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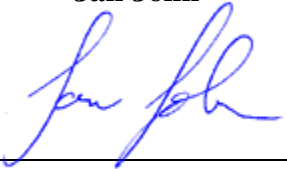
DELIVERABLE D1.4

Report listing and grouping the available textbooks of nuclear chemistry

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Dissemination Level

PU	Public	X
RE	Restricted to a group specified by the partners of the CINCH project	
CO	Confidential, only for partners of the CINCH project	

EXECUTIVE SUMMARY

Deliverable 1.4 has been created as a comprehensive list of textbooks, university textbooks and other teaching aids that are used in teaching all the topics within nuclear chemistry at different educational levels. The data were summarized from the questionnaire forms collected during the survey of nuclear- and radiochemistry curricula in the European universities (see Deliverable 1.1). This survey covered teaching materials from 26 universities in 19 countries. The list of teaching materials was created to be used as a “living document”, which would be uploaded to the CINCH web page for general use. All interested people – teachers, scientists, employers – may use the list and add their data to improve the impact and usefulness of such database. It can be found at NukWik at https://wiki.uio.no/mn/safe/nukwik/index.php/Main_Page.

This deliverable contributes to the following Work-Packages and Tasks:

WP 1

Task 1.1 Task 1.2 Task 1.3 Task 1.4 Task 1.5 Task 1.6

WP 2

Task 2.1 Task 2.2 Task 2.3

WP 3

Task 3.1 Task 3.2 Task 3.3 Task 3.4

WP 4

Task 4.1 Task 4.2 Task 4.3 Task 4.4 Task 4.5 Task 4.6 Task 4.7

WP 5

Task 5.1 Task 5.2 Task 5.3

WP 6

Task 6.1 Task 6.2 Task 6.3 Task 6.4 Task 6.5 Task 6.6

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1 INTRODUCTION

This deliverable is a part of the Work Package 1: University curricula evaluation and it further exploits the data collected in the previous deliverables, mainly from the questionnaire distributed among the European universities teaching NRC (see D1.1). This deliverable D1.4 is the output of Task 1.6: Compiling, reviewing and evaluating a list of textbooks in nuclear chemistry (CTU). The aim of this deliverable D1.4 “Report listing and grouping the available textbooks of nuclear chemistry” has been – based on the available data in the questionnaire – to create a comprehensive list of available textbooks, university textbooks and other teaching aids that adequately cover all the topics within nuclear chemistry at different educational levels. One of the results of this evaluation should have been identification of the potential gaps in the coverage of the field by available textbooks and suggestion of the correction measures.

2 CREATING THE LIST AND DATA MINING

Because of its sorting and filtration abilities, the MS Excel table processor was used to compile the list, all the data were then sorted and analysed. In addition to the data from the questionnaire, additional data were searched and added – mainly in the bibliography, full titles and similar fields. The file was also uploaded to the NukWik to be available to public.

2.1 List of textbooks used in NRC education

A list of all teaching materials, which were reported to be used by the respondents, was created from the data extracted from the questionnaires. The data in the list were then sorted according to criteria summarized in the following tables. In the respective fields, the sorting values were defined as follows.

Table 1: Sorting groups for the list of materials

Country	University	Faculty/Institute	Department
Level	Course title	Course language	Authors
Title	Bibliographic data	Type	Language

Table 2: Sorting values for educational level and type of material in the list of materials

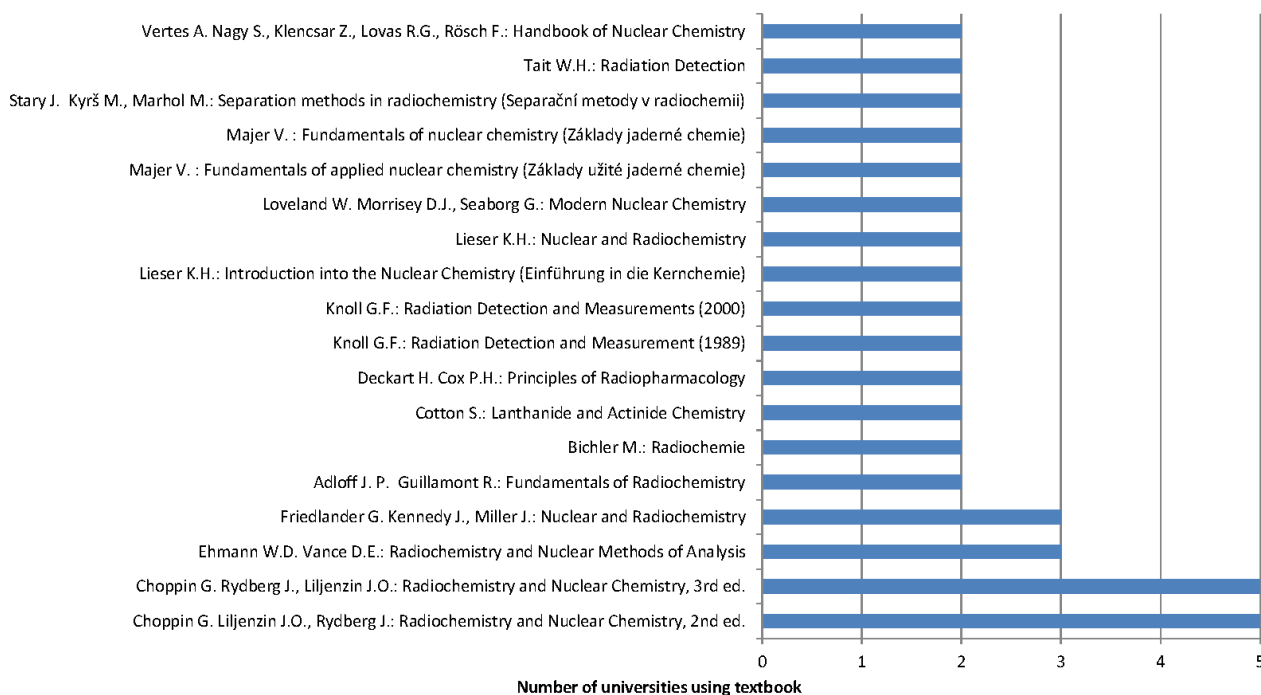
Level	BSc., MSc., BSc.-MSc., BSc.-MSc.-Ph.D., MSc.-PhD., Ph.D.
Type	Textbook, Course handout, Laboratory manual, Other teaching aid, Textbook-Course handout, Course handout-Laboratory manual
Scope	General, Comprehensive, “Topical” (see Table 5)

2.2 Findings from the list of teaching materials

In the list, the teaching materials from 26 universities in 19 countries are summarized. Most of the respondents did not fill sufficient details to get full statistics about teaching materials used. However, some significant general conclusions may be drawn from the collected data.

Table 3: Occurrence of types of materials in the questionnaire

Type	Hits
Textbook	181
Textbook + Course handout	8
Course handout + Laboratory manual	85
Other teaching aid	19
Laboratory manual	15



Graph 1: Number of universities using the most common textbooks listed in the questionnaire. Full list and tables of contents of selected textbooks are given in the Appendices.

Table 3 shows that, as it could be expected, the most common types of teaching aids are textbooks, laboratory manuals and course handouts. Graph 1 gives an overview of the most widely used textbooks. Various editions of the textbooks were not grouped because there are often significant differences among them and, following to the available information, in some groups, specific editions are preferred. Therefore, information about utilization of the versions is also valuable. This graph shows that, apart from the widely accepted Choppin et al.'s textbook, there is little agreement on specific textbooks and it is only rarely when more than two universities use the same textbook. The main reason for this is the relatively high percentage of textbooks in national languages (see Table 4) used in most of the non-Scandinavian universities/countries. The data listed in the Table 4 have been normalized so that each textbook was counted only once irrespective of its potential usage in more than one course at the respective university. It should be noted here that the data in Table 4 may be somewhat influenced by the fact that in some cases it was not clearly stated in the questionnaire if the textbook used is the original one or its translation to the national language.

Table 4: Overview of textbook in English used in European states

State	% of English textbooks	State	% of English textbooks
Austria	0	Greece	0
Bulgaria	33	Hungary	40
Croatia	100	Italy	75
Cyprus	0	Norway	100
Czech Republic	71	Poland	33
Finland	100	Sweden	100
Germany	71	The Netherlands	67

2.3 Grouping, availability and evaluation of the textbooks

As was already shown in the other Tasks in the CINCH project, the original presumption that the education in nuclear and radiochemistry in Europe is quite diverse was clearly confirmed. This is again confirmed in the list of used textbooks and other educational materials.

Grouping of the textbooks according to respective courses to make some more general conclusions collides with rather diverse structure of the courses over universities, countries etc. and relatively low number of specialized and/or national textbooks. In the Table 5, the number of textbooks in the sorting groups defined on the “Minimum requirements for teaching nuclear and radiochemistry” (CINCH Deliverable D2.1) basis is shown.

Anyway, the filtration and analysis features of MS Excel allow sorting and comparing various teaching materials according to specific interest of particular users. However, one should realize that – at this stage – the data still represent a rather informatively inhomogeneous collection and attempts to draw very comprehensive conclusions might provide misleading results. However, using this list as a living document, where all the users will provide necessary and updated information, could result in very valuable overview with clear output.

In the database, all textbooks used are listed. Some of them are not topically in the field of nuclear and radiochemistry however they are used as one of several textbooks in some courses. This concerns e.g. fundamental textbooks of physics, biology, or chemistry. Using filtration of the database, it can be easily found for which courses they are used.

Table 5: Number of textbooks in the used scope groups

Scope	Number
Comprehensive	14
Fundamental	26
Radiological protection	1
Radiation detection and dosimetry	4
Radioanalytics (Nuclear analytical methods, determination of radionuclides)	9
Radionuclides production	1
Nuclear fuel cycle	3
Radiopharmaceutical chemistry	7
Environmental radiochemistry	4
Radiation chemistry	9
Radioactive elements (Actinides, transactinides and radioactive elements)	5
Nuclear chemistry in life sciences	6

3 CONCLUSIONS

As it was mentioned above, the summarizing and analysis of the data extracted from the questionnaire was influenced by inconsistent filling of the form and not always sufficiently in-depth information on the teaching materials. Nevertheless, as is shown in the appendix, the tables above, and also the MS Excel database itself, the survey could be summarized in the following:

- in the list, the teaching materials from 26 universities in 19 countries are summarized,
- a rather limited number of generally internationally accepted textbooks exist for teaching general NRC,
- some of these books are relatively old even though some of them are updated in revised editions, but there is limited number of new original books,
- the situation with “topical” textbooks for specialized courses is even more diverse – it is only rarely that the specific (text)books are used at more than one university, many of them exist in national languages, only,
- the data seem to indicate (however not sufficiently conclusively) that there are some differences between northern (Scandinavia), western (mainly Germany) and eastern Europe (Czech Republic, Poland, Hungary, Bulgaria) in the language of the textbooks – in the mentioned order the use of the “international” English textbooks seems to decrease. This could be based on historical reasons and strong emphasis on teaching in English in the Scandinavia.

The list of teaching materials was created and is supposed to be used as a “living document”, which would be uploaded to the CINCH web page for general use. All interested people – teachers, scientists, employers – may use the list and add their data to improve the impact and usefulness of such database. It can be found at NukWik at:

https://wiki.uio.no/mn/safe/nukwik/index.php/Main_Page.

4 APPENDICES

1. Full list of textbooks occurring in the questionnaire.
2. Contents and front-pages of the selected most frequently used textbooks.
3. The MS Excel database (file available at NukWik)

Table: Full list of textbooks occurring in the questionnaire

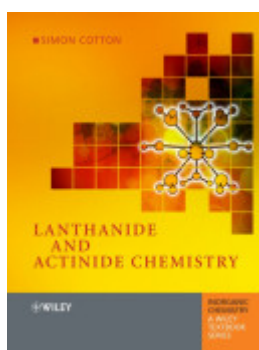
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Bichler M.: Radiochemie	2
Cotton S.: Lanthanide and Actinide Chemistry	2
Deckart H. Cox P.H.: Principles of Radiopharmacology	2
Knoll G.F.: Radiation Detection and Measurement (1989)	2
Knoll G.F.: Radiation Detection and Measurements (2000)	2
Lieser K.H.: Introduction into the Nuclear Chemistry (Einführung in die Kernchemie) (1991)	2
Lieser K.H.: Nuclear and Radiochemistry (1997)	2
Loveland W. Morrissey D.J., Seaborg G.: Modern Nuclear Chemistry	2
Majer V. : Fundamentals of applied nuclear chemistry (Základy užité jaderné chemie)	2
Majer V. : Fundamentals of nuclear chemistry (Základy jaderné chemie)	2
Stary J. Kyrš M., Marhol M.: Separation methods in radiochemistry (Separační metody v radiochemii)	2
Tait W.H.: Radiation Detection	2
Vertes A. Nagy S., Klencsar Z., Lovas R.G., Rösch F.: Handbook of Nuclear Chemistry	2
Aitken D.: Fizika és régészet	1
Alfassi Z.B.: Activation Analysis	1
Alfassi Z.B.: Chemical Analysis by Nuclear Methods	1
Alpen E.L.: Radiation biophysics	1
Bednář J.: Theoretical foundations of radiation chemistry	1
Beiser A.: Concepts of Modern Physics	1
Benedict M. Pigford T., Levi H.: Nuclear Chemical Engineering	1
Beneš P. Majer V.: Trace Chemistry of Aqueous Solutions	1
Betina V. Nemeč P.: General microbiology (Všeobecná mikrobiológia)	1
Bockris J. O'M. Khan S.UM.: Surface electrochemistry	1
Buncel E. Jones J.R.: Isotopes in the Physical and Biomedical Sciences	1
Czerwiński A.: Nuclear energy and radioactivity (Energia Jądrowa i Promieniotwórczość)	1
Das A. Ferbel T.: Introduction to nuclear and particle physics	1
Dienstbier Z.: Diagnostics with methods of nuclear medicine (Diagnostika metodami nukleární medicíny)	1
Dirac P.A.M.: The Principles of Quantum Mechanics, Fourth ed.,	1

Dwurjanyn P. Garnett J. : Radiation Curing in Polymer Science and Technology.	1
Eisenbud M.: Environmental Radioactivity	1
Evans E.A. Muramatsu M.: Radiotracer Techniques and Applications	1
Evans E.A.: Tritium and its Compounds	1
Farhataziz M.A Rodgers J.: Radiation chemistry - Principles and applications	1
Fehér I. Deme S.: Sugárvédelem	1
Földiák G.: Az izotópok ipari alkalmazása	1
Formanek J.: Introduction to quantum theory (Úvod do kvantové teorie)	1
Genov L. Kasabov G.: Basic course of general and applied radiochemistry	1
Gosman A. Čech J.: Nuclear methods in chemical research (Jaderné metody v chemickém výzkumu)	1
Hála J.: Radioactivity, ionizing radiation, nuclear energy (Radioaktivita, ionizující záření, jaderná energie)	1
Hall E.: Radiobiology for the radiologist	1
Hendee W. R.: Radioactive isotopes in biological research	1
Hess D.: Physiology of plants (Fyziologie rostlin)	1
Choppin G. Rydberg J.: Nuclear Chemistry	1
Choppin G. Rydberg J.: Nuclear Chemistry – Theory and Applications	1
Jones J.R.: Isotopes: Essential Chemistry and Application I.+II.	1
Kanyár B. Beres Cs., Somlai J., Szabo S. A.: Radioecology and environmental radiation protection (Radioökológia és környezeti sugárvédelem)	1
Kanyár B. Somlai J., Szabo L.D.: A sugárzások elleni védelem dozimetriai és hatástani alapjai	1
Katz J.J. Seborg G.T., Mors L.R.: The Chemistry of the Actinide Elements	1
Keller C.: Radiochemistry	1
Keller K.A. Lange J., Münzel H.: Estimation of unknown excitation functions and thick target yields for p, d, ³ He and α reactions.	1
Kilbourne M.R: Fluorine-18 Labelling of Radiopharmaceuticals.	1
Kónya Nagy L. Gy. : Basic Radiochemistry I	1
Köteles Gy.: Sugáregészségtan	1
L'Annunziata M.F.: Handbook of Radioactivity Analysis	1
Lehnert, S.: Biomolecular action of ionizing radiation	1
Lehto J. Hou X.: Chemistry and analysis of radionuclides	1
Lešetický L.: Labelled compounds (Metody přípravy izotopicky značených sloučenin)	1
Lieser K.H.: Einführung in die Kernchemie (1980)	1
Lilley J.: Nuclear Physics: Principles and Applications	1
Loizos Z.G.: Nuclear Chemistry – Nuclear Chemical Technology vol 1 and 2	1
Majer V. : Grundlagen der Kernchemie	1

Marcus Y. Kertes A.S.: Ion Exchange and Solvent Extraction of Metal Complexes	1
Marx Gy.: Atommag-közélen	1
Messiah A.: Quantum Mechanics, Two Volumes Bound as One	1
Mozumder A. Hatano Y.: Charged particle and photon interactions with matter: Chemical, Physicochemical, and Biological Consequences with Applications	1
Mozumder A.: Fundamentals of Radiation Chemistry	1
Nagy L.Gy.: Radiochemistry and isotope technique (Radiokémia és izotóptechnika)	1
Navratil O. Hála J., Kopunec R., Lešetický L., Macášek F., Mikulaj V.: Nuclear Chemistry (Jaderná chemie)	1
Navratil O. Hála J., Kopunec R., Macášek F., Mikulaj V., Lešetický L.: Nuclear Chemistry	1
Nemeth Z.: Basic of Radiochemistry and isotope technology	1
Nias A. H. W.: An introduction to radiobiology	1
Obrusník I. J. Zýka, ed.: Neutron activation analysis (Neutronová aktivační analýza), New trends in analytical chemistry, vol.2	1
Oddone M.: Radiochemistry	1
Parker S.P.: McGraw-Hill Encyclopedia of Environmental Science	1
Parsons A.F.: An Introduction to Free Radical Chemistry	1
Pashalidis I.: Basic Radiochemistry I	1
Phelps M. Mazziotta J., Scelbert H.: Positron Emission Tomography and Autoradiography: Principles and Applications for Brain and Heart.	1
Pierik R.L.M.: In Vitro Culture of Higher Plants	1
Pikaev A.K.: Present radiation chemistry (Sovremennaja radiacionnaja chimija)	1
Rontó Gy. Tarján I.: A biofizika alapjai	1
Rydberg J. Musikas C., Choppin G.: Principles and Practices of Solvent Extraction	1
Sakurai J.J.: Modern Quantum Mechanics	1
Schädel M.: The Chemistry of Superheavy Elements	1
Schubiger P.A. Alberto R., Smith A.: Vehicles Chelators, and Radionuclides: Choosing the "Building Blocks" of an Effective Therapeutic Radioimmunoconjugate.	1
Skwarzec B.: Environmental radiochemistry and radiological protection	1
Sobkowski J. Jelińska-Kazimierczuk M.: Nuclear chemistry (Chemia Jądrowa)	1
Sobkowski J.: Radiochemistry and radiation protection	1
Sood D.D. Reddy A.V., Ramamoorthy N.: Fundamentals of Radiochemistry	1
Spinks J.W.T. Woods R.J.: An introduction to radiation chemistry	1
Steel G.G.: Basic Clinical Radiobiology	1
Strijckmans K.: Analytische biochemie. Deel 1: Radiochemie	1
Sztanyik B. L.: Sugársérülések megelőzése és gyógykezelése	1

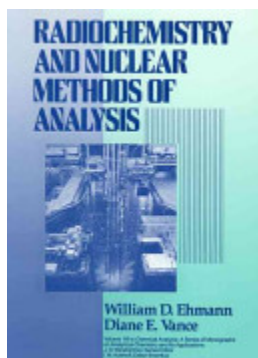
Šeda J. Musílek L., Petr I., Sabol J., Melichar Z.: Dosimetry of ionizing radiation (Dozimetrie ionizujícího záření)	1
Theobald T.: Sampson's Textbook of Radiopharmacy	1
Tölgyessy J. Kyrš M.: Radioanalytical Chemistry	1
Tölgyessy J. Varga Š.: Nuclear Analytical Chemistry	1
Tölgyessy J. Varga Š.: Nuclear Analytical Chemistry (Nukleární analytická chémia)	1
Turner J.E.: Atoms, Radiation, and Radiation protection	1
ÚISJP: Fundamentals of radiation technologies (Základy radiačních technologií)	1
Úlehla I. et al: Atoms, nuclei, particles (Atomy, jádra, částice)	1
Vallabhajosula S.: Molecular Imaging for PET and SPECT	1
Vertes A. Kiss I.: Nuclear Chemistry	1
Wieland D.M. Tobes M.C., Mangner T.J.: Analytical and Chromatographic Techniques in Radiopharmaceutical Chemistry	1
Williams W.S.C.: Nuclear and particle physics	1
Woods R.J. Pikaev A.K.: Applied Radiation Chemistry, Radiation Processing.	1
Zvára I.: The Inorganic Radiochemistry of Heavy Elements	1
Zýka J. et al: Analytical handbook (Analytická příručka)	1
Zýka J. et al: New trends in analytical chemistry (Nové směry v analytické chemii)	1

Cotton S.: Lanthanide and Actinide Chemistry



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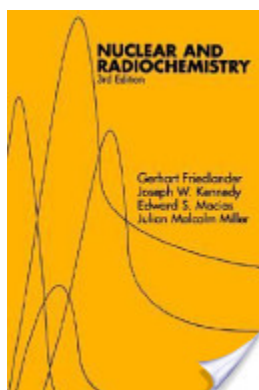
Ehmann W.D. Vance D.E.: Radiochemistry and Nuclear Methods of Analysis



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Nuclear Reactions	
Rates of Nuclear Decay	
Interactions of Radiation with Matter	
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Radiochemistry Instrumentation	
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The Origin of the Chemical Elements	
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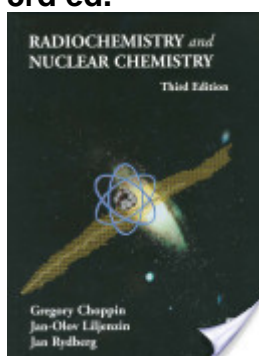
Friedlander G., Kennedy J., Miller J.: Nuclear and Radiochemistry

Friedlander G., Kennedy J. W., Macias E. S., Miller J. M.: Nuclear and Radiochemistry



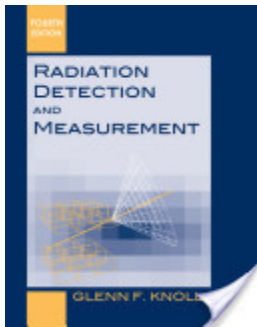
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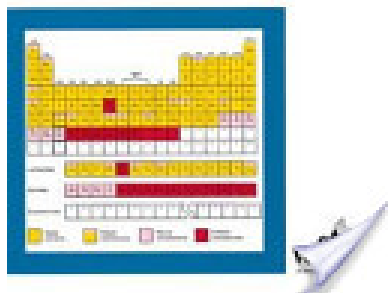
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Lieser K.H.: Nuclear and Radiochemistry

Karl Heinrich Lieser

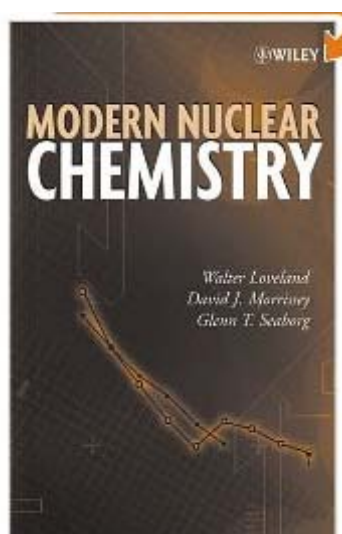
Nuclear and Radiochemistry

Fundamentals and Applications



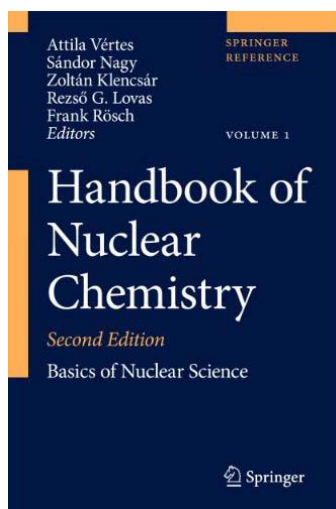
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Loveland W. Morrisey D.J., Seaborg G.: Modern Nuclear Chemistry



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