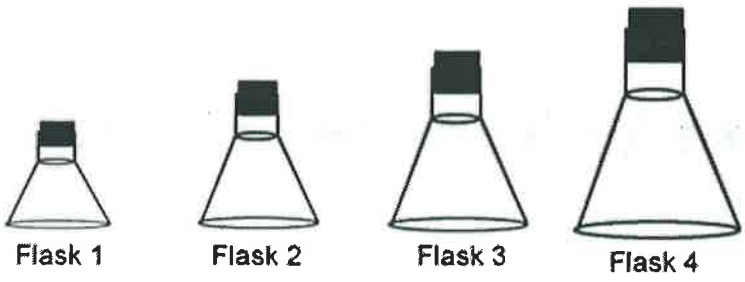
CLARK

1. 

Each of these flasks contains the same number of molecules. In which container is the pressure lowest?

A. ? Flask 4

B. ? Flask 2

C. ? Flask 3

D. ? Flask 1

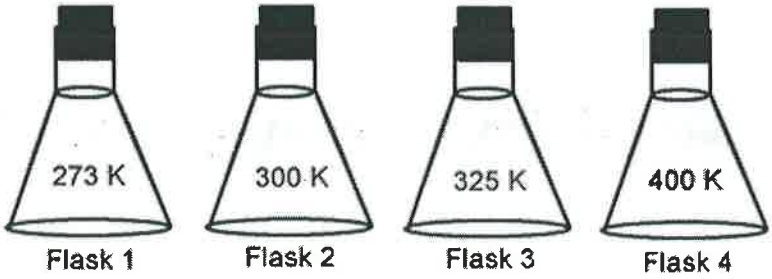
2. Which of the following changes to a system WILL NOT result in an increase in pressure?

A. ? Raising the temperature

B. ? Decreasing the volume of the container

C. ? Adding more gas molecules

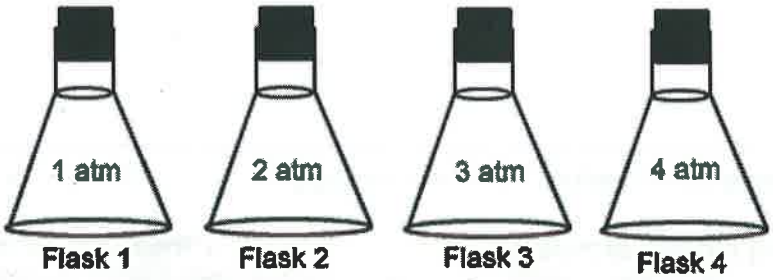
D. ? Increasing the volume of the container

3. 

Each of these flasks contains the same number of gas molecules. In which would the pressure be highest?

highest T

A. ? Flask 3
B. ? Flask 2
C. ? Flask 1
D. ? Flask 4

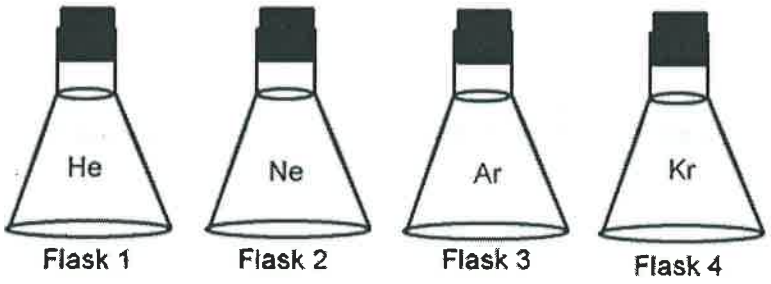
4. 

Each of these flasks is the same size and at the same temperature. Which one contains the fewest molecules?

lowest pressure

A. ? Flask 3
B. ? Flask 1
C. ? Flask 4
D. ? Flask 2

5.



If all of the following flasks are the same size, at the same temperature, and contain the same number of molecules, in which flask will the molecules be moving fastest?

A. ? Flask 4

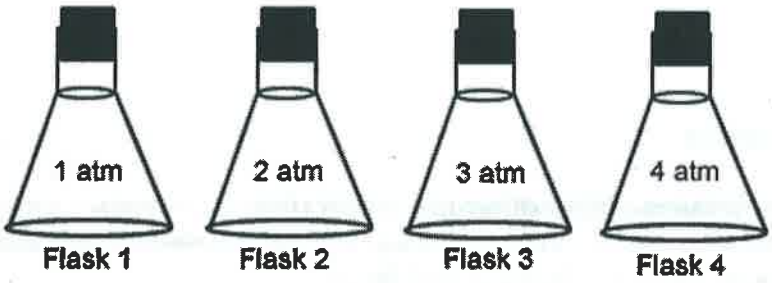
B. ? Flask 2

C. ? Flask 3

D. ? Flask 1

Smallest (He)

6.



Each of these flasks is the same size and at the same temperature. In which flask will diffusion occur most slowly?

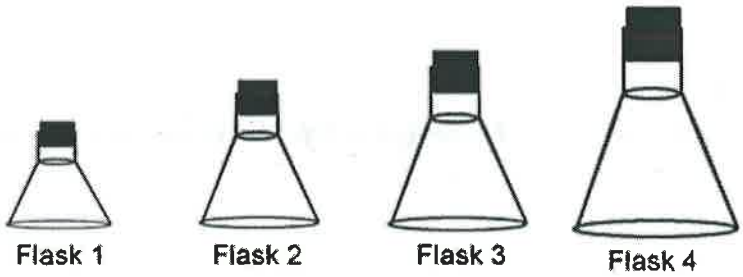
A. ? Flask 2

B. ? Flask 4

C. ? Flask 3

D. ? Flask 1

(lowest pressure)

7. 

Each of these flasks contains the same number of molecules. In which container is the pressure highest?

A. ? Flask 1
B. ? Flask 2
C. ? Flask 4
D. ? Flask 3

8. Gas pressure is caused by:

A. ? gas molecules colliding with surfaces
B. ? barometers
C. ? gas molecules hitting other gas molecules
D. ? gas molecules condensing to a liquid

9. Convert 755 torr to atm and kPa.

$755 \text{ torr} \times \frac{1 \text{ atm}}{760 \text{ torr}} = .993 \text{ atm}$

$.993 \text{ atm} \times \frac{101.325 \text{ kPa}}{1 \text{ atm}} = 100.6 \text{ kPa}$

10. Convert the following temperatures to K.

a) 104 C $+273 = 377 \text{ K}$

b) -3 C $+273 = 270 \text{ K}$

11. Convert the following temperatures to C.

a) 67 K $-273 = 206 \text{ °C}$

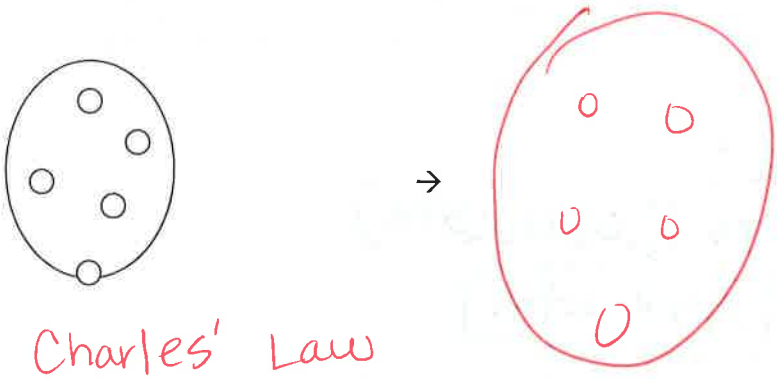
b) 1671 K $-273 = 1398 \text{ °C}$

12. Write the formulas for a) Boyle's Law, b) Charles' Law, c) the Combined Gas Law, and d) the Ideal Gas Equation and e) Dalton's Law

a) $P_1V_1 = P_2V_2$ c) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ d) $PV = nRT$ e) $P_T = P_1 + P_2 + P_3 \ldots$

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

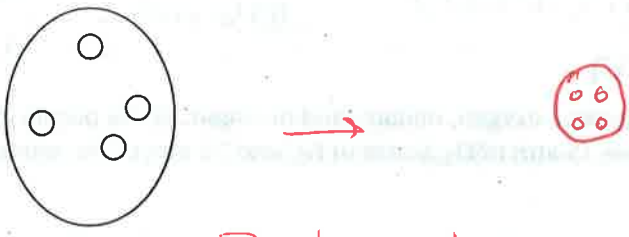
13. Consider the **closed** system (a balloon) below at a temperature of 200 K. Draw what will happen to the gas in the balloon if the balloon is heated to 400 K and pressure remains the same. Which gas law is being used in this example?



(volume ↑ as Temp ↑)

Charles' Law

14. Consider the **closed** system below at atmospheric pressure (1.00 atm) and constant temperature. Draw what will happen to the gas in the balloon if the pressure on the balloon is increased to 2.00 atm and temperature remains the same. Which gas law is being used in this example?



(Pressure ↑ Volume ↓)

Boyle's Law

15. A certain gas has a volume of 19.7 L at a pressure of 745 mm Hg. If the volume is increased to 22.5 L, what is the pressure of the system?

$(745\ mm\ Hg)(19.7\ L) = P_2(22.5\ L)$

$652\ mm\ Hg = P_2$

16. A sample of helium occupies 30.0 mL at a temperature of 25°C. If the temperature is increased to 75°C, what is the new volume of helium?

$+273 = 298K$ $+273 = 348K$

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

$\frac{30.0mL}{298K} = \frac{V}{348}$

$V = 35.0mL$

17. An inflated balloon has a volume of 6.0 L at sea level (1.0 atm) and is allowed to ascend in altitude until the pressure is 0.45 atm. During the ascent the temperature of the gas falls from 22°C to -21°C. Calculate the volume of the balloon at its final altitude.

$P_1 = 1.0 atm$ $P_2 = .45 atm$
$V_1 = 6.0 L$ $V_2 = ?$
$T_1 = 22°C + 273 = 295 K$ $T_2 = -21°C + 273 = 252 K$

$\frac{(1.0)(6.0)}{295} = \frac{(.45)V_2}{252}$

$1512 = 132.75 V_2$

$\frac{1512}{132.75} = \frac{132.75 V_2}{132.75}$

$11.4 L = V_2$

18. What is the pressure of 0.75 moles of an ideal gas at exactly 100°C that occupies 11.5 L of space?

$PV = nRT$

$P \cdot 11.5 L = (.75)(.0821)(373)$

$P = 1.997 atm$

19. A sample of calcium carbonate, $CaCO_3$, is decomposed to give CaO and CO_2. The carbon dioxide is collected in a 0.500 L flask. After the reaction is complete, the gas has a pressure of 1.3 atm and a temperature of 31°C. How many moles of CO2 were produced? How many grams of CO_2 were generated in the reaction? (convert moles to grams)

n is moles of CO_2

$PV = nRT$

$(1.3)(.500) = n(.0821)$

$.026 moles = n$

$31 + 273 = 304 K$

$.026 moles \times \frac{44.01 g}{1 mole} = 1.14 g\ CO_2$

20. A metal tank contains three gases: oxygen, helium, and nitrogen. If the partial pressures of the three gases in the tank are 35 atm of O_2, 5 atm of N_2, and 25 atm of He, what is the total pressure inside of the tank?

$P_T = 35_{atm} + 5_{atm} + 25_{atm} = 65 atm$

21. A sample of oxygen gas is saturated with water vapor at 27 °C. The total pressure of the, mixture is 772 torr, and the vapor pressure of water is 26.7 torr at 27 °C. What is the Partial pressure of the oxygen gas?

$P_T = P_{gas} + P_{H_2O}$

$772_{torr} = P_{gas} + 26.7_{torr}$

$745.3 torr = P_{O_2}$

22. Oxygen and chlorine gas are mixed in a container with partial pressures of 401 mmHg and 0.639 atm, respectively. What is the total pressure inside the container?

Convert so both are atm or both are mm Hg

$401 mmHg \times \frac{1 atm}{760 mmHg} = .528 atm$

$P_T = .639 atm + .528 atm$

$= 1.167 atm$

OR

$.639 atm \times \frac{760}{1} = 485.64$

$P_T = 485.64 + 401$

$= 886.64 mmHg$

23. List the 5 components of the Kinetic Molecular Theory of gases.

- Gases have particles w/no defined volume, but defined mass
- Gas particles undergo no intermolecular attraction or repulsi
- Particles in continuous random motion
- Collisions between particles are completely elastic
- The average Kinetic Energy is temperature dependent

24. List the 5 properties of gases

Compresses
expands
fluid
low density
effusion/diffusion

25. The following reactions take place at a pressure of 1.0 atm and a temperature of 298 K.

Given:

$CaCO_{3(s)} \rightarrow CO_{2(g)} + CaO_{(s)}$

How many grams of calcium carbonate will be needed to form 4.29 liters of carbon dioxide?

$PV = nRT$

$(1.0)(4.29) = n(.0821)(298)$

$.175 \text{ moles} = n \; CO_2$

$.175 \text{ moles } CO_2 \times \frac{1 \; CaCO_3}{1 \; CO_2} = .175 \text{ moles}$

$.175 \text{ moles } CaCO_3 \times \frac{100.09 g}{1 mol} = 17.5 g \; CaCO_3$

26. Given:

$2 C_6H_{6(g)} + 15 O_{2(g)} \rightarrow 12 CO_{2(g)} + 6 H_2O_{(g)}$

If 2.45 liters of benzene are consumed in this reaction, how many liters of water can be formed?

$PV = nRT$

$(1.0)(2.45) = n(.0821)(298)$

$0.100 \text{ moles benzene} = n$

$.100 \text{ moles benzene} \times \frac{6 \; H_2O}{2 \text{ mol benzene}} = .300 \text{ moles } H_2O$

$.300 \text{ mol } H_2O \times \frac{18.02 g}{1 mol} = 5.41 g \; H_2O$

27. How much faster does hydrogen escape through a porous container than sulfur dioxide?

$\frac{H_2}{SO_2} = \sqrt{\frac{64.07}{2.02}} = 5.63$

H_2 travels 5.63 times faster than SO_2

28. What is the molecular weight of a gas which diffuses 1/50 as fast as hydrogen?

$\frac{\text{Rate } X}{\text{Rate } H_2} = \frac{1}{50} = \sqrt{\frac{2.02}{X}}$

$.02^2 = \left(\sqrt{\frac{2.02}{X}}\right)^2$

$4 \times 10^{-4} = \frac{2.02}{X}$

$X = 5050 \text{ g/mol}$