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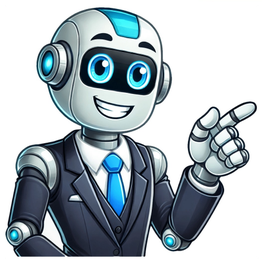

Graham's law examples

Graham’s law is also known as Graham’s law of effusion or diffusion. It was formulated by British chemist Thomas Graham in the year 1848. Graham’s law tends to establish a relationship between the rate of effusion or diffusion of a gas and its molar mass. Diffusion is the phenomenon that helps a material to move from an area of higher concentration to an area of lower concentration. It helps the molecules or particles of different gases to get mixed with each other and allows a substance to spread across a medium. Similarly, effusion is the process by virtue of which the gas molecules are able to escape through a small opening in the container easily. Graham’s law states that the rate of diffusion or effusion of a gas is inversely proportional to the square root of its density or the square root of its molar mass at a given temperature and pressure. This means that lighter gas effuses or diffuses easily; whereas, heavier gas molecules take time to effuse or diffuse. The limitation of Graham’s law of effusion or diffusion is that it breaks down when the concentration of the gases becomes considerably high. This means that Graham’s law stands correct for ideal gases that are present at low temperatures and pressure. Graham’s law is able to deliver accurate observations in case of effusion; however, in the case of diffusion the results are approximated and the values are rounded off to the nearest possible accurate value. Also, if the temperature and pressure values of the surroundings are not constant and tend to change with respect to time, the observed values of the experiment tend to deviate. Examples of Graham’s Law 1. Spraying Air Freshener When a perfume is sprayed in one corner of the room, its fragrance can be felt in the entire room. This is because of the diffusion phenomenon. The rate at which the fragrance spreads across the room is inversely proportional to the square root of the density of the molecules of the gas contained in the perfume and can be evaluated with the help of Graham’s law of diffusion or effusion. 2. Calculate the Effusion/Diffusion Rate of a Particular Gas Graham’s law of effusion or diffusion is typically used to calculate the effusion or diffusion rate of a particular gas. It also helps to compare the effusion or diffusion rates of two different gases. Thereby, helping the scientists to estimate the time required by a particular gas to escape the container or surrounding in which it is present. This estimation of effusion or diffusion rate is necessary to form the safety measures in case of a gas leak. 3. Incense Stick One can easily observe the application of Graham’s law in real life by lighting an incense stick and observing the behaviour of the smoke molecules generated by it. This is because the smoke coming out of the burning incense stick spreads in the surroundings quickly with the help of the diffusion process. 4. Balloons When an inflated balloon is pierced with the help of a sharp object, the gas molecules tend to escape through the hole pierced in the balloon. The escaping of gas molecules through the small opening in the balloon represents the effusion process. The time taken by the gas molecules to completely escape and the balloon to get properly deflated can be calculated with the help of Graham’s law of effusion or diffusion. The rate of effusion is different for different gases. 5. Compare the Nature of Various Gases Graham’s law of effusion or diffusion is highly used to compare the nature of two different gases. The law states that the gases with heavy molecules travel slower than the gases with light molecules. Thereby, establishing a distinction between the molecular weights of the two gases. 6. Comparing Hard and Soft Water Graham’s law of effusion or diffusion is also applicable to liquids and solids. It is effectively used to calculate the hardness of the water. Let us say that the diffusion rate of two samples of water is known to us, then Graham’s law can be used to determine which of the water samples is heavier thereby, differentiating hard water from soft water. 7. Separation Process Graham’s law is used in the separation process to separate different isotopes of an element. Also, it helps chemists and scientists to separate a particular gas from a mixture of gases. Hence, Graham’s law of diffusion or effusion finds its prime application in the medical and research domains to extract oxygen and other important gases. Composition of air 8. Identifying the Nature and Characteristics of an Unknown Gas Whenever a new element or gas is discovered, its prime characteristics such as molar mass, diffusion rate, effusion rate, etc., are required to be determined to know about its nature. For this purpose Graham’s law is most commonly used. 9. Construction of Chimneys The architects and engineers make use of Graham’s law to estimate the proper height of the industrial and domestic chimneys. The smoke and toxic gases must be released into the upper atmosphere to avoid health hazards and accidents. With the help of Graham’s law, the diffusion and effusion rate of the gases can be estimated in advance. This helps to determine the appropriate height of the chimneys required to ensure the escape of smoke and toxic gas particles away from the household and human contact. Different gases diffuse at different rates, depending on their molar masses. You can compare the rates at which two gases diffuse using Graham's law. Graham's law also applies to effusion, the process in which gas molecules flow through a small hole in a container. Diffusion is the movement of a substance from an area of higher concentration to an area of lower concentration. Diffusion occurs spontaneously, on its own. It leads to mixing, eventually producing a homogenous mixture in which the concentration of any gaseous component is equal throughout an entire volume. Of course, that state of complete diffusion is an equilibrium state, and achieving equilibrium can take time. Whether gases diffuse or effuse, they do so at a rate inversely proportional to the square root of their molar mass. In other words, more massive gas molecules diffuse and effuse more slowly than less massive gas molecules. So for Gases A and B, the following applies:Note: In the following problem, the molar masses are rounded to two decimal places before they are plugged into the formula. By far, the most important part of solving effusion problems is identifying which gas you'll identify as Gas A and which gas you'll identify as Gas B when you plug your values into the equation. Don't switch them up!Solving an effusion problem Now, on to the problem: How much faster does hydrogen gas effuse than neon gas?Hydrogen gas refers to H2 because hydrogen is a diatomic element. Consult your periodic table (or your memory, if you're that good) to obtain the molar masses of hydrogen gas (2.02 g/mol) and neon gas (20.18 g/mol).Finally, plug those values into the appropriate places within Graham's law, and you can see the ratio of effusion speed. In this example, let's assume that you chose hydrogen as Gas A and neon as Gas B.The answer you get to this problem is 3.16. Putting this number over 1 can help you understand your answer. The ratio 3.16/1 means is that for every 3.16 mol of hydrogen gas that effuses, 1.00 mol of neon gas will effuse. This ratio is designed to compare rates. So hydrogen gas effuses 3.16 times faster than neon. HomePSIBERG Team2024-12-06T16:19:51+05:00 Graham’s law is also known as Graham’s law of effusion or diffusion. It was formulated by British chemist Thomas Graham in the year 1848. Graham’s law tends to establish a relationship between the rate of effusion or diffusion of a gas and its molar mass. Diffusion is the phenomenon that helps a material to move from an area of higher concentration to an area of lower concentration. It helps the molecules or particles of different gases to get mixed with each other and allows a substance to spread across a medium. Similarly, effusion is the process by virtue of which the gas molecules are able to escape through a small opening in the container easily. Graham’s law states that the rate of diffusion or effusion of a gas is inversely proportional to the square root of its density or the square root of its molar mass at a given temperature and pressure. 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Graham’s law of diffusion states that the rate of diffusion of gases is inversely proportional to the square root of their molecular weight. Light gases (low molecular weight) have a higher diffusion rate as compared with heavier ones (high molecular weight) provided that the temperature, pressure, and density remain constant. For example, hydrogen with a molecular weight of 2 amu has a 4 times greater rate of diffusion than oxygen with a molecular weight of 16 amu. Thomas Graham (1805-1869), a Scottish chemist after observing effusion and diffusion through a thick plug of plaster of Paris, formulated this law in 1829. Relationship between Entropy and Diffusion of gases Entropy is the randomness of gas particles and the diffusion of gases is based on entropy law. The gas particles diffuse in the surrounding towards an increased state of entropy. As this process is spontaneous it occurs on its own. Equation of Graham’s law Consider two different gases with Molecular masses M1 and M2. The rate of their relative diffusion is given by: R1 ∝ 1/M1 R2 ∝ 1/M2 Derivation of equation for Graham law of diffusion with KMT In1857, Clausius proved Graham’s law with the Kinetic molecular theory (KMT) of gas. If two gases A and B are with masses m1 and m2, and the velocities of their molecules are CA and CB: From the Kinetic Molecular Theory of Gas; Kinetic energy of gas 1= 1/3 m1NACA2 → (i) Kinetic energy of gas 2 = 1/3 m2NBCB2 → (ii) From equation (i) and equation (ii), 1/3 m1NACA2= 1/3 m2NBCB2 → (iii) As we know that by Avagadro’s Law; NA = NB → (iv) Equation (iii) can be written after eliminating equation (iv), mACA2 = mB CB2 → (v) If we suppose m1 and m2 to be the molecular weights such as MA and MB, equation (v) can be written as; MACA2= MBCB2 or, (CA/CB)2 = MB/MA By taking square root on both sides, we get; CA/CB = √MB/MA The rate of diffusion of a gas is directly proportionated to its velocity, hence it is concluded that: r1/r2 = √MB/MA The above equation is known as Graham’s law. Calculation of molecular mass (Mr) Graham’s law is used to accurately calculate the unknown molecular mass of a gas. For this purpose, the rates of diffusion of these gases are to be measured carefully. The temperature and pressure should be kept constant during this analysis. Example: The rate of diffusion of a gas is twice as compared with carbon dioxide. what is the molecular mass of unknown gas? Solution: Ratio of the rate of gases= r1 : r2 = 2 : 1 Molecular mass of carbon dioxide = M2= 44 g/mol The molecular mass of unknown gas = M1 =? Using Graham’s Law of Diffusion, r1/r2 = √M2/M1 2/1 = √ 44/M1 4 = 44/M1 M1 = 11 Hence the molecular mass of unknown gas is 11 g/mol. Practical demonstration of the rate of diffusion Two pieces of the cotton pack are taken and dipped in ammonia and hydrochloric acid solutions. These pieces are then placed at positions A and B, the ends of the cylindrical tube. Now the vapors of these gases start moving towards each other. Eventually, the tube gets divided into 3 sections. The white fumes of ammonium chloride appear in the section near HCl cotton. Because HCl has a greater molecular mass hence diffuses slowly. While ammonia with lighter Mr travels at a higher speed to reach point C. Graham’s Law of Effusion The movement of molecules from an area of higher concentration to an area of lower concentration through a small hole is called effusion. The rate of diffusion depends upon the molecular mass of the gas. It has been observed that the rate of effusion of a gas is much easier to calculate, hence the rate of effusion is determined and employed to find the molecular mass of unknown gas. The rate of effusion is given by; ⇒ Pressure and temperature are kept constant while working in Graham’s law. Example A 20 cm3 of an unknown gas effuses through a pin-hole in 100 seconds, The same volume of oxygen O2 effuses in 140 seconds. Calculate the Mr of the unknown gas. Rate of effusion of unknown gas = volume of gas/ time taken = 20/100 Rate of Unknown gas = 0.2 ml/s Similarly ; Rate of dissusion of O2 gas =20/140 = 0.14 ml/s Putting r1, M1 and r2 in Graham’s law, we get; 0.14/0.2 = √M/ 32 Taking squares on both sides 0.71 = M/ 32 ⇒ M = 0.71 x 32 = 22. 8 g/mol Hence, 22.8 g/mol is the molecular mass of the unknown gas. Applications of Graham’s law Graham’s law has many applications such as: Separation of isotopes Dialyser Heterogeneous catalysis Determination of molecular masses of unknown and newly discovered gases, etc Separation of Isotopes Isotopes are the species with same atomic numbers but different atomic masses. They can be separated easily by using diffusion principles. For example, isotopes of uranium are separated through a diffusion process known as the Uranium enrichment process. Uranium-238 and U-235 are two (of a total of 5) isotopes of uranium found in nature. However, uranium-235 is a fissionable isotope, so it is first separated from U-238 to get pure U-235. For this purpose, U is first reacted with Flourione to form UF6. Actually, a mixture of 235UF6 and 238UF6 is produced and these isotopes have significantly different molecular weights. This mixture is volatilized and separated on the basis of differences in the rate of their diffusions. This process is done in the Enrichment plant as shown below. Diffusion of ions in liquids: Dialyser The transport of ions in liquids is somewhat the same in all gases. The rate of diffusion in liquid also depends upon their ionic masses. Its best application is the dialysis chamber which works on the principle of diffusion. In this method, the unwanted ions (nitrogenous wastes of the body) are removed from the solution (blood). When two solutions are separated through a perforated filter, which allows smaller ions to pass through, are placed together, the large molecular ion tends to stay in the solution due to a lower diffusion rate whereas the lighter one diffuses across the solution. Heterogeneous catalysis Gases are diffused on the metal surfaces where they adsorb and react with each other. The rate of diffusion of these gases controls reaction kinetics when in a reaction. For example, in heterogeneous catalysis, particular conditions of temperature and pressure are required to form ammonia from nitrogen and hydrogen. The reaction is catalyzed by iron. The following steps are involved in this reaction. Nitrogen gas and hydrogen gas diffuse to the surface of the iron. The reactants molecules are chemically adsorbed onto the surface of the iron. The adsorbed nitrogen and hydrogen atoms react together to form ammonia. The bonds between the ammonia and the surface of iron weaken and are eventually broken. Ammonia diffuses away from the surface of the iron. Hydrogenation of Vegetable oil A similar process goes for the hydrogenation of edible oils. The liquid oil is adsorbed along with hydrogen, for the reaction to occur. Pharmaceuticals Drugs used to treat several tumors and cysts are first investigated by using colored compounds, e.g gelatin through their rates of diffusion. This phenomenon is known as the Drug Modeling Technique. Additional topics Boyle’s Law Charles’s Law Dalton’s law of partial pressure Concepts Berg Can you use Graham’s law of effusion on diffusion? Both have the same equation but different working principles. Effusion is measured by using vacuumed container and no molecular collision is observed (small hole) whereas, whereas diffusion is the movement of molecules due to a concentration gradient through a large area. What is the concept of Graham’s law of effusion? Effusion, Work, and The principle of entropy are the basis of Graham’s law of discussion. When a gas is trapped in a container and is allowed to expand in a vacuumed container, It rapidly moves towards less concentration to increase its entropy. What gases diffuse the fastest, O2, CH4, CO2, or Cl2? The rates of diffusion of these gases are as: CH4 > O2 > CO2 > Cl2 Methane diffuses at the fastest rate because it has the least molecular weight. Similarly, chlorine has the most molecular weight here. What is the real formula of Graham’s law? The real formula of Graham’s law is its mathematical form. r = 1/√M Which gas diffuses faster hydrogen, oxygen, carbon monoxide, or nitrogen? Rate of diffusion; Hydrogen > Nitrogen > Oxygen > Carbon monoxide The rate of diffusion is inversely proportional to the molecular weight of the given gas. Carbon monoxide being the heaviest gas in these examples has the lowest diffusion rate followed by oxygen, and nitrogen, and then hydrogen gas has the fastest rate of diffusion among them. References Essential of Physical Chemistry: 2nd edition By B.S Bahl and Arun Bahl Cambridge International AS A level Chemistry by Lawrie Ryan and Roger Norris Graham’s law of diffusion states that the rate of diffusion of a gas or its effusion is inversely proportional to the square root of its molecular weight. The principle of the law of diffusion states that at any given temperature and pressure the rate of diffusion of any given gas is inversely proportional to the square root of its density. Diffusion is the process through which particles from one gas move to another. It is caused when the particles of a material are in low concentration and they move to areas with high area of concentration. An example of diffusion in the spreading of scent of perfume in the entire room when it’s sprayed in one part. Effusion is the process through which a gas escapes the container’s wall through a very small hole on the surface. The rate of diffusion refers to the change in diffusing molecules over time. Read More: Difference between Effusion and Diffusion Key terms: Effusion, Square root, Temperature, Density, Pressure, Collision, temperature, Molecule, Law of Diffusion [Click Here for Sample Questions] Diffusion of a gas is the random motion of a particle involved in the net movement of the substance from the higher concentration area to the lower concentration area. Each of the particles inside the gas starts colliding with each other. The rate of diffusion of a gas is directly proportional to the square root of the density of a gas molecule. The density of a gas molecule is equal to the mass of a gas that is divided by the volume of the gas molecule. If the volume of the gas molecule is held constant one gas can be compared with another gas. Graham's Law of Diffusion states that the rate of diffusion of a gas is inversely proportional to the square root of its molecular weight. Diffusion of Gases Read Also: Rate of Effusion [Click Here for Sample Questions] The effusion of a gas is the process in which the air particles escape or leak through a hole whose diameter is considerably smaller than the mean free path of the molecules. In this process, all the particles and the molecules that reach the hole will pass through, as due to the collisions between the molecules in these places are negligible in number. The rate of effusion of a gas can be defined as the process by which particles of a material from the closed space start escaping with time. Suppose when we make an opening in the balloon, the gas present inside it starts escaping into the atmosphere and the balloon starts deflating from inside. This is called the effusion of a gas into the atmosphere. Hence, we can say that the rate of effusion of a gas is inversely proportional to the density of a gas and its molar mass. Rate of Effusion ∝ 1/√density ∝ 1/√M Here M is the molar mass of a gas molecule. Read More: Difference between Diffusion and Osmosis Graham's Law of Diffusion [Click Here for Sample Questions] Graham's Law was first discovered by a scientist named Thomas Graham in the year 1848. He experimented with the effusion process of a gas and formulated an important aspect that the gas molecules are lighter in weight and will travel faster in air than the heavier gas molecule. This law is popularly known as Graham's law of Effusion. According to Graham’s law of diffusion and effusion, the atoms and molecules with lower molecular mass will diffuse faster in air than the molecules and atoms that are heavier, at constant temperature and pressure of a gas. It states that the rate of effusion of a gas molecule is inversely proportional to the square root of the density of a gas or its molecular mass. Graham’s Law Formula = \({Rate_1 \over Rate_2} = {\sqrt {M2 \over M1}}\) Here, Rate 1 = rate of effusion of the first gas Rate 2 = rate of effusion of the second gas. M1 = Molar mass of first gas M2 = Molar mass of second gas. It states that the rate of diffusion or effusion is inversely proportional to its molecular mass. Graham's law of diffusion, also known as Graham's law of effusion, states that the rate of diffusion or effusion of a gas is inversely proportional to the square root of its molecular weight. According to Graham's law, lighter gases diffuse or effuse quickly than heavier gases at the same temperature and pressure. Applications of Graham’s law of diffusion Graham's law has several applications such as – The separation of gases in industries such as petrochemicals, air separation, and natural gas processing. It is also used in fields such as atmospheric science, where it is used to understand the mixing of gases in the atmosphere. Importance of Graham's law of diffusion Graham's law of diffusion is important as: It provides a basis for separating gases of different molecular weights. So, the lighter gases can be separated from heavier gases using gas chromatography. Graham's law of diffusion helps to understand the mixing of gases in the atmosphere. It explains why lighter gases rise to the upper atmosphere while heavier gases remain closer to the surface. The law of diffusion is also used in chemical processes such as distillation. Graham's law of diffusion is a fundamental law of physics to understand the behavior of gases and how they interact with their environment. Suppose we have two gases, gas A with a molecular weight of 16 g/mol and gas B with a molecular weight of 64 g/mol. If both gases are at the same temperature and pressure, what is the ratio of their diffusion rates? Using Graham's law, we can calculate the ratio of the diffusion rates as follows: Ratio of diffusion rates = (Rate of diffusion of gas A) / (Rate of diffusion of gas B) Ratio of diffusion rates = √(Molecular weight of gas B) / √(Molecular weight of gas A) Ratio of diffusion rates = √(64 g/mol) / √(16 g/mol) Ratio of diffusion rates = 8 / 4 Ratio of diffusion rates = 2 Therefore, the ratio of the diffusion rates of gas A to gas B is 2:1. This means that gas A will diffuse twice as quickly as gas B at the same temperature and pressure. Read More: Bulk Modulus Things to Remember Diffusion is a phenomenon in which gas moves from higher concentration to lower concentrations. In effusion, the gas moves from lower to higher concentrations. The diffusion of a gas leads to a significant disorder in the entire system of the gas. It acts at slower rates in liquid as well as solid gasses. Graham's law of diffusion is used in determining the molecular masses and the vapor density of a gas molecule. Mathematically, Graham’s law can be expressed as Rate of diffusion/effusion ∝ 1/√(molecular weight) This is also used in separation of different gasses from the mixture of gasses and in separating the isotopes of same elements. Read More: Young's Modulus Ques. What is the equation for Graham's law of effusion? (2 marks) Ans. Graham's law of effusion can be used for calculating the rate of diffusion or effusion of a gas and its molar masses. The equation of the law of effusion can be expressed in the equation: r 1 / r 2 = √ (m 2 / m 1) r1 = rate of effusion of the first gas r2 = rate of effusion of the second gas. m1 = Molar mass of first gas m2 = Molar mass of second gas. Ques. Which gas Effuses the fastest? (3 marks) Ans. As we know, the rate of effusion of a gas is inversely proportional with the square root of the molecular masses of a gas as per Graham's law of effusion. Hence, the gas with the lowest molecular weight will effuse faster than the heavier gas. Therefore we can say the lightest and fastest gas is helium. Ques. Which gas is more ideal at STP? (3 marks) Ans. The real gas which acts most likely as an ideal gas is helium. It is because helium, not at all like most gases, exists as a solitary atom, which makes the van der Waals scattering powers as low as could really be possible. Another element is that helium, as other noble gases, has a totally filled valence electron shell. Ques. What is the value of R in an ideal gas equation? (2 marks) Ans. The numerical value of R on the ideal gas equation will depend upon the units involved in the equation, but it is usually stated with the S.I units as R: 8.314 J/mol K. The R is known as the Universal Gas Constant of the equation. Ques. Calculate the molar mass of a gas whose rate of diffusion is 2.92 times the diffusion rate of Ammonia NH3? (4 marks) Ans. As we know that the rate of diffusion of a gas is 2.92 times the ammonia gas, hence we can say that the ratio of rates of diffusion of the given gas should be 1/ 2.92. So it can be written as r1/r2 = 1/ 2.92. It is known that the molar mass of the Ammonia gas is 17.03. Them according to Graham's law of effusion r 1 / r 2 = √ (m 2 / m 1) After substituting the value given above we get 1/ 2.92 = √ (mass 2 / 17.03) After squaring both sides 0.11728 = (mass 2 / 17.03) Hence, mass 2 = 2.0 g per mol. Ques. Find the relative diffusion rates of a water H20 as compared to the hard water whose molar mass is 20.02? (5 marks) Ans. After calculating the molar masses of water and hard water we get The molar mass of H20 (mass 1) = 18.01 The molar mass of Hard Water (mass 2) = 20.02 Now let's assume that the rate of diffusion formula of a heavy water as one as it has a slower rate of diffusion. r2 = 1 According to Graham's law of effusion r 1 / r 2 = √ (m 2 / m 1) After squaring both sides we get (rate 1 / rate 2) ² = (mass 2 / mass 1) After substituting the values given above in the equation we get (rate 1)² / 1 = 20.02 / 18.01 (rate 1)² = 1.11 rate 1 = 1.05 Hence the relative diffusion rate of a gas is 1.05. Ques. A vessel having a capacity of 120 ml contains some amount of gas at 35°C and q pressure of 1.2 bar. The gas is then transferred into another vessel of 180 mL at a temperature of 35°C. What would be its pressure? (3 marks) Ans. It is given in the questions V1 = 120 ml V2 = 180 ml P1 = 1.2 bar P2 = ? As we know, the temperature remains constant at 35° Celsius. P1 V1 = P2 V2 1.2 bar × 120 ml = P2 × 180 ml 144 bar ml = P2 × 180 ml 144 bar ml / 180 ml = P2 P2 = ? bar P2 = 0.8 bar Ques. Calculate the molar mass of a gas whose rate of diffusion is 4 times the diffusion rate of water? (5 marks) Ans. As we know that the rate of diffusion of a gas is 4 times the water gas, hence we can say that the ratio of rates of diffusion of the given gas should be 1/ 4. So it can be written as r1/r2 = 1/ 4. It is known that the molar masses of the water gas is 18. Them according to Graham's law of effusion r 1 / r 2 = √ (m 2 / m 1) After substituting the value given above we get 1/ 4 = √ (mass 2 / 18) After squaring both sides 1/ 16 = (mass 2 / 18) Hence, mass 2 = 1.125 g per mol Ques. Find the relative diffusion rates of a hydrogen as compared to the nitrogen whose molar masses is 14? (5 marks) Ans. After calculating the molar masses of hydrogen and nitrogen we get The molar mass of water (mass 1) = 2 The molar mass of nitrogen (mass 2) = 14 Now let's assume that the rate of diffusion formula of hydrogen as one as it has a slower rate of diffusion. r2 = 1 According to Graham's law of effusion r 1 / r 2 = √ (m 2 / m 1) After squaring both sides we get (rate 1 / rate 2) ² = (mass 2 / mass 1) After substituting the values given above in the equation we get (rate 1)² / 1 = 14 / 2 (rate 1)² = 7 rate 1 = 2.64 Hence the relative diffusion rate of a gas is 2.64. Ques. What will be the minimum pressure that is required to compress 500 dm^3 of air at 1 bar of pressure to 200 dm^3 at a temperature of 30° C? (3 marks) Ans. It is given in the questions V1 = 500 dm^3 V2 = 200 dm P1 = 1 bar P2 = ? As we know, the temperature remains constant at 30° Celsius. P1 V1 = P2 V2 1 bar × 500 dm^3 = P2 × 200 dm^3 500 dm^3 = P2 × 200 dm^3 500 dm^3 / 200 dm^3 = P2 P2 = 5/2 bar P2 = 2.5 bar Also Read: