Name: _____ Date: _____ Period: _____

Review Unit 11: Gas Laws

1. What causes gas pressure in sealed containers? collisions of the gas particles w/ the walls of the container

2. To increase the gas pressure in a container, you could... (*circle* and *fill in the blank*)

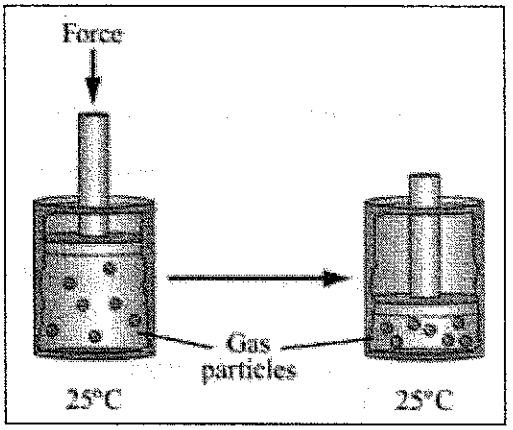
   a) increase / (decrease) the volume

   b) (increase) / decrease the temperature

   c) (increase) / decrease the kinetic energy of the gas particles

   or (increase)

3. Applying force to the piston pictured to the right results in the compression of the gas particles at a constant temperature causing an increase in gas pressure.
   Which one of the following ***best*** describes the change in gas particles after compression?



   A. The average kinetic energy of the gas particle increases.
   B. The average kinetic energy of the gas particles decreases.
   C. The gas particles hit the container walls harder with increased speed and force.
   (D.) The gas particles hit the container walls with more often with increased frequency.

4. If the volume of a gas sample is doubled, the pressure of the gas will...
   (A.) decrease by half
   B. remain the same
   C. increase 2 times
   D. increase 4 times

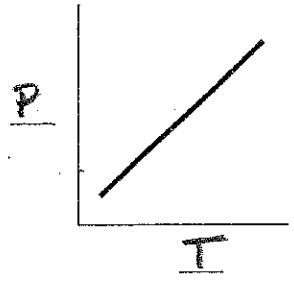
5. If the absolute temperature of a gas sample is doubled, the pressure of the gas will...
   A. decrease by half
   B. remain the same
   (C.) increase 2 times
   D. increase 4 times

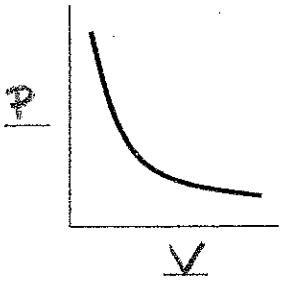
6. If the absolute temperature of a gas sample is doubled while the volume is halved, the pressure of the gas will...
   A. decrease by half
   B. remain the same
   (C.) increase 2 times
   D. increase 4 times

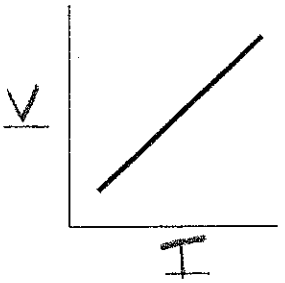
7. Under which conditions will the volume of a given sample of a gas increase?

A. decreased pressure and decreased temperature
B. decreased pressure and increased temperature
C. increased pressure and decreased temperature
D. increased pressure and increased temperature

8. Label each x and y axis of the graphs below to show the correct relationship between gas variables (*P, V, T*)







9. What does STP stand for? standard temperature + pressure

What are the values of STP with units? 273 K and 1.00 atm

For #10-11, you may refer to the following formulas and information:

$K = {}^{\circ}C + 273$	1 atm = 760 mmHg = 101.3 kPa

10. Convert the following pressures:

2.50 atm to 1900 mmHg

$$2.50\ atm \left| \frac{760\ mmHg}{1\ atm} \right. =$$

680 mmHg to .895 atm

125 kPa to 1.23 atm

$$125\ kPa \left| \frac{1\ atm}{101.3\ kPa} \right.$$

800 mmHg to 107 kPa

$$800\ mmHg \left| \frac{1\ atm}{760\ mmHg} \right| \frac{101.3\ kPa}{1\ atm} =$$

11. Convert the following temperatures:

25.0°C to 298 K

373 K to 100 °C

-86.0°C to 187 K

100 K to -173 °C

12. The temperature of a sample of water is changed from 150 K to 450 K. The same change in Celsius degrees would be _____.

A. 573
B. 300
C. 27
D. -27

$-123\,^{\circ}C$ to $177\,^{\circ}C$

300

For #13-??, you may refer to the following formulas and information:

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$K = {}^{\circ}C + 273$

1 atm = 760 mmHg = 101.3 kPa

Calculations: **SHOW WORK** and **BOX** your **ANSWER** with **UNIT**

(**ALL** temperatures **MUST** be in **K**, ***NOT °C***)

13. A gas at 285 K and a volume of 1.28 L is heated to 335 K. What is the new volume is pressure is held constant?

$T_1 = 285K$
$V_1 = 1.28L$
$T_2 = 335K$
$V_2 = ?$

$$V_2 = \frac{V_1 T_2}{T_1} = \frac{(1.28L)(335K)}{(285K)} = 1.50L$$

$V_2 T_1 = V_1 T_2 \quad (285K)V_2 = (1.28L)(335K)$

14. 2.00 L of a gas at 2.58 atm is compressed to a volume of 1.20 L. What is the new pressure if the temperature is constant?

$V_1 = 2.00L$
$P_1 = 2.58atm$
$V_2 = 1.20L$
$P_2 = ?$

$$P_2 = \frac{V_1 P_1}{V_2} = \frac{(2.00L)(2.58\,atm)}{(1.20L)} = 4.3atm$$

15. A gas at 25.0°C and 760 mmHg is cooled to 0.00°C. What is the pressure if the volume is held constant?

$T_1 = 295K$
$P_1 = 760mmHg$
$T_2 = 273K$
$P_2 = ?$

$$P_2 = \frac{P_1 T_2}{T_1} = \frac{(760mmHg)(273K)}{(295K)}$$

16. A gas at 285 K and a volume of 1.28 L is heated to a volume of 4.54 L. What is the final temperature of the gas if pressure is held constant?

$T_1 = 285K$
$V_1 = 1.28L$
$V_2 = 4.54L$
$T_2 = ?$

$$T_2 = \frac{T_1 V_2}{V_1} = \frac{(285K)(4.54L)}{(1.28L)} = 1010K = 738\,^{\circ}C$$

17. 5.00 L of a gas at 20°C and 0.815 atm is stored in a flexible container. What is the volume of the gas at STP?

$$V_2 = \frac{P_1 V_1 T_2}{P_2 T_1} = \frac{(0.815\,atm)(5.00\,L)(273\,K)}{(1.00\,atm)(293\,K)} = 3.80\,L$$

For #18-22, you may refer to the following formulas and information:

PV = nRT	R = 0.0821 L·atm / mol·K	1 atm = 760 mmHg = 101.3 kPa
		K = °C + 273

Calculations: SHOW WORK and BOX your ANSWER with UNIT

(ALL temperatures MUST be in K, NOT °C)

18. What is the volume of 2.00 moles of a gas at STP?

$$V = \frac{nRT}{P} = \frac{(2.00\,mol)(0.0821\,\frac{L\cdot atm}{mol\cdot K})(273\,K)}{(1.00\,atm)} = 44.8\,L$$

19. A 3.50 mol sample of a gas at 305 K and a pressure of 800 mmHg. What is the volume of the gas?

$$V = \frac{nRT}{P} = \frac{(3.50\,mol)(0.0821\,\frac{L\cdot atm}{mol\cdot K})(305\,K)}{1.05\,atm} = 83.5\,L$$

$$800\,mmHg \left| \frac{1\,atm}{760\,mmHg} \right. = 1.05\,atm$$

20. If 32.0 grams of a gas occupies 12.5 liters at 1.42 atm and 298 K, what is the molar mass of the gas? Check your reference sheet for the formula for Molar Mass (M)

$$M = \frac{mRT}{PV} = \frac{(32.0\,g)(0.0821\,\frac{L\cdot atm}{mol\cdot K})(298\,K)}{(1.42\,atm)(12.5\,L)} = 44.1\,g/mol$$

21. Consider the reaction: $N_2(g) + 3\,H_2(g) \rightarrow 2\,NH_3(g)$

What is the total number of liters of NH_3 produced when 11.2 liters of H_2 reacts completely at STP? (Use the IGL to find moles (n) of H_2 at STP then use stoichiometry to find liters of NH_3)

$$n = \frac{PV}{RT} = \frac{(1.00\,atm)(11.2\,L\,H_2)}{(0.0821\,\frac{L\cdot atm}{mol\cdot K})(273\,K)} = 0.500\,mol\,H_2 \left| \frac{2\,mol\,NH_3}{3\,mol\,H_2} \right. \left| \frac{22.4\,L}{1\,mol} \right. = 7.46\,L\,NH_3$$

22. Consider the reaction: $Mg(s) + 2\,HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

When 48.6 grams of Mg(s) reacts completely, what is the volume of $H_2(g)$ produced if the reaction occurs at 22.0°C and 0.910 atm? (Use stoichiometry first grams of Mg to moles of H_2 then the IGL)

$$48.6\,g\,Mg \left| \frac{1\,mol\,Mg}{24.31\,g\,Mg} \right. \left| \frac{1\,mol\,H_2}{1\,mol\,Mg} \right. = 2.00\,mol\,H_2$$

$$V = \frac{nRT}{P} = \frac{(2.00\,mol)(0.0821\,\frac{L\cdot atm}{mol\cdot K})(295\,K)}{(0.910\,atm)}$$

$$V = 53.2\,L$$