Chapter 11
Practice Test - Answers

Name: _____

Date: _____ Per: _____

Kinetic Molecular Theory

1. List the five postulates of the Kinetic-Molecular Theory.

_____

_____

_____

_____

_____

Name the Gas Law

2. A potato chip bag pops when taken up in the mountains. _____
3. A balloon put in the freezer shrinks. _____
4. A lighter gas moves faster than a heavier gas. _____
5. The pressure of two gases is the sum of their partial pressures. _____

Calculations, Etc.

6. Equal amounts of gas at the same temperature and pressure have the same _____.
7. If the temperature of a sample of gas is halved at constant volume, the pressure will be _____.
8. The temperature at which matter stops moving is called _____.
9. The values of standard temperature are _____.
10. The values of standard pressure (in atm & mmHg) are _____.
11. Derive the value of R for pressure in atmospheres. (Must show work)

How would this process be different if you were to calculate the value of R for mmHg?

12. A sample of hydrogen gas has a volume of 4.40 L at a temperature of 145 °C and a pressure of 2.30 atm.
    a) How many moles are in the sample?

V = 4.40 L
T = 145 °C (418 K)
P = 2.30 atm
n = ?
R = 0.0821 (atm•L)/(mol•K)

$PV = nRT$

$$n = \frac{PV}{RT} = \frac{(2.30\ \text{atm})(4.40\ \text{L})}{(0.0821\ ^{(\text{atm}\cdot\text{L})}/_{(\text{mol}\cdot\text{K})})(418\ \text{K})} = 0.2948\ \text{mol} \Rightarrow 0.295\ \text{mol H}_2$$

    b) What is the mass of the sample?

$$\frac{0.2948\ \text{mol H}_2}{} \left| \frac{2.018\ \text{g H}_2}{1\ \text{mol H}_2} \right. = 0.5943\ \text{g} \Rightarrow 0.594\ \text{g H}_2$$

13. A sample of gas measures 5.00 liters at 2.30 atmospheres of pressure. To change the volume to 3.50 liters at constant temperature, what pressure must be applied?

$V_1 = 5.00$ L
$P_1 = 2.30$ atm
$V_2 = 3.50$ L
$P_2 = ?$

$P_1V_1 = P_2V_2$

$$P_2 = \frac{P_1V_1}{V_2} = \frac{(2.30\ \text{atm})(5.00\ \text{L})}{(3.50\ \text{L})} = 3.2857\ \text{atm} \Rightarrow 3.29\ \text{atm}$$

Answers: 12) a. 0.295 mol, b. 0.595 g 13) 3.29 atm 14) 3760 K 15) 36.2 L 16) 5040 L, 3.47×10^{-4} g/L 17) 24.8 L 18) 5.00 atm

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14. A 2.50 L gas container is designed to hold gases with a pressure of up to 11000. mmHg. If a gas sample that has a pressure of 740. mmHg at -20.0 °C is placed in the container, at what temperature will the container burst?

$P_2 = 11000.\ mmHg$
$P_1 = 740.\ mmHg$
$T_1 = -20.0\ °C\ (253\ K)$
$T_2 = ?$

$T_1P_2 = T_2P_1$

The volume of the container is not important in this case as it cannot expand or contract. The volume will remain constant until the moment it bursts.

$$T_2 = \frac{T_1P_2}{P_1} = \frac{(253\ K)(11000.\ mmHg)}{(740.\ mmHg)} = 3760.8\ K \Rightarrow 3760\ K$$

15. A quantity of gas has a volume of 23.0 L at -45.0 °C and 1000. mmHg of pressure. If the conditions are changed to STP (STP = 273 K & 760. mmHg), what will the new volume be?

$V_1 = 23.0\ L$
$T_1 = -45.0\ °C\ (228\ K)$
$P_1 = 1000.\ mmHg$
$T_2 = 273\ K$
$P_2 = 760.\ mmHg$
$V_2 = ?$

$P_1V_1T_2 = P_2V_2T_1$

$$V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{(1000.\ mmHg)(23.0\ L)(273\ K)}{(760.\ mmHg)(228\ K)} = 36.23\ L \Rightarrow 36.2\ L$$

16. A quantity of gas has a volume of 650. L at 65.0 °C and 7300. mmHg of pressure. If the gas has a mass of 1.75 g, what is the density of the gas at STP (STP = 273 K & 760. mmHg)?

$V_1 = 650.\ L$
$T_1 = 65.0\ °C\ (338\ K)$
$P_1 = 7300.\ mmHg$
$T_2 = 273\ K$
$P_2 = 760.\ mmHg$
$V_2 = ?$

$P_1V_1T_2 = P_2V_2T_1$

$$V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{(7300.\ mmHg)(650.\ L)(273\ K)}{(760.\ mmHg)(338\ K)} = 5042\ L$$

$m = 1.75\ g$
$V = 5042\ L$

$$D = \frac{m}{V} = \frac{1.75\ g}{5042\ L} = 3.470 \times 10^{-4}\ g/L \Rightarrow 3.47 \times 10^{-4}\ g/L$$

17. Given the equation, ___ CuO(s) + ___ H_2(g) → ___ Cu(s) + ___ H_2O(g), how many liters of hydrogen are needed to react with 88.0 g of copper (II) oxide at STP (*STP means we can use 1 mol of gas = 22.4 L*)?

Analyze, rewrite, balance equation

1 CuO(s)	+	1 H_2(g)	→	1 Cu(s)	+	1 H_2O(g)
88.0 g		*? L*				

Solve for only given

$$\frac{88.0\ g\ CuO}{} \left| \frac{1\ mol\ CuO}{79.545\ CuO} \right| \frac{1\ mol\ H_2}{1\ mol\ CuO} \left| \frac{22.4\ L\ H_2}{1\ mol\ H_2} \right. = 24.78\ L \Rightarrow 24.8\ L\ H_2$$

18. Two gases are combined in a 2.00 L container. If the first gas has a pressure of 1.50 atm at a volume of 4.00 L and the second gas has a pressure of 4.00 atm at a volume of 1.00 L, what is the pressure of the combined gases?

First Gas + Second Gas ⇒ Combined Gases

$V_1 = 4.00\ L$
$P_1 = 1.50\ atm$

$V_1 = 1.00\ L$
$P_1 = 4.00\ atm$

$V_2 = 2.00\ L$
$P_{Total} = ?$

$P_2 = P_1V_1/V_2$

$$P_2 = \frac{(1.50\ atm)(4.00\ L)}{(2.00\ L)}$$

$P_2 = 3.00\ L$ +

$P_2 = P_1V_1/V_2$

$$P_2 = \frac{(4.00\ atm)(1.00\ L)}{(2.00\ L)}$$

$P_2 = 2.00\ L$ = $P_{Total} = 5.00\ L$

Answers: 12) a. 0.295 mol, b. 0.595 g 13) 3.29 atm 14) 3760 K 15) 36.2 L 16) 5040 L, 3.47×10^{-4} g/L 17) 24.8 L 18) 5.00 atm