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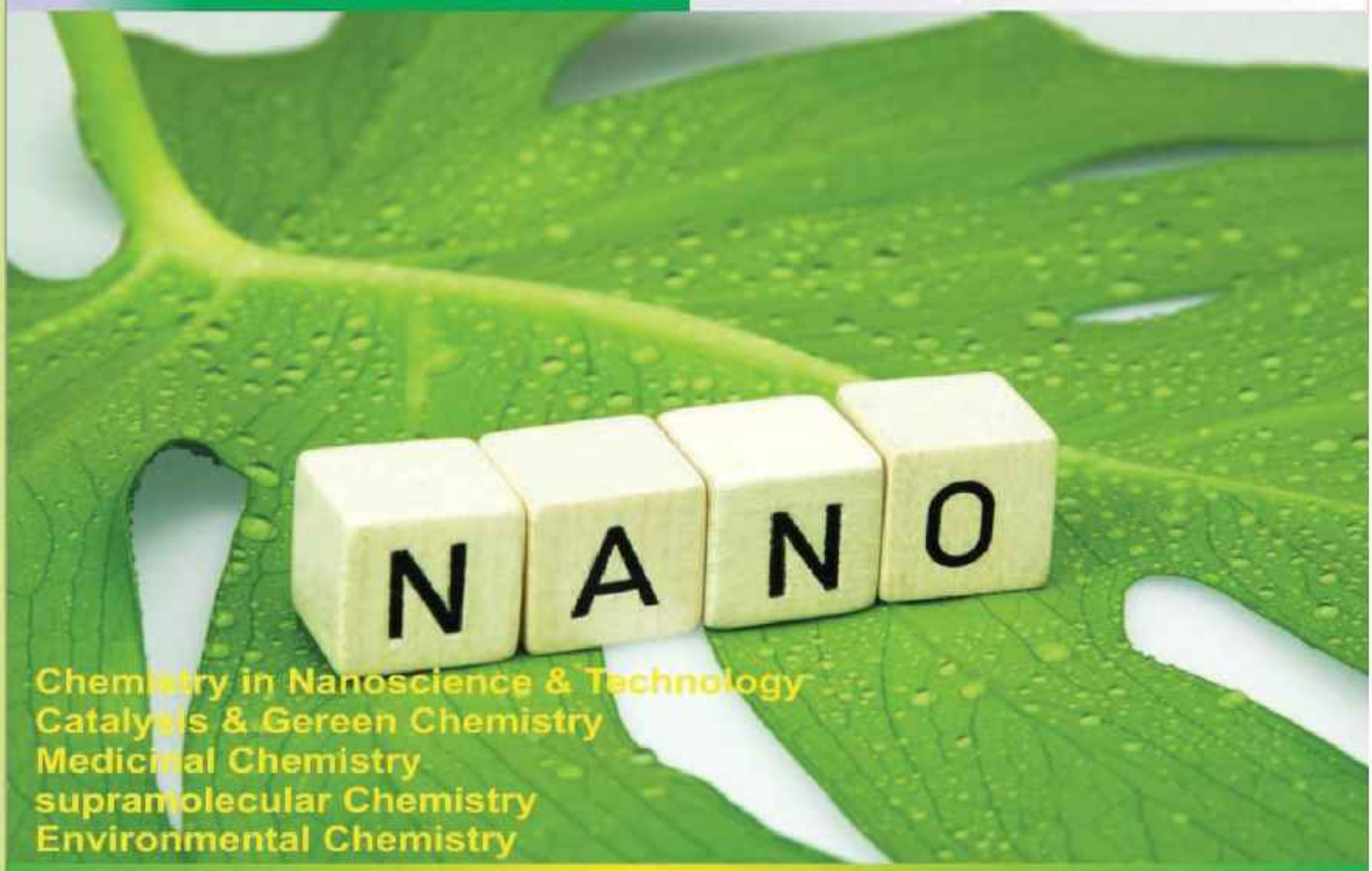
Topics For Chemical Science

Structure and Properties based

For CSIR-UGC-NET/JRF



Chemistry in Nanoscience & Technology
Catalysis & Gereen Chemistry
Medicinal Chemistry
supramolecular Chemistry
Environmental Chemistry

K.M.AMISH

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INTER DISCIPALIANARY TOPICS FOR CHEMICAL SCIENCE

Text Book

STRUCTURACTURAL PROPERTISE & HISTRY BASED

FOR CSIR, NET, JRF.

(Junior Research Fellowship and Eligibility for Lectureship)
Many Outher Competitive Exams

Written by

K. M. AMISH

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INTER DISCIPLINARY TOPIC FOR CHEMICAL SCIENCE
For CSIR, NET, JRF,
(Junior Research Fellowship and Eligibility for Lectureship)

By
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The Greek Alphabet for you

Letter	Name
Α α	alpha, άλφα
Β β	beta, βήτα
Γ γ	gamma, γάμμα
Δ δ	delta, δέλτα
Ε ε	epsilon, έψιλον
Ζ ζ	zeta, ζήτα
Η η	eta, ήτα
Θ θ	theta, θήτα
Ι ι	iota, ιώτα
Κ κ	kappa, κάππα
Λ λ	lambda, λάμδα
Μ μ	mu, μυ

Letter	Name
Ν ν	nu, νυ
Ξ ξ	xi, ξι
Ο ο	omicron, όμικρον
Π π	pi, πι
Ρ ρ	rho, ρώ
Σ σ/ς[note 1]	sigma, σίγμα
Τ τ	tau, ταυ
Υ υ	upsilon, ύψιλον
Φ φ	phi, φι
Χ χ	chi, χι
Ψ ψ	psi, ψι
Ω ω	omega, ωμέγα

Fundamental constant for you

Constant	Symbol	Value
✓ acceleration due to gravity	g	9.8 m s^{-2}
✓ atomic mass unit	amu, m_u or u	1.66 x10^{-27} kg
✓ Avogadro's Number	N	6.022 x 10^{23} mol^{-1}
✓ Bohr radius	a_o	0.529 x 10^{-10} m
✓ Boltzmann constant	k	1.38 x 10^{-23} J K^{-1}
✓ electron charge to mass ratio	$-e/m_e$	-1.7588 x 10^{11} C kg^{-1}
✓ electron classical radius	r_e	2.818 x 10^{-15} m
✓ electron mass energy (J)	m_ec^2	8.187 x 10^{-14} J
✓ electron mass energy (MeV)	m_ec^2	0.511 MeV
✓ electron rest mass	m_e	9.109 x 10^{-31} kg
✓ Faraday constant	F	9.649 x 10^4 C mol^{-1}
✓ fine-structure constant	α	7.297 x 10^{-3}
✓ gas constant	R	8.314 J mol^{-1} K^{-1}
✓ gravitational constant	G	6.67 x 10^{-11} Nm^2kg^{-2}
✓ neutron mass energy (J)	m_nc^2	1.505 x 10^{-10} J
✓ neutron mass energy (MeV)	m_nc^2	939.565 MeV
✓ neutron rest mass	m_n	1.675 x 10^{-27} kg
✓ neutron-electron mass ratio	m_n/m_e	1838.68
✓ neutron-proton mass ratio	m_n/m_p	1.0014
✓ permeability of a vacuum	μ_o	4π x 10^{-7} N A^{-2}
✓ permittivity of a vacuum	ε_o	8.854 x 10^{-12} F m^{-1}
✓ Planck constant	h	6.626 x 10^{-34} J s
✓ proton mass energy (J)	m_pc^2	1.503 x 10^{-10} J
✓ proton mass energy (MeV)	m_pc^2	938.272 MeV
✓ proton rest mass	m_p	1.6726 x 10^{-27} kg
✓ proton-electron mass ratio	m_p/m_e	1836.15
✓ Rydberg constant	r_∞	1.0974 x 10^7 m^{-1}
✓ speed of light in vacuum	C	2.9979 x 10^8 m/s

REFACE

This book has been written with an aim to provide a source for ***CSIR, NET, JRF***, students of Chemical Science opting five disciplinary topics as an open elective and is exactly based on the syllabus.

The objective of this book, ***Interdisciplinary Topics*** is to introduce various topics according to the syllabus outline in easy and effective way. According to the topics of syllabus the whole book is divided into five parts in total. The first part covers to ***"Chemistry in Nanoscience and Technology"*** and part second is ***"Catalyst and Green Chemistry"*** and part third is on ***"Medicinal Chemistry"***and part four is on ***"Supramolecular Chemistry"*** and last part five is on ***"Environmental Chemistry"***

The main features of this book are it is in **structure and properties based** and future application on different topic which is given in this book in **multicolored**. It is strictly based on the syllabus of C.S.I.R., NET, JRF students for Chemical Science. That book is text as well as competitive simply, coherent and completed. All topics in this book are in detailed in simple language, attached with external knowledge side of the pages and having different question marks which is required to understanding of the topic and after completed chapters giving large exercise of related topics.The main focus of writer of the book Illustration and diagram are used in almost in dimensional based effective way to explain difficult images or diagrams of the topics. Offers the readers a multitude of actual and potential systems for planning, designing and implementing various emerging technologies.

The final form of this book is the outcome of an extensive survey of related literature than our knowledge. We have tried to consult the best available sources of information in respect to various topics discussed. We sincerely hope that the book will go a long way to satisfy the long felt need of students for a friendly book on Chemical science.

We gratefully acknowledge the assistance and constructive comments of Institutes or colleges and Research students during the preparation of this book. ***Any suggestions for improvement of the book are welcome and will be gratefully acknowledged.***

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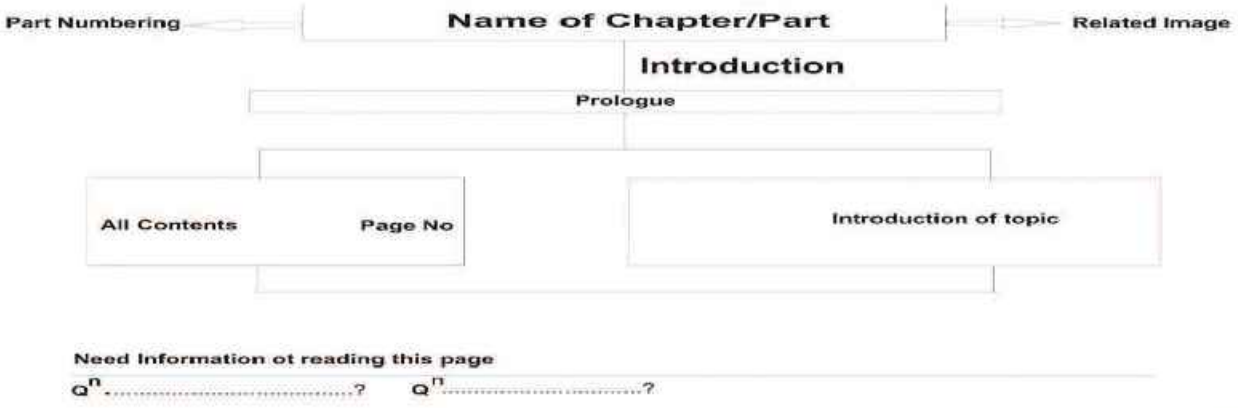
ABOUT THE BOOK:- We are extremely delighted to present this version of Chemical Sciences which will cover the total need of the student preparing for CSIR-UGC (NET) examination for selection of scholars for Junior Research Fellowship of CSIR and UGC and for determining the eligibility for Lectureship in the Colleges and Universities of India. Our major objective is also to develop confidence among the candidates who are taking competitive examination in the field related to Chemical Sciences after Postgraduation by providing them solved objective as well as short descriptive type questions which covers both fundamental and practical aspects of the topic. This book is designed to satisfy the challenging requirements of NET (CSIR-UGC), GATE, SET, ONGC, IARI, BARC and Ph.D. Entrance of Various Indian University. The final form of this book is the outcome of an extensive survey of related literature than our knowledge. We have tried to consult the best available sources of information in respect to various topics discussed. We sincerely hope that the book will go a long way to satisfy the long felt need of students for a friendly book on Chemistry.**There are numerous features in this first edition that are designed to make learning Interdiciplenery tpics for chemical science more effective and more enjoyable, structural properties histry based.** The objective of this book, ***Interdisciplinary Topics*** is to introduce various topics according to the syllabus outline in easy and effective way. According to the topics of syllabus the whole book is divided into five parts in total. The first part covers to ***"Chemistry in Nanoscience and Technology"*** and part second is ***"Catalyst and Green Chemistry"*** and part third is on ***"Medicinal Chemistry"***and part four is on ***"Supramolecular Chemistry"*** and last part five is on ***"Environmental Chemistry"*** **We appreciate that Interdiciplenary is often troublesome, and therefore have taken care to give help with this enormously important aspect of chemical science.**

We gratefully acknowledge the assistance and constructive comments of our colleagues and Research students during the preparation of this book. Any suggestions for improvement of the book are welcome and will be gratefully acknowledged.

Key points of the book:- The first key point is to present the subject matter in a logical order, from the simple to the more complex.Each part builds on the contant of CSIR NET/JRF based syllabus.

- ✓ **The second key pont the philosophy-that we strive to maintain throughout the text is that if a topic or concept is worth treating, the it is worth treating in sufficient deatail and to the extent students have the opportunity to fully understand it without having to consult other sources.**
- ✓ **The third key point is to include features in the book that will expedite the learning process. These learning aids include the following;**
- ✓ **Numerous illustration, now presented in full color, and photographs to helpvisualize what is being presented**
- ✓ **Learning objectives to focus student/ scholers attention on what they should be getting from each chapter**
- ✓ **Why study ……'and Interdiciplenary is so importat, items as well as case studies that provide relevance to topic discussions**
- ✓ **Concept Check, objective questions that test whether a student understand the subject maater on a conceptual level**
- ✓ **Starting of part summary of all used topics are given in the first pages, with pages numbering.**
- ✓ **Histry terms, and description of histry highlighted in the left side of the pages related to topics**
- ✓ **Need information to understand this page, highlighted in the margins in the down of the all pages**
- ✓ **End of part objective questions and problems designed to peogressively develop students,understanding of concepts and facility with skills**
- ✓ **Answers to selected problems, so students can check their Answers sheets**
- ✓ **Aglossary, a global list of symbols, and reference to facilitate understanding of the subject matther**

Chapter/Part maps:- In all parts it is helpful to see the all details about stating part. This suite of "Chapter/ Part map" summarizing these relation are found in the Resource section at the stating of the part.



PART-1 CHEMISTRY IN NANOSCIENCE AND TECHNOLOGY

PROLOGUE

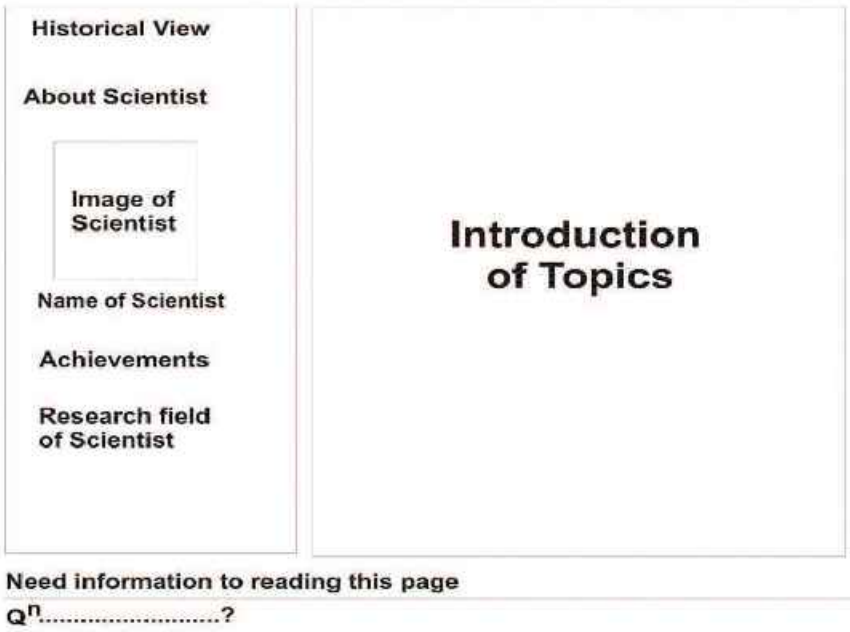
INTRODUCTION

"Nanoscience is an emerging area of science which concerns itself with the study of materials that have very small size dimensions, in the range of Nano scale. The word itself is a combination of Nano from the Greek "Nanos "(or Latin"nanus") meaning "dwarf" and word "Science" meaning knowledge "It is an interdisciplinary field that seeks to bring about mature nanotechnology, focusing on the Nano scale intersection of fields such as Physics, Chemistry, Engineering computer science and more. Nanoscience is interesting in part of lesson because it by definition is new. But a more profound and important reason is that it deals with objects which are only slightly larger than an atom. This means that the properties of Nanoscience the objects can be influenced by direct manifestation of quantum mechanics. It is also possible that Nanoscale objects do behave just like as expected from (semi) classical physics, but the downgrading in size opens up possible new applications. In order to understand the meaning of Nanoelectronics, it is useful to fracture the word into components. The first half of the word Nano refers to the size of something, in particular something very small. One of the historically important observations on the size dependent properties of materials came from the great scientist of 19th century. Many decades later in (1926) the first laboratory test proof on the size dependency of electronics properties of semiconductor had been published. Although nanotechnology is a relatively recent development in scientific research, the development of its central concepts happened over a longer period of time. The emergence of nanotechnology in the 1980s was caused by the convergence of experimental advances such as the invention of the scanning tunneling microscope in 1981 and the discovery of fullerenes in 1985.

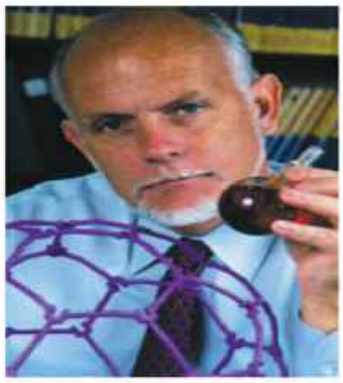
Need Information to reading this page

Q*. Atom & Molecule? Q*. Material? Q*.Device? Q*. Quantum mechanics? Q*.Dimension?

Histrical view:- You will find that many of the graph in the text have historical Activity attached, this is a suggestion about how you can explore the consequence of changing various historical view or of carrying out a more elaborate investigation related to the institution.



Richard Smalley an advocate of nanotechnology and its applications.



Richard Smalley

In 1996, along with Robert Curl, also a professor of chemistry at Rice, and Harold Kroto, a professor at the University of Sussex, he was awarded the Nobel Prize in Chemistry for the discovery of a new form of carbon, buckminsterfullerene, also known as buckyballs.

The different field of Nanoparticles:-Quantum dots, Nanoclusters, Liposome's, Functionalized NPs, Iron oxide NPs, Ag, Fe, Al, Bi, Mo, Nanoparticles, Carbonnanotube, Gold NPs, Polymer NPs, Dendrimers, Micro and Nanobubbles, Up converting NPs, Iron, platinum NPs, Nanodevices, Nanotransisters, Nanocell, Nanocapsules, Nanoforum, Nanosphere, Nanofibers, Nanoribbon, Nanopipette, Nanowires, Nanobds, Nanohorn, Nanospring, Nanoneedles, Nanoarray, Nanobelts, Nanopolymers, Nanobomb, Nanofluids, Nanocompopsits, Nanocontilever, Nanoplates, Nanoceramics, Nanochannels, Nanosensors, Nancages , Nanobeam, Nanobots, Nanoshell, Nanosim etc.

Nanomaterials:-A Nanomaterials is an object that has at least one dimension in the nanometer scale (approximately 1 to 100nm .Inorganic, Organic and Biological materials can be prepared in Nanorange. In other word "Any material manipulated at the scale of nanometer is called Nanomaterials." Nanomaterials can be inorganic, organic and biological. Nanomaterials can be from made carbon, ceramics, chemical precursors, ferrites, minerals, polymers, semiconductors and silica or silicate. Nanotechnology products are consolidated materials or devices that utilize nanostructure.

Natural Nanomaterials:-Biological systems often feature natural, functional Nanomaterials. The structure of foraminifera (mainly chalk) and viruses (protein, capsid), the wax crystals covering a lotus or nasturtium leaf, spider and spidermite silk, the blue hue of tarantulas, the "spatulae" on the bottom of gecko feet, some butterfly wing scales, natural colloids (milk, blood), horny

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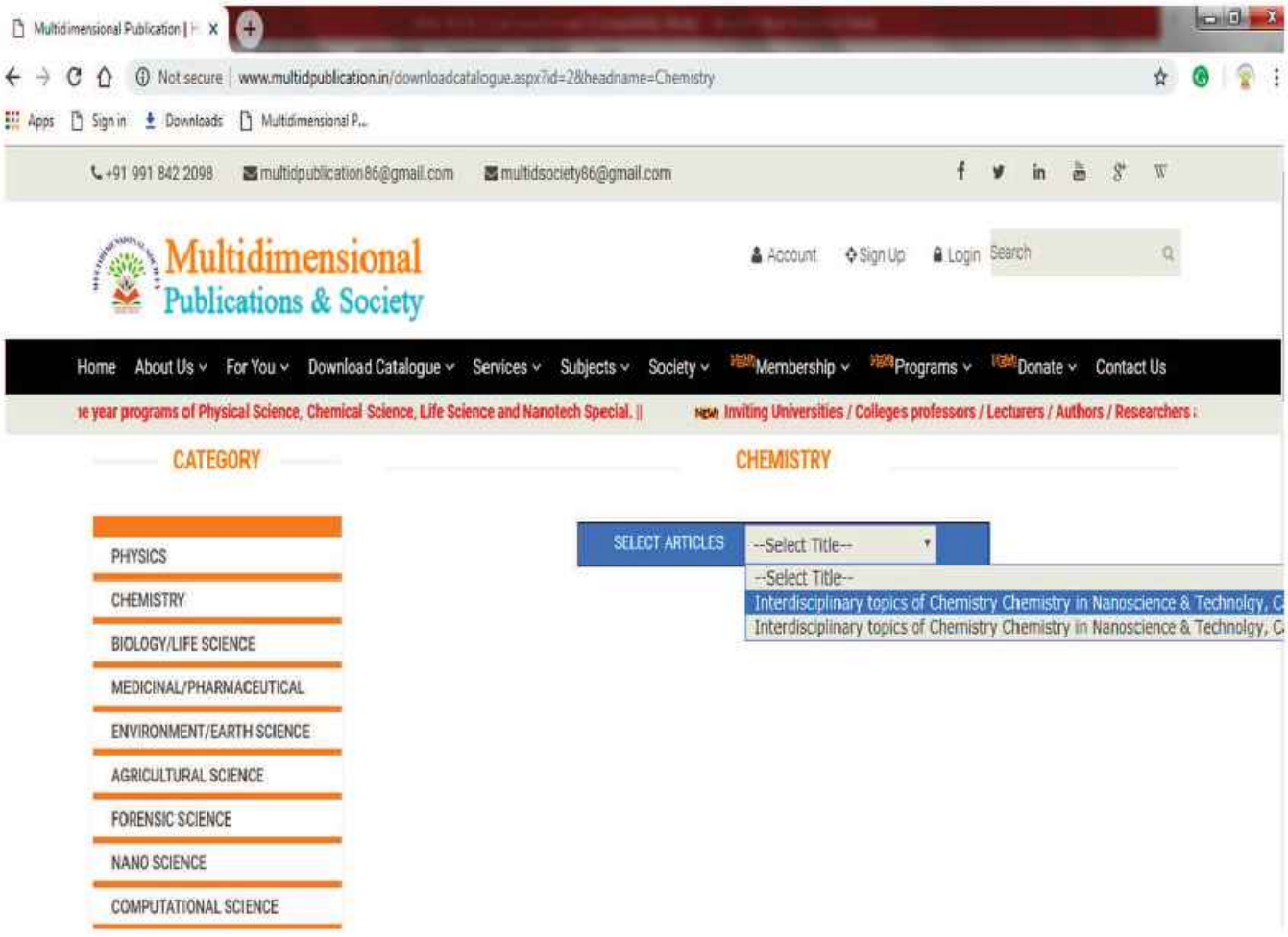

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"Little achievements often require long, tortuous effort and bitter experiences including some sacrifices. And this is only possible when the almighty God keep his Handful of blessings on the head of anybody, I would like to submit everything beneath the feet of God."

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