

GAS LAWS: AN INTRODUCTION

KMT, PRESSURE & TEMPERATURE

Name: _____

Period: _____ Date: _____

KEY

GAS LAWS: AN INTRODUCTION

KINETIC
MOLECULAR
THEORY OF GASES

- ✓ Pressure
- ✓ Temperature
- ✓ Volume
- ✓ # of moles

PLEASE NOTE

PRESSURE (STANDARD)

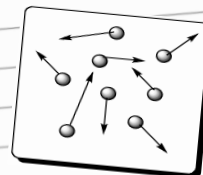
$$1 \text{ atm} =$$

$$101.3 \text{ kPa} = 760. \text{ mm Hg} = 760. \text{ torr} = 14.7 \text{ psi}$$

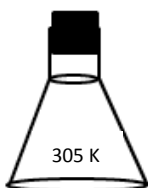
TEMPERATURE (STANDARD)

$$\text{K} = 273 + \text{ }^\circ\text{C}$$

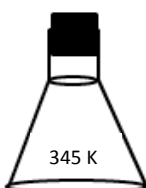
$$\text{ }^\circ\text{C} = \text{K} - 273$$

STP
*Standard
Temperature
& Pressure*Avogadro's
Hypothesis**EXERCISE 1****KMT of Gases**

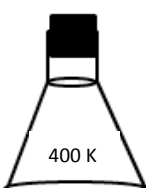
Flask 1



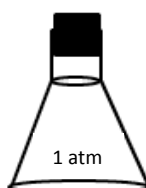
Flask 2



Flask 3



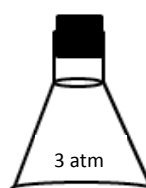
Flask 4

Fig. 1

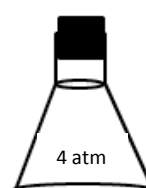
Flask 1



Flask 2



Flask 3



Flask 4

Fig. 2

Study the two figures above. Then, answer the questions below.

- 1** 1. Each of the flasks in Fig. 1, above, contain the same number of gas particles. Which of the flasks would have the lowest pressure?
- 4** 2. Each of the flasks in Fig. 1, above, contain the same number of gas particles. Which of the flasks would have the highest pressure?
- 1** 3. All of the flasks in Fig. 2, above, are the same size and are at the same temperature. Which flask contains the least amount of gas particles?
- 3** 4. Which of the flasks in Fig. 2, above, have a pressure equal to 2280 torr?
- 1** 5. Consider flask 2 in Fig. 2, above. Which of the following would result in an decrease in pressure:
1.) lowering the temperature 2.) adding more gas molecules 3.) decreasing the volume?

EXERCISE 2**STP**

- c** 1. Which of the following is a valid pair representing STP?
- a. 1 atm and 760. K c. 273 K and 760. torr
b. 760. mm Hg and 0 K d. 760. torr and 273°C
- d** 2. Standard pressure is equal to:
- a. 760. torr and 0 atm c. 101.3 kPa and 273 torr
b. 760. atm and 273 kPa d. 1 atm and 760. mm Hg
- b** 3. Which of the following is a valid pair representing STP?
- a. 1 atm and 0 K c. 760. torr and 0 K
b. 0 °C and 1 atm d. 760. K and 273 mm Hg
- d** 4. Standard temperature is equal to:
- a. 0 °F c. 0 K
b. 273 °C d. 0 °C

EXERCISE 2 | *STP—con't***KEY**

- b_** 5. Which of the following is a valid pair representing STP?
 a. 1 atm and 0 °F c. 273 K and 101.3 torr
 b. 0 °C and 101.3 kPa d. 760. atm and 0 K
- d_** 6. Two units of pressure that are identical to one another are:
 a. torr and atm c. mm Hg and atm
 b. kPa and psi d. mm Hg and torr
- b_** 7. Which of the following represent an equality that is TRUE?
 a. 760. torr = 1 kPa c. 101.3 atm = 760. kPa
 b. 101.3 kPa = 760. mm Hg d. 101.3 psi = 1 torr

EXERCISE 3 | *Temperature Conversions*

1. On the Celsius scale, a temperature of 332 K has a corresponding value of 59 °C.
2. On the Kelvin scale, a temperature of 27 °C has a corresponding value of 300 K.
3. Convert 150 K to °C: -123 °C
4. Convert 125 °C to Kelvin: 398 K
5. What is the Kelvin temperature that is equivalent to 400 °C? 673 K
6. 1200 K is equal to what Celsius temperature? 927 °C

EXERCISE 4 | *Pressure Conversions*Convert each of the following to the unit specified. **Show your dimensional analysis.**

1.) 135 mm Hg = _____ atm

$$\frac{135 \text{ mm Hg}}{1} \times \frac{1 \text{ atm}}{760. \text{ mm Hg}} = 0.178 \text{ atm}$$

2.) 3.10 atm = _____ kPa

$$\frac{3.10 \text{ atm}}{1} \times \frac{101.3 \text{ kPa}}{1 \text{ atm}} = 314 \text{ kPa}$$

3.) 574 mm Hg = _____ torr

$$\frac{574 \text{ mm Hg}}{1} \times \frac{760. \text{ torr}}{760. \text{ mm Hg}} = 574 \text{ torr}$$

4.) 2.89 kPa = _____ mm Hg

$$\frac{2.89 \text{ kPa}}{1} \times \frac{760. \text{ mm Hg}}{101.3 \text{ kPa}} = 21.7 \text{ mm Hg}$$

5.) 1580. kPa = _____ atm

$$\frac{1580. \text{ kPa}}{1} \times \frac{1 \text{ atm}}{101.3 \text{ kPa}} = 15.60 \text{ atm}$$

6.) 1425 mm Hg = _____ atm

$$\frac{1425 \text{ mm Hg}}{1} \times \frac{1 \text{ atm}}{760. \text{ mm Hg}} = 1.875 \text{ atm}$$

Challenge: In the United States, meteorologists usually report barometric pressure in inches of mercury (in. Hg). If the local weather channel reports the barometric pressure as 30.03 in. Hg, what is this pressure in atm? (Hint: Think about unit conversions.) Show your solution below.

(convert from in. Hg to cm Hg. Then to mm Hg. Then to atm)

$$\frac{30.03 \text{ in. Hg}}{1} \times \frac{2.54 \text{ cm Hg}}{1 \text{ in. Hg}} \times \frac{10 \text{ mm Hg}}{1 \text{ cm Hg}} \times \frac{1 \text{ atm}}{760. \text{ mm Hg}} = 1.004 \text{ atm}$$