Chapter 2: Gasses

1. The atmospheric pressure of 768.2 mm Hg. Expressed in kilopascals (kPa) what would the value be the pressure?

(1 atm = 101325 Pa = 760 torr = 760 mm Hg)

a. 778.4 kPa
b. 102.4 kPa
c. 100.3 kPa
d. 91.62 kPa
e. 1024 kPa

101.325 kPa = 760 mm Hg
? 768.2 mm Hg
P = 102.4 kPa

2. A sample of a gas occupied a volume of 6.414 liters when the pressure was 850 torr and the temperature was 27.2 °C. The pressure was readjusted to 4423 torr. What was the new volume?

a. 0.837 L
b. 0.937 L
c. 1.23 L
d. 1.53 L
e. 3.34 L

V_1=6.414 L P_1= 850 torr
V_2=? L P_2= 4423 torr

$$P_1 . V_1 = P_2 . V_2$$
$$(850 \text{ torr})\ (6.414 \text{ L}) = (V_2)\ (4423 \text{ torr})$$
$$V_2 = 1.23 \text{ L}$$

3. A sample of a gas 1.40 liters when the pressure was 762 torr and the temperature was 26.9 °C. The volume of the system was readjusted to 0.150 liters. What was the new pressure?

a. 13.4 atm
b. 883 atm
c. 918 atm
d. 1020 atm
e. 9.36 atm

$$P_1 . V_1 = P_2 . V_2$$
$$(762 \text{ torr})\ (1.40 \text{ L}) = (x)\ (0.150 \text{ L})$$
$$P = 7112 \text{ torr}$$
$$P = 7112 / 760 = 9.36 \text{ atm}$$

4. A sample of a gas occupied a volume of 1.40 liters when the pressure was 768 torr and the temperature was 26.9 °C. The volume of the system was readjusted to 2.16 liters. What was the temperature in the system at this point?

a. 41.5 °C
b. 41.9 °C
c. 189.8 °C
d. 194.7 °C
e. 288.6 °C

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

$T_2 = V_2\, T_1 / V_1$

2.16 x (26.9+273.15) / 1.40 = 462.9 K

462.9 – 273.15 = 189.8 °C

5. STP for gases has the values;

a. temperature: 0.00 K; pressure: 1.000 standard atmosphere
b. temperature: 0.00 °C; pressure: 1.000 standard atmosphere
c. temperature: 273.15 K; pressure: 1.000 Pascal
d. temperature: 298.15 K; pressure: 1.000 standard atmosphere
e. temperature: 298.15 K; pressure: 1.000 Pascal

6. The volume of gas was 1.524 liters at 28.40 °C, and 637.6 torr. What volume would this gas sample occupy at STP?

a. 1.069 L
b. 1.158 L
c. 1.412 L
d. 1.645 L
e. 2.006 L

STP : P_2= 760 torr and T_2=273 K

$P_1.V_1 / T_1 = P_2.V_2 / T_2$

$V_2 = (P_1V_1T_2) / (P_2T_1)$

V_2 = 637.6 x 1.524 x 273 / 760 x 301.55

V_2 = 1.158 L

7. How many **liters** of pure **oxygen** gas, measured at STP, are required for the complete combustion of 11.2 L of CH_4 gas, also measured at STP?

$$\mathbf{1}CH_4 + \mathbf{2}O_2 \rightarrow CO_2 + 2H_2O$$

1 L 2 L

11.2 L ? L

V= 11.2 x 2 / 1 = 22.4 L

a. 11.2 L
b. 16.8 L
c. 22.4 L
d. 32.0 L
e. 33.6 L

8. A chemical reaction is shown: $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$. How many **liters** of pure **oxygen** gas, measured at STP, are required for the complete reaction with 8.82 L of NO(*g*), also measured at STP?

$2NO(g) + 1\ O_2(g) \rightarrow 2NO_2(g)$

2 L 1 L

8.82 L ? L

V= 8.82 / 2= 4.41 L

a. 4.41 L
b. 8.82 L
c. 11.2 L
d. 17.6 L
e. 22.4 L

9. A gas sample weighing 3.78 grams occupies a volume of 2.28 L at STP. What is the molecular mass of the sample?

P.V = n.R.T

PV = mRT/MM

MM = mRT/PV

MM = [(3.78 g) (0.08206 L atm mol^{-1} K^{-1}) (273)] / [1 atm) (2.28 L)

MM = 30.6 g mol^{-1}

a. 8.54 g mol^{-1}
b. 13.5 g mol^{-1}
c. 37.1 g mol^{-1}
d. 51.1 g mol^{-1}
e. 193 g mol^{-1}

10. Two moles of CO_2 gas at 35°C are heated to 250°C, The density of the gas in the gas will:

P.MM = d.R.T

The Density is inversely proportional to Temperature

T increases, Density decreases

a. increase.
b. decrease.
c. remain the same.
d. There is not enough information given to correctly answer this question.

11. What volume would 11.2 g of a gaseous compound occupy at STP if its molecular weight is 44.0 g/mole?

P.V = n.R.T

P V = m R T / MM

V = m R T / P MM

V = [(11.2 g) (0.08206 L atm mol^{-1} K^{-1}) (273)] / [1 atm) (44.0 g/mole)

V = 5.71 L

a. 5.71 liters
b. 11.0 liters
c. 11.2 liters
d. 22.4 liters
e. 44.0 liters

12. A gas sample occupies a volume of 1.66 L when the temperature is 150.0 °C and the pressure is 842 torr. How many molecules are in the sample?

$$\mathbf{P.V = n.R.T}$$
$$\mathbf{n = p.V/RT}$$
$$\mathbf{n = (842/760)atm \times 1.66\ L / 0.08206\ L\ atm\ mol^{-1}\ K^{-1}\ (150+273.15\ K)}$$
$$\mathbf{n = 0.053\ mol}$$
$$\mathbf{N = n \times N_A = 0.053 \times 6.022 \times 10^{23} = 3.19 \times 10^{22}\ molecules}$$

a. 1.52×10^{22}
b. 2.60×10^{22}
c. 3.19×10^{22}
d. 9.01×10^{22}
e. 9.42×10^{21}

13. A gas container has a volume of 6.504 L. When filled with C_3H_8, at 28.3 °C, the pressure is 486.3 torr. How much should the gas sample weigh?

$$\mathbf{P.V = n.R.T}$$
$$\mathbf{P\ V = m\ R\ T / MM}$$
$$\mathbf{m = P.V.\ MM / R\ T}$$
$$\mathbf{m = (486.3/760)atm \times 6.504\ L \times (44\ g/mol) / 0.08206\ L\ atm\ mol^{-1}\ K^{-1}\ (28.3 + 273.15\ K)}$$
$$\mathbf{m = 7.41\ g}$$

a. 4.67 g
b. 7.41 g
c. 7.52 g
d. 18.1 g
e. 263. G

14. A container contains 0.2 moles of O_2 gas and 0.3 moles of N_2 gas. If the total pressure is 0.75 atm what is the partial pressure of O_2?

$$\mathbf{P_i = X_i\ .\ P_t}$$
$$\mathbf{P_i = (n_i / n_T)\ .\ P_t}$$
$$\mathbf{P_i = (0.2 / 0.5)\ 0.75}$$
$$\mathbf{P_i = 0.30\ atm}$$

a. 0.20 atm
b. 0.30 atm
c. 0.50 atm
d. 0.75 atm
e. 0.45 atm

15. A container contains partial pressures of 0.80 atm CO_2 gas and 0.35 atm N_2 gas. What is the mole fraction of N_2 in the glass container?

$$\mathbf{X_i = P_i / P_t}$$
$$\mathbf{X_i = 0.35 / (0.8 + 0.35)}$$
$$\mathbf{X_i = 0.30}$$

a. 0.35
b. 1.15
c. 0.70
d. 0.80
e. 0.30

16. A gaseous substance diffuses twice as rapidly as SO_2 gas. The gas could be
a. CO
b. He
c. H_2
d. CH_4
e. O_2

$$\frac{r_1}{r_2} = \sqrt{\frac{MM_2}{MM_1}}$$
$$2 = \sqrt{\frac{32+32}{MM_1}}$$
$$4 = \frac{64}{MM_1}$$
$$MM_1 = \frac{64}{4} = 16 g / mol$$

17. According to the kinetic theory of gases, the average **kinetic energy** of the gas particles in a gas sample is directly proportional to the;
a. pressure.
b. volume.
c. absolute temperature.
d. molar mass.
e. number of moles of gas.

18. The van der Waals equation of state for a real gas is: $\left[P + \frac{n^2 a}{V^2}\right]\left[\frac{V - nb}{}\right] = nRT$

At what pressure will 1.00 mole of CH_4 be in a 10.0 L container at 298 K assuming CH_4 is a **real gas**.
(van der Waals constants for CH_4 are a = 2.253 L^2 atm mol^{-2}, b = 0.04278 L mol^{-1})
a. 2.43 atm
b. 2.28 atm
c. 2.51 atm
d. 24.5 atm
e. 0.440 atm

19. A **real gas behaves** most nearly **like an ideal gas** under conditions of

a. low temperature and high pressure.

b. low temperature and low pressure.

c. high temperature and low pressure.

d. high temperature and high pressure.

e. Actually it will behave like an ideal gas regardless of the temperature or the pressure as long as it remains in the gaseous state.