



The Effects of Temperature on the Volume of a Gas

Purpose: The purpose of this investigation is to study a general relationship between the temperature and volume of a given amount of gas at a constant pressure.

Problem: What effect does increasing the temperature have on the volume of a sample of gas at constant pressure?

Hypothesis: I have observed that when I heat any gas, the temperature of the gas increases and the volume of the gas expands.

Materials:

- Lab apron
- Eye protection
- Plastic syringe (35-60mL)
- Cap or stopper for the syringe tip
- Burette clamp
- Thermometer or temperature probe and clamp
- 600mL beaker
- ring stand
- hot plate
- stirring rod
- boiling stones or chips

Variables:

- Manipulated variable: temperature of gas
- Responding variable: volume of gas
- Controlled variable: pressure, solvent (water), amount of gas (moles)

Procedure:

1. Syringe plunger set to 15-20 mL of air.
2. Seal tip of syringe with cap or stopper.
3. Set up the ring stand with 600mL beaker on the hot plate.
4. Use the burette clamp to hold the syringe as far as possible into the beaker without touching the sides or the bottom.
5. Clamp the thermometer or probe so that the bulb is close to, but not touching, the syringe.
6. Add water at room temperature to about 1 cm from the top of the beaker. Drop in a few boiling stones.
7. After a few minutes, record the temperature and volume of air.
8. Turn on the hot plate. Heat the water slowly, stirring occasionally.
9. Record the gas volume and temperature about every 10°C until about 90°C.



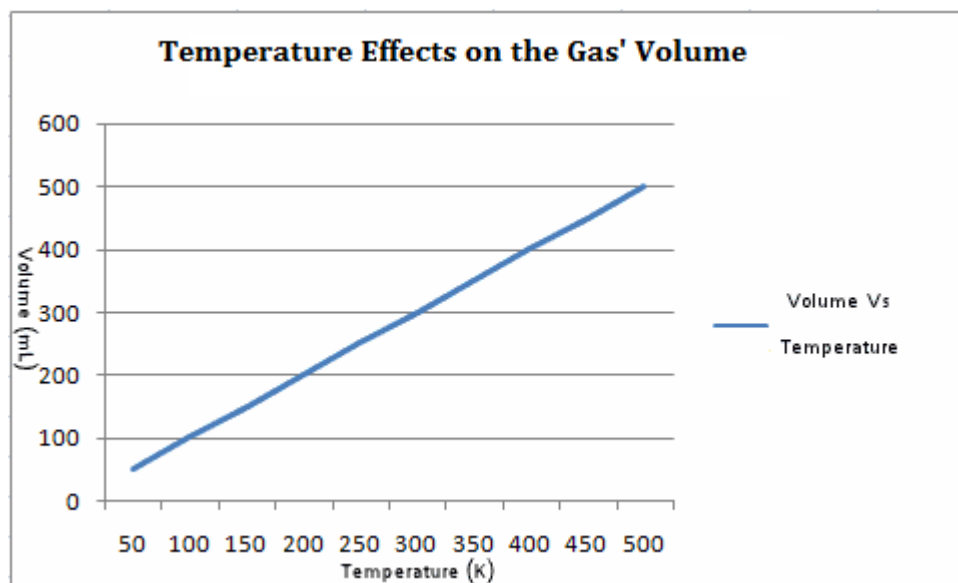
Observations/Results:

Table 1: The effect of temperature on the volume of a gas.

Serial#	Temperature (°C)	Temperature (K)	Volume (mL)
1	25	298.15	15.0
2	35	308.15	21.0
3	45	318.15	27.2
4	55	328.15	33.4
5	65	338.15	38.5
6	75	348.15	43.8
7	85	358.15	49.8
8	95	368.15	55.6

Analysis:

According to the results, as the temperature increased, the volume of the gas in the syringe also increased. At the initial temperature of 25°C, the volume was the lowest at 15.0mL. At the highest temperature of 95°C the volume was the highest at 55.6 mL. The results correlate according to the Charles Law where there is a direct relationship between temperature and volume when the pressure and moles of the gas are kept constant. A direct relationship means when one variable increases the other one will also increase. The plotted graph below shows a linear relationship between temperature and volume of a gas.



Conclusion:

The hypothesis was correct, as the temperature of the gas increased the volume of the gas also increased. Hence, the temperature and volume of a gas are directly proportional to one another.