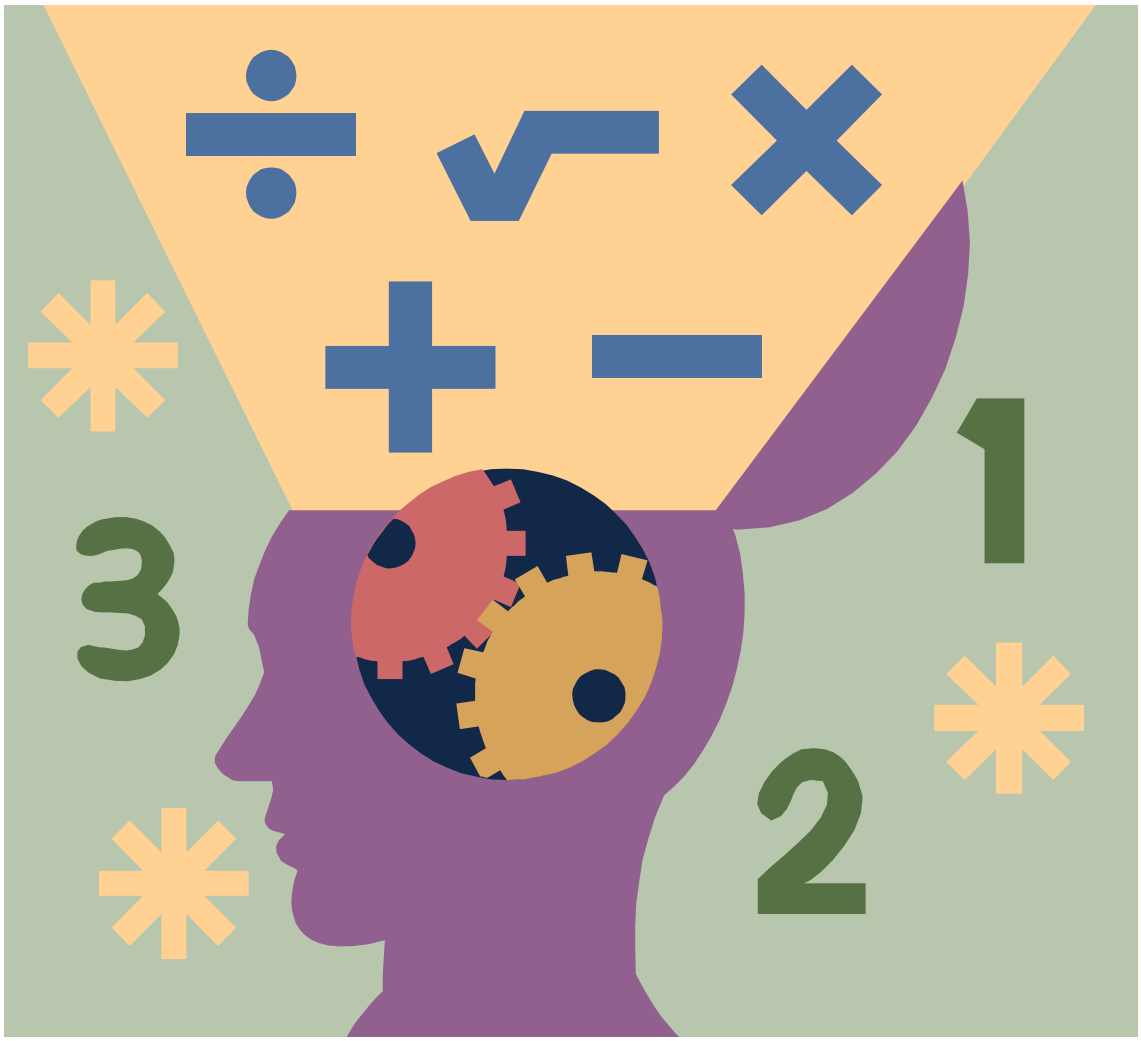
Maths Resource Database

Find the resources your students need



RSC | Advancing the Chemical Sciences

The Higher Education Academy Physical Sciences Centre

Maths for Scientists: A Guide to Resources

The mathematical ability of new chemistry undergraduates varies widely and as such it is vital for universities to provide remedial mathematics tuition.

This document aims to provide an insight into some of the resources available to institutions to provide this tuition using various methods of delivery, including VLE based materials and CBL/PBL resources.

Drawing on the expertise of both the RSC and the HEA Physical Sciences Centre an extensive survey of the available resources has been undertaken; however this is by no means a definitive list.

To add a resource to this guide please email the RSC, education@rsc.org, or the Physical Sciences Centre, psc@hull.ac.uk.

Books

i) Maths for Chemistry: A chemist's toolkit of calculations
by Paul Monk
http://www.oup.com/uk/catalogue/?ci=9780199277414

This book uses chemical examples throughout to demonstrate the relevance of mathematical concepts to the study of chemistry and help motivate the student.

The companion web site has certain password protected features for lecturers:

- Figures from the book available to download, to facilitate lecture preparation
- Solutions to end of chapter problems, to aid assessment

This book was reviewed by the RSC publication, Education in Chemistry. The review can be accessed here:
http://rsc.org/Education/EiC/issues/2007Jan/EssentialCalculations.asp

ii) Essential Algebra for Chemistry Students
by David Ball
http://academic.cengage.com/cengage/instructor.do?codeid=6F22&sortby=copy&type=all_radio&courseid=CH04&product_isbn=9780495013273&disciplinenumber=12&codeFlag=true

This textbook is ideal for chemical science students who lack confidence of competence in basic essential algebra skills. It focuses on the algebra skills required for general chemistry with worked examples to show how these skills translate into successful chemical problem solving.

iii) Chemical Calculations at a Glance
by Paul Yates
http://eu.wiley.com/WileyCDA/WileyTitle/productCd-1405118717.html

This book puts maths into a chemistry context, using detailed chemical examples, to aid the students' appreciation of maths within a chemistry course. Problems and answers have been included for each presentation, so encouraging the student to practice both the mathematical manipulations and the application to problems in chemistry. More detailed chemical problems at the end of each topic illustrate the range of chemistry to which the maths is relevant and help the student acquire sufficient confidence to apply it when necessary.

iv) Maths for Chemists (Tutorial Chemistry Texts)
by M. Cockett and G. Doggett

Vol 1 Numbers, Functions and Calculus Vol 1
http://www.rsc.org/shop/books/2003/9780854046775.asp

Vol 2 Power Series, Complex Numbers and Linear Algebra
http://www.rsc.org/shop/books/2003/9780854044955.asp

"Maths for Chemists" comes in two volumes and provides an introduction to the maths undergraduate chemistry students will need throughout their studies. Support is provided for those students who may not have studied maths beyond GCSE level as well as giving scope for those students with a more in depth maths background to expand their knowledge.

Whilst early chapters explain the basic maths skills the students need, later chapters build on this knowledge and allow them to progress to more complex mathematical principles.

v) Catch Up Maths and Stats: For the Life and Medical Sciences
by M. Harris, G. Taylor and J. Taylor
http://www.scionpublishing.com/shop/product_display.asp?mscssid=9KFMD6J5PVCB9GH0L6NS4X8JQC500439&CurrencyID=1&ProductID=9781904842118

These books are aimed at students both prior to starting university and within introductory courses. The focus is on the major principles required within life and medical science degrees with context provided by a series of relevant worked examples and problems. Whilst the book initially covers very basic concepts it quickly moves on to the more complex theory required by undergraduates studying these subjects.

vi) Math Review Toolkit for Chemistry
By Gary Long and Sharon Long
http://www.pearsonhighered.com/educator/academic/product/1,3110,0131493833,00.html

Ideal for students who find the mathematics behind chemistry difficult, this book gives a step-by-step guide to a range of problems covering the essentials required for an undergraduate chemical science degree.

vii) Guide to Essential Math: A Review for Physics, Chemistry and Engineering Students
by Sy M. Blinder
http://www.elsevier.com/wps/find/bookdescription.cws_home/713988/description#description

Focussing on the maths required for chemical science, physics and engineering undergraduate degree studies this book begins with 12 context-based worked problems designed to introduce mathematical terms and methods. Development of these skills should enable students to transfer their knowledge of quantitative methods to scientific problems within their studies.

viii) Basic Concepts of Chemistry
by Leo J. Malone
http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0471215228.html

This general chemistry book offers extensive appendices to help students provide a quick and effective review of the mathematical concepts used in introductory chemistry. Supplements include access to a maths skills website.

ix) Basic Laboratory Calculations for Biotechnology
by Lisa Seidman
http://www.pearsonhighered.com/educator/academic/product/0,3110,0132238101,00.html

This book gives a succinct introduction to common calculations encountered throughout laboratory work. Students are given the opportunity to practice maths calculations within the context of laboratory examples enabling them to become more confident and competent within a practical situation.

x) The Chemistry Maths Book
by Erich Steiner
http://www.oup.com/us/catalog/general/subject/Chemistry/?view=usa&ci=9780199205356

This resource is aimed at students of all levels and covers the topics required throughout a chemical science degree course. Applications to chemistry and the physical sciences are included allowing students to work through the subject and gain a contextualised understanding. Topics are divided into the broad areas of algebra, mechanics and statistics with exercises at the end of each chapter bringing together the use of key concepts.

xi) Essential Mathematics and Statistics for Science
by Graham Currell and Antony Dowman
http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0470022280.html

A low-level introduction to the fundamental concepts students need, little prior knowledge is assumed making this an ideal introduction to the subject. Examples are given in both the book and on the companion website allowing students the chance to work through problems using the concepts they've learned. Ready-prepared material for lectures, tutorials and computer practical's are also available for tutors. The authors have also produced video clips giving worked examples for the questions in the book (http://science.uwe.ac.uk/MathsStats/video_link/video.htm).

xii) Mathematical Problems for Chemistry Students
by Gyorgy Pota
http://www.elsevier.com/wps/find/bookdescription.cws_home/708839/description#description

This resource provides context based examples of maths within a chemical science setting giving students the opportunity to apply their maths skills. Examples from standard chemistry text books as well as from theoretical chemistry journals are included to cover all the major areas of chemical science. It is intended for beginner to intermediate level users.

xiii) Beginning Mathematics for Chemistry
by Stephen K. Scott
http://www.oup.com/uk/catalogue/?ci=9780198559306

This workbook provides worked examples as well as practice exercises making it suitable for use in class or for independent study. Aiming to build confidence with mathematical techniques through practice this resource is aimed at first year chemical science undergraduates.

xiv) Basic Mathematics for Chemists
by Peter Tebbutt
http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0471972843.html

Using applications, data, examples and problems drawn from chemistry this book aims to introduce students to all the concepts they need to know in order to study chemical science at degree level. Little prior knowledge is assumed and students are taken through basic mathematical principles and their usage within chemistry.

xv) Engineering Mathematics
by K. A. Stroud and Dexter J. Booth
http://www.palgrave.com/stroud/stroud6e/index.html

In this book students are taken through the subject step-by-step using worked examples and exercises. The sixth edition includes a Personal Tutor CD-ROM. The companion website provides access to questions and applications.

xvi) Basic Mathematics for Biochemists
by Athel Cornish-Bowden
http://www.oup.com/uk/catalogue/?ci=9780198502166

This book covers the maths required by biochemistry undergraduates throughout their studies but may also be a useful reminder to postgraduate students and above. Minimal prior knowledge of maths is assumed and students are guided through a series of worked examples and exercises. The basic concepts needed by biochemists are introduced and built on throughout the subsequent chapters and examples specific to biochemistry are given.

xvii) Foundations of science mathematics
by D. S. Sivia and S. G. Rawlings
http://www.oup.com/uk/catalogue/?ci=9780198504283

This resource gives an informal approach to maths, starting from GCSE level progressing through the basic concepts and on to more in-depth knowledge. A large range of topics are covered giving students the breadth of knowledge they need for their undergraduate chemical science studies.

The informal, readable style makes this resource accessible to all students and their tutors.

xviii) Foundations of science mathematics: worked problems
by D. S. Sivia and S. G. Rawlings
http://www.oup.com/uk/catalogue/?ci=9780198504290

A concise resource aimed at developing the maths skills needed by students throughout their studies. This book provides solutions to most of the problems set in the companion book “Foundations of Science Mathematics, model answers are given alongside additional comments to assist the reader.

xix) Beginning Calculations in Physical Chemistry
by B. R. Johnson and S. K. Scott
http://www.oup.com/uk/catalogue/?ci=9780198559658

Aimed at first year undergraduate chemical science students this workbook provides students with a range of exercises to practice their maths skills and develop their confidence in using them in a chemical science situation.

xx) Chemistry: Chemistry Calculations Explained
by A. Ninan and G. Lawler
http://www.amazon.co.uk/Chemistry-Calculations-Explained-Studymates-Focus/dp/1842850725

Chemical science students need to be able to apply their maths skills in both theoretical and practical situations. This book takes students through the key concepts step-by-step demonstrating how to tackle different problems, from percentage yield to Avogadro’s constant. Tutorials at the end of each chapter summarise the key points and introduce sample problems, discussion points, practical tasks and revision tips. A list of useful websites is also included.

xxi) Mathematical Methods for Science Students
by G. Stephenson
http://vig.pearsoned.co.uk/catalog/academic/product/0,1144,0582444160,00.html

Aimed at all science students this book doesn't assume any prior knowledge but works through key concepts in detail allowing students to develop a good grounding in the subject. Worked examples and exercises are included to enable students to practice their skills.

xxii) Essential Mathematics for Chemists
by J. Gormally
http://vig.pearsoned.co.uk/catalog/academic/product/0,1144,0130863459,00.html

This book addresses many of the common difficulties encountered by undergraduates when learning maths by introducing basic skills in handling numbers before tackling key chemistry-related topics. Little knowledge of maths is assumed and the order of chapters is designed to reflect the structure of many chemistry courses relating to both lecture and laboratory studies. Worked examples and graded problems are included allowing students the opportunity to practice their skills and gain confidence in working through chemical science problems.

xxiii) Maths: A student's survival guide
by J. Olive
http://www.cambridge.org/catalogue/catalogue.asp?isbn=0521017076

This resource is aimed at first year undergraduate science and engineering students. It covers the core maths needed by most students starting these courses and contains almost 800 exercises as well as worked solutions.

xxiv) Foundation Maths
by A. Croft and R. Davison
http://www.pearsoned.co.uk/Bookshop/detail.asp?item=100000000116064

This book is aimed at students who have not studied maths at post-16 level but are now taking further or higher education courses and is ideal for students studying a range of courses, including the chemical sciences. Guidance is given in mathematical methods and worked examples are given to help improve students confidence in answering questions. It is useful as a revision or reference guide and also for self study.

Software

i) mathtutor

http://www.mathtutor.ac.uk/

mathtutor aims to bridge the gap between school and university. It contains diagnostic tests, video tutorials, summary text and exercises for topics from algebra to integration. It can be viewed on-line (http://www.mathtutor.ac.uk/viewdisks.php) or purchased on DVD-Rom disks.

ii) Mathletics

http://people.brunel.ac.uk/~mastmmg/Downloads/entry.htm

The Mathletics program comprises a suite of mathematics tests for diagnostic, formative and summative assessment in commonly taught areas of number, algebra and calculus from GCSE to year 2 undergraduate level. The aim is to provide an assessment environment where topic question libraries can be combined in various ways (pentathlon, decathlon etc.) and immediate feedback given. Each test starts with information and revision screens. Much of Mathletics was written by final-year project students using Question Designer. It has been used extensively at Brunel University, where it has been developed, and can be supplied to any academic or teacher, free of charge.

Online resources

General maths

i) Quantitative Chemistry

http://www.symplekta.co.uk/QC/

This pilot project features a series of interactive online resources aimed at helping students with the maths they need throughout their chemical science degree courses. Featuring video clips, worked problems and sample questions this resource gives context-based examples of key mathematical principles within a chemical science setting. Feedback on this resource is welcomed, please email the RSC Chemistry for our Future team at education@rsc.org with your comments.

ii) The University of Hull, Study Advice Centre

http://www.hull.ac.uk/studyadvice/MathsResources/index.html

The University of Hull Study Advice Centre produce a wide range of leaflets covering basic maths skills from algebra to vectors. These leaflets are available as .pdf files. Some sections have online quizzes available.

iii) mathcentre
http://www.mathcentre.ac.uk/

mathcentre is an on-line mathematics support centre which provides resources to help students make the transition from school-level to university-level mathematics. There are also resources and useful links for those who teach or support students.

mathcentre offers students quick reference guides, practice and revision materials, video tutorials, workbooks and online practice exercises on many branches of mathematics, including: Algebra, Arithmetic, Complex Numbers, Differentiation, Drug dose calculations, Finance, Functions and Graphs, Geometry, Graphs for health sciences, Guides & Case Studies, Integration, Matrices, Mechanics, Numeracy Skills, Sequences & Series, Statistics, Trigonometry and Vectors.

iv) Tackling the Mathematics Problem for Chemists toolkit
http://www.heacademy.ac.uk/physsci/publications/toolkits

This document is intended to help teachers of chemistry deal with the mathematics problem. It brings together relevant reports and information about useful resources with hyperlinks to allow further investigation or downloading of materials.

v) Mathematics courseware
This is a further list of maths for scientists resources.
http://www.heacademy.ac.uk/physsci/resources/courseware/mathematics

vi) Reviews of resources
http://www.heacademy.ac.uk/physsci/publications/journals

The HEA Physical Sciences Centre commissions reviews of teaching, learning and assessment resources. These reviews are published in the journal ‘Reviews’, available as both a paper version and on-line

vii) Maths Support
http://www.heacademy.ac.uk/physsci/home/pedagogicthemes/mathssupport

The HEA Physical Sciences Centre produces a wide range of supporting information to help support the teaching of maths to chemical science students, available online.

vii) Mathematical Learning Hierarchies in the Physical Sciences
by Paul Yates, Keele University
http://www.heacademy.ac.uk/physsci/resources/detail/resources/downloads/mathematical_learning_hierarchies

This downloadable resource is designed to support the teaching of chemical and physical scientists with a weak mathematical background and includes maths problems related to both chemistry and physics. It can also be accessed online (http://www.keele.ac.uk/depts/ch/ltsn/home.html).

ix) Mathematics for Economics: Enhancing Teaching and Learning (METAL)
http://www.metalproject.co.uk/

These resources are aimed at 1st year undergraduate economics students however the content may be useful to those teaching introductory maths to chemical science students as the fundamental principles remain the same. The website offers video streamed real world examples alongside teaching and learning guides, a question bank and series of case studies.

x) Helping Engineers Learn Mathematics (HELM)
http://www.lboro.ac.uk/research/helm/

These resources developed by a consortium of 5 universities (Loughborough, Hull, Reading, Sunderland and Manchester) aim to enhance the teaching and learning of maths to UK engineering undergraduates, however the content may be relevant to those teaching other science subjects.

Available free of charge to UK HEIs and FEIs from Loughborough University's Mathematics Education Centre HELM consists of a series of workbooks, computer-aided learning courseware and computer-aided assessments.

xi) Maths, Stats and OR Network resources

The HEA Maths, Stats and OR Network produce a wide range of maths resources which are available on the website or a paper copy can be requested. http://mathstore.gla.ac.uk/
These include facts and formulae leaflets available at:
http://mathstore.gla.ac.uk/index.php?pid=41

They also produce the following resources that can be accessed online or requested from the HEA Physical Sciences Centre (psc@hull.ac.uk):

Diagnostic testing for mathematics
http://mathstore.gla.ac.uk/mathsteam/packs/diagnostic_test.pdf

An in-depth review of diagnostic testing including the results of a focused project and national survey carried out in 2002. There are detailed case studies as well as brief outlines of the actual testing procedures within various institutions.

Maths support for students
http://mathstore.ac.uk/mathsteam/packs/student_support.pdf

As Engineering and Science departments face the problems of inadequate mathematical preparation by students, many are setting in place networks of support-based activities, e.g. maths learning centres. This booklet presents examples of these initiatives through a series of case studies.

Maths for engineering and science
http://mathstore.gla.ac.uk/mathsteam/packs/engineering__science.pdf

This booklet looks at teaching mathematics to engineering and science students. Case studies from contributing authors describe the execution of the learning activities, the support needed, the implementation difficulties, evidence of success and suggestion of how other academics could reproduce the activity.

xii) Diagnostic Maths Test for Undergraduates
http://science.uwe.ac.uk/CalcScience/Development/DiagAssess/DiagAssess.htm

This diagnostic assessment has been developed by Graham Currell at the University of the West of England. Undergraduate students entering courses in bioscience, forensic and pharmaceutical science, environmental sciences and health sit this paper-based test which lasts a maximum of 45 minutes.

A PDF version of the test is available and the document can be requested in word format.

xiii) NuMBerS, Numerical Methods for Biosciences Students
http://web.anglia.ac.uk/numbers/index.html

The NuMBerS project is designed to support the teaching of maths for the biosciences. It is built as a series of toolkits, some of which are web-based and interactive, whilst others are currently printable files. Where appropriate, example data is provided that puts the test or technique into a bioscience context.

xiv) Learn Higher CETL
http://www.learnhigher.ac.uk/learningareas/numeracymathsstatistics/home.htm
This website offers support to students who are struggling with the mathematical and statistical components of their degree programme. Resources are provided for staff, including information and resources for using computer aided assessment (CAA) and small group teaching to support students. There are also links to numerous websites. Student resources include workbooks on algebra, differentiation and integration that can be used for independent study.

Statistics

i) DISCUSS: Discovering Important Statistical Concepts Using SpreadSheets

http://www.mis.coventry.ac.uk/~nhunt/home/

The DISCUSS project is a modified and supplemented web-based implementation of the widely used DISCUS materials for teaching elementary Statistics. It aims to integrate the powerful interactive capabilities of Microsoft Excel with the convenience of web-based resource materials using Microsoft Internet Explorer. There are modules covering Charts and Graphs, The Binomial Distribution, The Poisson Distribution, Sampling, Regression and Correlation, Buffon's Needle, Coupon Collecting, Critical Path Analysis, Sampling Methods and Probabilities with Dice.

ii) STARS: Creation of Statistical Resources from Real Data Sets

http://stars.ac.uk/

The STARS project has used real datasets and scenarios to help develop teaching and learning resources for staff and students. The statistics packages being used are Excel, MINITAB, SPSS and, to a minor extent, SAS. The datasets cover business, health and psychology, but these may be useful datasets for the general teaching of statistics

University on-line material

i) Queen Mary, University of London

Quantitative methods in chemistry
http://www.chem.qmul.ac.uk/software/download/qmc/

This contains support maths material for students use.

ii) University of Plymouth

http://www.tech.plym.ac.uk/maths/resources/PDFLaTeX/mathaid.html

Maths support materials. This includes interactive quizzes.

iii) University of Birmingham

AIM - Assessment on Mathematics
http://mat111.bham.ac.uk/index.html

This is the University of Birmingham's assessment in mathematics tool for its students. Many of the topics are available to guest users, and include algebra and calculus. Each topic contains online quizzes, with solutions.