



RHODES UNIVERSITY

Where leaders learn

CHEMISTRY 1

GENERAL INFORMATION

&

COURSE CONTENTS

2022

STRUCTURE OF THE COURSE

CHEMISTRY 1 is divided into two semester courses:

CHE101 - lectured from March to June and examined in June, and

CHE102 - lectured from July to October and examined in November.

These courses normally involve 4 lectures per week with either a test or tutorial in the remaining weekly period, and one practical session of 3 hours per week. However, please listen for updated information coming from lecturers and course coordinators, since the aim is to have as much of this as face to face as is possible under the circumstances.

Normally a student registers for **both** courses at the beginning of the year.

You **MUST** be able to access the course sites on RUConnected:

Chemistry 101 Theory: <https://ruconnected.ru.ac.za/course/view.php?id=8864>

Chemistry 101 Practicals: <https://ruconnected.ru.ac.za/course/view.php?id=8337>

Chemistry 102 Theory: <https://ruconnected.ru.ac.za/course/view.php?id=8338>

Chemistry 102 Practicals: <https://ruconnected.ru.ac.za/course/view.php?id=9033>

Please email K.Lobb@ru.ac.za immediately if you are unable to do so.

LATECOMERS

If you have not registered during the Orientation Week you **must** see the following people as soon as possible:

1. Either: Your Faculty Dean:

Science – Prof T Booth, Botany Department

Pharmacy - Prof S Khamanga, 4th floor, room 405 Chemistry Building

Or: Enquire at the **Student Bureau** in the **Eden Grove Building**, Lucas Avenue.

They will formally register you as a BSc (or BPharm) student and will indicate on which afternoons you will do the practical sessions for each of your subjects.

2. Prof K Lobb, Room S40, Second Floor, Chemistry Building (K.Lobb@ru.ac.za),

3. It is also important to find out who has been lecturing the course so that you can obtain any handouts, tutorial sheets, etc. that have already been issued. You will then need to catch up as quickly as possible.

LECTURES

These are in Barratt 1 Lecture Theatre

Depending on your group (and the allowed capacity) this may be Monday 21 February at 11:25 am (5th period) or Tuesday 22 February at 07:45 am. Please listen for details.

Lecture Periods:

Monday	period 5	11:25 - 12:10
Tuesday	period 1	07:45 - 08:30
Wednesday	period 2	08:40 - 09:25
Thursday	period 3	09:35 - 10:20
Friday	period 4	10:30 - 11:15

Non-refundable Fee:

R370 per semester is charged to cover accidental breakage of equipment and gloves in practical classes, laboratory notes and other course material, such as handouts.

TEXTBOOKS

- (i) D.D. Ebbing and S.D. Gammon, *General Chemistry*., 11th ed. (or earlier), Brookes/Cole/ Cengage Learning.

NOTE: It will be expected that students have this book from the beginning of the course.

- (ii) Tim Soderberg, *Organic Chemistry with a Biological Emphasis*,
[https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Organic_Chemistry_with_a_Biological_Emphasis_v2.0_\(Soderberg\)](https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Organic_Chemistry_with_a_Biological_Emphasis_v2.0_(Soderberg))

This textbook is also on RUConnected.

The following textbook is strongly recommended for Chemistry 102:

P. Atkins, L. Jones and L. Laverman: *Chemical Principles, The Quest for Insight*, 6th ed. W. H. Freeman and Company, New York, 2013.

New and second-hand textbooks are stocked by **Van Schaik Booksellers, 129 High Street**, (on the left, a short distance down High Street from the Drostdy Arch). Other first year general textbooks are also suitable for the **physical** and **inorganic** parts of the course. Similarly, other **organic** textbooks are suitable for the **organic** parts, especially: J. McMurry, *Fundamentals of Organic Chemistry*, Brooks/Cole; J. McMurry, *Organic Chemistry*, Brooks/Cole; T. W. Graham Solomons, Craig B. Fryhle, *Organic Chemistry*, Wiley; J. McMurry, *Organic Chemistry: a Biological Approach*, 2nd ed. (or earlier), Brookes/Cole/ Cengage Learning.

Second-hand books can often be purchased from previous students (see notices around the campus).

Some open source textbooks are available and linked to on the RUConnected Site:

<https://ruconnected.ru.ac.za/course/view.php?id=8864>

Also have a look at:

<http://www.chem1.com/acad/webtext/virtualtextbook.html>

<http://bookboon.com/en/textbooks/chemistry-chemical-engineering/chemistry>

<http://bookboon.com/en/textbooks/chemistry-chemical-engineering/fundamentals-of-chemistry>

<http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm>

Other online resources:

www.kahnacademy.org

www.chemtube3d.com

Interesting websites:

Interactive Periodic Table: <http://www.ptable.com/>
<http://rsc.li/periodic-table>

On this day in chemistry: <http://rsc.li/chemistry-calendar>

Chemistry students are also expected to purchase organic model kits. These are available from the Chemistry stores.

ABSENCES FROM TUTORIALS, TESTS, PRACTICALS & EXAMS

You are expected to ***be involved with all*** online activities, assignments, tutorials and practicals and ***hand in*** work for ***all*** tutorials and ***all*** practicals. If you are unable to do this for any reason you must provide a ***written*** explanation using an official '**Leave of Absence**'(LOA) form. These can be obtained from the Student Bureau, Eden Grove or from the departmental secretaries - First Floor, Chemistry Building. You may also contact K.Lobb@ru.ac.za (Room S40, Second Floor, Chemistry Building) for help with this.

If you have an on-going problem or illness, this must be made known well ***before*** an assessment task. If you miss an exam or summative assessment you ***must*** report within **24 hours** to The Student Bureau, Eden Grove.

PRACTICAL SESSIONS

The **First Year Laboratory** (the "**John Nunn Laboratory**") is on the Lower Ground Floor at the back of the building looking out on Prince Alfred Street. Either enter the Chemistry Building via the door near the North-West corner of the building (nearest corner to the traffic boom) and the laboratory doors are immediately on your left; or enter from the foyer at the front of the building, follow the Ground Floor corridor to the back, down to the bottom of the stairs, and the laboratory is facing you.

Practicals:

You will be assigned to attend practicals on a particular day each week, according to social distancing protocols. This information will be communicated to you. It is not possible to change your day and time without good reason. If you have such a reason, contact **Prof K Lobb (Room S40, Second Floor, Chemistry Building)** or email K.Lobb@ru.ac.za.

Equipment:

You will be issued with a locker of equipment for your exclusive use during the year. You are issued with a locker key and ***must*** ensure that ***all*** your equipment is returned to the locker and that it is ***properly*** locked at the end of each practical session. 'Borrowing' apparatus from fellow students is not permitted.

You will receive a Practical Manual containing details of, and instructions for, all the exercises you will be doing in the practical sessions. The practical exercises are designed to be completed, written up and marked on the same afternoon. ***You are expected to read through the practical before coming to the laboratory.***

Safety and Clothing:

Laboratory safety glasses are issued with the apparatus and you are strongly advised to wear them when there is the slightest danger of corrosive/hot liquids, etc., getting near your eyes. ***In practicals it is mandatory to wear the glasses throughout the practical session.***

You must provide your own '**laboratory coat**', which ***must*** be worn at all times while in the laboratory. You will be sent back to your room to fetch it if you forget to bring it! This is to protect your clothing and person from damage from acids, alkalis, coloured compounds, etc. Laboratory coats are sold at the **Main Chemistry Store** (while stocks last!).

You ***must*** also wear **closed shoes** that are securely fastened at the heel - i.e. no slops or sandals or pumps. These are to protect your feet from liquids, and also from broken glass. All **long** hair must be tied up and away from your face.

Practical Assessments:

These are held during normal practical periods throughout each semester. They will mostly be "**open book**" tests so you can refer to your Practical Manual. The total mark obtained for these short tests will form most

of your Practical Mark for the semester. **The Practical Mark counts 25% towards the end-of-semester Overall Mark** (see EXAMINATIONS below).

ASSESSMENT

One day every week is usually either a tutorial or a multiple-choice test on the material covered in the preceding few weeks. The tutorials and the tests are held, in place of a lecture, in the **Great Hall**, generally in the following timetabled Chemistry 1 slot: **Friday, 4th Period (10:30 - 11:15)**

If you have **not** been told of a tutorial or test, go to your lecture venue for a normal lecture.

Multiple-choice Tests:

At regular intervals, multiple-choice tests are held on the current work, in place of the weekly tutorials. The combined marks count **7.5% of the final semester mark** (see EXAMINATIONS below).

At the beginning of the second and fourth terms (ie in April and September) there will be **Departmental Tests** in the same format as the end-of-semester University Examinations. The marks for each test will count **7.5% towards the Final Overall Mark** for that semester. Writing each Test is a DP requirement for that semester (see below).

Examinations

University examinations are held at the end of each semester in June and November.

Overall Mark

The Overall Mark for each semester-course comprises:

End-of-Semester Theory Examination Mark	60%
Practical Mark (including practical tests) + Practical Coursework	25%
Course Mark (Continuous Assessment)	15%

Credits, Rewrites and Remedial Courses:

In the CHE101 examinations in June:

- (1) Students who obtain **at least 50% overall** with **at least 40%** in **theory** will obtain a Credit for CHE101 and will continue with the CHE102 course in July.
- (2) Students who fail to get **at least 50% overall** but who achieve **at least 40%** in the **theory** paper, may join the CHE102 course in July but must write a second CHE101 paper as well as their CHE102 paper in November. The highest mark will count as their mark for CHE101. Those with **at least 45% overall** may opt not to rewrite in November, but take a chance on aggregating with their (hopefully good) CHE102 mark.
- (3) Students who obtain from **20% to 39%** in the **theory** paper will transfer to **Chemistry 1R1** and take 1½ years to complete Chemistry 1 as follows:

(a) July-Nov 2022: Revision of CHE101 material covered in February-June + attendance at CHE102 practicals.

(b) November 2022: Write the CHE1R1 Examination.

If a Credit is then obtained for CHE1R1:

(c) Feb-June 2023: Do CHE1R2 (same curriculum as CHE102)

(d) June 2023: Write a CHE1R2 examination.

If a credit is not obtained for CHE1R2:

(e) July 2023: Join the CHE102 course.

- (4) Students who obtain **less than 20%** in the **theory** paper cannot continue with any Chemistry courses in 2022.

In the CHE102 examination in November:

- (1) Students who obtain **at least 50% overall** with **at least 40%** in **theory** will obtain a Credit for CHE102.
- (2) An Aggregated Credit (**ACR**) will be awarded for **CHEMISTRY 1** if the combined overall marks for CHE101 and CHE102 are **at least 50%** with **at least 40%** for each CHE101 **theory** and CHE102 **theory**. **NOTE:** Aggregation is only permitted for semesters written in the **same calendar** year. Further the individual total mark for either course **may not be less than 45%**.
- (3) The following may be granted a Supplementary CHE102 Examination in January:
 - (a) Students whose **combined overall** mark for CHE101 and CHE102 is **less than 50%** and whose CHE102 **theory** mark is **at least 40%**.

Repeating Students in February:

- (1) Students with a Credit in CHE102 will register for only CHE101 with the possibility of obtaining a Credit in June and completing the requirements for Chemistry 1.
- (2) Students with a Credit in CHE101 and who already have a practical mark for CHE102 will register for only CHE1R2 first semester and will write a CHE1R2 paper in June with the chance of obtaining a Credit and completing the requirements for Chemistry 1.

Support Tutorials

Support tutorials are run by **Mrs Joyce Sewry** and **Mrs Bertha Chithambo**. If you are struggling or wish to improve your mark you should be involved with these support tutorials. Accessing these support tutorials is detailed on RU connected. If you are on a 4-year programme (BScF2), or if you did not do Physical Science at school you **must** be involved with these at least 2 times a week. In these cases, it is a **DP** requirement.

Academic Problems:

Several possible sources of help exist depending on the nature of the problem:

- If you are having trouble with aspects of a particular topic in Chemistry, the best source of help is the **lecturer** giving that topic. However, first make a serious attempt to understand the problems yourself with the aid of your notes and textbook.
- If your question is about the course please contact the course coordinator Prof. Kevin Lobb (K.Lobb@ru.ac.za).
- You can also contact **Mrs Joyce Sewry, room S36, on the second floor of the Chemistry Building**. She runs the **Support Tutorials** for students who need extra help (see above).
- If you find that all your subjects are overwhelming you, then it is worth talking to:
Dean of Science (Prof T Booth, Botany Dept)
 or to the **Dean of Pharmacy (Prof S Khamanga, 4th Floor, Chemistry Building)**.

DULY PERFORMED (DP) CERTIFICATES

Rule G19 in the General Regulations in the Rhodes University Calendar reads as follows:

'Subject to any exceptions approved by Senate, a student shall not be admitted to an examination in any course unless the Head of the Department concerned has certified that the student has satisfactorily attended the class meetings for the course under examination, and has satisfactorily performed the work of the class.'

The *'work of the class'* is a broad term including lectures, tutorial attendance, assignments, practicals and tests. To obtain a DP Certificate in first year Chemistry, a student must have

- (i) attended lectures and performed **all** assigned tutorials, essays and practical work satisfactorily. Students are expected to provide reasons **in writing** for any absences using an official '**Leave of Absence**' form.

In addition, to be admitted to:

the CHE101 Examination in June:

- (ii) a student must have written all continuous assessment tasks, and attended and submitted all practicals.

the CHE102 Examination in November:

- (ii) a student must have written all continuous assessment tasks, and attended and submitted all practicals.; and
- (iii) a student must have achieved at least 40% in the CHE101 June Theory Paper.

LECTURERS

All the lecturers have offices above the Chemistry Entrance Foyer overlooking Artillery Road. A room number with the letter 'F' indicates 'First Floor', while an 'S' indicates 'Second Floor'.



Prof K. Lobb
Initials: KL (S40)
Course Coordinator
K.Lobb@ru.ac.za



Mrs B. Chithambo
Initials: BC
Course Coordinator
B.Chithambo@ru.ac.za



Mrs J. Sewry
Initials: JDS
Deputy Dean of
Science (S36)
J.Sewry@ru.ac.za



Mrs V. Makabe-Manyati
Practical
Coordinator
V.Makabe@ru.ac.za



Prof R. Klein
Initials: RK
(F38) Head of
Department
R,Klein@ru.ac.za



Dr N Molefe
Initials: NM
M.Molefe@ru.ac.za



Dr V. Smith
Initials: VS (S35)
V.Smith@ru.ac.za



Prof R. Krause
Initials: RWMK (F42)
R.Krause@ru.ac.za



Dr T. Geswindt
Initials: TG
T.Geswindt@ru.ac.za



Prof. P. Mashazi
Initials: PM (F44)
P.Mashazi@ru.ac.za



Dr T. Tshiwawa
Initials: TT
T.Tshiwawa@ru.ac.za

COURSE CONTENTS

CHE101 – FUNDAMENTAL PRINCIPLES OF CHEMICAL SYSTEMS

Lectured from February to June. Examined in June by one 2½ hour theory paper
Contents of the paper are as follows (number of lectures is indicated in the Timetable below):

Symbols and Chemical Numeracy

Units. Nomenclature and definitions. Chemical equations. Measuring amounts of substances; moles; concentrations of solutions, molarity, Stoichiometric calculations. The ideal gas law and moles of gas.

Atomic Structure

Background: light, spectra, quantum theory, early atomic theories, Rutherford's nuclear atom, Bohr and Bohr-Sommerfeld theories, quantum numbers.

Wave Theory: De Broglie and the nature of the electron, wave mechanical theory, a qualitative look at solutions to the theory, orbital shapes and energies, quantum numbers, Aufbau, Pauli, Hund, Periodic Table.

Bonding:

Effective nuclear charge, atomic radii, ionisation energies, electron affinity, ionic bonding. Covalent bonding, polar molecules, σ and π bonds, bonding and antibonding orbitals, homonuclear diatomic molecules. Heteronuclear molecules, Lewis structures, VSEPR theory, sp^n hybridisation, delocalised orbitals, C_6H_6 , SO_2 . Polarity, van der Waals forces, H-bonding.

Physical Equilibrium, Colligative Properties

Phases, states, physical equilibria. Changes of state and phase. Phase diagrams. Colligative properties: lowering of vapour pressure, depression of freezing point, elevation of the boiling point, osmotic pressure

Chemical Equilibrium, Analytical Chemistry.

Concentration units; Chemical equilibria. Solutions and solubility. Ionic reactions and ionic equilibria. Solubility product. Effect of common ions and complex formation. Acids and bases. Arrhenius, Bronsted-Lowry and Lewis theories. Ionisation constants. pH. Hydrolysis of salts. Acid-base titration curves. Buffer solutions. Polyprotic acids. Acid-base indicators.

Introductory Principles in Organic Chemistry

Organic chemistry (functional groups; saturated and unsaturated structures; isomers; IUPAC naming and structural formulae, drawing organic structures, physical properties in relation to structure - as chain length and functional group change; Geometric isomerism and introduction to E/Z nomenclature. Introduction to IR and NMR spectroscopy

CHE102 – FUNDAMENTAL PROPERTIES OF CHEMICAL SYSTEMS

Lectured from July to October. Examined in November by one 2½ hour theory paper
Contents of the paper are as follows (number of lectures is indicated in the Timetable below):

Chemical Energy

Conservation of energy, heat and work, heat capacity and calorimetry. Enthalpy changes, phase changes and enthalpy of transition, enthalpy of reaction, enthalpy of formation, bond energies. Entropy changes, spontaneous direction of reaction, Gibbs function.

Reaction Rates (Kinetics)

Definition of reaction rate, Dependence of rate on concentration, rate equations. Reaction order, determination of order of reaction. Half lives of reactions. Temperature dependence (Arrhenius equation). Molecularity and the activated complex. Reaction mechanisms. Catalysis. Inhibition. Radiocarbon dating; dating rocks.

Electrochemistry

Electrolysis. Voltaic cells, electrode potentials, the Nernst equation, applications of electrochemistry. Oxidation numbers, redox reactions.

Organic Functional Group Chemistry

Structure/reaction relationships, SN1/SN2, E1/E2 reactions mechanisms; chemical reactions (oxidation and reduction, substitution, addition and elimination, condensation - preparation of esters). Organic Acids and bases. Introduction to Biological Molecules.

Inorganic Systems

General properties of elements and their compounds related to the Periodic Table : Atomic size, electronegativity and electronic structure. The chemistry of the s block elements. Nitrogen, Oxygen, Sulphur and the Halogens. Introduction to transition elements (general properties, coordination complexes, stereochemistry, introduction to crystal field theory).

Environment

Atmospheric chemistry (Chemical implications of acid rain, the ozone layer and the Greenhouse Effect). Nuclear chemistry.

TIMETABLE - CHEMISTRY 1 - 2022

CHEMISTRY 101			
Dates	Topic	Lecturer	No. of Lectures
21/02 – 04/03	Symbols and chemical numeracy	Mrs J Sewry	10
07/03 – 24/03	Atomic Structure & Bonding	Prof K Lobb	14
28/03 – 06/05	Chemical and Physical Equilibria	Dr N. Molefe	21
09/05 – 25/05	Organic Chemistry I	Prof R Krause	14
CHEMISTRY 102			
11/07– 02/08	Organic II and Bio Building Blocks	Prof R Klein	17
03/08 – 19/08	Chemical Energy	Dr T. Tshiwawa	11
29/08 – 07/09	Kinetics	Prof P Mashazi	8
08/09 – 21/09	Electrochemistry	Prof P Mashazi	9
22/09 – 03/10	Atmospheric, Environmental and Nuclear Chemistry	Dr V Smith	8
04/10 – 14/10	Inorganic Chem	Dr V Smith	8

Multiple Choice Tests in 4th Period (10h30) Friday (venue to be confirmed):

First Semester: 25 March, 29 April and 27 May

Second Semester: 05 August, 16 September and 14 October

Departmental Tests at 7:00 pm:

Wednesday 30 March Barratt Lecture Theatres

Wednesday 17 August Barratt Lecture Theatres
