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COMPAIRING OF PERFECT GASES AND REAL GASES

In brief, we may state that Ideal gases have molecular interactions, with the mass of the molecules receiving more attention. However, the factors are altered by an unusually low temperature and high pressure. The Bayel Maryot rule states that for Ideal gases, the effect of pressure on the bulk at constant temperature has a constant magnitude, hence in this instance, PV is equal to CONST (PV = constant). The attractive force between molecules and the majority of molecules in actual gases (gases seen in nature) should be investigated under high pressure and low temperature (relatively). Actual gases in environments similar to Ideal gases must be very dependent on the rule for Ideal gases. And it should be distinct from the circumstances of ethylene gas. This indicates that gases differ from the principles of Normal gases to the extent that their gravity increases as a result of high pressure and a lower temperature. The distance between molecules decreases when pressure is high enough and temperature is low enough. However, the strength of molecular interactions has greatly increased, which has the effect of changing a substance from a gas to a liquid. As this method was once used to turn gases into liquids. Compressor is the term used to describe the process by which gases are changed into liquids. The compression factor of all perfect gases is z=1, and under any pressure, it neither drops nor increases from 1. This is another contrast between the behavior of perfect gases and real gases. However, this behavior differs in real gases because they can have compression factors that are diametrically opposed to 1, or ($z\neq1$).

Keywords: Ideal gas, Real gas, Carbon dioxide, compression factor, compressor.

Introduction

Generally speaking, gases make up the Earth's atmosphere and cover the entire globe, creating ideal circumstances for human life. Gases play a significant role in human existence and make life easier. There are many distinct types of gases in nature with varied states that can be referred to as ideal gases and Ideal gases. It is crucial to understand the distinctions between real and ideal gases. Every perfect gas cannot be a genuine gas, yet every real gas can be a perfect gas. It is undeniable that perfect gases exhibit forces of interaction between their molecules, and every observer can easily make out the volume of molecules present. With the significant drop in temperature and rise in pressure, these factors, however, change. In real gases, it is necessary to study the force of attraction between molecules and the volume of gas molecules at high and low pressures. According to the laws of gases, the effect of pressure on volume is a constant quantity for ideal gases at constant temperature. Real gases must mostly abide by the law of ideal gases when they exist in conditions that are similar to those of ideal gases, which implies when strong molecules are separated (in this case, the pressure is low and the temperature is high). Additionally, it differs from the conditions of ideal gases in its opposite. In other words, the more gases diverge from the laws of ideal gases, the more their density rises as a result of high pressure and low temperature. The distance between the molecules will shorten if the temperature is low and the pressure is high enough. However, the force of molecular interaction becomes so strong that the substance transforms from a gas to a liquid. Gas liquefaction is another purpose for this technique. Compressor is the name of the machinery used to turn gases into liquid. Thermal energy is used to reabsorb the energy from the gases in its surroundings in order to re-expand the gases and remove the force between its molecules. On the other hand, the environment cools as a result of the energy absorption by the gas.

Materials and Methods

In this research, the library method and information collection from various scientific books related to the subject, have been used. The title that has been chosen for research is certainly a very new, pristine and up-to-date subject and is considered one of the most valuable parts of physical chemistry.

Ideal gas

Calculations can be used to demonstrate that a perfect gas truly is an ideal gas in the field of physical chemistry. The distinction between perfect and ideal gases can be explained by the fact that, as previously stated, there is no intermolecular force between the particles of a perfect gas. However, a perfect gas is referred to as such if all interactions between its molecules are uniform. Accordingly, a perfect gas is ideal but an ideal gas is unquestionably not a perfect gas according to this definition. Small molecules in an ideal gas have average kinetic energies that depend on temperature. The size of molecules and their intermolecular forces are disregarded in the ideal gas law. For both high temperatures and low pressures, this law is applicable [9].

Results and discussion

The ideal gas laws

Boyle's law states that volume and pressure have an inverse relationship when the number of particles and gas temperature are both constant.

At constant n, P V = constant, and T

According to Boyl's law, an object's volume reduces as its surrounding pressure rises at constant temperature and vice versa [3].

2 - Charles's law: When both the number of particles and the gas pressure are constant, the volume and temperature will be closely related.

V= constant X T, at constant n, p   P = constant X T, at constant n, V

According to Charles' law, under isobar or constant pressure conditions, a substance's volume increases as its temperature rises, and its volume decreases as its temperature goes down [1].

3 - Avogadro's principle: When the temperature and pressure are constant, the number of particles will have a direct relationship with the volume of the gas [5].

V = constant X n at constant p, T

Real gas

The perfect gas law is not exactly followed by real gases. At high pressures and low temperatures, especially when a gas is about to condense into a liquid, deviations from the law are crucial [5].

Since molecules interact with one another, real gases deviate from the perfect gas law. Between molecules, positive forces help with compression while repulsive forces help with expansion. Repulsive forces only become important when molecules are virtually in contact; even at a scale measured in molecular diameters, they are short-range interactions [7].

When molecules are quite close to one another but not necessarily touching, intermolecular forces are significant. When molecules are far apart, attractive forces are ineffectual. When the temperature is so low and the molecules are moving at such slow mean speeds that they can collide with one another, intermolecular forces become even more crucial. When the sample is under low pressure and has a large volume, the molecules are typically so far away that intermolecular forces don't matter much and the gas behaves almost perfectly [11].

When molecules are only a few molecular diameters apart on average at moderate pressures, attractive forces outweigh repulsive forces. Because of the forces pulling the molecules together, it is reasonable to assume that the gas in this situation will be more compressible than a perfect gas [6].

For ideal gases, constant temperature is a constant number according to the equations of the influence of pressure on volume, but in real gases, it's important to investigate the gas force between molecules and the volume of gas molecules at high and low pressure. Real gases must be subject to the law of ideal gases in a certain way when they are in conditions that are similar to those of ideal gases, which implies when molecules are separated. And instead, it should differ from ideal circumstances [8].

That is, the more the gases diverge from the laws of ideal gases, the more their density rises as a result of high pressure and low temperature. Every gas has a critical temperature at which it cannot condense under any pressure and is hence incapable of condensing. The volume occupied by the gas at the critical temperature and pressure is known as the critical volume. At the critical temperature, an exceptionally high pressure is required in order to liquefy a gas, which is known as the critical pressure [8].

The critical situation of the gas is the state of the gas at critical pressure, critical temperature, and critical volume. The distance between the molecules will shorten if the temperature is low and the pressure is high enough. However, the force of molecular interaction becomes so strong that the substance transforms from a gas to a liquid. Gas liquefaction is done using this technique. And the compressor is the tool used to turn gases into liquids [10].

Thermal energy must be used to re-expand the gases and break up the force between their molecules. This energy is absorbed by the gases in the surrounding atmosphere, which also causes the atmosphere to cool. The same idea underlies the operation of refrigerators and the ability to compress and expand gases at low temperatures (enough to cool the dense gas) [2].

Except for several gases (N_2, H_2, and O_2), which he could not liquefy even at extremely low temperatures and high pressure in 1823, Faraday employed low temperature and high pressure to liquefy CO_2, NH2, and Cl_2 gas. Mendeleev established the liquefaction of gases theory in 1860. Every gas has a critical temperature at which it cannot condense under any pressure, and this value is what we refer to as the critical temperature. The volume that the gas occupies at the critical temperature and pressure is referred to as the critical volume. Nitrogen must be under an exceptionally high pressure at the critical temperature in order to liquefy it [9].

For example: the critical state of CO_2 gas is determined by the following quantities.

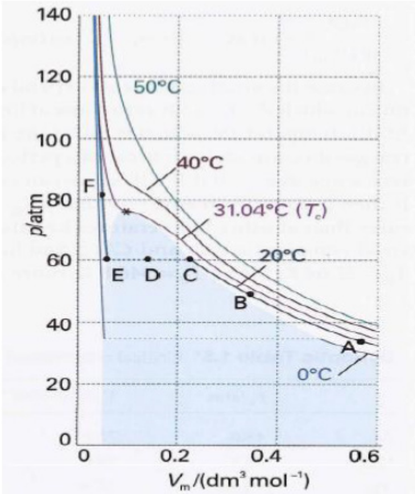

Figure (1) critical state of carbon dioxide gas [9]

At a temperature of +31.04 °C, a pressure of 60 atm CO_2 has a volume of 0.02Li Therefore, CO_2 turns into a liquid at a temperature of 31.3 and a pressure of 60 atm. If the temperature is higher than the critical state, CO_2 will not turn into a liquid under any pressure [4].

Here, the isotherm is studied at a temperature of 40, in the curve, three parts can be indicated, CD, BC, EB, as can be seen in the figure, only in the EB part, the gas obeys the Bayle-Marriot law, which decreases the gas volume at a certain temperature. And is inversely proportional to pressure. In part BC, the volume decreases to a constant pressure, which is a characteristic of the gas to liquid transition. In the CD part, no noticeable decrease in volume is observed with the increase in pressure, which means that the gas does not liquefy despite the strong increase in pressure. Because this is not the property of gas-like substances, but the property of the liquid state. The vertical percentage of the isotherm that corresponds to the portion of BC that bends gradually diminishes until it ultimately changes into a liquid at the temperature of 31.04 °C at the bending point at a very high temperature [5].

The compression factor

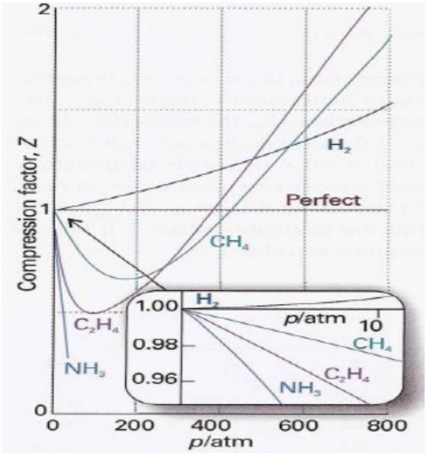

Figure (2) the variation of the compression factor, Z, with pressure [9]

The compression factor, Z, of a gas is the ratio of its measured molar volume, Vm = V/n, to the molar volume of a perfect gas, at the same pressure and temperature:

$$z = \frac{Vm}{V^{\circ}}$$

Because the molar volume of a perfect gas is equal to RT/p, an equivalent expression is z=RT/pV° , which we can write as

P Vm = RTZ

Because Z = 1 for a perfect gas under all circumstances, Z deviation serves as a gauge of behavior divergence from ideal. All of the gases in the diagram have Z = 1 and behave almost flawlessly at very low pressures. All gases have Z > I at high pressures, which means they have a higher molar volume than an ideal gas [9].

Conclusion

We conclude that ideal gases are often in molecular form, contain incredibly small particles, and can pass through the smallest pores based on the studies and research done on them. A perfect gas is one that completely abides by the ideal gas law and also has temperature-independent heat capacity. A perfect gas is made up of numerous identical molecules, hence it is insignificant to compare its volume to that of its constituent particles. The volume and intermolecular force of a perfect gas cannot be determined. A real gas is a gas that does not obey the gas laws under all circumstances of standard pressure and temperature. The research of real gases also yielded the following conclusions. The gas departs from its optimum behavior as it grows larger and larger. Real gas has a defined volume, a force of intermolecular attraction, and its particle collisions are not elastic. Real gas is affected by pressure, whereas ideal gas is not affected by pressure. And another difference between the behavior of perfect gases and real gases is their compression factor, because the compression factor of all perfect gases are, and under any type of pressure, its compression factor neither decreases nor increases from 1. But this behavior is different in real gases because the compression factor of real gases can be opposite to 1, that is, it can be($z \neq 1$).

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ИДЕАЛ ГАЗДАР МЕН НАҚТЫ ГАЗДАРДЫ САЛЫСТЫРУ

Қысқаша айтқанда, идеал газдарының молекулалық өзара әрекеттесулері бар, молекулалардың массасына көбірек назар аударылады деп айта аламыз. Дегенмен, факторлар әдеттен тыс төмен температура мен жоғары қысыммен өзгереді. Байел Мариот ережесі идеал газдар үшін тұрақты температурадағы қысымның массаға әсері тұрақты шамаға ие болады, демек, бұл жағдайда PV CONST (PV = тұрақты) тең болады. Нақты газдардағы (табиғатта кездесетін газдар) молекулалар мен молекулалардың көпшілігі арасындағы тартымды күшті жоғары қысымда және төмен температурада (салыстырмалы түрде) зерттеу керек. идеал газдарына ұқсас орталардағы нақты газдар идеал газдары ережесіне өте тәуелді болуы керек. Және ол этилен газының жағдайларынан ерекшеленуі керек. Бұл газдардың Қалыпты газдардың принциптерінен жоғары қысым мен төмен температура нәтижесінде ауырлық күші арта түсетін дәрежеде ерекшеленетінін көрсетеді. Молекулалар арасындағы қашықтық қысым жеткілікті жоғары және температура жеткілікті төмен болған кезде азаяды. Бірақ молекулалық әрекеттесулердің күші айтарлықтай өсті, бұл затты газ күйінен сұйықтыққа ауыстыруға әсер етеді. Өйткені бұл әдіс бір кездері газдарды сұйықтыққа айналдыру үшін қолданылған. Компрессор – бұл газдардың сұйықтыққа айналу процесін сипаттау үшін қолданылатын термин. Барлық тамаша газдардың сығылу коэффициенті z=1, кез келген қысымда ол 1-ден төмендемейді де, өспейді де. Бұл тамаша газдар мен нақты газдардың мінез-құлқы арасындағы тағы бір қарама-қайшылық. Дегенмен, бұл мінез-құлық нақты газдарда ерекшеленеді, өйткені оларда диаметральді түрде 1 немесе (z≠1) қарсы болатын қысу факторлары болуы мүмкін.

Кілтті сөздер: Идеал газ, Нақты газ, Көмірқышқыл газы, қысу коэффициенті, компрессор

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СРАВНЕНИЕ ИДЕАЛЬНЫХ ГАЗОВ И РЕАЛЬНЫХ ГАЗОВ

Короче говоря, мы можем констатировать, что идеальные газы имеют молекулярные взаимодействия, при этом больше внимания уделяется массе молекул. Однако факторы изменяются необычно низкой температурой и высоким давлением. Правило Байеля-Марио гласит, что для идеальных газов влияние давления на объем при постоянной температуре имеет постоянную величину, поэтому в этом случае PV равно CONST (PV = константа). Силу притяжения между молекулами и большинством молекул в реальных газах (газах, наблюдаемых в природе) следует исследовать при высоком давлении и низкой температуре (относительно). Фактические газы в средах, подобных идеальным газам, должны сильно зависеть от правила для идеальных газов. И это должно быть отлично от обстоятельств газообразного этилена. Это указывает на то, что газы отличаются от принципов нормальных газов тем, что их плотность увеличивается в результате высокого давления и более низкой температуры. Расстояние между молекулами уменьшается, когда давление достаточно высокое, а температура достаточно низкая. Однако сильно возросла сила молекулярных взаимодействий, в результате чего вещество превратилось из газа в жидкость. Так как этот метод когда-то использовался для превращения газов в жидкости. Компрессор – это термин, используемый для описания процесса, при котором газы превращаются в жидкости. Коэффициент сжатия всех совершенных газов равен $z=1$, и при любом давлении он не падает и не увеличивается от 1. Это еще одно различие между поведением идеальных и реальных газов. Однако это поведение отличается в реальных газах, потому что они могут иметь коэффициенты сжатия, диаметрально противоположные 1 или ($z \neq 1$).

Ключевые слова: идеальный газ, реальный газ, углекислый газ, коэффициент сжатия, компрессор.

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