

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY

**METHODOLOGICAL INSTRUCTIONS
FOR THE PREPARATION AND DESIGN OF
COURSE AND QUALIFICATION WORKS
IN CHEMICAL DISCIPLINES**

KHARKIV 2024

BBK

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Methodical instructions for the preparation and design of course and qualification works in chemical disciplines. Kharkiv: V.N. Karazin Kharkiv National University, 2002-2024. - 24 p. - Ukr.

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Methodical guidelines are compiled in accordance with the educational programs of fundamental, specialized and special chemical disciplines.

Methodical instructions are intended for students of the School of Chemistry of the V.N. Karazin Kharkiv National University.

Recommended for publication by the Academic Council of the School of Chemistry, protocol No. 6 of May 17, 2019.

Updated " 06 " February 2015
Updated " 30 " May 2017
Updated " 12 " May 2019
Updated " 17 " November 2024

Reviewer: PhD, Associate Professor O.V. Lebed (Department of Physical Chemistry, V.N. Karazin Kharkiv National University).

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1 GENERAL PROVISIONS

Coursework and qualification work of bachelor's and master's degrees in chemical disciplines is an important stage in the training of highly qualified chemists. They should have the nature of scientific research.

The purpose of research work is to create primary information about the work carried out and the results obtained. It is a scientific document, which should contain the author's proposed solution to a scientific, technological or technical problem and an impression of his own vision of the considered range of issues. When performing the work, the student must creatively apply theoretical knowledge and skills of experimental methods of research, analysis and synthesis of substances. The performance of the work (experimental or theoretical) is preceded by an abstract work with scientific literature, which necessarily contains elements of an analytical review and theoretical research. Therefore, mastering the information search system is one of the important tasks when preparing work.

Qualification work is performed by students at the departments of chemical profile of V.N. Karazin Kharkiv National University, in other scientific research units of universities or in research institutes (for example, in the Institute of Chemistry of KhNU, NTC "Institute of Single Crystals of NASU", etc.). Regardless of the place of performance, the topic of the qualification work is approved by the department where the work is performed and the Academic Council of the School of Chemistry. The head of the qualification work in advance (not later than 3 months before the defense) issues an individual task to the student, in which he indicates the initial data for the work, formulates the goal, tasks, objects and research methods, and also outlines a calendar plan for its implementation. The work manager systematically conducts individual consultations with the executor and monitors the implementation of the calendar plan.

Course work is performed by the student within the framework of the corresponding course according to the curriculum. The topic of the course work is formulated by the lecturer or teacher who conducts laboratory (practical) classes on the corresponding course at the beginning of the corresponding semester.

The qualification work is completed and submitted to the preliminary defense within the term established by the department. The defense of the qualification work takes place in the Attestation Commission (AC) on the condition that it (the work) is positively evaluated by the department based on the results of the preliminary defense.

The public defense of the coursework takes place in the study group of students, at a department meeting or at scientific seminars of students and graduate students of the School of Chemistry of KhNU.

The structure and rules of registration of qualification (coursework) must comply with the State Standard of Ukraine **DSTU 3008:2015 "SCIENTIFIC AND TECHNICAL REPORTS. Structure and rules of putting into official form"**.

2 MANUSCRIPT STRUCTURE

The qualification (course) paper must include the following mandatory elements.

For experimental work:

1. Title page.
2. Abstract in three languages (Ukrainian, Russian and English or another European language).
3. Contents.
4. List of conventions, symbols, units, abbreviations and terms.
5. Introduction.
6. Literary (analytical) review.
7. Experimental part.
8. Safety measures (if necessary and/or important)
9. Conclusions (summaries of the work).
10. List of used sources (list of references).
11. Appendix (if necessary).

For theoretical (calculation) work:

1. Title page.
2. Abstract in three languages (Ukrainian, Russian and English or another European language).
3. Contents.
4. List of conventions, symbols, units, abbreviations and terms.
5. Introduction.
6. Literary (analytical) review.
7. Theoretical (calculation) part.
8. Conclusions (summaries of the work).
9. List of used sources (list of references).
10. Appendix (if necessary).

3 REQUIREMENTS FOR THE CONTENT OF THE WORK

3.1 Title page

The title page is the first page of the work and contains all the necessary data that characterize it. An example of the design of the title page is given in Appendix A.

3.2 Abstract

The abstract is intended for familiarization with the qualification (course) work. In a concise, informative form, it should reflect the essence of the performed research and contain specific information about the obtained results and conclusions regarding possible areas of their application.

The abstract should contain (in sequence):

- information on the scope of the qualification (course) work, on the number of sections, illustrations, tables, appendices, sources according to the list of references (including appendices data);
- abstract text;
- list of keywords.

The abstract may contain information about the terms of distribution of the work.

The text of the abstract should reflect the information presented in the work and, as a rule, in the following sequence:

- object of research or development;
- the purpose of the work;
- research methods and equipment;
- results and their novelty;
- basic structural, technological and operational characteristics and indicators;
- degree of implementation;
- relationship with other works;
- recommendations on the use of work results;
- field of application;
- significance of work and conclusions;
- predictive assumptions about the development of the object of research or development.

The abstract should contain no more than 500 words and be placed on one page of A4 sheet (210x297 mm).

Keywords that are decisive for revealing the essence of the work are placed after the text of the abstract.

The list contains from 5 to 15 key words (phrases) printed in capital letters in a line separated by commas.

The abstract must be written in three languages (Ukrainian, Russian, English or another European language) and fully adequate in content.

The abstract should be placed directly behind the title page.

3.3 Contents

The content is placed directly after the abstract, starting from a new page.

The table of contents includes the names of all sections, subsections, paragraphs and subsections (if they have headings) with an indication of the pages on which they are located. A sample table of contents is provided in Appendix B.

3.4 List of conventions, symbols, units, abbreviations and terms

If notations, symbols, abbreviations and terms are used when writing the work, and their number is more than 20, then a list of them is made in the form of a table, on the left side of which the symbols are indicated, and on the right - they are expanded. Regardless of this, for the first appearance of these elements in the text of the work, their transcription is provided.

3.5 Introduction

In the introduction to the work, an assessment of the current state of the solved problem is briefly presented. It is necessary to show the novelty and relevance of this work, its main purpose, the scientific and technical significance of the research, the initial data for conducting the work, and global trends in solving the tasks. If there is an experimental (calculation) part in the work, the introduction justifies the advisability of setting up and performing relevant research.

An introduction of 2-3 pages starts on a separate page.

3.6 Literary (analytical) review

This section of the qualification (coursework) sufficiently and systematically reflects the state of research on the given topic. The review contains a critical and objective discussion of data from the literature and other sources on the topic of the work. In it, it is necessary to conduct an analysis of new ideas and problems regarding the subject (object) of research, to show ways of solving the task. The analytical review should include only those materials that are relevant to the given issue.

Writing the review is preceded by work with the literature, as a result of which the student has a clear idea of the subject of research, the physicochemical properties of substances, their structure and reactivity, methods of synthesis and identification of substances, as well as their practical significance. Before writing an analytical review, it is necessary to compose the content of the review part, dividing the material into sections. Chapters can be divided into subsections or paragraphs. Items, if necessary, are divided into sub-items.

If the work is devoted to the measurement of some characteristic of substances, then a description of the measurement method (research) is mandatory. In the latter case, it is helpful to outline the physico-chemical basis of the used method and justify its choice.

In the review, it is necessary to pay attention to the possibility of using the results of the synthesis or applying research for the needs of practice.

The review is compiled by the student independently based on the study of literary sources. Rewriting individual parts of the text of articles, monographs in one or another sequence is not allowed. References in the text to literary sources should be indicated by a serial number in the list of references, separated by two square brackets. For example, [2, p.78] or [54].

The presentation of the material in the review, if necessary, should be accompanied by illustrations, drawings and tables. It is advisable to provide illustrative materials in the review, reflecting the final results of the study. When researching theoretical questions, in some cases

it is helpful to give explanations of mathematical and chemical formulas and equations in the overview.

3.7 Experimental (theoretical, calculation) part

The experimental (theoretical, calculation) part of the qualification work is the main author's work of the student (the original part of the work) and it should include: justification of the feasibility of conducting the research, description of the research methodology, generalization and analysis of the research results. The relevance and usefulness of the research is justified by the significance of the expected results for science and technology.

For qualifying work, the volume of the original part must be at least 40% of the total volume of work.

In this part, the physical and chemical foundations of research (synthesis) methods are defined. In case of making changes to them, substantiated evidence must be provided.

They specify the qualification of substances, methods of their purification (if necessary), give methods of synthesis (experiment), description of measuring devices and mathematical processing of the results of experimental work.

In the experimental part, all intermediate and final results, including negative ones, indicate the accuracy and reliability of the obtained data, the yield of the substance, and the results of the analysis. The obtained results are compared with known or theoretically calculated ones.

In the case of synthesis of substances, their description is carried out: color, dispersion, shape of crystals, solubility in water, relation to acids and alkalis, oxidation-reduction properties, etc. are indicated.

Conclusions about some properties of synthesized substances must be confirmed with the help of chemical reactions. At the end of the section, a brief description of the obtained results is given.

Obtained theoretical or experimental results are illustrated with figures, formulas or data tables. If relevant data are available in the literature, they are compared (theoretical (calculated) results with experimental data and vice versa).

In the case of the synthesis of new compounds, the development of experimental samples of devices, equipment, individual components, their characteristics and parameters are described, and the possibilities of their use in practice are indicated. When receiving new results, it is necessary to describe them.

If the work is calculated, all mathematical calculations are explained in detail, the solving algorithm (calculation) is described, the deviation of the performed calculations is estimated, and the source of computer programs are given.

The recommended volume of the experimental (theoretical, calculation) part is at least 8-10 pages.

3.8 Safety and labor protection

In this section of the work, it is indicated:

- basic information about the harmfulness of chemical substances used in the work for humans and the environment;
- safety and labor protection when working with the above-mentioned substances;
- safety and labor protection during all experimental operations performed according to the work topic.

The volume of the chapter is 1-2 pages.

This section may be absent from the work if all experiments were performed in accordance with the current regulations at the School of Chemistry of the V.N. Karazin Kharkiv National University instructions on labor protection and life safety.

3.9 Conclusions (summaries) of the work

The results of the work should contain short conclusions based on the results of the work. When they are written, the nature and scope of the performed research are first evaluated. It is necessary to indicate the possible fields of use of the work results. Specific conclusions based on the work performed must be recorded in the form of separate items. The sequence of presentation of conclusions should include the priority of the most important of them and the conditioning of each subsequent one by the previous one.

If the work is devoted to generalizations based on a review of literary sources, then the conclusions should be placed after it. In this case, the conclusions should be clear, as short as possible. Their volume should not exceed 1.5 pages.

The results of the work should give a reason not only about what was done in the paper, but also about the results (positive or negative) that were obtained.

In the case when the work is an integral part of the department's research and is devoted to the development of new specific issues, it should be indicated how the work ended:

- obtaining scientific results about new objects, processes, phenomena, patterns;
- development of scientific foundations of new research methods and principles;
- obtaining qualitative and quantitative characteristics of objects and phenomena;
- development instructions, recommendations, methods (calculations, measurements, tests, etc.);
- production of laboratory and experimental samples of products.

If a negative result was obtained at the end of the work, this is also indicated in the conclusions. The appropriateness of continuing the work, its ways and purpose are indicated.

After the conclusions, the author signs the paper.

3.10 Appendix

The appendix may include:

- illustrations or tables that contain the nature of primary experimental data;
- materials that due to the large volume, form of submission or presentation cannot be attributed to the main part (photographs, microfilms, intermediate mathematical proofs, formulas, calculations, test reports, conclusions of metrological examination, instructions, methods, description of computer programs, developed in the course of work, etc.);
- an additional list of sources to which there were no references in the work, but which may be of interest;
- a description of the new equipment and devices that were used during the experiment, measurements and tests.

4 STYLE GUIDES FOR A QUALIFICATION (COURSE) WORK

The qualification (course) paper is printed on one side of white A4 paper (210×297 mm). If necessary, it is allowed to use sheets of A3 format (297×420 mm).

Course work is performed by handwritten, typewritten or machine (with the help of computer technology) methods. It is recommended to prepare the qualification work by typewriting or machine methods.

In the machine method, the work is performed in accordance with these instructions and the standard for document processing using printer and graphic computer devices for outputting information.

In the typewritten method of execution, the work is printed in one and a half intervals. When using the text editor Microsoft Word, it is recommended to use the font Times New Roman 12 or 13 pt. Individual parts of the work can be performed in different ways.

The text of the work should be printed following such margins: top and bottom - at least 20 mm, right - at least 10 mm, left - at least 30 mm.

Recommended volumes of work:

- coursework - within 20-35 pages,
- bachelor's qualification thesis - at least 20 pages, typewritten or typed,
- master's qualification thesis - at least 35 pages, typewritten or typed.

As a rule, the official language should be used for writing the qualification paper. It is allowed to use other languages for writing the work upon agreement with the graduation department and the Attestation Commission.

The qualification (course) work must be written absolutely competently, in a clear and understandable language. The text must be divided into paragraphs consisting of several logically connected sentences. The past tense is mostly used, and the author must use the first person plural. For example, "We think that...".

When authors' surnames are mentioned in the text, their initials are placed before the surname.

Only customary terms recommended by existing standards should be used. Abbreviations should also be clear and understandable.

It is advisable to use only one name for a given substance or phenomenon.

Give the names of chemical compounds in accordance with the accepted nomenclature. They are capitalized in headings and at the beginning of sentences. It is not allowed to use professional scientific jargon when writing a qualification paper.

Names and designations of measurement units are given in the SI system of units.

In the text of the paper, it is allowed to cite chemical compounds in the form of characteristic standard abbreviations, which are accepted in the scientific journal. Abbreviations of the names of well-known methods, physical and chemical properties, some typical solvents, etc. are also allowed.

When describing methods of synthesis, measurements, calculations, etc. you should use uniform methods of writing defining words throughout the work. For example, "the sediment was filtered and then dried."

Mathematical values should be denoted by the usual symbols and names of physical and other values.

When styling the work, it is necessary to observe uniform writing of the text, contrast and clear image of the letters throughout the entire work. Lines, letters, numbers and other signs must be clear and not fuzzy.

Individual words, formulas, signs that are included in the printed text must be black; the size of the written text should be as close as possible to the size of the main image.

Errors, typos and graphic inaccuracies may be corrected with a corrector or painted over with white paint applied in the same place or between the lines of the corrected image.

Corrections must be made in black.

Structural elements "ABSTRACT", "CONTENTS", "LIST OF TERMS, SYMBOLS, UNITS, ABBREVIATIONS AND TERMS", "INTRODUCTION", "CONCLUSIONS", "REFERENCE LIST", "APPENDICES", etc. are not numbered, and their names follow the headings of structural elements.

Sections and subsections must have headings. Items and sub-items can have headings.

Headings of structural elements of the work and headings of sections should be placed in the middle of the line and printed in capital letters without a period at the end, without underlining.

Headings of subsections, clauses and subsections of the work should begin with a paragraph indentation and be printed in small letters, except for the first capital letter, without a period at the end, without underlining.

Paragraph indentation must be the same throughout the text and equal to five characters.

If the title consists of two or more sentences, separate them with a period. Moving words in the section heading is not allowed.

The distance between the title and the text should be: in the case of the typewritten method - not less than three intervals, in the case of the machine method - not less than two lines.

The distance between the lines of the heading, as well as between two headings, is taken as the same as in the text.

It is not allowed to place the name of the section, subdivision, as well as item, sub-item at the bottom of the page, if only one line of text is placed after it.

The pages of the qualification (coursework) should be numbered with Arabic numerals, adhering to the numbering throughout the entire text of the work. The page number is placed in the upper right corner of the page without a period at the end.

The title page is included in the total page numbering. The page number is not placed on the title page.

Chapters, subdivisions, items and sub-items of the work should be numbered with Arabic numerals.

The sections of the work must have sequential numbering within the framework of the presentation of the essence of the work and be marked with Arabic numerals without a period. For example, 1, 2, 3, etc.

Subsections must be sequentially numbered within each section. The subdivision number consists of the section number and the serial number of the subdivision, separated by a dot. For example, 1.2, 1.3, 1.4, etc.

Paragraphs should be sequentially numbered within each section or subsection. The item number consists of the section number and the serial number of the item, or of the section number, the serial number of the subdivision and the serial number of the item, separated by a period. Do not put a period after the item number. For example, 1.1, 1.2, or 1.1.1, 1.1.2, etc.

If the text is divided only into paragraphs, they should be numbered, with the exception of appendices, with sequential numbers.

The number of the subsection consists of the number of the section, the serial number of the subdivision, the serial number of the item, and the serial number of the sub-paragraph,

separated by a period. For example, 1.1.1.1, 1.1.1.2, etc. If the section, not having subsections, is divided into clauses and further - into subsections, the subsection number consists of the section number, the serial number of the clause and the serial number of the subsection, separated by a dot. For example, 1.1.3, 1.2.1, etc. There is no dot after the sub-item number.

If a section or subsection consists of one clause, or a subsection consists of one subsection, it is not numbered.

Illustrations (drawings, figures, schemes, diagrams, photographs) should be placed in the work immediately after the text, where they are first mentioned, or on the next page. All illustrations must be referenced. If the illustrations were not created by the author of the qualification (course) work, it is necessary to comply with the requirements of current copyright legislation when submitting them in the work.

Photographs smaller than A4 size should be pasted on a sheet of white A4 paper.

The illustration must have a title that is placed below it. If necessary, explanatory data (caption text) is placed under the illustration.

The illustration is marked with the word "Figure ____", which, together with its name, is placed after explanatory data, for example, "Figure 3.1 Dependence of molar electrical conductivity on concentration". Illustrations should be numbered with Arabic numerals in sequential numbering within the chapter, except for illustrations that are given in the appendices. The illustration number consists of the section number and the serial number of the illustration, separated by a dot. Example. Figure 3.1 is the first figure of the third section.

If the illustration does not fit on one page, it can be transferred to other pages, placing its name on the first page, explanatory data - on each page, and under it is marked: "Figure _____, sheet _____".

Illustrations, if necessary, can be listed in the table of contents with their numbers, titles and page numbers on which they are placed.

A sample design of the drawing is given in Appendix B.

Digital materials, usually are drawn up in the form of a table, placing in front of it the name, which is printed in small letters (except for the first capital letter):

Table _____	_____
number	table name

The name of the table should be relevant and reflect its content. Horizontal and vertical lines delimiting the rows of the table, as well as lines on the left, right and bottom, limiting the table may not be drawn, if their absence does not make it difficult to use it.

A table should be placed immediately after the text in which it is mentioned for the first time or on the next page.

There should be references to all tables in the text of the work.

Tables should be numbered with Arabic numerals with sequential numbering within the section, except for tables that are given in the appendices.

The table number consists of the section number and the serial number of the table, separated by a dot. For example, table 3.1 is the first table of the third section. If there is one table in the work, it should also be numbered.

If the rows or columns of the table go beyond the format of the page, it is divided into parts, placing one part under the other or next to it, or transferring part of the table to the next page, repeating its header and sidebar in each part of the table. When dividing the table into two parts, it is allowed to replace its head or body with the numbers of graphs or rows, numbering them with numbers in the first part of the table. The word "Table ____" is indicated

once on the left above the first part, above the other parts it is written: "Continuation of table ____" with its number indicated.

Headings of graphs in the table begin with a capital letter, and subheadings with a lower case, if they form one sentence with the heading. Subheadings that have an independent meaning are capitalized. Do not put a period at the end of the headings and subheadings of the graph tables. Headings and subheadings of graphs are indicated in the singular. The headings and subheadings indicate the dimension. If necessary, tables can be listed in the table of contents with their numbers, titles and page numbers on which they are placed.

If there is no data in the table cell, put a dash sign in it.

A sample of the table design is given in Appendix D.

Lists, if necessary, can be given in the middle of paragraphs or subsections. A colon is placed before the list. Each item in the list should be preceded by a lowercase letter of the alphabet with a parenthesis, or without numbering - a hyphen (first level of detail).

Arabic numbers with brackets should be used for further detailing of the list (second level of detail).

For example:

- a) ionic bond;
- b) hydrogen bond:
 - 1) intermolecular bond;
 - 2) intramolecular bond;
- c) covalent bond.

Lists of the first nesting level are printed in small letters with paragraph indentation, second level - with indentation relative to the location of the lists of the first level.

Formulas and equations are placed immediately after the text in which they are mentioned, in the middle of the page. Above and below the previous formula or equation, at least one empty line should be left.

Formulas and equations (except those given in the appendices) should be numbered sequentially within the section of the work. The formula or equation number consists of the section number and the serial number of the formula or equation, separated by a period. For example, formula 1.2 is the second formula of the first section. The number of the formula or equation is indicated at the level of the formula or equation in round brackets in the rightmost position on the line.

Explanations of the values of the symbols and numerical coefficients included in the formula or equation should be given below the formula in the sequence in which they are given in the formula or equation.

The explanation of the meaning of each symbol and numerical coefficient should be given on a new line. The first line of the explanation begins the paragraph with the word "where" without a colon.

Example:

"The movement of an electron in an atom is described by a wave function, which is a solution to the Schrödinger equation

$$-\frac{h^2}{8\pi^2m}\nabla^2\psi + U\psi = E\psi, \quad (4.1)$$

where

h - Planck's constant,
 ψ - the wave function,
m - mass of the electron,
U - potential energy of the interaction of the electron with the nucleus,
E - full energy."

It is allowed to transfer the formula or equation to the next line only on the signs of the performed operations, repeating the operation sign at the beginning of the next line. When transferring to sign operations of multiplication, the sign "×" is used.

Formulas (or equations) that follow one another and are not separated by text are separated by commas. Example:

$\nu_i A_i = \nu_j B_j,$	(4.2)
--------------------------	-------

$\Delta H_{298}^0 = \sum_j \nu_j \Delta_f H_{298}^0(B_j) - \sum_i \nu_i \Delta_f H_{298}^0(A_i)$	(4.3)
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Formulas or equations should be given in the text only once. In the following text, they must be referenced. For example, "According to equation (1.2)".

Appendices should be numbered as a continuation of the work on its following pages, placing them in the order of references to them in the text. Each such application must start on a new page. The appendix must have a title printed at the top, centered and in small letters with the first capital letter. In the middle of the line above the title in small letters (except for the first capital letter), the word "Appendix ____" and a capital letter indicating the appendix should be printed. Appendices should be marked consecutively with capital letters. For example, appendix A, appendix B, etc. Single appendix is marked as appendix A.

Appendices must have the same page numbering as the rest of the work.

If necessary, the text of the appendices can be divided into sections, subsections, clauses and subsections, which should be numbered within each annex. In this case, each number is preceded by an appendix (letter) and a dot. For example, A.2 - the second section of appendix A, D.3.1 - subsection 3.1 of appendix D, D.4.1.2 - clause 4.1.2. of appendix D, E.1.33.4 - subsection 1.3.3.4 of appendix E.

Illustrations, tables, formulas and equations contained in the text of the appendix should be numbered within each appendix. For example, figure D.3 is the third figure of appendix D, table A.2 is the second table of appendix A, formula (A.1) is the first formula of appendix A. If the appendix has one illustration, one table, one formula, one equation, their are also numbered. For example, figure F.1, table B.1, formula A.1, etc.

In the references in the text of the appendix to illustrations, tables, formulas, equations, it is recommended to write: "in figure A.2", "in figure A.1" - if the figure is the only one in appendix A, "in table B.3", "by formula (B.1)", "in equation (D.2)". If necessary, the text of computer programs is given in the appendix - a sample is given in appendix D.

Bibliography is provided at the end of the qualification (coursework), starting from a new page, entitled "List of used sources" or "List of references". Each bibliographic reference begins with a new line and is drawn up in the following sequence: serial number of the reference, surname and initials of the authors, title of the book (monograph, collection, etc.)

or article, name of the journal, year, volume, issue number, pages. The names of monographs, articles and collections are given in full. Journal names are given in abbreviated form in accordance with current standards for library and publishing.

A complete list of journal abbreviations can be found at the following links:

https://www.elsevier.com/_data/promis_misc/BMCL_Abbreviations.pdf

<https://woodward.library.ubc.ca/research-help/journal-abbreviations>

Descriptions of sources are made only according to the title page and only in the language of the original if this language is based on the Cyrillic or Latin alphabet. In other cases, the description of the sources is submitted by transcription in the language of the qualification (coursework).

The list of references is presented in the order in which they are first mentioned in the text. Serial numbers of descriptions in the list are references in the text (reference numbers).

Examples of compiling a bibliographic description for a list of sources used

(based on the American Chemical Society ACS style format)
(recommendations for 2019)

Source	Styling example
Books:	
– single author	Walla P. J., Single-biomolecule techniques. In <i>Modern Biophysical Chemistry</i> , Wiley-VCH Verlag GmbH & Co. KGaA: 2014; pp 203-256.
– two authors	Šachl R., Johansson L. B. Å., Heterogeneous lipid distributions in membranes as revealed by electronic energy transfer. In <i>Reviews in Fluorescence</i> 2015, Geddes, C. D., Ed. Springer International Publishing: 2016; Vol. 8, pp 171-187.
– three authors	Hermann E., Ries J., García-Sáez A., Scanning fluorescence correlation spectroscopy on biomembranes. In <i>Methods in Membrane Lipids</i> , Owen, D. M., Ed.; Springer New York: 2015; Vol. 1232, pp 181-197.
Dissertation:	Chandrakanth J.S. Effects of ozone on the colloidal stability of particles coated with natural organic matter. Ph.D. Dissertation, University of Colorado, Boulder, CO, 1994.
Multi-volume documents:	
– single volume reference	Annual Review of Physical Chemistry; Leone S.R., McDermott A.E., Paul A., Eds.; Annual Reviews: Palo Alto, CA, 2005; Vol. 56.
	Wiberg, K. In <i>Investigations of Rates and Mechanisms of Reactions</i> ; Lewis, E.S., Ed.; Techniques of Chemistry, Vol. VI, Part I; Wiley & Sons: New York, 1974; p 764.
Reference books:	Advanced Inorganic Chemistry; Wiley, 1999; p. 532.
Journal article:	

- single author	Walsh T. R. Pathways to structure–property relationships of peptide–materials interfaces: Challenges in predicting molecular structures. <i>Acc. Chem. Res.</i> 2017 , 50 (7), 1617-1624.
- two authors	Shao Q., Hall C. K. Allosteric effects of gold nanoparticles on human serum albumin. <i>Nanoscale</i> 2017 , 9 (1), 380-390.
- three authors	Pan, X. J.; Kadla, J. F.; Ehara, K. Organosolv Ethanol Lignin from Hybrid Poplar as a Radical Scavenger: Relationship Between Lignin Structure, Extraction Conditions, and Antioxidant Activity. <i>J. Agric. Food Chem.</i> 2006 , 54 (16), 5806-5813. DOI: 10.1021/jf0605392
- four authors	Caetano D. L. Z., de Carvalho S. J., Metzler R., Cherstvy A. G. Critical adsorption of periodic and random polyampholytes onto charged surfaces. <i>Phys. Chem. Chem. Phys.</i> 2017 , 19 (22), 23397-23413.
- five or more authors	Foster, J. C.; Varlas, S.; Couturaud, B.; Coe, J.; O'Reilly, R. K. Getting into Shape: Reflections on a New Generation of Cylindrical Nanostructures' Self-Assembly Using Polymer Building Block. <i>J. Am. Chem. Soc.</i> 2019 , 141 (7), 2742–2753. DOI: 10.1021/jacs.8b08648
Conference proceedings:	
– single author	Aleksandrov S.V. Problems of oil-contaminated land reclamation. In <i>Problems of Life Safety and Industrial Ecology</i> , Proceedings of the III-th International Scientific and Practical Conference, Ulyanovsk, Russia, June 3-4 2010; Savinykh V.V., Krasnogorskaya N.N., Silina E.K., Ed.; UIGTU, 2010; pp. 29-30.
– two authors	Garrone E., Ugliengo P. In <i>Structure and reactivity of surfaces</i> , Proceedings of the European Conference, Trieste, Italy, Sept 13–20, 1988; Zecchina A., Cost G., Morterra C., Eds.; Elsevier: Amsterdam, 1988.

Conference paper:	
– single author	Kaplan L.J. <i>Books of Abstracts, Part 2</i> , 213 th ACS National Meeting, San Francisco, CA, April 13-17, 1997; American Chemical Society: Washington, DC, 1997; CHED-824.
– two author	Ierapetritou, M. G.; Androulakis, I. P.; Monas, D. S.; Floudas, C. A. Structure Prediction of Binding Sites of MHC Class II Molecules Based on the Crystal HLA-DRB1 and Global Optimization. In <i>Optimization in Computational Chemistry and Molecular Biology: Local and Global Approaches</i> : Proceedings, 1999, Princeton University, Princeton, NJ, May 7-9, 1999; Floudas, C. A., Pardalos, P. M., Eds.; Kluwer, 2000; pp 157-190.
Online resources:	CARO Analytical Services. <i>Soil Testing Capabilities</i> . https://www.caro.ca/soil-testings/ (accessed 2020-09-14).

Patents:	1. Lenssen K.C., Jantscheff P., Kiedrowski G., Massing U. Cationic lipids with serine backbone for transfecting biological molecules. Eur. Pat. Appl. 1457483, 2004. 2. Langhals H., Wetzel F. Perylene pigments with metallic effects. Ger. Offen. DE 10357978.8, Dec 11, 2003; <i>Chem. Abstr.</i> 2005 , 143, 134834.
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Journal names shortening

Full name	Shorten name
Angewandte Chemie International Edition	Angew. Chem. Int. Ed.
Journal of the American Chemical Society	J. Am. Chem. Soc.
Journal of Physical Chemistry A	J. Phys. Chem. A
Journal of Photochemistry and Photobiology A: Chemistry	J. Photochem. Photobiol., A
Inorganic Chemistry	Inorg. Chem.
Annual Review of Physical Chemistry	Annu. Rev. Phys. Chem.
Doklady Physical Chemistry	Dokl. Phys. Chem.
Physical Chemistry Chemical Physics	Phys. Chem. Chem. Phys.
Journal of Molecular Liquids	J. Mol. Liq.
Ukrainskii Khimicheskii Zhurnal	Ukr. Khim. Zh.
Optika i Spektroskopiya	Opt. Spektrosk.

A complete list of journal abbreviations can be found at the following links:

https://www.elsevier.com/_data/promis_misc/BMCL_Abbreviations.pdf

<https://woodward.library.ubc.ca/research-help/journal-abbreviations>

5 SOURCES OF CHEMICAL INFORMATION

All scientific literature can be divided into two main types: periodicals and non-periodicals. The periodical literature includes, first of all, numerous scientific and scientific and technical journals published regularly, as well as publications of research institutes, universities, and factory laboratories. Non-periodical publications include scientific books, monographs, textbooks, reference literature.

The Internet is a modern and effective means of searching for chemical information. Below are the addresses of some web pages that may be useful when writing a qualification (course) paper:

<https://scholar.google.com/> (Goolge Scholar)

<https://www.scopus.com> (SCOPUS)

<https://apps.webofknowledge.com> (Web of Science)

<https://onlinelibrary.wiley.com/> (Wiley Online Library)

<https://www.sciencedirect.com/> (ScienceDirect)

<https://www.ncbi.nlm.nih.gov/pubmed/> (PubMed)

<https://www.chemweb.com/>

<https://arxiv.org/>

<http://www.chemindustry.com/index.html>

<https://www.elsevier.com/>

<https://www.springer.com/gp>

<https://pubs.acs.org/>

<https://ioppublishing.org/>

Appendix A.1
Example of title page

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY

Department of Inorganic Chemistry

UDC 541.35

Allow for defense

_____ 2024
«___» _____

Head of Department
DSc, prof. I. Vyunnik

**SOLVATION OF IIA SUBGROUP CATIONS
IN NON-AQUEOUS SOLVENTS**

Master thesis
2 year of the School of Chemistry
Volodymyr PETROV

Supervisor
PhD, assoc. prof.

Oles SYDOROV

KHARKIV 2024

Appendix A.2
A sample of the title page of a term paper

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY

Department of Inorganic Chemistry

COORDINATION COMPOUNDS

Coursework of
student of the group XB-12
School of Chemistry
Oleh HRYSHKO

Supervisor
PhD, assoc. professor

Mykola BILYK

KHARKIV 2024

Appendix B

A sample of the content of a qualification (course) work "TAP WATER"

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Appendix C
Figure styling example

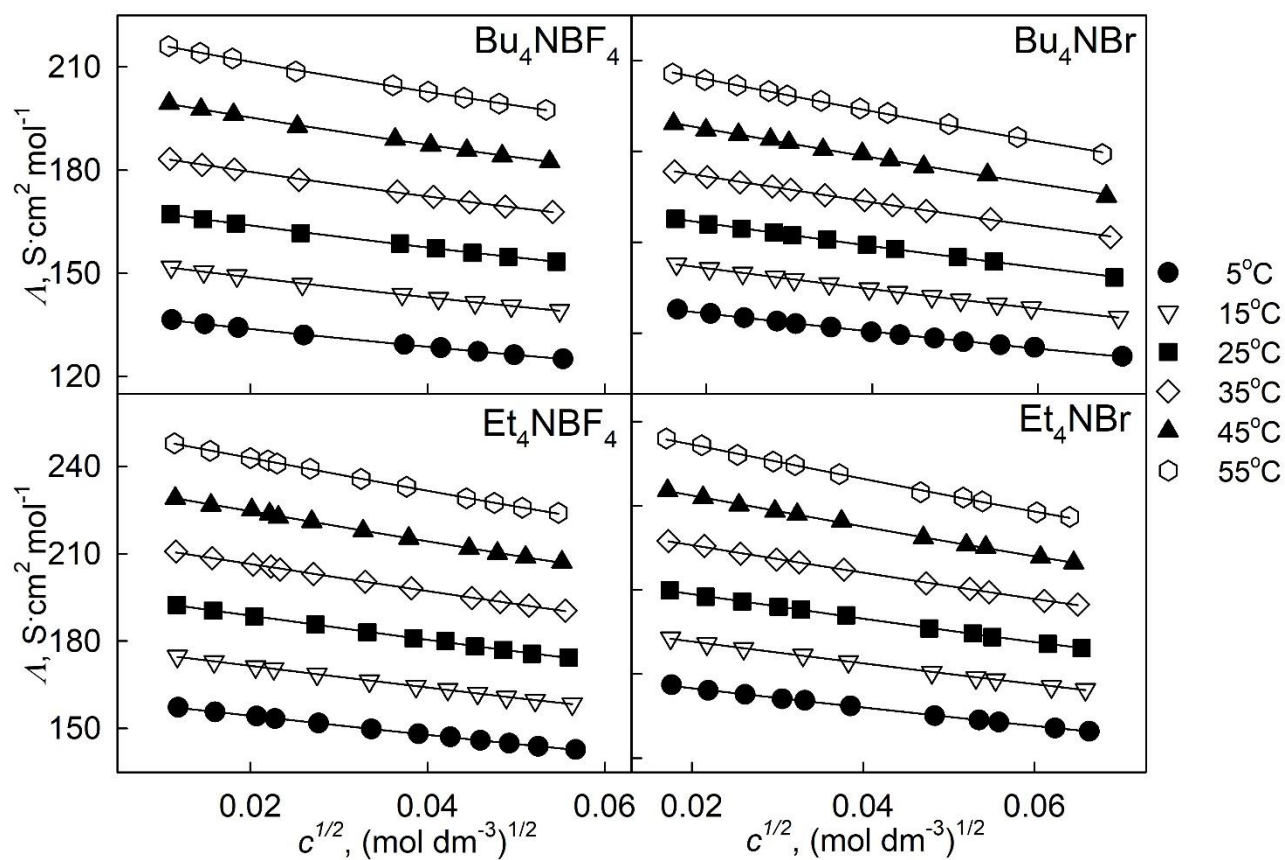


Figure 1.7 Concentration dependence of molar electrical conductivity of tetraalkylammonium salts in acetonitrile at different temperatures. Lines on the figure represent theoretical function of electrical conductance obtained by the f Lee-Wheaton equation.

Appendix D
Table styling example

Table 3.2 Physico-chemical properties of non-aqueous solvents
($P=101.325$ kPa, $T=298.15$ K)

Solvent	M , g/mol	T_b , K	T_m , K	μ_v , D	DN	$\eta \cdot 10^3$, Pa·s	ϵ
Methanol	32.04	337.66	175.66	1.70	19.1	0.5409	32.6
Ethanol	46.07	351.45	158.65	1.69	19.2	1.087	24.3
Propanol-1	60.11	370.35	146.15	1.66	19.8	1.967	20.1
Butanol-1	74.12	390.95	183.15	1.66	19.5	2.571	17.1
Pentanol-1	88.15	411.15	192.56	1.66	20.4	3.335	14.6
Hexanol-1	102.18	430.25	225.75	1.66	20.5	4.470	12.9
Hheptanol-1	116.21	449.45	240.35	1.66	-	5.675	11.1
Octanol-1	130.23	468.25	256.85	1.66	20.3	7.260	9.7
Nonanol-1	144.26	486.65	268.15	1.66	-	10.27	8.8
Acetonitrile	41.05	354.65	227.45	3.97	14.1	0.347	36.7
DMSO	78.09	462.15	291.35	3.96	29.8	1.963	46.3
Ethylene glycol	62.07	470.35	259.35	2.28	19.1	16.72	37.7
Acetone	58.1	329.39	177.80	2.85	17.0	0.304	20.7

Appendix E

A sample of computer program source styling

Appendix A.1

A program for computer simulation of fluids by the methods of Brownian and molecular dynamics

```
// file: BDHMAIN.CPP

// "Brownian and molecular Dynamics" after Heerman D.W.
// Author: O.N. Kalugin , September 2023
// updating 20.11.2023
// .....
#include <time.h>
#include <math.h>
#include <string.h>
#include <complex.h>
#include "BDH.H"

int Analyse(int argc, char *argv[]);
int FileNames(int argc, char *argv[]);

FILE *in, *out, *store, *key, *par, *lgn;
char *fk, *fp, *fi, *fo, *fs, *fl, *fomd, *fobd;

int key_init = 1,      // Key for start new calculation or read previous
one                    // { x, vh, f } from "in" file *.str
                        // Nonequilibrium or equilibrium calculation
key_eqv  = 0,          // (1) for RDF calculation (0) for opposite case
key_RDF  = 0,          // (1) for VACF and square disp. calculation
key_trans= 0,          // (0) for opposite case
                        // (1) for VACF and square disp. calculation
key_BDH  = 1;          // (0) for opposite case

time_t t;
clock_t starttime, endtime;
float elapsed_time;

double x[n3]={0},vh[n3]={0},f[n3]={0},
den    = 0.83134,
side   = 6.75284, // side length of the cubical box in sigma units
tref   = 0.722,   // reduced temperature
rcoff  = 2.5,     // cutoff of the potential in sigma units
ek,ekin,epot,etot,pres,vel,rp,vir,sideh,
hsq,hsq2,rcoffs,tscale,vaver,temp;

//
MAIN .....
int main(int argc, char *argv[])
{
int i;
double E_total;
```