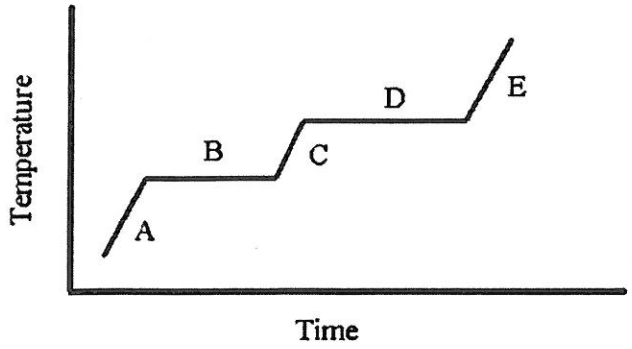
Gases- Accelerated Review Worksheet Name: Key Period: _____

***Note:* <u>You must memorize STP and pressure conversions!!</u>**

Use the graph below to answer the following questions:



1. Label each letter below with either the state of matter or the phase change that is happening in the graph above.
   - A. solid
   - B. solid → liquid (melting) liquid → solid (freezing)
   - C. liquid
   - D. l → g (boiling or evaporation) g → l (condens
   - E. gas

2. Write the phase change equation for the phase changes below for water (make sure to include energy and phases) and determine whether it is an exothermic or endothermic process.
   - a. Freezing: $H_2O_{(l)} \rightarrow H_2O_{(s)} + energy$ exothermic
   - b. Melting: $H_2O_{(s)} + energy \rightarrow H_2O_{(l)}$ endothermic
   - c. Boiling: $H_2O_{(l)} + energy \rightarrow H_2O_{(g)}$ endothermic
   - d. Condensing: $H_2O_{(g)} \rightarrow H_2O_{(l)} + energy$ exothermic

3. The Kinetic Molecular Theory states that gas particles are tiny and are separated from one another by lots of empty space. Particles are in constant, rapid and random motion. The particles collide with each other and the sides of the container – this is what causes pressure. During these collisions, no energy is lost. The higher the Kinetic energy (temp.) the faster the particles move.

4. List 4 properties of gases.
   1. low density
   2. expandable
   3. compressible
   4. diffuse + effuse

5. Explain why gases are compressible, have a low density and can diffuse:
   Because of all the space between particles

6. A barometer is used to measure atmospheric pressure.

7. What 4 variables are used to describe gases? What units do we use for these variables?
   1. P = atm
   2. V = L
   3. T = K
   4. n = mol

8. When pressure doubles on a fixed sample of gas and the temperature remains constant, what will happen to the volume?
cut in half (be specific)

9. When the absolute (Kelvin) temperature of a fixed sample of gas triples and the pressure remains constant, what happens to the volume? it triples (be specific)

10. If the pressure on a fixed amount of gas in a rigid container is reduced by half, what had to happen to the temperature of that gas?
cut in half (be specific)

11. State Dalton's law of partial pressures in words & write the equation.
Total pressure is equal to the sum of the partial pressures
$P_T = P_1 + P_2 + \ldots$

12. What does STP stand for? Standard Temperature + Pressure
13. Standard temperature is 0 °C or 273 K.
14. Standard pressure is 1 atm, 101.3 kPa or 760 mm Hg.
15. State Avogadro's Principle.

16. One mole of any gas at STP occupies 22.4 L. This is called the molar volume.
17. Write the equation for the combined gas law.
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
18. Write the equation for the ideal gas law. Know what all the variables represent!
$PV = nRT$
19. When solving gas law problems, temperature must always be expressed in K.
20. When using the ideal gas law (and only this law), volume must be in units of L
temperature must be in K
pressure must be in atm
"n" must be in moles
21. When pressure is expressed in atm the value for the ideal gas law constant R = .0821.

Problems – Show and name (if applicable) the equation. Show the numbers and units in the problem. Round according to significant figure rules. Include the correct units with the answer. Circle your final answer.

22. A 1.25 L container holds 17.5 g oxygen gas (O_2) of gas at 275 K. What is the pressure?
$PV=nRT$ Ideal $P \times 1.25L = .547mol\,O_2 \times .0821 \times 275K$
$\frac{17.5g\,O_2}{31.998g\,O_2} \left| \frac{1mol\,O_2}{} \right. = .547mol\,O_2$
$P = 9.88atm$

23. A balloon as a volume of 15.4 L at STP. What would its volume be at 150K and 1.25 atm?
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ Combined $\frac{1atm \times 15.4L}{273K} = \frac{1.250atm \times V_2}{150K}$
$V_2 = 6.77L$

25. A gas is under 755.0-mmHg pressure in a flexible container with a volume of 0.50 L at a temperature of –45.0°C. When the gas is heated and the temperature raises 70 degrees and the volume expanded to 4.0 L, what is the new pressure?
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ Combined $\frac{755mmHg \times .50L}{228K} = \frac{P_2 \times 4.0L}{298K}$
$P_2 = 123mmHg$

26. If 2.65 mole of methane gas occupy 15.0 L at 1.50 atm, what is the temperature of the gas in K? And in Celsius?
$PV=nRT$ Ideal
$1.500atm \times 15.0L = 2.65mol \times .0821 \times T$
$T = 103K + -170°C$

27. A gas is collected by water displacement. If the total pressure is 103.67 kPa and the pressure due to the water vapor is 1.72 kPa, what is the pressure of the dry gas? $P_T = P_1 + P_2$ Dalton's Law
$103.67 = 1.72 - P_2$
$P_2 = 101.95kPa$

28. How many liters of gaseous carbon monoxide at 27°C and 0.247 atm can be produced from the burning of 65.5 g of carbon according to the following equation?
gas stoichiometry
$2C(s) + O_2(g) \rightarrow 2CO(g)$
$\frac{65.5g\,C}{12.0111g\,C} \left| \frac{2mol\,CO}{2mol\,C} \right. = 5.45mol\,CO$
$PV=nRT$
$.247atm \times V = 5.45mol\,CO \times .0821 \times 300K$
$V = 543L$

29. A container holds 265 mL of chlorine gas, Cl_2. Assuming that the gas sample is at STP, what is its mass?
molar volume
$\frac{265mL}{1000mL} \left| \frac{1L\,Cl_2}{22.4L\,Cl_2} \right| \frac{1mol\,Cl_2}{} \left| \frac{70.906g\,Cl_2}{} \right. = .839g\,Cl_2$