CHEMISTRY II

Name: KEY
Date: ___________

Chapter 10 Review – Gases

Match the gas with its description

1. I Methane (CH_4)
2. A Ethylene (C_2H_4)
3. E Nitrogen dioxide (NO_2)
4. J Ammonia (NH_3)
5. H Propane(C_3H_8)
6. C Nitrous oxide (N_2O)
7. G Hydrogen Cyanide (HCN)
8. D Hydrogen Sulfide (H_2S)
9. B Carbon monoxide (CO)
10. F Sulfur dioxide (SO_2)

a) Colorless, ripens fruit
b) Toxic, colorless, odorless
c) Colorless, sweet odor, laughing gas
d) Very toxic, odor of rotten eggs
e) Toxic, red-brown, irritating odor
f) Colorless, irritating odor
g) Very Toxic, slight odor of bitter almonds
h) heavier, colorless; flammable
i) lighter, odorless, flammable
j) Colorless, pungent odor

11. As the temperature of a gas increases, the molecules move faster

12. The assumption of the kinetic theory that explains why the pressure exerted by an enclosed gas is constant is that Average KE $\propto$ Temperature

13. What are the principles of the kinetic-molecular theory?

14. What types of gases will have the **highest** average kinetic energy?

higher temerature

15. A chemical factory has a vat of gas at a pressure of 13 atm. Under these conditions, what equation could the chemical engineers use to calculate the temperature inside the vat? Combined Gas ~~Combined~~ $\frac{PV}{T}$

16. Which part of the Kinetic Molecular Theory fails at extreme conditions?

- Volume of gas negligable
- Attractions negligable

17. Which of the following makes the most significant impact on whether a gas follows the ideal gas law?

Pressure

18. An engineer wants to calculate the number of moles of O_2 gas with a pressure of 23 atm, 300 K, and volume of 230 L. Name 2 ways with which he can alter the conditions to allow him to use the ideal gas law.

- very higher temp >1000°C
- get pressure under 10 atm

$P_{total} = P_{gas} + P_{H2O}$	$d = \frac{PM}{RT}$	$M = \frac{dRT}{P}$	$P_t = n_t \frac{RT}{V}$

Other provided equations in test periodic table packet.

Part III: Calculations

19. Mercury oxide can decompose to produce liquid mercury and oxygen gas. If we use 22.5 g of HgO and it is produced at a barometric pressure of 825 mm Hg and temperature of 27.0 degrees celcius.
    a. How many moles of oxygen gas are produced? (ans: .052)
    b. Calculate the partial pressure of oxygen collected over H_2O (ans: 798)
    c. The actual yield of oxygen gas is .935 L . What is the percent yield of this reaction? (ans: 76.6)

$$\underline{2}\,HgO \xrightarrow{} \underline{2}\,Hg\,(l) + \underline{\ \ }\,O_2\,(g)$$

a) $$\frac{22.5g\ HgO}{} \left|\frac{1\ mol}{216.59g}\right| \frac{1\ O_2}{2\ HgO} = \boxed{.0519\ mol\ O_2}$$

b) $$P_{total} = P_{O_2} + P_{H_2O}$$
$$825\ torr = P_{O_2} + 26.74\ torr \qquad P_{O_2} = \boxed{798\ torr}$$

c) $$\frac{\text{Actual}}{\text{teoretical}} \times 100\%$$

$$PV = nRT$$
$$(1.05_{atm})(v) = (.0519_{mol})\left(\frac{.0821\ L\,atm}{K\,mol}\right)(300.15)$$
$$V = 1.218L$$

$$\frac{.935}{1.218L} \times 100\% = \boxed{76.8\%}$$

20. We have an unknown gas in a balloon and a helium balloon of the same size. We observe that the helium that effuses out of a balloon 2.827 times faster than the unknown gas.

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- a. Calculate the molar mass of the unknown gas (ans: 31.99)
- b. What gas do you think it is?

r_2

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}} \qquad 4.003 \cdot (2.827)^2 = \left(\sqrt{\frac{M_2}{4.003}}\right)^2 \cdot 4.003$$

$$M_2 = \boxed{31.99\,g/mol}$$

O_2?

21. The temperature inside my refrigerator is about 2.00^0 Celsius. If I place a balloon in my fridge that initially has a temperature of 32.00^0 C and a volume of 1.72 liters, what will be the volume of the balloon when it is fully cooled by my refrigerator? (ans: 1.55)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \frac{(1.72L)}{305.15K} = \frac{V_2}{275.15K} \qquad V_2 = \boxed{1.55L}$$

22. We have a 2.85 mole balloon of oxygen gas at STP.

$$d = \frac{PM}{RT}$$

- a. Calculate the density of the oxygen gas (ans: 1.43)
- b. Calculate the rms speed of the oxygen molecules (ans: 461.4)
- c. Calculate the volume of the balloon (ans: 63.8)

a) $$d = \frac{(1\,atm)(32.00\,g/mol)}{(.0821\,\frac{L\,atm}{K\,mol})(273.15)} = \boxed{1.43\,g/L}$$

b) $$u = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3(8.314\,\frac{J}{K\,mol})(273.15)}{\overset{32.00}{.03200\,kg/mol}}} = \boxed{\cancel{14.59}\,m/s} = \boxed{461.4\,m/s}$$

c) $PV = nRT$

23. We have 63.2 mole Xenon gas system with a pressure of 33.1 atm, a volume of 43.2 L. We don't have a thermometer that works at that pressure. Calculate the temperature of the system (ans: 324)

> 10 atm Van

p. 395

$$\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$$