

Physics

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(Chapter 1) (Units and Measurement) (Exercises)

(Class 11)

Question 1.14:

The unit of length convenient on the atomic scale is known as an angstrom and is denoted by Å: $1 \text{ Å} = 10^{-10} \text{ m}$. The size of a hydrogen atom is about 0.5 Å . What is the total atomic volume in m^3 of a mole of hydrogen atoms?

Answer 1.14:

Radius of hydrogen atom, $r = 0.5 \text{ Å} = 0.5 \times 10^{-10} \text{ m}$

Volume of hydrogen atom $= \frac{4}{3} \pi r^3$

$$= \frac{4}{3} \times \frac{22}{7} \times (0.5 \times 10^{-10})^3$$

$$= 0.524 \times 10^{-30} \text{ m}^3$$

1 mole of hydrogen contains 6.023×10^{23} hydrogen atoms.

Volume of 1 mole of hydrogen atoms

$$= 6.023 \times 10^{23} \times 0.524 \times 10^{-30}$$

$$= 3.16 \times 10^{-7} \text{ m}^3$$

Question 1.15:

One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). What is the ratio of molar volume to the atomic volume of a mole of hydrogen? (Take the size of hydrogen molecule to be about 1 Å). Why is this ratio so large?

Answer 1.15:

Radius of hydrogen atom, $r = 0.5 \text{ Å} = 0.5 \times 10^{-10} \text{ m}$

$$\text{Volume of hydrogen atom} = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (0.5 \times 10^{-10})^3 = 0.524 \times 10^{-30} \text{ m}^3$$

Now, 1 mole of hydrogen contains 6.023×10^{23} hydrogen atoms.

$$\therefore \text{Volume of 1 mole of hydrogen atoms, } V_a = 6.023 \times 10^{23} \times 0.524 \times 10^{-30}$$

$$= 3.16 \times 10^{-7} \text{ m}^3$$

Molar volume of 1 mole of hydrogen atoms at STP, $V_m = 22.4 \text{ L} = 22.4 \times 10^{-3} \text{ m}^3$

$$\therefore \frac{V_m}{V_a} = \frac{22.4 \times 10^{-3}}{3.16 \times 10^{-7}} = 7.08 \times 10^4$$

Hence, the molar volume is 7.08×10^4 times higher than the atomic volume. For this reason, the inter-atomic separation in hydrogen gas is much larger than the size of a hydrogen atom.

Question 1.16:

Explain this common observation clearly: If you look out of the window of a fast moving train, the nearby trees, houses etc. seem to move rapidly in a direction opposite to the train's motion, but the distant objects (hill tops, the Moon, the stars etc.) seem to be stationary. (In fact, since you are aware that you are moving, these distant objects seem to move with you).

Answer 1.16:

Line of sight is defined as an imaginary line joining an object and an observer's eye. When we observe nearby stationary objects such as trees, houses, etc. while sitting in a moving train, they appear to move rapidly in the opposite direction because the line of sight changes very rapidly.

On the other hand, distant objects such as trees, stars, etc. appear stationary because of the large distance. As a result, the line of sight does not change its direction rapidly.

Tescce Physics Unit 13 Lesson 11

Ying-Ying Zheng



Tescoc Physics Unit 13 Lesson 11:

Tesccc Physics Unit 13 Lesson 11: Bestsellers in 2023 The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous captivating novels captivating the hearts of readers worldwide. Lets delve into the realm of popular books, exploring the engaging narratives that have captivated audiences this year. The Must-Read : Colleen Hoover "It Ends with Us" This poignant tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can prevail. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids compelling storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This captivating coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens spins a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting. These bestselling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of engaging stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and thrilling novel that will keep you guessing until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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