
❖ Bibliography

- [1] B. R. Puri, L. R. Sharma, M. S. Pathania, *Principles of Physical Chemistry*, Vishal Publications, Jalandhar, India, 2008.
- [2] P. Atkins, J. Paula, *Physical Chemistry*, Oxford University Press, Oxford, UK, 2010.
- [3] E. Steiner, *The Chemistry Maths Book*, Oxford University Press, Oxford, UK, 2008.
- [4] S. A. Arrhenius, *Über die Dissociationswärme und den Einfluß der Temperatur auf den Dissociationsgrad der Elektrolyte*. Z. Phys. Chem. 4 (1889) 96–116.
- [5] S. A. Arrhenius, *Über die Reaktionsgeschwindigkeit bei der Inversion von Rohrzucker durch Säuren*. Z. Phys. Chem. 4 (1889) 226–248.
- [6] K. J. Laidler, *Chemical Kinetics*, Harper & Row, New York, USA, 1987.
- [7] K. J. Laidler, *The World of Physical Chemistry*, Oxford University Press, Oxford, UK, 1993.
- [8] H. Eyring, *The Activated Complex in Chemical Reactions*, J. Chem. Phys. 3 (1935) 107-115.
- [9] K. L. Kapoor, *A Textbook of Physical Chemistry Volume 5*, Macmillan Publishers, New Delhi, India, 2011.

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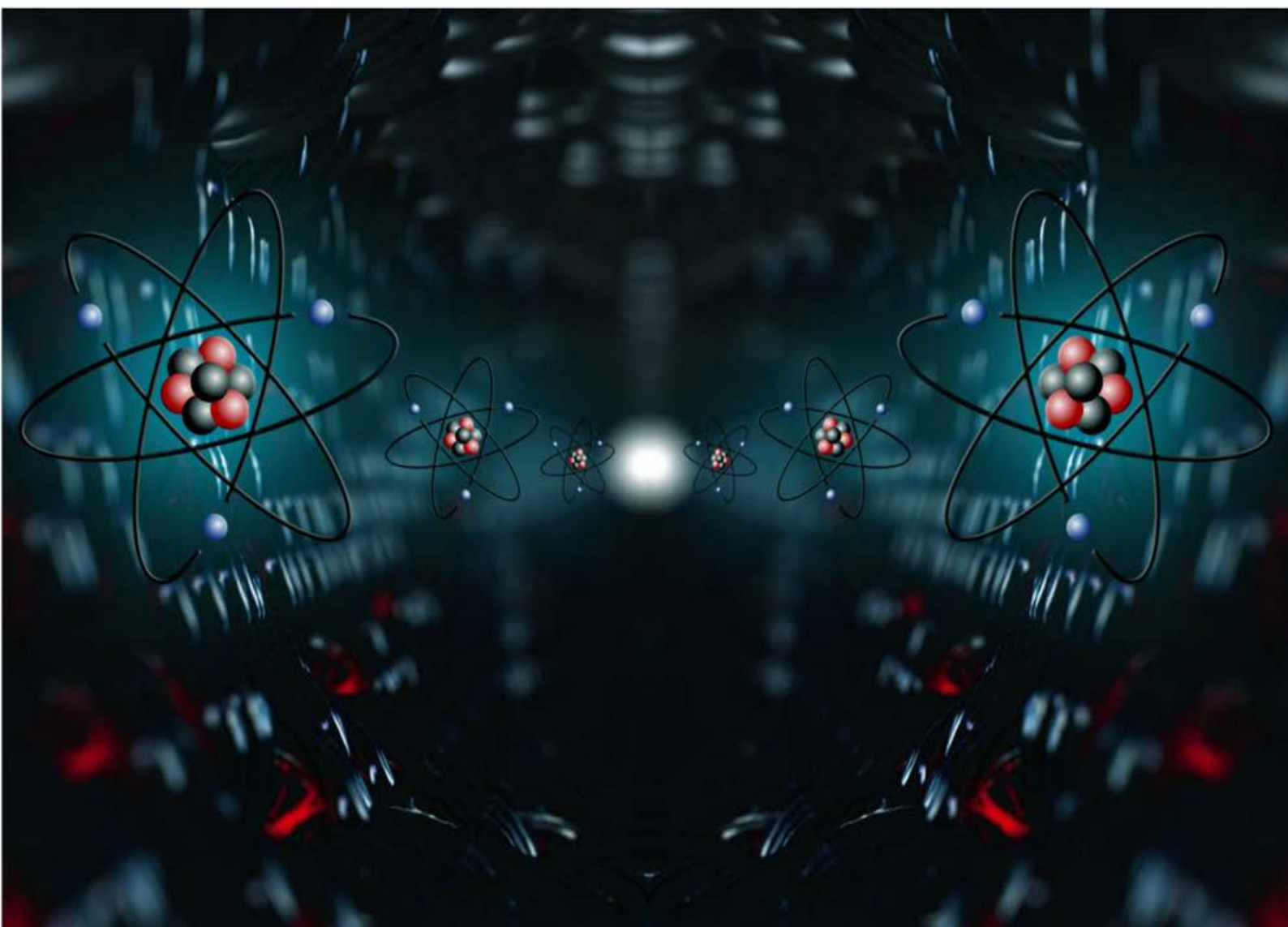
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Volume I

MANDEEP DALAL



First Edition

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ISBN: 978-81-938720-1-7



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