Gas laws

Aim
- to analyze the relationship among the number of particles, temperature, pressure, and volume of a gas
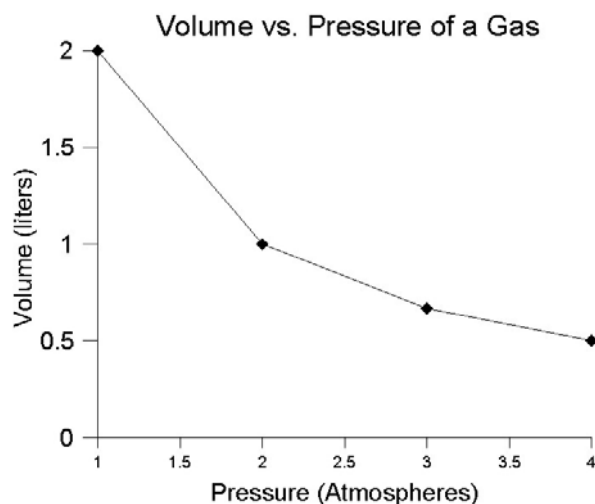
Notes

Relationship between the pressure and volume of a gas (at a constant temperature)
★ Observations
  ☆ Putting pressure on a gas compresses it or reduces its volume
  ☆ Sample data

Trial	Pressure (atmospheres)	Volume (liters)	Pressure × Volume (atm-L)
1	1.0	2.0	2.0
2	2.0	1.0	2.0
3	3.0	0.67	2.0
4	4.0	0.50	2.0

Volume vs. Pressure of a Gas

  ☆ Conclusion - The volume of a gas is inversely proportional to the pressure at a constant temperature
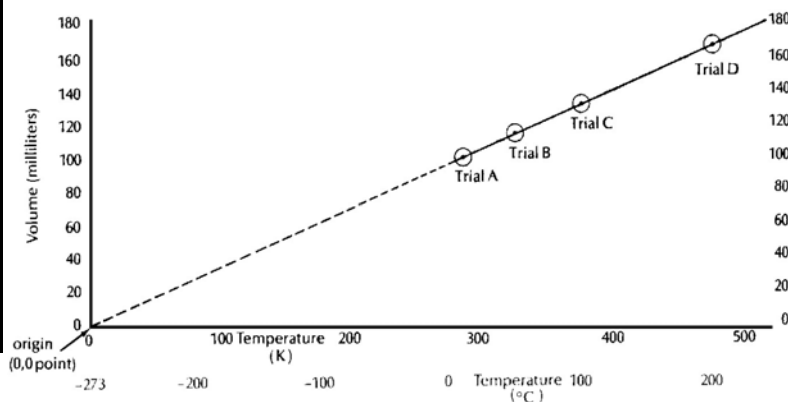
Relationship between temperature and volume of a gas (at a constant pressure)
★ Observations
  ☆ As the temperature of a gas increases at a constant pressure, its volume increases
  ☆ Sample data

Trial	Temperature Celsius	Temperature Kelvin	Volume (mL)	Ratio: V/T
A	10.0	283	100	0.35
B	50.0	323	114	0.35
C	100.0	373	132	0.35
D	200.0	473	167	0.35

★ Conclusion - At a constant pressure, the volume of a gas is directly proportional to its Kelvin temperature

Combined gas law

★ $$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Number of particles
★ Equal volumes of different gases at the same temperature and pressure contain an equal number of particles.
Standard temperature and pressure (STP)- agreed upon value of temperature and pressure for the sake of comparing gases
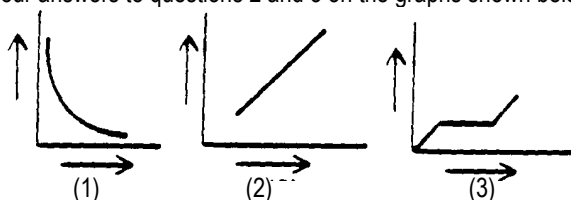★ Temperature: 0°C or 273 K
★ Pressure: 101.3 kPa or 1 atmosphere

Answer the questions below by circling the number of the correct response

1. A sample of a gas is at STP. As the pressure decreases and the temperature increases, the volume of the gas (1) decreases (2) increases (3) remains the same

Base your answers to questions 2 and 3 on the graphs shown below.

(1)   (2)   (3)

Note that questions 2 and 3 have only three choices.

2. Which graph best represents how the volume of a given mass of a gas varies with the Kelvin temperature at constant pressure?

3. Which graph best represents how the volume of a given mass of a gas varies with the pressure on it at constant temperature.

4. A 100. milliliter sample of a gas at a pressure of 50.8 kPa is reduced to 25.4 kPa at constant temperature. What is the new volume of the gas? (1) 50.0 mL (2) 90.0 mL (3) 200. mL (4) 290. mL

5. At STP, which gas would most likely behave as an ideal gas? (1) H_2 (2) CO_2 (3) C_{l2} (4) SO_2

6. At constant temperature the pressure on 8.0 liters of a gas is increased from 1 atmosphere to 4 atmospheres. What will be the new volume of the gas? (1) 1.0 ℓ (2) 2.0 ℓ (3) 32 ℓ (4) 4.0 ℓ

7. As the temperature of a sample of gas decreases constant pressure. the volume of the gas (1) decreases (2) increases (3) remains the same

8. A 100 milliliter sample of a gas is enclosed in cylinder under a pressure of 101.3 kPa. What volume would the gas sample occupy at a pressure of 202.6 kPa, temperature remaining constant? (1) 50 mL (2) 100 mL (3) 200 mL (4) 380 mL

9. The volume of a sample of hydrogen gas at STP is 1.00 liter. As the temperature decreases, pressure remaining constant, the volume of the sample (1) decreases (2) increases (3) remains the same

10. The pressure on 200. milliliters of a gas at constant temperature is changed from 0.500 atm to 1.00 atm. The new volume of the gas is (1) 100. mL (2) 200. mL (3) 400. mL (4) 600. mL

11. As the pressure on a given sample of a gas increases at constant temperature, the mass of the sample (1) decreases (2) increases (3) remains the same

12. A gas sample is at 10.0°C. If pressure remains constant, the volume will increase when the temperature is changed to (1) 263 K (2) 283 K (3) 273 K (4) 293 K