



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 temperature

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 Law $\frac{PV}{T}$

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

- Volume of gas negligible
- Attractions negligible

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 $> 1000^\circ C$
- get pressure under 10 atm

$$P_{\text{total}} = P_{\text{gas}} + P_{H_2O}$$

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

$$M = \frac{dRT}{P}$$

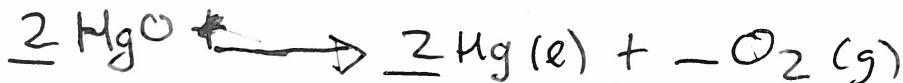
$$P_i = n_i \frac{RT}{V}$$

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.

- How many moles of oxygen gas are produced? (ans: .052)
- Calculate the partial pressure of oxygen collected over H_2O (ans: 798)
- The actual yield of oxygen gas is .935 L. What is the percent yield of this reaction? (ans: 76.6)



$$a) \frac{22.5g HgO}{216.59g} \times \frac{1 mol}{2 HgO} \times \frac{1 O_2}{2 HgO} = .0519 mol O_2$$

$$b) P_{\text{total}} = P_{O_2} + P_{H_2O}$$

$$825 \text{ torr} = P_{O_2} + 26.74 \text{ torr}$$

$$P_{O_2} = 798 \text{ torr}$$

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

$$PV = nRT$$

$$(1.05 \text{ atm})(V) = (.0519 \text{ mol}) \left(\frac{.0821 \text{ L atm}}{\text{mol K}} \right) (300.15)$$

$$V = 1.218 L$$

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

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.

a. Calculate the molar mass of the unknown gas (ans: 31.99)

b. What gas do you think it is?

He $\frac{r_1}{r_2} = \sqrt{\frac{m_2}{m_1}}$ $4.003 (2.827)^2 = \sqrt{\frac{m_2}{4.003}}$ $m_2 = \boxed{31.99 \text{ g/mol}}$

bottom r_2 4.003

21. The temperature inside my refrigerator is about 2.00°C . If I place a balloon in my fridge that initially has a temperature of 32.00°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)

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\frac{(1.72 \text{ L})}{305.15 \text{ K}} = \frac{V_2}{273.15 \text{ K}}$ $V_2 = \boxed{1.55 \text{ L}}$

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

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)

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

a) $d = \frac{(1 \text{ atm})(32.00 \text{ g/mol})}{(0.0821 \frac{\text{L atm}}{\text{K mol}})(273.15)} = \boxed{1.43 \text{ g/L}}$

b) $u = \sqrt{\frac{3RT}{m}} = \sqrt{\frac{3(8.314)(273.15)}{.03200 \text{ kg/mol}}} = \boxed{461.4 \text{ m/s}}$

~~14.59 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)

$> 10 \text{ atm}$ Van

p. 395

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

