❖ Mobility of Ions

It has already been discussed in the previous section that the ions in a homogeneous electrolytic solution move randomly with zero net displacements, and the situation changes when the external electric field is applied. The applied field imparts a directive velocity component to the ion under consideration and makes it move towards the oppositely charged electrode. This ion collides with other ions and drifts towards the oppositely charged electrode with a stop-start and zig-zag fashion. The drift velocity (v_d) of such ion is given by the following relation.

$$v_d = \frac{\tau}{m}\vec{F} \tag{9}$$

Where $\vec{F}$ is the force exerted upon the ion by applied field and m is the mass of the ion. The symbol τ represents the mean lifetime between to collisions during the ionic drift.

It is obvious from the equation (9) that drift velocity is proportional to forces exerted by the electric field and τ/m is the constant of proportionality. The physical significance of the proportionality constant lies in the fact that it becomes equal to the drift velocity when the force is unity, and therefore, represents the "mobility nature" of the ion considered. In other words, we can say that the proportionality constant in equation (9) represents the absolute mobility ($\bar{u}_{abs}$) of the ion i.e.

$$\bar{u}_{abs} = \frac{\tau}{m} = \frac{v_d}{\vec{F}} \tag{10}$$

The units of absolute mobility are cm s^{-1} $dyne^{-1}$. Now, since the functional electric force is equal to the electric force per unit charge; or the electric field (X) multiplied with the charge on the ion ($z_i e_0$) i.e.

$$\vec{F} = z_i e_0 X \tag{11}$$

After using the value of $\vec{F}$ from equation (11) in equation (10), we get

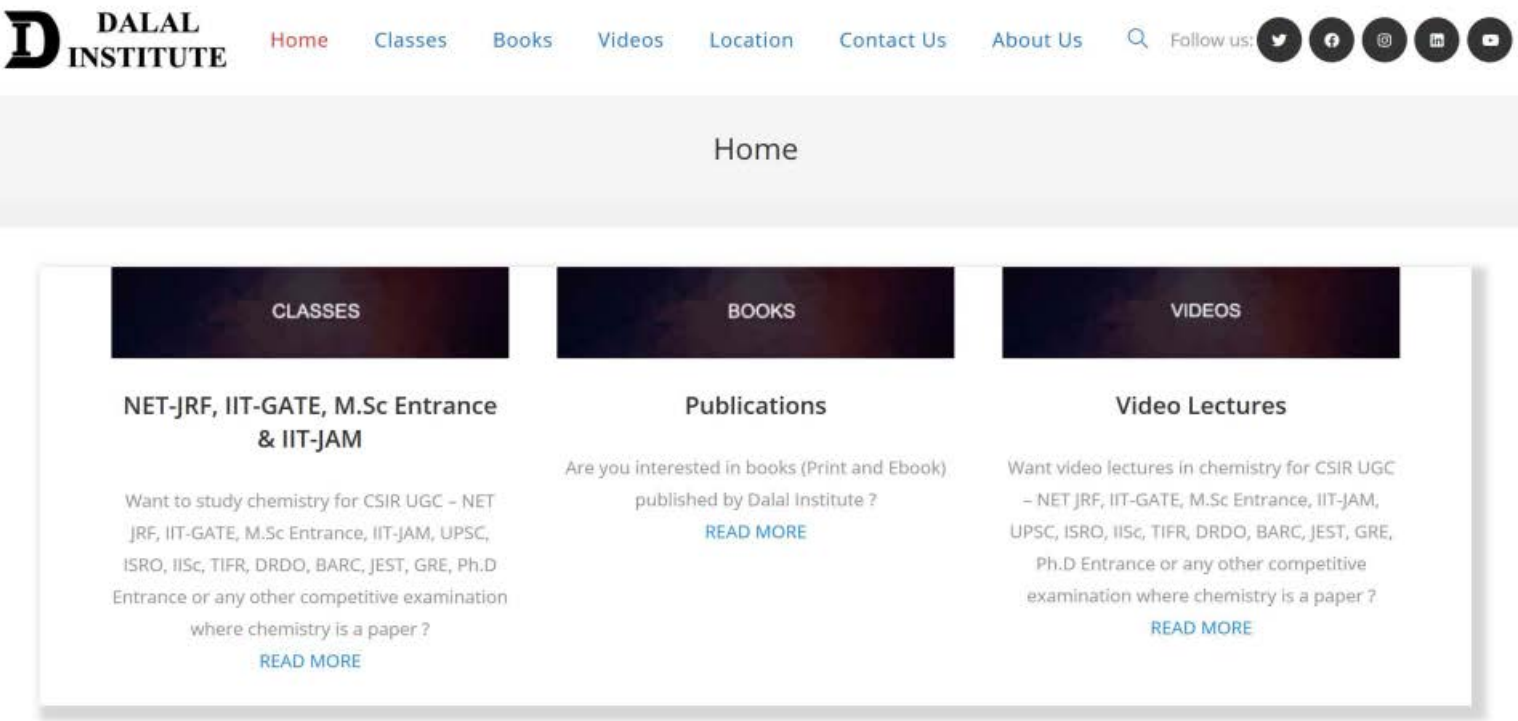
$$\bar{u}_{abs} = \frac{v_d}{z_i e_0 X} \tag{12}$$

$$v_d = \bar{u}_{abs}\, z_i e_0 X \tag{13}$$

When, $X = 1\ volt$, the above equation takes the form

$$(v_d)_{1\text{volt cm}^{-1}} = \bar{u}_{abs}\, z_i e_0 = \bar{u}_{conv} \tag{14}$$

Where $\bar{u}_{conv}$ represents the conventional mobility of the ion with units cm^2 $Volt^{-1}$ s^{-1}. Now although the expressions of both types of mobilities are quite similar, it is worthy to note that the "absolute mobility" has a broader domain of application because any force that governs the drift velocity can be used. On the other hand, the conventional mobility is pretty much limited to the electric force only.



Home: https://www.dalalinstitute.com/
Classes: https://www.dalalinstitute.com/classes/
Books: https://www.dalalinstitute.com/books/
Videos: https://www.dalalinstitute.com/videos/
Location: https://www.dalalinstitute.com/location/
Contact Us: https://www.dalalinstitute.com/contact-us/
About Us: https://www.dalalinstitute.com/about-us/

Postgraduate Level Classes (NET-JRF & IIT-GATE)
Admission
Regular Program Distance Learning
Test Series Result

Undergraduate Level Classes (M.Sc Entrance & IIT-JAM)
Admission
Regular Program Distance Learning
Test Series Result

A Textbook of Physical Chemistry – Volume 1

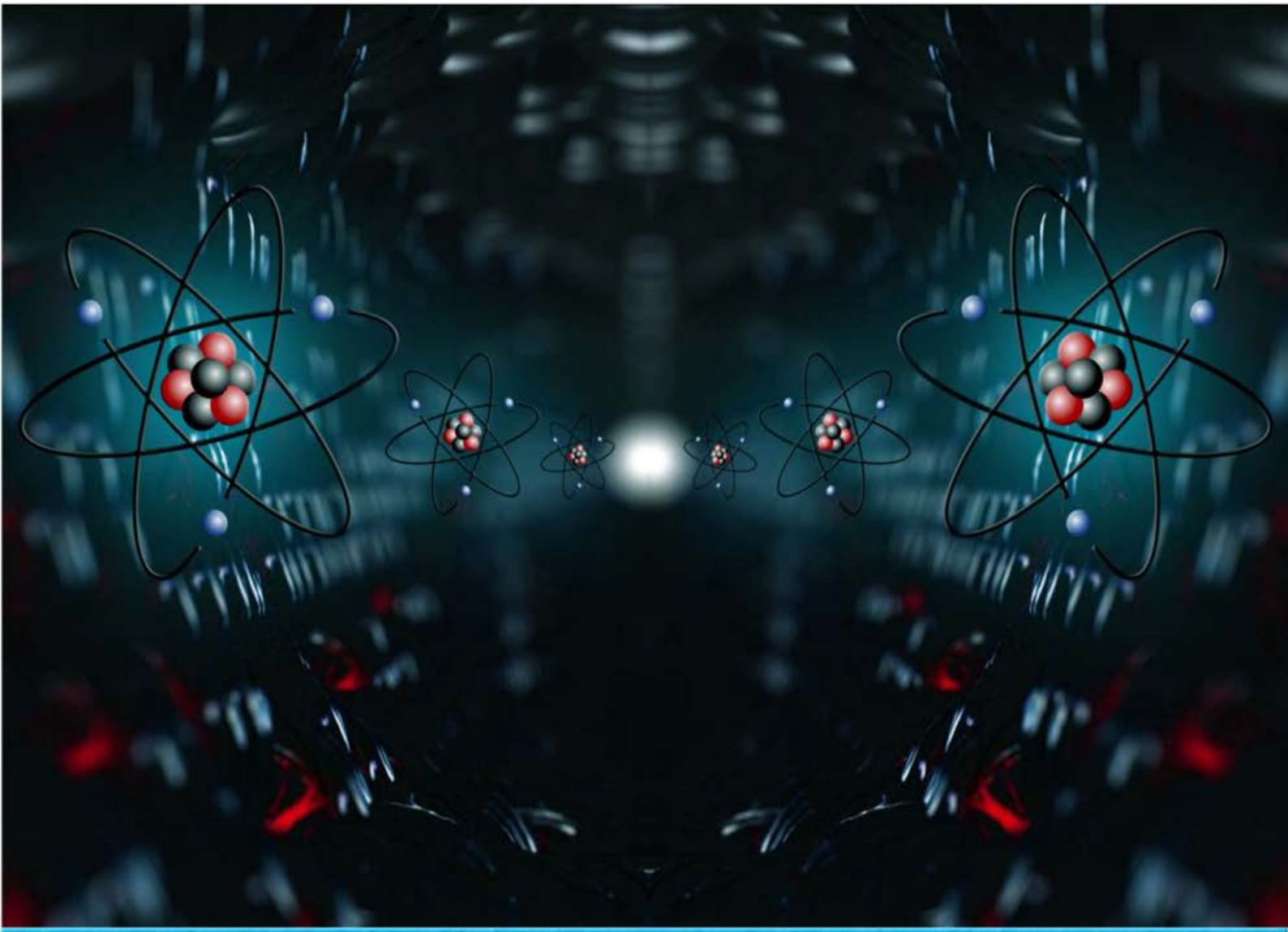
"A Textbook of Physical Chemistry – Volume 1 by Mandeep Dalal" is now available globally; including India, America and most of the European continent. Please ask at your local bookshop or get it online here.
READ MORE

International Edition

A TEXTBOOK OF PHYSICAL CHEMISTRY

Volume I

MANDEEP DALAL



First Edition

DALAL INSTITUTE

Table of Contents

Mandeep Dalal
(M.Sc, Ph.D, CSIR UGC - NET JRF, IIT - GATE)
Founder & Director, Dalal Institute
Contact No: +91-9802825820
Homepage: www.mandeepdalal.com
E-Mail: dr.mandeep.dalal@gmail.com

Mandeep Dalal is an Indian research scholar who is primarily working in the field of Science and Philosophy. He received his Ph.D in Chemistry from Maharshi Dayanand University, Rohtak, in 2018. He is also the Founder and Director of "Dalal Institute", an India-based educational organization which is trying to revolutionize the mode of higher education in Chemistry across the globe. He has published more than 40 research papers in various international scientific journals, including mostly from Elsevier (USA), IOP (UK) and Springer (Netherlands) .

Other Books by the Author

A TEXTBOOK OF INORGANIC CHEMISTRY - VOLUME I, II, III, IV

A TEXTBOOK OF PHYSICAL CHEMISTRY - VOLUME I, II, III, IV

A TEXTBOOK OF ORGANIC CHEMISTRY - VOLUME I, II, III, IV

ISBN: 978-81-938720-1-7

MRP: Rs 800.00

DALAL INSTITUTE
Main Market, Sector-14, Rohtak, Haryana-124001
(+91-9802825820, info@dalalinstitute.com)
www.dalalinstitute.com