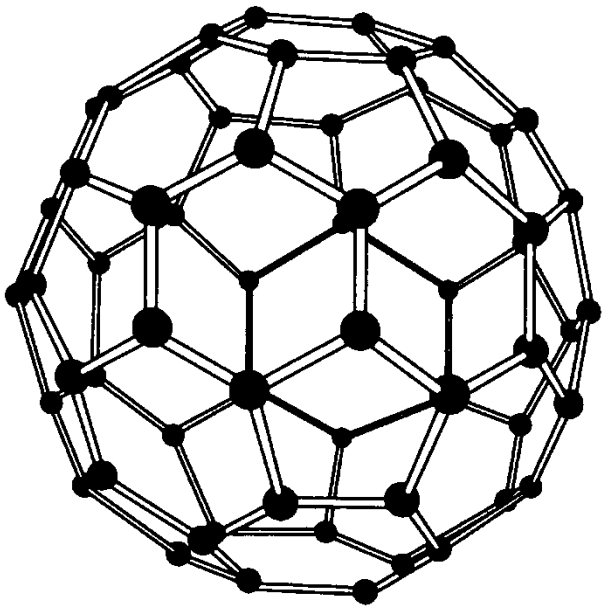
University of Glasgow | School of Chemistry

Chemistry 1

CHEM 1001

Course Handbook

2019 – 2020



Welcome from the Head of School

Welcome to first-year Chemistry at the University of Glasgow. You join a University where chemistry has been taught for over 250 years, and a School of Chemistry that is one of the leading UK centres of research; the lecturers you will encounter during your time here will often be leaders in their field, researching and publishing papers as well as lecturing and tutoring our undergraduates. Whether your intention is to stay with us to complete an Honours BSc or MSci degree in one of the Chemistry programmes or to study for some other degree, we hope you will enjoy and benefit from your time spent studying chemistry, one of the central sciences with many links to other disciplines.

The Chemistry-1 course has been designed to be both useful and interesting to all students by providing a firm basis for later courses in Chemistry and other subjects. The Chemistry-1 course is not easy; no course at university should be easy. It is challenging and will be a major change from your previous studies in chemistry. Now that you are undergraduates, the emphasis in your learning should shift – we are here to help teach you and introduce a structured approach to many of the relevant ideas in Chemistry, but most importantly, you are here to learn. The onus is on you to read, discuss and practise during the year. In addition to lectures and laboratory courses, you will be required to attend problem sessions, which are intended to help you to understand the concepts introduced during the lectures, to discuss these and to practise them by answering appropriate questions.

At university, with the large classes, you will have to organise your study time, check your progress and, if you have difficulties, ask for help. Nobody is penalised for asking for help or further explanation. The staff are here to help you, but we can only help if we know you have a problem. There are regular voluntary tutorials where you can ask questions. You can also ask the lecturer or any member of staff in problem sessions or laboratories if you require help or send an e-mail to your lecturers. For any matters relating to administration or personal problems, please consult the course head, Dr Hans Senn (chem-level1@glasgow.ac.uk).

It is essential that you read this Handbook carefully and thoroughly. I would draw your attention particularly to the sections dealing with the Award of Credits and Absence. It is important that we have full details of any absences through illness or other problems during the year in order that these may be taken into account in the assessment of your work at the end of the course.

I am sure that you will find the Chemistry-1 course interesting and enjoyable and that you will be successful at the end of the course. We look forward to welcoming many of you into the Chemistry 2 course in a year's time.

Professor Graeme Cooke
Head of School
Graeme.Cooke@glasgow.ac.uk

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1 Course aims and Intended Learning Outcomes

The aims of the Chemistry-1 course are to

- broaden students' knowledge of the facts, theories, concepts, applications, development, and importance of chemistry;
- enhance skills in handling numbers, units, equations, diagrams and abstract ideas; analysing data; prioritising information; making deductions; taking decisions; making and justifying proposals; and in communicating and reporting clearly;
- provide a sound basis for those students who may decide to proceed to Honours in chemistry or a related science;
- encourage interest in the subject and its interaction with other sciences;
- give experience in the safe and accurate handling of chemical substances and apparatus;
- encourage development of learning strategies.

Intended Learning Outcomes (ILOs): By the end of this course, students should be able to

- demonstrate a knowledge and understanding of the basic facts and experimental basis of modern chemistry;
- solve elementary problems of a numeric or logical nature in the chemistry context;
- demonstrate practical skills in chemical techniques.

For a more detailed overview of the topics covered in each of the modules of the course, see Sect. 10 on pp. 15 ff.

2 Contacts and communications

If you have any queries or problems, bring them to the attention of the relevant person as soon as possible. Staff are here to help, but we can only help if we are aware of the problem. Try to raise the problem when and where it arises – often there is a straightforward, practical solution right there and then.

Course head

Dr Hans Senn
chem-level1@glasgow.ac.uk, direct line 0141 330 6574
Joseph Black Building, Room A5-11

Contact Dr Senn for any course-related administrative or general inquiries or if there are any personal problems affecting your studies.

Deputy course head: Prof S. David Jackson
David.Jackson@glasgow.ac.uk

Course secretary: Mrs Kate McGarrigle
cathrine.mcgarrigle@glasgow.ac.uk, direct line 0141 330 6438
Chemistry Teaching Office (Joseph Black, Room A4-30)

Synthesis Lab coordinator	Dr Götz Bucher synth-1-lab@chem.gla.ac.uk
Quantitative Lab coordinator	Dr Smita Odedra Smita.Odedra@glasgow.ac.uk
Lecturers	If you have a question on the material or contents of a particular lecture, feel free to contact the respective lecturer directly. You find the names and e-mail addresses of the lecturers in Sect. 10 on pp. 15 ff.
School disability coordinator	Prof S. David Jackson David.Jackson@glasgow.ac.uk, Joseph Black, Room A4-42 If you have a physical or mental condition that might impact on your studies, you should register with Disability Service, which will ensure that the appropriate information is disseminated to relevant staff across the University. However, if there are any disability-related concerns or requirements specific to Chemistry, please contact Prof Jackson.
Advisors of studies	Your personal Advisor of studies is the central point of contact for advice about programme and course choices, study-related or personal problems that impact on more than one course, and any queries you are not sure where to go with. Your Advisor may not have all the answers at his/her fingertips, but he/she will be able to help you find the right person or service for your problem.

The course head and lecturers (and most other branches of the University) rely primarily on e-mail to communicate with you. It is therefore essential that you **check your *University e-mail account* on a daily basis**.

Also, course materials, notices, and updates are posted on **Moodle**, the University's e-learning system. Everyone enrolled in the course automatically has access to the Chemistry-1 Moodle pages and will receive messages posted on the News Forum. Check Moodle regularly for news and updates.

3 Enrolment

All students in the class must register and enrol on MyCampus and complete a student information form (handed out at the Induction session and also available on Moodle). All students must have a white, 100% cotton **lab coat**, which can be purchased on MyCampus for £15.

If you have difficulties enrolling on MyCampus, please see www.gla.ac.uk/services/registry/enrolment/#/self-serviceguide or contact your Advisor of studies. The *Welcome to Science Guide* (www.gla.ac.uk/media/media_596348_en.pdf) provides useful information about enrolling, course options, and progression to higher levels.

4 Course structure

4.1 Overview

Lectures

There are ca. 80 one-hour lectures, given Monday to Friday over 22 weeks; see the timetable on p. 14. Because of its large size, the class meets in two sections: one in the morning at 10:00 and one in the afternoon at 15:00. It is important to only go to the lectures at the time allocated to you. *The course uses a number of different lecture venues. Please check the timetable and MyCampus for the correct venue for any given lecture slot.*

Lectures provide facts, theories, demonstrations, textbook references and background. The lectures are grouped into **modules** of 6–8 lectures, which cover a particular topic and are delivered by different lecturers.

An overview of the topics covered in each module can be found in Sect. 10 on pp. 15 ff.

Problem sessions

The last slot of each module is used for a problem-solving session. Supplementary problems may be provided for you to work on at home. See Sect. 4.2 below for more details.

Laboratory

Each student will attend one three-hour laboratory session per week, starting in Week 3. Lab times are 10:00–13:00 on Tuesday–Friday and 14:00–17:00 on Monday, Tuesday and Thursday. You will be assigned a bench number and first experiment number. More details are given in Sect. 4.3 below.

Maths For Chemists

Eight **e-learning units**, covering basic mathematical concepts and skills, are presented on Moodle. Each unit comes with an e-assessment in the form of a Moodle quiz. **The Maths For Chemists module is compulsory for students without sufficient prior maths qualifications** (Higher Maths at B or equivalent). See Sect. 4.4 below for more details.

Learning

Involves all of the above plus text books (see Sect. 4.5 below), private study and practice, general reading and discussion.

4.2 Problem-solving sessions

Problem-solving sessions will be held at the normal lecture times and are indicated by “PS” on the timetable. Their purpose is to practise using the knowledge you have gained from lectures, to present worked solutions to exam-type problems, and to prepare you for the laboratory work.

You should bring the following **equipment** with you in every problem session:

- The **problem sheet(s)** with the questions. These will be available on Moodle in advance of the session.

- A **calculator** capable of scientific notation ("1.5E–4"), decadic ("log") and natural ("ln") logarithms (i.e., logarithms to base 10 and base e), trigonometric functions, and inverse functions. Please note that programmable calculators are not allowed in University examinations.

- A **Periodic Table** (*e.g.*, the one you received at the Induction session at the start of the course).

The topics of the sessions and the problem sheets will be available on Moodle in advance. The sessions are run in *workshop style*. After a short introduction by the lecturer, you will be asked to work through the problems, collaborating with friends if you wish. In addition to the lecturer, student tutors will be available. Raise your hand if you need help with the problems. Answers and explanations will be given as the session progresses, but it is no use sitting waiting until they are displayed – you will not have learned anything unless you work at it yourself. Some lecturers will provide supplementary problems for you to try at home.

The solutions to the problems will be available on Moodle after the sessions.

4.3 Laboratory practical work

The laboratory work (3 hours per week) is designed to give you practice in safely and accurately carrying out preparations, analyses or measurements, reporting and interpreting results.

It also offers a chance to

- undertake chemical reactions yourself,
- operate instruments and collect experimental data,
- think about experiment design,
- check your understanding of particular topics,
- talk to demonstrators.

Concepts, procedures and knowledge met in the lab may appear in written exams. Your reports and oral answers will be marked, and these marks and your attendance record contribute to the award of lab grades and count for 10% of the overall mark (see Sect. 5).

Attendance in Laboratories is compulsory. For justified, planned absences (*e.g.*, participation at University sports events, attendance at a family wedding, medical appointments), it may be possible to rearrange your Lab time. Please contact the Lab coordinator in good time.

If this is not possible, you need to report and explain your absence in an **Absence Report**, as set out in Sect. 6.

When in the Lab, you must wear a white, 100% cotton **lab coat** and **safety glasses** at **all** times. A suitable lab coat may be purchased from us for £15. You will be provided with a lab manual, safety glasses, and other materials. You must bring these items to every Lab session. You will not be allowed to enter the laboratory without the required safety equipment.

Lab sessions start in Week 3 with workshops on laboratory calculations; no lab coat and safety glasses are required for the workshops in Weeks 3 and 4. Safety glasses will be distributed in the Week 5 Labs. Bring a calculator to all Labs; the use of mobile phones in the Lab is not allowed.

For organisational and practical reasons, it is not possible to repeat experiments.

4.4 Maths For Chemists e-learning module

Chemistry-1 does not require any specialised mathematical skills beyond what we would expect you to be familiar with from school. The purpose of the ***Maths For Chemists*** **(M4C) e-learning units** is to introduce and practise a minimal set of mathematical concepts and skills as a reminder for everyone and specifically to support those students who may have gaps in their school maths. The M4C module is a pure e-learning module.

The M4C e-learning module is **compulsory** for students **without** prior maths qualifications equivalent to at least **Higher Maths at B**. Taking, or having passed, the courses Mathematics 1C **and** 1G (MATHS 1015 and 1016) is accepted as an equivalent to Higher Maths at B.

All students are encouraged to peruse the M4C material and quizzes to make sure that they are familiar with the skills and concepts presented. There are eight units, each covering a set of connected topics relevant to chemistry. Each unit comes with an e-assessment in the form of a Moodle quiz.

For students who do **not** have at least **Higher Maths at B** (or equivalent), the following requirements apply:

- **You must complete all M4C units during Semester 1. Each quiz will be open for one week only, starting in Week 3. You must take each quiz during the allocated time window.** By the end of the semester, you must have **passed at least 75% of the quizzes** (that is, 6 out of 8).
- The schedule of when the quizzes open and close will be available on Moodle. While a quiz is open, you have several attempts to pass it. The pass level for each quiz is set at 70%. Failing the M4C requirement puts you at risk of being refused credit for the Chemistry-1 course.
- Switching to a Chemistry degree programme later on requires that you have passed the M4C module in Chem-1.

If you have any difficulties with the M4C material, please seek help from the Maths Adviser (see Sect. 4.7).

4.5 Textbooks

All students should have a copy of the main course text:

> Burrows, Holman, Parsons, Pilling, Price, *Chemistry*^{3}, **3rd edn.**, Oxford University Press, 2017; ISBN 9780198733805.

You can also opt to get the **e-book** instead of the print copy. The e-book allows for off-line reading and annotating.

The book comes with an on-line "**Ancillary Resource Centre**" (https://oup-arc.com/access/burrows3e-student-resources), which is freely accessible to everybody. The ARC offers a range of additional learning resources, including chapter summaries, video clips, and self-test questions.

Students with a weaker **mathematical background** will find the following book useful; it covers all the maths required, and sufficient, for the entire chemistry degree programme.

> Cockett, Doggett, *Maths for Chemists*, 2nd edn., RSC Publishing, 2012; ISBN 9781849733595.

The following little book is a compact source of advice and information on various **"soft" skills** required at university (preparing for lectures, writing lab reports and essays, presenting talks and posters, *etc*.). The book is useful throughout all levels of Chemistry and for the physical sciences generally.

> Overton, Johnson, Scott, *Study and Communication Skills for the Chemical Sciences*, 3rd edn., Oxford University Press, 2019; ISBN 9780198821816.

4.6 Your own learning

Lecturers will post the slides used in the lectures and/or separate lecture notes on Moodle ahead of the lecture. It is strongly recommended that you take a look at this material *before* the lecture to get an idea of the general content. It is expected that you have a printed or electronic copy of the material in front of you when you go into the lecture.

During the lectures, follow the explanations given by the lecturer and annotate your copy of the material. Note down additional points presented by the lecturer on the board or screen. Try to capture as much as you can of the *key points* of what is said. As soon as possible after the lecture, fill out your notes from memory, by collaborating with a friend, and by looking up books to reconstruct the full story.

We know that you will not always understand topics fully during the lecture. Lectures, Labs, *etc*. provide the *teaching*: you are presented with – often unfamiliar and complex – concepts, knowledge, and skills. The lecturer will break down and structure the material, introducing and explaining it, to help you digest it. Problem sessions and revision tutorials will also support you in mastering the material. However, the *learning* is largely your own responsibility. Later reading, digestion, discussion and practice are needed. Book references will be given in lectures; *look them up* and incorporate diagrams, examples *etc*. from them into your notes.

The amount of private study you do will depend on your level of interest and ambition for excellence in the subject. To achieve a good grade and consolidate your knowledge, you need to invest a considerable amount of time in private study. Although there are only about 130 contact hours for the course (~80 h of lectures and problem sessions, ~50 h of labs), the total number of *learning hours* is 400 (hence, it is a 40-credit course). That is, *in addition to attending the timetabled contact hours, you should expect to spend about 270 h in private study*. This includes preparing for lectures, consolidating the material and text-book reading after each lecture, solving problems and sample questions, revising for tests and exams, *etc*.

Keep your lecture notes safe; it is not only cumbersome and costly to copy other students' notes, but they can never be as good as your own. Students who "skip" lectures often find it very difficult to catch up with their work. The purpose of a lecture is to help you understand the material – not just to give you a set of notes. *So attendance at all lectures helps you to understand the chemistry.*

4.7 Additional learning resources

Students who have difficulties with the level of **maths** required are strongly advised to seek help from the Maths Adviser (part of the Learning Enhancement and Academic Development Service, LEADS); see www.gla.ac.uk/myglasgow/leads/students/mathsandstats/maths/.

LEADS also offers workshops and individual appointments to help you with various aspects of **academic skills**; see www.gla.ac.uk/myglasgow/leads/students/writingstudyadvice/scienceengineering/.

Several websites are available that are useful for helping you understand certain aspects of chemistry; *e.g.*, https://www.thoughtco.com/chemistry-4133594. Further links are available on the Chemistry-1 Moodle pages.

5 Assessment

5.1 Calculation of the final grade

The final grade for the course is calculated from the following components (items of "summative assessment"):

End-of-course Exam (2 h)	50% (in April/May, covering the entire course)
Class Exam (2 h)	30% (in December, covering all of Semester 1)
Class Tests	10% (4 tests in regular lecture slots)
Laboratory work	10%

5.2 Minimum requirements for the award of credit

In order to be awarded credit for the course, you must complete **at least 75%** of the overall assessment. You therefore must meet the following requirements:

- sit the December Class Examination;
- sit the End-of-course Examination.

In addition, you are required to

- have a good participation and **attendance** record (**minimum 75%**) in **both Laboratory components**;
- if you do **not** have at least Higher Maths at B (or equivalent): pass **at least 75%** of the **M4C Moodle quizzes**.

No grade or credits shall normally be awarded to a candidate who has not met these requirements. In this case, you will be deemed not to have completed the course, which is shown by a grade CR ("Credit Refused") on MyCampus. This will prevent you from entering Level-2 courses that have Chemistry-1 as a prerequisite; in particular, Chem-2X/2Y and most Level-2 Biology courses.

If you miss an assessment due to adverse circumstances (*e.g.*, illness), you should submit a **Good Cause** claim on MyCampus, providing an explanation and supporting evidence; see Sect. 6.3.

5.3 Class Tests

Four Class Tests will take place over on Fridays at normal lecture times over the course of the year. These slots are labelled as PB or PBL sessions on the on-line timetable. The purpose of the Tests is to encourage you to work steadily throughout the year and to give you an indication of your progress. The class will be split between two lecture theatres; details will be announced on Moodle. Each Test lasts ~30 min, allowing time for settling down before the Test starts and collection of papers afterwards.

Class Tests will be in **multiple-choice format**. A sample test in the same format will be available on Moodle a week before each test for you to practise at home. The answers to the practice questions will be released on Moodle two days before the test. A **Revision Tutorial** is scheduled for the day before the test. This provides an opportunity for you to ask questions about the practice problems and the material being examined.

Like for problem sessions, you need to bring a **Periodic Table** and your own **calculator** to the Class Tests. **The Periodic Table must be unmarked; programmable or graphical calculators are not allowed**.

If you are absent from any of the Class Tests, it is important that you explain your absence on MyCampus, submitting a **Good Cause** claim (see Sect. 6.3). If you do not provide an acceptable explanation, the test will count with grade H (0 Points) towards your final grade.

The answers and results of the Tests will be available on Moodle. Students who performed poorly are expected to attend the **Revision Tutorial after the test**, which will cover the questions of the Test.

5.4 Examinations

The **Class Examination** (2 h) takes place in December. *It is important that you do well in the Class Exam as this contributes 30% to your final course grade.* A poor performance will put pressure on you to work significantly harder for the End-of-course Exam. It is vitally important for you to plan your work from the start with this in mind.

The Class Exam will be in **multiple-choice format**, with which you will be familiar from the Class Tests. However, the Class Exam will take place under examination conditions, that is, in a venue with spaced-out, individual desks and invigilators present. A sample exam will be available on Moodle.

The **End-of-course Examination** (2 h) takes place in April or early May. This exam will also be in **multiple-choice format**. Past exam papers will be available on Moodle. Exams may include material presented in lectures, Labs, and Problem Sessions, testing knowledge, understanding, and application.

Periodic Tables will be provided for both examinations. However, you need to bring your own **calculator**. Programmable or graphical calculators are not allowed.

Absence or adverse circumstances (*e.g.*, illness) at exam times must be reported on MyCampus (**Good Cause claim**, see Sect. 6.3) and supported by a medical certificate or other appropriate documentation.

5.5 Grade scales, grade reporting

Throughout the course, you will receive feedback through marks and grades in Tests, Lab reports, and the Class Exam, together with verbal feedback in Laboratories. This will enable you to judge how you are performing on the course and seek help when necessary.

Grades for Labs, Tests, and the Class Exam will be expressed on the University's grade scale of 0–22 Points, which is divided into eight bands designated by letters A to H. Each band is subdivided (*e.g.*, C1, C2, C3) to create 23 secondary bands that correspond to the point scale.

Grades will initially be calculated as a percentage (*e.g.*, for a Class Test, 18/26 marks = 69.2%). The table shows the correspondence between percentages, Points, and grades. Note that the conversion from percentages to Points is done by a formula, the table should be used as an indication only.

All feedback provided on coursework used in assessment, including grades from the Class Exam, Class Tests, and Laboratories, is strictly provisional and for your guidance only and is subject to ratification by the Board of Examiners at the end of the course. The University code of assessment is available in the General Section of the University Calendar (www.gla.ac.uk/services/senateoffice/policies/calendar/).

Points	Grade	% Mark
0	H	0.0
1	G2	11.9
2	G1	15.5
3	F3	19.1
4	F2	22.8
5	F1	26.4
6	E3	30.0
7	E2	33.7
8	E1	37.3
9	D3	41.0
10	D2	44.6
11	D1	48.2
12	C3	51.9
13	C2	55.5
14	C1	59.1
15	B3	62.8
16	B2	66.4
17	B1	70.0
18	A5	73.7
19	A4	77.3
20	A3	81.0
21	A2	84.6
22	A1	88.2

5.6 Grade point average, progression, admission to Honours

The final grade awarded at the end of the course contributes towards your grade-point average (GPA), which is calculated as follows:

> Total Grade Points = Sum of (Points × credits) for all courses
> GPA = Total Grade Points / Total credits

The full GPA and credit requirements for BSc and MSci programmes are set out in the University Calendar; please consult your Advisor of studies for details. The following is a brief summary of the most pertinent points:

- Your GPA should normally be 9 or above in each year of study.
- Most Level-2 courses require that you have passed the prerequisite Level-1 courses with at least grade D3. *E.g.*, entry into Chemistry-2 courses requires a D3 or better in Chemistry-1.
- For some Level-2 and Level-3 courses, entry is competitive, with preference given to those students with a higher GPA or higher grades in the prerequisite courses.
- Admission to Honours after the end of Year 2 requires a GPA over the first two years of at least 9 for BSc (Hons) and at least 12 for MSci.
- Most Honours programmes have additional minimum-grade requirements for subject-specific-courses. *E.g.*, for Chemistry, admission to BSc (Hons) requires at least grade C3 in the Level-2 Chemistry courses; admission to MSci requires at least grade B3.

It is therefore important that you make sure you work steadily throughout the year in every subject. Low grades may cause problems with progress.

6 Absence reporting, Good Cause claims

6.1 Absence report or Good Cause claim?

The full University student absence policy can be found on www.gla.ac.uk/services/senateoffice/policies/studentsupport/absencepolicy/. The following is a summary of the essential points. The main mechanism to report, and explain, absences is MyCampus. The advantage of this system is that it allows you to register your report and upload supporting evidence, which will be on record and available to the course head and your Advisor of studies.

There are two types of reports: *Absence Reports* and *Good Cause claims*. Depending on the situation, you should use one or the other.

Report of a "significant absence":

1. You have missed (are going to miss) more than seven consecutive days of classes.
2. You have had (are going to have) a number of shorter absences.
3. You have missed (are going to miss) a class where attendance is compulsory for the award of credit or that is part of a set of classes with a required minimum attendance level.

Good Cause claim:

1. You have missed (are going to miss) a "scheduled summative assessment" (that is, tests, exams, and the like) or a deadline for the submission of an assessed piece of work.
2. You attended an assessment, but you believe that your performance was impaired by adverse circumstances.

Additional details for each case are provided in the following two sections. There is also a flow chart available that will help you determine which type of report to use: www.glasgow.ac.uk/media/media_424718_en.pdf.

You should use the type of report appropriate for your situation. However, a formally incorrect report is still better than no report. We try to take into account, and compensate for, adverse circumstances as fairly as we can within the University regulations. However, we can only do so if you let us know (in whatever form) *in good time* that you have been affected and *explain* (supported by documentary evidence) what happened.

If you have any concerns regarding your attendance, please contact the course head and/or your Advisor of studies.

6.2 Significant absence from classes

In the case of a "significant absence" (as defined above: a long absence; a series of shorter absences; or missing a class with required attendance), you must complete an *Absence Report* on MyCampus. Submit Part A of the report as soon as practical; Part B of the report must be completed within seven days of your return to the University.

Documentary evidence is required for any significant absence. MyCampus provides a facility for documentary evidence to be uploaded. It is your responsibility to keep the originals of all additional documentation and submit it to the Head of School on request. If you have concerns about uploading sensitive personal information, you must submit the original documents to your Advisor of studies, course head, or Head of School.

For Chemistry 1, an **Absence Report** is required in the following two situations: (1) You have missed (are going to miss) a **significant number of lectures**. (2) You have missed (are going to miss) a **Lab session** or **M4C submission deadline** (if you require an M4C pass).

6.3 Good cause claims

You must submit a *Good Cause claim* on MyCampus if you missed an assessment or believe that your performance in an assessment you attended was impaired by adverse circumstances. Good Cause claims must be received within **five working days** of the assessment affected. Late claims will not be considered unless a valid explanation for the delay is provided.

If you encounter any difficulties with submitting the claim on MyCampus in time, contact the course secretary (chem-level1@glasgow.ac.uk, 0141 330 6438) immediately to inform us about your Good Cause claim.

The course head will ensure that your claim is considered in accordance with the University's Code of Assessment (§§16.45–16.53). The decision about your claim will be posted on MyCampus under the Approval Information section of your Good Cause claim. If your claim is accepted, the work in question will be set aside and you will (as far as practicable) be afforded another opportunity to take the assessment. Further guidance on Good Cause claims is available from www.glasgow.ac.uk/media/media_420013_en.pdf.

For Chemistry 1, a **Good Cause claim** is required in connection with the following assessments: **Class Tests**, the December **Class Examination**, and the **End-of-course Examination**.

Note that a r**esit opportunity is available *only* for the End-of-course Exam**. If any of the other assessment components (Class Tests, Class Exams, Labs) are set aside, they are simply removed from the calculation of the final grade (which increases the weight of the remaining components accordingly).

7 Student support

7.1 Support services

Your mental and physical health and wellbeing are of prime importance. An up-to-date overview of crisis contacts as well as various kinds of support services is available on www.gla.ac.uk/myglasgow/students/safetyhealth/ .

7.2 Staff–student committee, course evaluation

At the start of the year, we will invite students in the Chemistry-1 class to volunteer to join the Chemistry Staff–Student Liaison Committee, which meets to discuss courses and other School business once per semester. The class representatives have a special responsibility to alert staff of any problems that develop in the running of the Chemistry-1 course.

All students will have an opportunity to comment on aspects of the course *via* on-line questionnaires. A summary of previous evaluations is available on Moodle. Any difficulties are most quickly resolved by informing the relevant member of staff or the class head directly.

7.3 Alchemists' club

The "Alchemists" are the chemistry student club and organise social events for undergraduates and postgrads throughout the year. The Alchemists also offer useful services, including a tutor service and a lab-coat hire facility; see www.chem.gla.ac.uk/alchemist/.

8 Relevant University policies

8.1 Plagiarism

Plagiarism is defined as the submission or presentation of work, in any form, which is not one's own, without acknowledgement of the sources. The University's degrees and other academic awards are given in recognition of the candidate's personal achievement. Plagiarism is therefore considered as an act of academic fraudulence and as an offence against University discipline.

Allegations of plagiarism will be treated very seriously and referred to the Head of School. A full statement of the University of Glasgow procedure for dealing with cases of suspected plagiarism

can be found in the General Section of the University Calendar (www.gla.ac.uk/services/senateoffice/policies/calendar/).

The University reserves the right to use plagiarism detection systems, which may be externally based, in the interests of improving academic standards when assessing student work. This regulation applies to all work submitted for assessment, including lab reports, class tests, and research projects unless you have specifically been told otherwise, for example, in the case of a group project or when a number of students share experimental data. Special cases of plagiarism can arise from one student copying another student's work or from inappropriate collaboration.

8.2 Recording of lectures

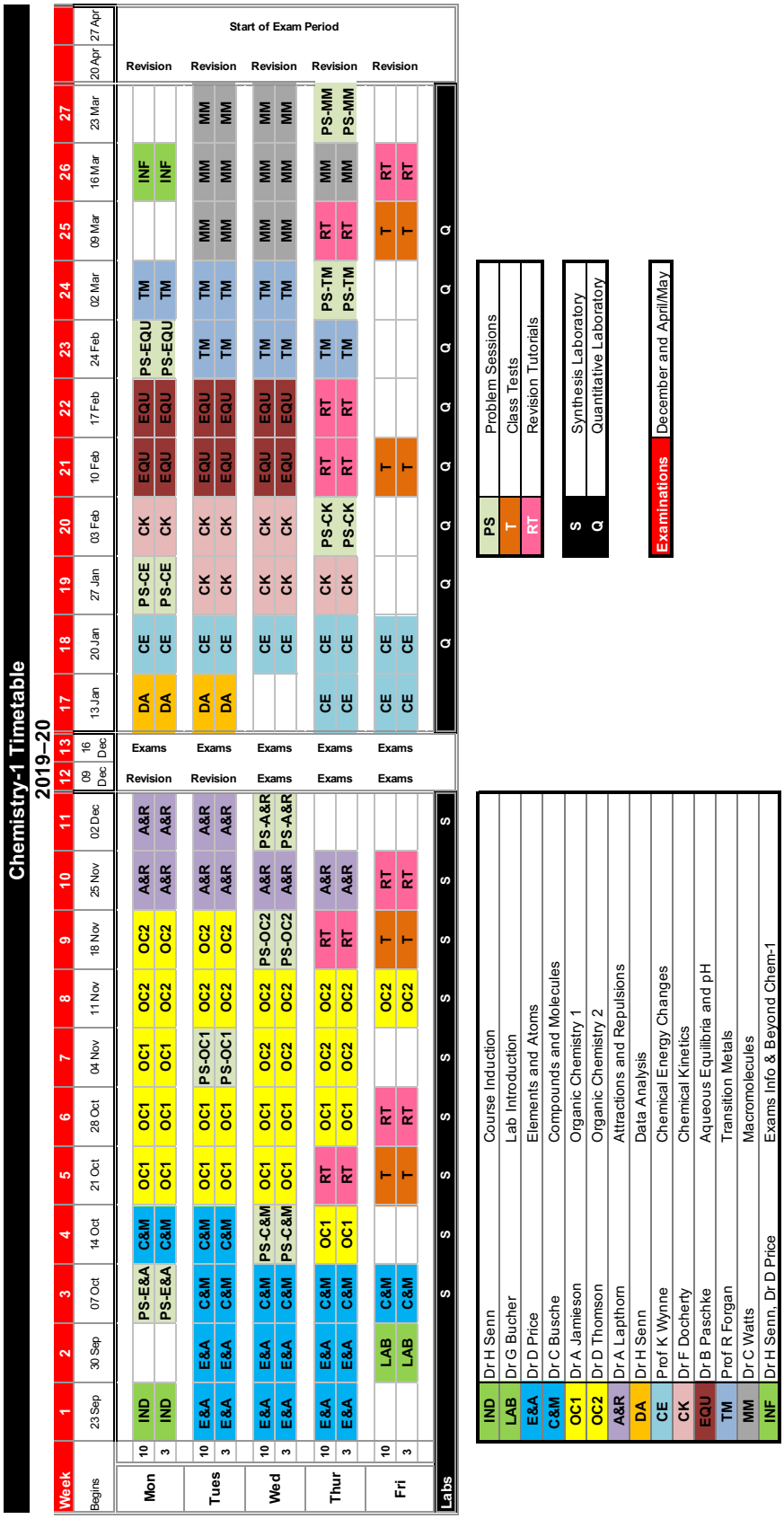
All course materials provided as well as any recordings of lectures are for your own personal use and can only be used in relation to your studies. Any unauthorised distribution of course materials, including uploading them onto unauthorised web sites and social media sites (such as YouTube or CourseHero) will be considered a breach of the code of conduct and will be subject to disciplinary action. Please see www.gla.ac.uk/services/senateoffice/policies/regulationsandguidelines/.

8.3 Mobile Phones

Mobile phones must be switched off (or in silent mode) during lectures, problem sessions, tests, examinations, *etc.*, and in the library. Mobile phones may not be used in the labs. Note that for examinations, you must leave your phone, together with your other belongings, in a closed bag at the entrance of the exam hall or under your desk. You should therefore bring a watch or timer to keep time during the exam.

9 Timetable

This timetable was accurate at the time the Handbook was produced. Please check Moodle and MyCampus for the most up-to-date timetable, including room allocations.



10 Course overview by module

Title: **Elements and Atoms, Compounds and Molecules**

Duration: 12 lectures + 2 problem sessions.

Lecturer: Dr Dan Price (Daniel.Price@glasgow.ac.uk)
Dr Christoph Busche (Christoph.Busche@glasgow.ac.uk)

Aims: To establish an understanding of the Periodic Table in order to be able to use it to rationalise chemical behaviour, to enable students to make predictions of the chemical behaviour of compounds so far not encountered, to help students appreciate the idea of molecular structure and scientific disciplines in the “real” world.

Outline

The development and significance of the Periodic Table; atomic structure and atomic orbitals; the relationship of the Periodic Table to atomic structure; blocks, columns and rows; trends in properties such as ion size, ionisation potential, electron affinity, electronegativity; oxidation states; balance redox equations; Born-Haber cycles; ionic lattice structure, p-block elements, covalent bonding, polarity, VSEPR rules and molecular shape; radioactivity.

Title: **Organic Chemistry 1**

Duration: 9 lectures + 1 problem sessions

Lecturer: Dr Andrew Jamieson (Andrew.Jamieson.2@glasgow.ac.uk)

Aims: To introduce the principles of organic chemistry, to relate atomic and molecular structures to properties and reactions.

Outline

Atomic and molecular structure derived from VSEPR theory and σ and π bonds; electron counting; structural isomers with tetrahedral, trigonal and digonal carbons; lone pairs, drawing organic structures; the foregoing principles developed alongside the chemistry of alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, aldehydes, ketones, carboxylic acids and their derivatives, amines and amides; functional groups and nomenclature; rotation about single bonds and equivalent hydrogens; chirality and geometrical isomerism; polar and non-polar bonds; nucleophiles and electrophiles; reaction mechanisms understood in terms of electron pair movement indicated by curly arrows; Markovnikov’s rule for addition reactions; nucleophilic substitution and elimination reactions; hydrogen bonding and polarity; physical properties related to structure, combustion analysis and molecular weights.

Title: **Organic Chemistry 2**

Duration: 9 lectures + 1 problem sessions

Lecturer: Dr Drew Thomson (Drew.Thomson@glasgow.ac.uk)

Aims: To give students the confidence and skills to apply the principles of organic chemistry, to relate structures to properties and predict reactions.

Outline

Natural and synthetic covalent structures; examples of simple compounds of everyday, industrial and medicinal importance; functional groups (aldehydes, ketones, carboxylic acids, amides, esters etc.); Spectroscopy applied to organic molecules (IR, UV-vis and NMR); fundamental properties and mechanisms of carbonyl chemistry; reactions of aldehydes and ketones (Nucleophilic addition, Imine formation, Acetal formation, Oxidation); properties, interactions and synthesis of carboxylic acids; carboxylic acid derivatives; chemistry of esters, amides and amines; aromatic chemistry.

Title: **Attractions and Repulsions**

Duration: 6 lectures + 1 problem session

Lecturer: Dr Adrian Lapthorn (Adrian.Lapthorn@glasgow.ac.uk)

Aims: To introduce the principles of intermolecular forces and how they determine the properties of bulk materials

Outline

Ionic bonds, covalent bonds, bond polarity, dipole, dipole moment and bond dipoles. Ion-ion interactions in ionic solids; Atom-atom interactions in metals; Dipole-dipole interactions; Hydrogen bonding; London (or dispersion) forces and how these forces manifest themselves in the behaviour of melting points, boiling points, vapour pressures, and deviations from the ideal gas laws. Ionic, metallic, covalent network and molecular solids. The effect of temperature and pressure on the phase of a compound. Phase diagrams, critical points and supercritical fluids.

Title: **Data Analysis**

Duration: 2 lectures

Lecturer: Dr Hans Senn (Hans.Senn@glasgow.ac.uk)

Aims: To introduce the systematic treatment of physical quantities and units in the SI system; to introduce concepts of statistical analysis and statistical tools applicable to datasets typically encountered in a laboratory exercise.

Outline

The SI system: foundations, base units, derived units, multiplier prefixes. Calculus of units. Statistics of measurements: distributions and variability, sample and population, variability of individuals and variability of means. Precision and accuracy, random and systematic errors.

Title: **Chemical Energy Changes**

Duration: 7 lectures + 1 problem session

Lecturer: Prof Klaas Wynne (Klaas.Wynne@glasgow.ac.uk)

Aims: To develop an understanding of the energy changes occurring during chemical reactions and the role these changes have in deciding whether a reaction will be exothermic or endothermic. To introduce and develop the way in which enthalpy and entropy contribute to the free energy change of a reaction and how this indicates if a reaction is favourable. To illustrate the role of the Gibbs free energy in determining the state of equilibrium of a chemical reaction.

Outline

Part 1 – Basics: Introduction to chemical energy; first law of thermodynamics; internal energy; exothermic and endothermic

Part 2 – Enthalpy: Reaction enthalpies; bond energies to calculate enthalpy; standard enthalpies of formation; reaction enthalpies; calorimetry and heats of combustion; Hess's law.

Part 3 – Entropy: Spontaneous reactions, disorder, entropy; second law of thermodynamics; heat, temperature & entropy; third law of thermodynamics; absolute entropies & the second law in action; entropy changes and entropy values; reactions with negative entropy.

Part 4 – Free Energy: (Gibbs) free energy; driving forces to reaction, the ΔH, ΔS competition; free energy in action; feasibility of reactions; making reactions feasible.

Part 5 – Equilibrium: Free energy and equilibrium; equilibrium and the meaning of "the reaction will proceed"; the balance of equilibrium; examples of equilibrium; changing the position of equilibrium.

Title: **Chemical Kinetics**

Duration: 6 lectures + 1 problem session

Lecturer: Dr Frances Docherty

Aims: To show how chemical reactions can be followed and their reaction rates measured. To introduce and demonstrate by means of worked examples the fundamental concepts of the kinetics of spontaneous chemical reactions, and the measurement of reaction rate, reaction order and rate constants. To show how collision theory can be used to explain the effects of concentration and temperature on reaction rates and lead to the Arrhenius equation. To show how catalysts and enzymes influence reaction rate. To explain how kinetics can be used to investigate reaction mechanisms.

Outline

What is kinetics? Rates of chemical reactions. Measuring reaction rates. Definition of reaction rate; variation of rates as a function of time; rate equations; reaction order; rate constants; initial rate method for the determination of rate equations; integrated rate equations for zero-, first- and second-order reactions; graphical methods; half-life; Collision theory, activation energy; Arrhenius equation; determination of the activation energy from temperature dependent rate constant data. Catalysts, enzymes and transition states. Reaction mechanisms, elementary steps, molecularity and rate determining step.

Title: **Aqueous Equilibria and pH**

Duration: 6 lectures + 1 problem session

Lecturer: Dr Beth Paschke

Aims: To introduce topics relating to aqueous solutions and the factors that influence pH.

Outline

Water as a solvent; hydrogen bonding; dipoles; dielectric constant; ice structure; concentrations; electrolytes; degree of dissociation in relation to a range of solutes; characteristics of sparingly soluble solutes, including the common ion effect and solubility product; dissociation of weak acids and bases and associated constants such as K_a, pK_a, K_b , pK_b,; various definitions of acids and bases; pH and pOH calculations for strong and weak acids and bases; degree of ionisation of weak acids and bases at various pHs; salt hydrolysis and its influence upon pH; buffers; Le Chatelier's Principle; Henderson-Hasselbalch equation, examples of buffers and their importance in biological systems; titrations; indicators.

Title: **Transition metals**

Duration: 6 lectures + 1 problem session

Lecturer: Prof Ross Forgan (Ross.Forgan@glasgow.ac.uk)

Aims: To introduce the chemistry of the transition metals and the properties, structures and bonding of transition metal complexes.

Outline

Electronic configurations of *d* block elements; oxidation states; *d* electron counting; extractive metallurgy; dative bonding between metals and ligands; introduction to ligand structure, charge and denticity; co-ordination complexes; co-ordination geometries; isomerism in co-ordination complexes; introduction to Crystal Field Theory; electronic configurations of octahedral co-ordination complexes; rationalisation of colour, magnetism and reactivity of co-ordination complexes; selected uses.

Title: **Macromolecules**

Duration: 7 lectures + 1 problem session

Lecturer: Dr Ciorsdaidh Watts

Aims: To provide an overview of the structures, preparation, properties and uses of synthetic macromolecules and to introduce the chemistry of the main food components and to illustrate how the structures are related to their physical and nutritional characteristics

Outline

Polyalkenes, polyesters, polyamides, polyethers; mechanisms of alkene polymerisation, addition and condensation polymerisation, conformation, flexibility, glass transition temperature, stability to heat, fire, solvents; backbone and side-chain functional groups; crosslinking; application related to structure; Natural molecules, fats, proteins, sugars, polysaccharides.

Title: **Synthesis-1 Laboratory**

Duration: 9 × 3-hour sessions

Coordinator: Dr Götz Bucher (synth-1-lab@chem.gla.ac.uk)

Aims: (a) To demonstrate, illustrate and extend understanding of some of the basic principles, processes and phenomena covered in associated lecture courses, (b) to give training in experimental methods and practical skills which cannot be taught by formal lectures but which can only be acquired from hands-on experience, (c) to develop appropriate skills and confidence in the safe handling of potentially hazardous materials, (d) to give experience in the design of safe and effective experimental procedures to investigate unfamiliar problems.

Outline

Exercises in chemical stoichiometry, balancing redox equations. Synthesis of copper and nickel complexes, separation of benzoic acid from other compounds by extraction or thin layer chromatography, synthesis and interconversion of carbonyl compounds (amides, esters, ketones).

Title: **Quantitative-1 Laboratory**

Duration: 8 × 3-hour sessions

Coordinator: Dr Smita Odedra (Smita.Odedra@glasgow.ac.uk)

Aims: (a) To demonstrate, illustrate and extend understanding of some of the basic principles, processes and phenomena covered in associated lecture courses, (b) to give training in experimental methods and practical skills which cannot be taught by formal lectures but which can only be acquired from hands-on experience, (c) to develop appropriate skills and confidence in the safe handling of potentially hazardous materials, (d) to give experience in the design of safe and effective experimental procedures to investigate unfamiliar problems, (e) to give an opportunity to develop a writing style appropriate for scientific work, (f) to provide the opportunity to work with real experimental data in graphical form and use mathematical techniques and statistical analyses to solve a variety of problems, (g) to reflect on results and identify sources of error, (h) to allow students to work collaboratively and fairly with a lab partner, (i) to allow students to develop a range of graduate attributes in the context of a laboratory environment.

Outline

The thermite reaction, acid base titrations, iodimetry, pH titrations, conductometric titrations, solubility product, heat of reaction, activation energy, colorimetric analysis.

IUPAC Periodic Table of the Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** hydrogen 1.008 [1.0078, 1.0082]																	2 **He** helium 4.0026
3 **Li** lithium 6.94 [6.938, 6.997]	4 **Be** beryllium 9.0122											5 **B** boron 10.81 [10.806, 10.821]	6 **C** carbon 12.011 [12.009, 12.012]	7 **N** nitrogen 14.007 [14.006, 14.008]	8 **O** oxygen 15.999 [15.999, 16.000]	9 **F** fluorine 18.998	10 **Ne** neon 20.180
11 **Na** sodium 22.990	12 **Mg** magnesium 24.305 [24.304, 24.307]											13 **Al** aluminium 26.982	14 **Si** silicon 28.085 [28.084, 28.086]	15 **P** phosphorus 30.974	16 **S** sulfur 32.06 [32.059, 32.076]	17 **Cl** chlorine 35.45 [35.446, 35.457]	18 **Ar** argon 39.95 [39.792, 39.963]
19 **K** potassium 39.098	20 **Ca** calcium 40.078(4)	21 **Sc** scandium 44.956	22 **Ti** titanium 47.867	23 **V** vanadium 50.942	24 **Cr** chromium 51.996	25 **Mn** manganese 54.938	26 **Fe** iron 55.845(2)	27 **Co** cobalt 58.933	28 **Ni** nickel 58.693	29 **Cu** copper 63.546(3)	30 **Zn** zinc 65.38(2)	31 **Ga** gallium 69.723	32 **Ge** germanium 72.630(8)	33 **As** arsenic 74.922	34 **Se** selenium 78.971(8)	35 **Br** bromine 79.904 [79.901, 79.907]	36 **Kr** krypton 83.798(2)
37 **Rb** rubidium 85.468	38 **Sr** strontium 87.62	39 **Y** yttrium 88.906	40 **Zr** zirconium 91.224(2)	41 **Nb** niobium 92.906	42 **Mo** molybdenum 95.95	43 **Tc** technetium	44 **Ru** ruthenium 101.07(2)	45 **Rh** rhodium 102.91	46 **Pd** palladium 106.42	47 **Ag** silver 107.87	48 **Cd** cadmium 112.41	49 **In** indium 114.82	50 **Sn** tin 118.71	51 **Sb** antimony 121.76	52 **Te** tellurium 127.60(3)	53 **I** iodine 126.90	54 **Xe** xenon 131.29
55 **Cs** caesium 132.91	56 **Ba** barium 137.33	57-71 lanthanoids	72 **Hf** hafnium 178.49(2)	73 **Ta** tantalum 180.95	74 **W** tungsten 183.84	75 **Re** rhenium 186.21	76 **Os** osmium 190.23(3)	77 **Ir** iridium 192.22	78 **Pt** platinum 195.08	79 **Au** gold 196.97	80 **Hg** mercury 200.59	81 **Tl** thallium 204.38 [204.38, 204.39]	82 **Pb** lead 207.2	83 **Bi** bismuth 208.98	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	89-103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium	113 **Nh** nihonium	114 **Fl** flerovium	115 **Mc** moscovium	116 **Lv** livermorium	117 **Ts** tennessine	118 **Og** oganesson

Key:

atomic number
Symbol
name
conventional atomic weight
standard atomic weight

57 **La** lanthanum 138.91	58 **Ce** cerium 140.12	59 **Pr** praseodymium 140.91	60 **Nd** neodymium 144.24	61 **Pm** promethium	62 **Sm** samarium 150.36(2)	63 **Eu** europium 151.96	64 **Gd** gadolinium 157.25(3)	65 **Tb** terbium 158.93	66 **Dy** dysprosium 162.50	67 **Ho** holmium 164.93	68 **Er** erbium 167.26	69 **Tm** thulium 168.93	70 **Yb** ytterbium 173.05	71 **Lu** lutetium 174.97
89 **Ac** actinium	90 **Th** thorium 232.04	91 **Pa** protactinium 231.04	92 **U** uranium 238.03	93 **Np** neptunium	94 **Pu** plutonium	95 **Am** americium	96 **Cm** curium	97 **Bk** berkelium	98 **Cf** californium	99 **Es** einsteinium	100 **Fm** fermium	101 **Md** mendelevium	102 **No** nobelium	103 **Lr** lawrencium

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

For notes and updates to this table, see www.iupac.org. This version is dated 1 December 2018.

United Nations Educational, Scientific and Cultural Organization

2019 IYPT International Year of the Periodic Table of Chemical Elements

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