Gas law

Science, Chemistry

Gas laws Objective Investigate the relationship between pressure, temperature, volume, and the amount of gas occupying an enclosed room. This experiment consists of three parts. In part one, the relationship between pressure and volume will be measured. In part two, the relationship between pressure and the amount of gas present in the chamber will be determined. Part three will illustrate the relationship between pressure and temperature. The results of these measurements will be used to derive the Ideal Gas Law.

Data

Temperature, K

Volume, L

Vapor Pressure, atm PH2O

PH2O/Ptotal

Vair, L

339. 05

0. 01

26. 167

0. 963190636

107. 731009

332. 45

0. 009

19. 028

0. 950069902

145. 266044

327. 45

0. 0085

15. 012

0. 93754684

181. 358265

324. 95

0. 0082

13. 623

0. 93161458

198. 323738

322. 65

0. 0081

12. 045

0. 923342277

222. 718237

320. 95

0. 008

11. 171

0. 917837483

238. 878049

318. 55

0. 0078

9. 842

0. 907766095

269. 107104

318. 35

0. 0076

8. 2054

0. 89136811

322. 578941

313. 15

0. 0075

7. 3814

0. 880688191

352. 73178

Figure 1 Volume temperature relationship

Part IV Relationship Between Pressure and Temperature

Temperature, K

Pressure, atm

289. 85

0. 891402126

371. 95

1. 272459523

273. 05

0. 979861879

196. 15

0. 728091813

Figure 2 pressure temperature relationship

Figure 3 pressure volume relation ship

Figure 4 Pressure volume inverse law

Discussion

From figure 1, we deduct that volume of a gas increases proportionally to the temperature when the pressure is kept constant. The independent variable in this chart is temperature whereas the dependent variable is volume. This corresponds to Charles law V/T = k

X intercept is when y= 0

From equation y = 0. 0001x-0. 0262

X= = - 262K

From figure 2, it is seen that at constant volume pressure of a gas increases proportionally with temperature. The independent variable is temperature whereas the dependent variable is pressure

From equation y= 0. 003x+0. 1111

X intercept = = -37. 033K

From figure 3, it is seen that the volume of a gas decreases exponentially with the increase in pressure. Plotting the values of pressure against the inverse of the volume gives us Boyles law (PV = Constant) that states that at constant temperature the pressure of the gas is inversely proportional to the size. From the figure for it is observed that when the pressure is doubled the volume is reduced by half. The linear graph passes through the point of origin (0, 0).

Air is a mixture of different gases that respond differently in different conditions. The ideal gas law provides provisions for incorporation of various gasses in a system. Therefore, air was a suitable choice for an ideal gas

According to the ideal gas law PV= nRT, therefore at constant number of moles and temperature the pressure is inversely proportional to the volume and therefore obeys Boyles law. At constant n and P, V is directly proportional to T with increasing T, V will also increase. From the data calculated and represented in figures 1-3 the ideal gas law is experimentally defined. From figure 1, it has been seen that the volume is directly proportional to temperature at constant pressure. From figure 2 it is observed that the volume is directly proportional to temperature and from figure 3 and 4 it is observed that the volume is inversely proportional to pressure. All these are the ideas behind the ideal gas law.

References

Goldberg D. E. (2007). Gases. In Fundamentals of Chemistry (315-334). New York: The McGraw−Hill