CHEMISTRY Name: Mr L

Date: 3/28

# Gas Laws Quiz

| | | |
|---|---|---|
| $P_1V_1 = P_2V_2$ Boyle's Law | $P_{total} = P_1 + P_2 \ldots$ Dalton's Law | $P_{gas\ collected} = P_{atm} - P_{H2O}$ Gas Collection Calculation |
| $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ Charles's Law | $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ Combined Gas Law | |

Conversion Factors

1 atm = 760 mmHg*

1 atm = 760 torr*

1 atm = 101.325 kPa*

1 atm = 1.013 bar *exact

1. What is the Ideal Gas Law? Write out the equation.

PV = nRT (will be given to you on test)

STP 0°C 1 atm 273.15 K 22.4 L/mol @STP

2. What is the Ideal Gas Law Constant, R? (include units)

.0821 $\frac{L\,atm}{K\,mol}$

Problems – 5 pts each: 1 point correct equation SHOWN, 2 points correct work, 1 point correct answer, and 1 point correct units. Show all your WORK for full credit. (oh and watch those significant digits).

3. 38 L of gas is at a pressure of 5.3 atm. If the gas is compressed to a volume of 2450 mL, what will the pressure of the gas be?

$P_1V_1 = P_2V_2$ $\quad 5.3\ atm \times 38\ L = P_2 \times 2.45\ L$

$P_2 =$ 82 atm

4. Some students believe that teachers are full of hot air. If I inhale 3.2 liters of gas at a temperature of 12° C and it heats to a temperature of 35° C in my lungs, what is the new volume of the gas?

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{3.2\ L}{285.15\ K} = \frac{V_2}{308.15\ K}$

$V_2 =$ 3.5 L

5. If I have 2.3 moles of hydrogen gas at a pressure of 2.1 atm, and a temperature of 256 K, what volume of hydrogen do we have?

$PV = nRT$ $\quad (2.1\,atm)V = (2.3\,mol)(.0821\,\frac{L\,atm}{K\,mol})(256\,K)$

$V = \boxed{23\,L}$

6. I have an unknown volume of gas at a pressure of .75 atm and a temperature of 343 K. After putting the gas in the refrigerator, we reach standard temperature and gas conditions(STP) and measure the final volume to be 33 liters. What was the initial volume of the gas?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\quad \frac{(.75\,atm)(V_1)}{343\,K} = \frac{(1\,atm)(33\,L)}{273.15\,K}$

$V_1 = \boxed{55\,L}$

7. A sample of hydrogen is collected over water at ~~28°C~~ 28.0°C when the atmospheric pressure is 1.12 atm. What is the partial pressure of the hydrogen collected? (answer over 800 or over 1.0 depending on your unit) → chart

$P_{gas} = P_{atm} - P_{H_2O}$ (same unit)

$= 1.12\,atm -$ (×760)

$= 851.2\,torr - 28.35\,torr = \boxed{823\,torr}$

8. Magnesium metal reacts with hydrochloric acid to produce hydrogen gas and an ionic salt. How many liters of hydrogen can be produced at STP if 10.5g of hydrochloric acid are reacted with excess magnesium? (answer: 3.23)

$Mg + 2HCl \rightarrow H_2 + MgCl_2$

$10.5\,g\,HCl \left|\frac{1\,mol}{36.45\,g}\right.\left|\frac{1\,H_2}{2\,HCl}\right.\left|\frac{22.4\,L}{1\,mol}\right. =$

$\boxed{3.23\,L}\ H_2$

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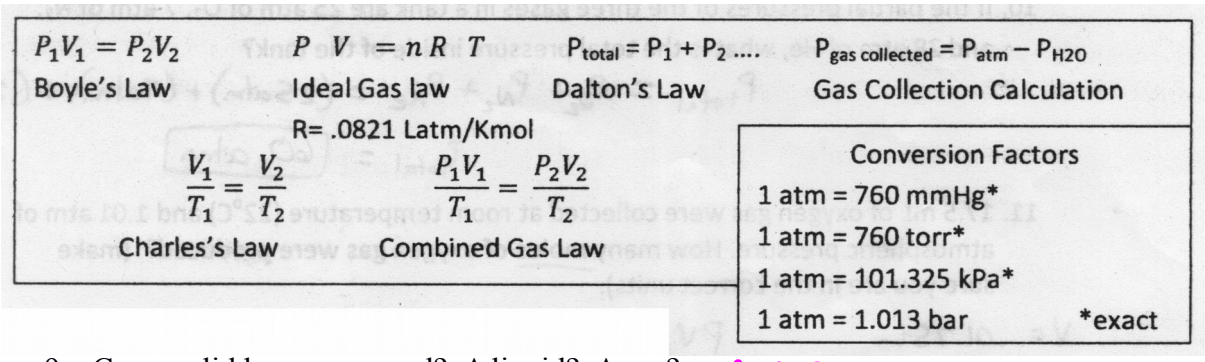
# Chapter 12 Review

*This chapter has been about how gases act and how we can predict their behavior. Besides knowing the concepts for your test, you will need to be able to perform a number of calculations.*




9. Can a solid be compressed? A liquid? A gas?
   no negligible yes
10. What do we assume about the type of collisions between gas molecules?
    straight motion, fast, elastic collisions
11. In Boyle's Law are pressure and volume directly or inversely related?
    inversely
12. What happens to the kinetic energy of a gas as temperature goes up? And the velocity of the molecules?
    more more
13. How many atm are equivalent to 544 mm Hg? $\frac{1\ atm}{760\ mmHg} = .716\ atm$
14. What unit of temperature should you always be in for Gas Law calculations?
    Kelvin
15. How many Kelvin are in 35.0°C?
    308.15K
16. As a gas is compressed in a cylinder... (tell me *increases, decreases, or constant)*
    a. its mass constant.
    b. the number of gas molecules constant.
    c. its pressure increases
    d. its volume decreases.
    e. the distance between gas molecules decreases
    f. its density increases.

17. Synthetic diamonds can be manufactured at pressures of $6.00 \times 10^4$ atm. If we took 2.00 liters of gas at 1.00 atm and compressed it to this pressure, what would the volume of that gas be?

$P_1V_1 = P_2V_2$ $(60{,}000\ atm)(V_1) = (1.00\ atm)(2.00\ L)$

$V_1 = \frac{2.00}{60{,}000}$ $V_1 = 3.33 \times 10^{-5}\ L$

18. If the partial pressures of the three gases in a tank are 25 atm of $O_2$, 7 atm of $N_2$, and 28 atm of He, what is the total pressure inside of the tank?

$P_{total} = 25 + 7 + 28 = 60\ atm$

1000mL = L

19. 17.5 mL of oxygen gas were collected at room temperature (22°C) and 1.01 atm of atmospheric pressure. How many moles of oxygen gas were produced? (make sure you are in the correct units).

$PV = nRT$

$P_{gas} = P_{atm} - P_{H_2O}$ $(.98421\ atm)(.0175\ L) = n(.0821)(295.15)$

$= 1.01\ atm - 19.83\ torr = 767\ torr - 19.83\ torr$ $n = 7.11 \times 10^{-4}\ mol$

$= 748\ torr$

1 atm = 760 torr

20. Calculate the partial pressure of hydrogen gas collected when the barometric pressure is 735 mmHg and a temperature of 24 °C. (Use the vapor pressure sheet).

= atmospheric

$P_{gas} = P_{atm} - P_{H_2O}$ (chart)

$= 735\ torr - 22.38\ torr = 713\ torr$

21. Zinc metal reacts with hydrochloric acid to produce hydrogen gas. How many liters of hydrogen can be produced at STP if 17.5g of zinc are reacted with excess HCl?

$Zn + 2\ HCl \rightarrow H_2 + ZnCl_2$

$17.5\ g\ Zn \left| \frac{1\ mol}{65.39\ g} \right| \frac{1\ H_2}{1\ Zn} \left| \frac{22.4\ L}{1\ mol} \right| = 5.99\ L\ H_2$

22. What does STP stand for? What temperature and pressure correspond to it?

Standard Temperature (0°C) and Pressure (1 atm)

23. How many liters does one mole of krypton gas occupy at STP?

22.4 L