

# 12 • Gases and Their Properties

## PRACTICE TEST

- A pressure of 745 mmHg corresponds to \_\_\_\_ kPa.  
c) 99.3 kPa  
 $745 \text{ mmHg} \times (101.3 \text{ kPa}/760 \text{ mmHg})$
- Liquid nitrogen has a boiling point of  $-196^\circ\text{C}$  this corresponds to...  
b) 77 K                       $-196 + 273$
- 1.20 atm is the same pressure as:  
c) 912 mmHg               $1.20 \text{ atm} \times (760 \text{ mmHg}/1 \text{ atm})$
- For an ideal gas, which pair of variables are inversely proportional to each other (if all other factors remain constant)?  
a) P, V
- A real gas would act most ideal at  
d) 0.5 atm and 546 K  
low pressure & high temperature
- One mole of hydrogen,  $\text{H}_2$ , occupies 61.2 L at  
e)  $100^\circ\text{C}$  and .500 atm  
calculated by trial and error
- A 31.0 mL sample of gas is collected at a temperature of  $37^\circ\text{C}$  and pressure of 720 mmHg. What is its volume at  $17^\circ\text{C}$  and 580 mmHg.  
c) 36 mL  
 $31 \text{ mL} \times (290/310) \times (720/580)$
- The coldest possible temperature of a gas is:  
d)  $-273^\circ\text{C}$  (actually  $-273.15^\circ\text{C}$ )
- The pressure of 4.0 L of an ideal gas in a flexible container is decreased to one-third of its original pressure and its absolute temperature is decreased by one-half. The volume then is  
c) 6.0 L                       $4 \text{ L} \times (3/1) \times (1/2)$
- A given mass of gas in a rigid container is heated from  $100^\circ\text{C}$  to  $300^\circ\text{C}$ . Which of the following best describes what will happen to the pressure of the gas? The pressure will...  
c) increase by a factor less than three.  
increase by ( $573 \text{ K}/373 \text{ K}$ )
- What is the pressure exerted by some nitrogen gas collected in a tube filled with water on a day when the room temperature is  $18.0^\circ\text{C}$  and the room pressure is 750.0 mmHg? [The partial pressure of water at  $18^\circ\text{C}$  is 15.5 mmHg.]  
c) 734.5 mmHg               $P_{\text{N}_2} = 750 - 15.5$
- As the average kinetic energy of the molecules of a sample increases, the temperature of the sample  
b) increases      T is proportional to ave. KE
- If a gas that is confined in a rigid container is heated, the pressure of the gas will...  
a) increase
- A mixture of gases at 810 kPa pressure contains:  
3.0 moles of oxygen gas,  
2.0 moles of helium gas, and  
4.0 moles of carbon dioxide gas.  
What is the partial pressure of helium gas,  $P_{\text{He}}$ .  
e) 180 kPa ( $2 \text{ mol He}/9 \text{ mol total}$ )  $\times 810 \text{ kPa}$

15. If a gas has a pressure of 2.0 atm, which one of the following equations will express its pressure after...
- the number of moles has been increased to three times the original amount,
  - the absolute temperature (K) has been reduced to half, and
  - the volume has been tripled?
- b)  $P_2 = 2.0 \text{ atm} \times \frac{3}{1} \times \frac{1}{2} \times \frac{1}{3}$
16. A sample of gas occupies 30.0 L at 0.800 atm and 298 K. How many moles of gas are in the sample?
- b) 0.981       $PV=nRT$        $n=PV/RT$   
 $n = (.8)(30)/(.0821)(298)$
17. When ammonium nitrite undergoes decomposition, only gases are produced according to the equation:  

$$\text{NH}_4\text{NO}_2(\text{s}) \rightarrow \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$$
What is the total volume of gases produced at 819K and 1.00 atm pressure when 128 g of ammonium nitrite undergoes the above decomposition reaction?  
M of  $\text{NH}_4\text{NO}_2 = 64 \text{ g/mol}$   
**403 L**    128 g  $\text{NH}_4\text{NO}_2 = 2$  moles reactant  
so, there are 6 moles of product gases.  
 $PV=nRT$      $V = nRT/P = (6)(.0821)(819)/(1) = \mathbf{403}$   
**L**
18. At STP, it was found that 1.12 L of a gas had a mass of 2.78 g. Its molar mass is
- c) 55.6 g/mol    STP means  $P=1 \text{ atm}$ ;  $T=273 \text{ K}$   
first, use 1.12 L at STP to calculate moles  
 $PV = nRT$      $n = PV/RT = (1)(1.12)/(.0821)(273)$   
 $n = .04997$  moles    molar mass =  $2.78\text{g}/.04997 \text{ mol}$
19. A mixture of gases, nitrogen, oxygen, and carbon dioxide at 27 °C and 0.50 atmospheres pressure occupied a volume of 492 mL. How many moles of gas are there in this sample?
- a) 0.010      watch your units!  
 $PV=nRT$      $n=PV/RT = (.5)(.492)/(.0821)(300)$
20. At a given temperature, gaseous ammonia molecules ( $\text{NH}_3$ ) have a velocity that is \_\_\_\_\_ gaseous sulfur dioxide molecules ( $\text{SO}_2$ ).
- a) greater than      smaller = faster
21. The ratio of the average velocities of  $\text{SO}_2(\text{g})$  to  $\text{CH}_4(\text{g})$  at 300 K is
- b) 1:2     $\sqrt{(64/16)} = \sqrt{(4)} = 2$      $\text{CH}_4$  twice as fast as  $\text{SO}_2$ , question asks for  $\text{SO}_2:\text{CH}_4$
22. A sealed flask contains 1 molecule of hydrogen for every 3 molecules of helium at 20 °C. If the total pressure is 400 kPa, the partial pressure of the hydrogen is...
- a) 100 kPa       $\frac{1}{4} \times 400 \text{ kPa}$
23. A given mass of a gas occupies 5.00 L at 65 °C and 480 mmHg. What is the volume of the gas at 630 mmHg and 85 °C?
- c)  $5.00 \times \frac{358}{338} \times \frac{480}{630}$
24. Which statement best explains why a confined gas exerts pressure?
- d) the molecules collide with the container walls
25.  $\text{CH}_4$  gas and  $\text{O}_2$  gas are together in a container. Which statement correctly describes the **velocities** of the two molecules.
- c) The  $\text{CH}_4$  is moving **faster**, but **not twice as fast** as the  $\text{O}_2$ .      faster by  $\sqrt{(32/16)} = \sqrt{2}$