#65

Name_____ Date_____ Period_____

Review: States of Matter and The Gas Laws Exam

1) The temperature of Substance A is 50°C. The temperature of Substance B is 320 K.

50 + 273.15 = 323.15K

a) Which substance is hotter? Substance A

b) Which substance has a greater average kinetic energy? Substance A

2) Summarize what happens in each phase change.

a) Condensation Gas to Liquid

b) Deposition Gas to Solid

c) Freezing Liquid to Solid

d) Melting Solid to Liquid

e) Sublimation Solid to Gas

f) Vaporization Liquid to Gas

3a) What temperature is absolute zero? OK

b) What happens at this temperature? All motion stops / even molecules in solids

4a) Define Heat of Fusion.

Energy required to melt 1 mole of ice

b) Define Heat of Vaporization.

Energy required to change 1 mole of H_2O to Vapor

5) What is the difference between a crystalline solid and an amorphous solid?

by organized structure — by no organized structure

6) Summarize the Kinetic Theory of Gases.

- Very small particles separated by empty space
- particles in constant, rapid, random, independent motion
- particles move in straight lines until they collide w/others or their container
- no attraction or repulsion
- collisions elastic

7) The following statements are false. Underline what makes them false statements, and change the underlined items so that the statements are true.

a) Standard conditions when working with gases are 0 K and 1 p.s.i.
0°C 1 atm

b) When using a gas law, if temperature is given in Celsius, it must be converted to Fahrenheit. K

8) The Ideal Gas Law is PV = nRT.

a) State what each variable represents.

P: Pressure V: Volume n: moles R: constant T: Temp.

b) Keep "n, R and T" constant to derive Boyle's Law: $P_1V_1 = P_2V_2$

According to Boyle's Law, as pressure ↑, volume ↓,
or as pressure ↓, volume ↑.

c) Keep "n, R and ~~V~~ P" constant to derive Charles' Law: $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

According to Charles' Law, as temperature ↑, volume ↑,
or as temperature ↓, volume ↓.

d) Keep "n, R and V" constant to derive Amonton's Law: $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

According to Amonton's Law, as temperature ↑, pressure ↑,
or as temperature ↓, pressure ↓.

e) Keep "R, T and P" constant to derive Avogadro's Law: $\frac{V_1}{n_1} = \frac{V_2}{n_2}$

According to Avogadro's Law, as moles ↑, volume ↑,
or as moles ↓, volume ↓.

9a) What is the Combined Gas Law? $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

b) What gas laws are combined to form the Combined Gas Law?

Boyle's, Charles', Amonton's

10) Which of the following expresses Avogadro's Principle.

(a) Equal volumes of gases at the same temperature and pressure contain equal number of particles.
b) One mole of any gas will occupy a certain volume at STP.
c) STP stands for standard temperature and pressure.
d) The molar volume of gas is the volume that one mole occupies at STP.

$PV = nRT$

11) Each of the following examples gives a change in volume, temperature, amount, or pressure of a gas sample. Indicate whether the other variable mentioned would increase or decrease as a result. If the variable is not mentioned, assume it is constant.

a) Compressed air in scuba tanks cools off as a diver swims at deeper levels. The pressure in the tanks Decreased. (temp) $T \downarrow P \downarrow$ $\frac{P}{T}$

b) The volume of an inflated balloon increases when the amount of gas in the balloon Increases. $V \uparrow n \uparrow$

c) A person sits on an air mattress. The pressure Increased. $V \downarrow P \uparrow$

12) For each question below, write *increases* or *decreases*.

a) The room temperature increases. What happens to the pressure inside a cylinder of oxygen contained in the room? Increases $T \uparrow P \uparrow$

b) An aerosol can of air freshener is sprayed into a room. What happens to the pressure of the gas if the temperature stays constant? Decreases $n \downarrow P \downarrow$ (can) $V \uparrow P \downarrow$ (room)

c) The volume of air in human lungs increases before it is exhaled. What happens to the temperature of the air in the lungs to cause this change, assuming pressure stays constant? Increases $V \uparrow T \uparrow$

d) A leftover hamburger patty is sealed in a plastic bag and placed in the refrigerator. What happens to the volume of air in the bag? Decreases $T \downarrow V \downarrow$

e) What happens to the pressure of a gas in a lightbulb a few minutes after the light is turned on? Increases $T \uparrow P \uparrow$

13) Use the appropriate gas law to solve the following problems.

a) At 15°C (T_1), a gas has a volume of 43.2 mL (V_1). The temperature is increased to 75°C (T_2). Assuming that the pressure is constant, calculate the new volume (V_2).

Charles' $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$T_1 = 15°C + 273.15 = 288.15K$

$T_2 = 75°C + 273.15 = 348.15K$

$\frac{43.2mL}{288.15K} = \frac{V_2}{348.15K}$

$V_2 = 52mL$

b) At 4.56 atm (P_1), the volume of a gas is 34.3 L (V_1). The pressure is reduced to 1.23 atm (P_2). What is the new volume (V_2), assuming the temperature remains constant.

Boyle's $P_1V_1 = P_2V_2$

$\frac{(4.56\ atm)(34.3L)}{1.23\ atm} = \frac{(1.23\ atm)(V_2)}{1.23\ atm}$

$V_2 = 127L$

KHO4DCM 23.6 mL → 0.0236 L

c) Find the number of moles of CO_2 gas if you have 23.6 mL at 14°C and the pressure is 0.82 atm. How many molecules of CO_2 do you have?

$T + 273.15 = 287.15 K$

Ideal $\frac{PV}{RT} = \frac{nRT}{RT}$

$n = \frac{PV}{RT}$

$n = \frac{(0.82 atm)(23.6 L)}{(0.0821 \frac{atm \cdot L}{mol \cdot K})(287.15 K)}$

$n = 0.82$ moles CO_2

$0.82 mol\ CO_2 \times \frac{6.02 \times 10^{23} molecules}{1 mol\ CO_2} = 4.9 \times 10^{23}$ molecules CO_2

d) A gas has a pressure of 12 atm at 215°C. What will its pressure be at 35°C if the volume remains constant.

Amontons

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ ______

$\frac{12 atm}{488.15 K} = \frac{P_2}{308.15 K}$

$P_2 = 7.6 atm$

$T_1 = 215°C + 273.15 = 488.15 K$

$T_2 = 35°C + 273.15 = 308.15 K$

e) Calculate the volume that 6.21 moles of Br_2 at 33.1°C and 891 mbar will occupy.

1.23 atm

$\frac{PV}{P} = \frac{nRT}{P}$

$T = 33.1°C + 273.15 = 306.25 K$

$V = \frac{nRT}{P}$

$V = \frac{(6.21 moles)(0.0821 \frac{atm \cdot L}{mol \cdot K})(306.25 K)}{1.23 atm}$

$V = 127 L$