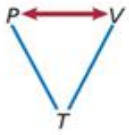
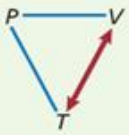
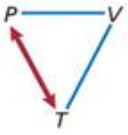
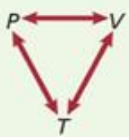
CHAPTER 9: Gas Laws

The Gas Laws

Law	Boyle's	Charles's	Gay-Lussac's	Combined
Formula	$P_1V_1 = P_2V_2$	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
What is constant?	amount of gas, temperature	amount of gas, pressure	amount of gas, volume	amount of gas
Graphic organizer				

Avogadro's principle states that equal volumes of gases at the same temperature and pressure contain equal numbers of particles.

The molar volume of a gas is the volume 1 mol occupies at 0.00°C and 1.00 atm of pressure**.**

0.00°C and 1.00 atm are called standard temperature and pressure (STP).

At STP, 1 mol of gas occupies 22.4 L.

The ideal gas law describes the physical behavior of an ideal gas in terms of pressure, volume, temperature, and amount.

The ideal gas constant is represented by **R** and is 0.0821 L•atm/mol•K when pressure is in atmospheres.

The Ideal Gas Law

$$PV = nRT$$

P represents pressure. *V* represents volume.
n represents number of moles. R is the ideal gas constant.
T represents temperature.

For a given amount of gas held at constant temperature, the product of pressure and volume is a constant.

Ideal gases follow the assumptions of the kinetic-molecular theory.

Characteristics of ideal gases:

- There are no intermolecular attractive or repulsive forces between particles or with their containers.
- The particles are in constant random motion.
- Collisions are perfectly elastic.
- No gas is truly ideal, but most behave as ideal gases at a wide range of temperatures and pressures.

1 **Boyle's Law explains which relationship of properties in gases?**

CH 9

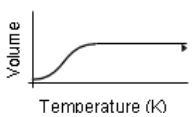
A Pressure and volume
B Amount and pressure
C Temperature and volume
D Volume and temperature

Boyle's Law states that the volume of a fixed amount of gas held at a constant temperature varies inversely with the pressure. →A

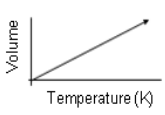
2 **Charles's Law explains the relationship between the temperature and volume of a gas. Which graph best represents this relationship?**

CH 9

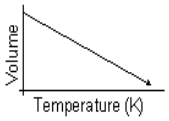
A



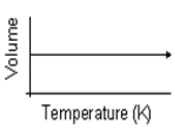
B



C



D



Charles's law states that the volume of a given amount of gas is directly proportional to its kelvin temperature at constant pressure. →B

3 **Which of these decreases as a given volume of gas increases**

CH 9

A Number of gas particles
B Temperature
C Pressure
D Kinetic energy

Boyle's Law states that the volume of a fixed amount of gas held at a constant temperature varies inversely with the pressure. →C

4 **Which of these decreases as a given volume of gas increases**

CH 9

A Number of gas particles
B Temperature
C Pressure
D Kinetic energy

Boyle's Law states that the volume of a fixed amount of gas held at a constant temperature varies inversely with the pressure. →C

5 **states that the pressure of a fixed amount of gas varies directly with the kelvin temperature when the volume remains constant.**

CH 9

A Boyle's Law **B** Charles's law
C Gay-Lussac's law **D** Ideal gas law

Gay-Lussac's law states that the pressure of a fixed amount of gas varies directly with the kelvin temperature when the volume remains constant.→C

6 **According to Avogadro's principle, 1 L of $H_2(g)$ and 1 L of $O_2(g)$ at the same temperature and pressure.**

CH 9

A have the same mass.
B have the same molar mass.
C contain 1 mol of gas each.
D contain equal numbers of molecules

Avogadro's principle states that equal volumes of gases at the same temperature and pressure contain equal numbers of particles. →D

7 **What volume will one mole of a gas occupy under standard temperature and pressure?**

CH 9

A 1 L **B** 273 L
C 22.4 L **D** 293 L

The molar volume of a gas is the volume 1 mol occupies at 0.00°C and 1.00 atm of pressure.
= 22.4 L →C

8 **3.00 mol of O_2 at STP occupies how much volume**

CH 9

A 30.0 L **B** 25.4 L
C 22.4 L **D** 67.2 L

3 x 22.4 L = 67.2 L →D

9 **What does the combined gas law relate?**

CH 9

A Pressure and temperature
B Volume and pressure
C Pressure, temperature, and volume
D Pressure, temperature, volume, and amount

The combined gas law states the relationship among pressure, temperature, and volume of a fixed amount of gas. →C

10 **When do real gases behave differently than ideal gases?**

CH 9

A High temperature or low pressure
B High temperature or high pressure
C Low temperature or low pressure
D Low temperature or high pressure

Real gases deviate most from ideal gases at high pressures and low temperatures. →D

11 **What conditions represent standard temperature and pressure?**

CH 9

A 0.00°C and 0.00atm
B 1.00°C and 1.00atm
C 0.00°F and 1.00atm
D 0.00°C and 1.00atm

0.00°C and 1.00 atm are called standard temperature and pressure (STP). →D

12 **Which of the following is NOT one of the related physical properties described in the ideal gas law?**

CH 9

A Pressure **B** Volume
C Density **D** Temperature

Ideal gas law, PV=nRT →C

13 **What variable is mentioned in the ideal gas law that is assumed to be constant in the other gas laws?**

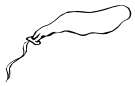
CH 9

A Pressure **B** Volume
C Temperature **D** Number of moles

Ideal gas law, PV=nRT →D

14 **You are given a balloon filled with a known volume of helium gas. You place the balloon inside a freezer for an hour. How will the balloon look after being in the freezer?**

CH 9

A 
B 
C 
D 

Charles's law states that the volume of a given amount of gas is directly proportional to its kelvin temperature at constant pressure. →B

15 **At a constant temperature, the pressure of a gas is given as 1 atm pressure and 4 liters. When the atmospheric pressure is increased to 2 atm, then what is the volume of the gas**

CH 9

A 1 L **B** 4 L
C 10 L **D** 2 L

$P_1V_1=P_2V_2$
$V_2 = P_1V_1 \div P_2$
$V_2 = (1\text{ atm} \times 4\text{ L}) \div 2\text{ atm}$
$V_2 = 2\text{ L}$ →D

16 **There is a balloon filled with a gas at 300°K and has a volume of about 2 liters when the balloon is taken to a place which is at 600°K , what would be the volume of the gas that is inside the balloon?**

CH 9

A 8 L **B** 2 L
C 10 L **D** 4 L

$V_1/T_1 = V_2/T_2$
$V_2 = (V_1 \times T_2)/T_1$
$V_2 = (2\text{ L} \times 600\text{ K}) \div 300\text{ K}$
$V_2 = 4\text{ L}$ →D

17 **There is a balloon filled with a gas at 250°K and the pressure of the gas inside the balloon is 0.1atm then the balloon is taken to a place which is at 500°K, what would be the pressure of the gas that is inside the balloon?**

CH 9

A 0.4 atm **B** 0.2 atm
C 1 atm **D** 0.1 atm

$P_1/T_1 = P_2/T_2$
$P_2 = (P_1 \times T_2)/T_1$
$P_2 = (0.1\text{ atm} \times 500\text{ K}) \div 250\text{ K}$
$p_2 = 0.2\text{ atm}$ →B

18 **The volume of a gas collected when the temperature is 250°K and the pressure is 2 atm measures 4L. What is the calculated volume of the gas at 500°K and 4 atm?**

CH 9

A 0.4L **B** 0.2L
C 4L **D** 2L

$$V_2 = \frac{P_1V_1T_2}{P_2T_1}$$

$$V2 = \frac{2\text{ atm} \times 4\text{ L} \times 500^0\text{K}}{4\text{atm} \times 250^0\text{K}}$$

V2 = 4 L →C