) 12. kPa C) 48 kPa D) 101.3 kPa

  A   5. What is the boiling point of ethanol when the external pressure is

50 kPa ? A) 62°C B) 71 °C C) 13°C D) 78°C

  B   6. At room temperature H<sub>2</sub>O is a liquid, while H<sub>2</sub>S is a gas. The best explanation of this difference is that at room temperature

A) water is denser than H<sub>2</sub>S

B) water has stronger intermolecular attractions than H<sub>2</sub>S

C) water molecules have a smaller mass than H<sub>2</sub>S molecules

D) the motion of water molecules is slower than the motion of H<sub>2</sub>S molecules

Base your answers to questions 7 - 9 on the following information about glycerol: Glycerol is a liquid that has a normal boiling point of 290°C. Glycerol molecules are about 5 times heavier than water molecules.

  C   7. At 100°C, the vapor pressure of glycerol must be

A) greater than 101.3 kPa B) greater than the vapor pressure of ethanol, but less than the vapor pressure of propanone.

C) less than the vapor pressure of propanoic acid D) less than the vapor pressure of water, but greater than the vapor pressure of propanoic acid.

  B   8. At 300°C and 1 atm. both glycerol and water are in the gas state. It is most likely that

A) glycerol gas is more ideal than water gas. B) water molecules are moving faster than glycerol molecules. C) water gas is denser than glycerol gas D) water molecules have stronger attractions than glycerol molecules

- B   9. Which of these equations shows sublimation?  
A)  $\text{NaCl(s)} \rightarrow \text{NaCl(aq)}$       B)  $\text{I}_2\text{(s)} \rightarrow \text{I}_2\text{(g)}$   
C)  $\text{Br}_2\text{(l)} \rightarrow \text{Br}_2\text{(g)}$       D)  $2 \text{O}_3\text{(g)} \rightarrow 3 \text{O}_2\text{(g)}$
- D   10. A gas at standard temperature has a volume of 10.0 liters. The temperature increases to 819 K, while the pressure remains the same. What is the new volume of the gas ? A) 3.33 liters   B) 5.00 liters   C) 25.0 liters   D) 30.0 liters
- C   11. Gases tend to deviate most from ideal gas behavior under conditions of  
A) high temperature and low pressure   B) high temperature and high pressure  
C) low temperature and high pressure   D) low temperature and low pressure
- A   12. At constant temperature, 10.0 liters of a gas, at an initial pressure of 120. kPa, are expanded to a new volume of 40.0 liters. What is the new pressure of the gas?  
A) 30.0 kPa   B) 480 kPa   C) 100 kPa   D) 40.0 kPa
- B   13. When the kelvin temperature of a gas is doubled, and the volume remains constant, the pressure of the gas   A) halves   B) doubles   C) quadruples  
D) remains the same
- C   14. Two **different** ideal gases are in separate containers. They have the same volume, the same temperature, and the same pressure. The gas that has the smaller mass will also have a **greater** A) number of molecules   B) average kinetic energy   C) average molecular velocity (speed)   D) density
- B   15. The density of an ideal gas will decrease if  
A) the pressure is increased, at constant temperature  
B) the temperature is increased, at constant pressure  
C) the size of the container is decreased, with the temperature constant  
D) the Kelvin temperature and pressure of the gas are both doubled
- A   16. A 10.0 liter tank contains oxygen and neon, at a total pressure of 12.0 atm. Argon gas is added to the tank, with the temperature constant, until the total pressure increases to 18.0 atm. The partial pressure of the argon gas is  
A) 6.0 atm   B) 12.0 atm   C) 18.0 atm   D) 24.0 atm
- B   17. As the external pressure decreases, the boiling point of a liquid  
A) increases   B) decreases   C) remains the same.

\_\_\_C\_\_\_ 18. Which graph produces a straight line in an ideal gas ?

- A) Pressure vs. volume at constant temperature
- B) Temperature vs. vapor pressure
- C) Temperature vs. volume, at constant pressure
- D) Density vs. boiling point, at standard pressure.

\_\_\_A\_\_\_ 19. A substance that maintains the same shape no matter what container it occupies is A) a solid only B) a liquid only C) a solid or liquid only D) a liquid or gas only

\_\_\_D\_\_\_ 20. Constant molecular motion occurs in A) gases only B) gases and liquids only C) gases and solids only D) all states of matter

Fill-ins. Dimethyl ether is a compound that has a normal boiling point of 38°C.

\_\_\_101.3kPa\_\_\_ 21. What is the vapor pressure of dimethyl ether at a temperature of 38°C?

22. A gas is collected at a pressure of 2.00 atmospheres and a temperature of 300K. The volume is determined to be 4.00 liters. At constant temperature the volume of the gas is changed until the pressure drops to 51.2 kilopascals.

A. Convert the initial pressure from atm. to kPa.

$$2 ( 101.3 ) = 202.6 \text{ kPa}$$

B. Find the new volume of the gas. (Show work)

$$P_1V_1 = P_2V_2 \quad 202.6 ( 4.00 ) = 51.2 ( x ) \quad x = 15.8 \text{ liters.}$$

23. A sample of Ar gas is collected at STP, where it has a volume of 12.00 liters. It is expanded to a volume of 24.00 liters, while the temperature **decreases** to -23°C. Assuming that the gas remains ideal under those conditions, calculate the new pressure of the gas. Include the equation that you use to arrive at your answer.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad \text{Can be solved in kPa or atm, but atm. Is easier.}$$

$$1.000 \text{ atm}(12.00 \text{ L})/ 273 \text{ K} = x \text{ atm} ( 24.00 \text{ L})/ 250 \text{ K} \quad x = 0.458 \text{ atm. ( or 46.38 kPa)}$$

Extra Credit: In question 16, suppose that the partial pressure of the neon is twice the partial pressure of the oxygen. If the container contains 4.00 moles of oxygen, how many moles of **argon** does it contain? (show work, or explain)

EC II. 2.00 moles of Ne gas in a 30 liter tank at 273 K exerts a pressure of 1.00 atm. What is the pressure of 3.00 moles of Ar gas in a 90 liter tank at 546 K ?

(show work)

III. In what way is an ideal woman (or man) the opposite of an ideal gas?