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AP Chemistry

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Period _____

**Gas Laws Worksheet**

1. A gas occupying a volume of 725 mL at a pressure of 0.970 atm is allowed to expand at constant temperature until its pressure reaches 0.541 atm. What is the final volume of the sample?

   $V_1 = 725$ mL
   $P_1 = .970$ atm
   $V_2 =$
   $P_2 = .541$ atm

   $(.970)(725) = (.541)(V_2)$

   $V_2 = 1300$ mL

2. A 36.4-L volume of methane gas is heated from 25°C to 88°C at constant pressure. What is the final volume of the gas?

   $V_1 = 36.4$ Liters
   $T_1 = 25 + 273 = 298$ K
   $V_2 =$
   $T_2 = 88 + 273 = 361$ K

   $\frac{PV_1}{T_1} = \frac{PV_2}{T_2}$

   $\frac{36.4}{298} = \frac{V_2}{361}$

   $V_2 = 44.1$ Liters

3. A sample of air occupies 3.8 Liters when the pressure is 1.2 atm. What pressure is required to reduce the volume to 0.075 Liters? (assuming the temperature remains constant)

   $V_1 = 3.8$ Liters
   $P_1 = 1.2$ atm
   $V_2 = 0.075$ Liters
   $P_2 =$

   $(1.2)(3.8) = (P_2)(.075)$

   $P_2 = 60.8$ atm

   $P_2 = 61$ atm

4. Under constant-pressure conditions 9.6 Liters of hydrogen gas initially at 88°C is cooled until its volume is 3.4 Liters. What is its final temperature?

   $V_1 = 9.6$ Liters
   $T_1 = 88 + 273 = 361$ K
   $V_2 = 3.4$ Liters
   $T_2 =$

   $\frac{9.6}{361} = \frac{3.4}{T_2}$

   $T_2 = 130$ K

5. A sample of nitrogen gas kept in a container of volume 2.3 Liters and a temperature of 32oC exerts a pressure of 4.7 atm. How many moles of nitrogen gas was present?

   $N_2$
   $V = 2.3$ Liters
   $T = 32 + 273 = 305$ K
   $P = 4.7$ atm

   $PV = nRT$

   $(4.7)(2.3) = n(.0821)(305)$

   $n = 0.43$ moles $N_2$

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6. Given that 6.9 moles of carbon monoxide gas are present in a container with a volume 30.4 L, what is the pressure of the gas (in atm) if the temperature is 62°C?

$n = 6.9$ moles of CO

$V = 30.4$ Liters

$P = ?$

$T = 62 + 273 = 335$ K

$PV = nRT$

$(P)(30.4) = (6.9)(.0821)(335)$

$P = 6.2$ atm

7. A certain amount of gas at 25°C and a pressure of 0.800 atm is contained in a glass vessel. Suppose that the vessel can withstand a pressure of 2.00 atm. How high can you raise the temperature of the gas without bursting the vessel?

constant volume

$T_1 = 25 + 273 = 298$ K

$P_1 = 0.800$ atm

$P_2 = 2.00$ atm

$T_2 = ?$

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

$\frac{.800}{298} = \frac{2.00}{T_2}$

$T_2 = 745$ K or 472 °C

8. The volume of a gas at STP is 488 mL. Calculate its volume at 22.5 atm and 150°C.

moles @ STP $\frac{.488}{22.4} = .0218$ moles

$PV = nRT$

$(22.5)(V) = (.0218)(.0821)(423)$

$P = 22.5$ atm

$T = 150 + 273 = 423$ K

$V = 0.0336$ Liters

$V = 33.6$ mL

9. What is the density of hydrogen bromide gas (in grams per Liter) at 733 mmHg and 46°C?

$P_{atm} = \frac{733}{760} = .964$ atm

$T = 46 + 273 = 319$ K

$\frac{PV}{V} = \frac{nRT}{V}$

$\frac{P}{RT} = \frac{n}{V}$

$\frac{P}{RT} = \frac{\frac{mass}{F.wt}}{V}$

$\frac{P \cdot F.wt}{RT} = \frac{mass}{Volume}$

$\frac{(.964)(80.9079)}{(.0821)(319)}$

2.98 g/Liter

10. At 741 Torr and 44°C, 7.10 grams of a gas occupies a volume of 5.40 Liters. What is the molar mass (formula weight) of this gas?

$P_{atm} = \frac{741}{760} = .975$ atm

$T = 44 + 273 = 317$ K

$V = 5.40$ Liters

$(.975)(5.40) = n(.0821)(317)$

$n = .202$ moles

$.202 = \frac{7.10}{x}$

$x = 35.1$ g/mole