

Diffusion

Spoken Tutorial Project

<https://spoken-tutorial.org>

National Mission on Education through ICT

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Learning Objectives



Learning Objectives

We will learn about,



Learning Objectives

We will learn about,

- ▶ **Factors affecting the rate of diffusion**



Learning Objectives

We will learn about,

- ▶ **Factors affecting the rate of diffusion**
- ▶ **Graham's law of diffusion**



System Requirement



System Requirement

Here I am using,



System Requirement

Here I am using,

▶ **Windows 11 (64 bit)**



System Requirement

Here I am using,

- ▶ Windows 11 (64 bit)
- ▶ Google Chrome Version 103.0.50



Prerequisites



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- ▶ **Learner should be familiar with topics in high school science**



Prerequisites

- ▶ Learner should be familiar with topics in high school science
- ▶ Please use the link below to access the tutorials on PhET Simulations
<https://spoken-tutorial.org>



PhET Simulations



PhET Simulations

- ▶ Please use the given link to download the PhET simulation
<https://phet.colorado.edu/en/simulations/diffusion/about>



Diffusion Rate and Number of Particles

Table 1

S.No	Number of molecules on the left side	Time to reach equilibrium(ps)
1	50	28 ps
2	100	26 ps
3	150	24 ps
4	200	22 ps



Diffusion Rate and Radius

Table 2

S.No	Radius (pm)	Time to reach equilibrium(ps)
1	50	31 ps
2	100	30 ps
3	150	28 ps
4	200	24 ps



Diffusion Rate and Temperature

Table 3

S.No	Temperature(K)	Time to reach equilibrium(ps)
1	100	48 ps
2	200	38 ps
3	300	29 ps
4	400	24 ps



Ratio of Diffusion Rate

- ▶ Rate of Diffusion of blue particles is $54 - 46 = 8 \text{ nm/ps}$



Ratio of Diffusion Rate

- ▶ Rate of Diffusion of blue particles is $54 - 46 = 8 \text{ nm/ps}$
- ▶ Rate of Diffusion of red particles is $58 - 42 = 16 \text{ nm/ps}$



Ratio of Diffusion Rate

- ▶ Rate of Diffusion of blue particles is $54 - 46 = 8 \text{ nm/ps}$
- ▶ Rate of Diffusion of red particles is $58 - 42 = 16 \text{ nm/ps}$
- ▶ **Ratio of diffusion rate of**
$$\frac{\text{red particles}}{\text{blue particles}} = \frac{16}{8} = 2$$



Molar Mass of the Particles

- ▶ Molar mass of blue particles is 16



Molar Mass of the Particles

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Molar Mass of the Particles

- ▶ Molar mass of blue particles is 16
- ▶ Molar mass of red particles is 4
- ▶ **Ratio of molar mass of**

$$\frac{\text{blue particles}}{\text{red particles}} = \frac{16}{4} = 4$$



Molar Mass of the Particles

- ▶ Molar mass of blue particles is 16
- ▶ Molar mass of red particles is 4

- ▶ Ratio of molar mass of

$$\frac{\text{blue particles}}{\text{red particles}} = \frac{16}{4} = 4$$

- ▶ Ratio of square root of molar mass
of $\frac{\text{blue particles}}{\text{red particles}} = 2$



Graham's Law of Diffusion

- ▶ **Ratio of rate of diffusion of**
 $\frac{\text{red particles}}{\text{blue particles}} = \text{ratio of square root of}$
molar mass of $\frac{\text{blue particles}}{\text{red particles}}$



Graham's Law of Diffusion

- ▶ **Ratio of rate of diffusion of**
 $\frac{\text{red particles}}{\text{blue particles}} = \text{ratio of square root of}$
molar mass of $\frac{\text{blue particles}}{\text{red particles}}$
- ▶ **Rate of diffusion is inversely proportional to the square root of its molar mass**



Summary

We have learnt about,

- ▶ **Factors affecting the rate of diffusion**
- ▶ **Graham's law of diffusion**



Assignment

- ▶ **Verify Graham's law of diffusion for particles of different molar masses**



About the Spoken Tutorial Project

- ▶ Watch the video available at https://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- ▶ It summarises the Spoken Tutorial project



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- ▶ If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- ▶ Conducts workshops using spoken tutorials
- ▶ Gives certificates to those who pass an online test
- ▶ For more details, please write to contact@spoken-tutorial.org



Answers for THIS Spoken Tutorial

- ▶ Questions in THIS Spoken Tutorial?
- ▶ Visit <https://forums.spoken-tutorial.org>
- ▶ Choose the minute and second where you have the question
- ▶ Explain your question briefly
- ▶ The Spoken Tutorial project will ensure an answer



Acknowledgements

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Thank you

- ▶ This is Vidhi Thakur, a FOSSEE summer fellow 2022, IIT Bombay signing off

