

AL-FARABI KAZAKH NATIONAL UNIVERSITY

A. O. Adilbekova  
K. B. Musabekov

COLLOID CHEMISTRY  
OF NANODISPERSE SYSTEMS  
BRIEF LECTURE NOTES

*Educational manual*

Almaty  
«Qazaq University»  
2017

UDC 544 (075)  
LBC 24.6 я 73  
А 20

*Recommended for publication by the decision  
of the Faculty of Chemistry and Chemical Technology  
Academic Council, and Editorial and Publishing Council  
of al-Farabi Kazakh National University  
(Protocol №2 dated 03.11.2017)*

#### Reviewers

Candidate of Chemical sciences, Associate professor **Zh.B. Ospanova**

**Adilbekova A.O.**

A 20 Colloid chemistry of nanodisperse systems. Brief lecture notes: educational manual / A.O. Adilbekova, K.B. Musabekov. – Almaty: Qazaq university, 2017. – 124 p.  
**ISBN 978-601-04-3042-6**

The manual is written on the base of lecture courses of the disciplines «Colloid Chemistry of nanodisperse systems», «Colloidal chemical bases of nanotechnology» and «Bases of nanotechnology». The educational manual represents a set of lecture notes devoted to colloidal chemical fundamentals of nanotechnology and nanochemistry. It is shown the connection between Colloid Science and Nanoscience, historical background of Nanotechnology. The lecture material contains the basic concepts, definitions, classifications regarding to nanoparticles, nanodisperse systems and their properties.

The textbook will be in interest of bachelor students of specialties «Chemistry», «Chemical Technology of Organic Substances», «Chemical Technology of Inorganic Substances», master students, PhD students of Faculty of Chemistry and Chemical Technology.

Published in authorial release.

ISBN 978-601-04-3042-6

**UDC 544 (075)**  
**LBC 24.6 я 73**

© Adilbekova A.O., Musabekov K.B., 2017  
© Al-Farabi KazNU, 2017

*Many of the cells are very tiny, but they are very active; they manufacture various substances; they walk around; they wiggle; and they do all kinds of marvelous things – all on a very small scale. Also, they store information. Consider the possibility that we too can make a thing very small which does what we want – that we can manufacture an object that maneuvers at that level.*

(From the lecture «There's Plenty of Room at the Bottom», delivered by Richard P. Feynman at the annual meeting of the American Physical Society at the California Institute of Technology; Pasadena, December 29, 1959).

## INTRODUCTION

Colloid Science describes the features of substances in colloidal state and studies the coarse and fine disperse materials. According to their sizes the colloid systems occupy the intermediate area between molecules (atoms, ions) and macroscopic objects (macrophases). The size of dispersed particles approximately equals to 1 nm – 100 µm. Among fine disperse systems there are particles with nanosizes (1-100 nm) which possess by unique physicochemical properties due to their small sizes. The uniqueness of nanosized systems is explained by the influence of so called «size effect». Nowadays, the new branch of chemistry concerning the special properties associated with assemblies of atoms or molecules of nanoscale (1-100 nm) is referred as Nanochemistry.

Therefore, Colloid Science and Nanochemistry study the fine disperse systems (ultradisperse systems) or nanosystems. The size of the nanoparticles should be in the range of approximately 1 nm to 100 nm at least one of three dimensions. So, one of the parameters of nanosystems is that should be measured in nanometers.

Generally, Colloid Chemistry as an area of science has emerged due to fine disperse systems. In second half of the 19th century Italian scientist F. Selmi noticed abnormal properties of some solutions of highly dispersed systems according to the modern classification, sols, i.e. highly dispersed solid particles distributed in