School of Chemistry

CHEM101: Chemistry IA: Introductory Physical and General Chemistry

Subject Outline
Autumn, 2016
On-Campus
Wollongong

Subject Information
Credit Points: 6
Pre-requisite(s): Nil
Co-requisite(s): Nil
Restrictions: Restricted to students who have completed NSW HSC Chemistry with a mark of 65% or greater, or equivalent.
Contact Hours: 3 x 1 hr Lecture and Tutorial; 1 x 3 hr Practical or 1 x 3 hr Workshop (fortnight cycle)

Subject Contacts
Subject Coordinator/Lecturer

<table>
<thead>
<tr>
<th>Name:</th>
<th>Dr Carolyn Dillon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>Building 18, Room 129</td>
</tr>
<tr>
<td>Telephone:</td>
<td>61 2 4221 4930</td>
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<tr>
<td>Email:</td>
<td><a href="mailto:carolyn_dillon@uow.edu.au">carolyn_dillon@uow.edu.au</a></td>
</tr>
<tr>
<td>Consultation mode and times:</td>
<td>Email for appointment</td>
</tr>
</tbody>
</table>

Student Support and Advice
For general enquiries please contact StudentHub 41:

| Location: | 41.138B         |
| Telephone:| 61 2 4221 3492  |
| Email:    | smah-students@uow.edu.au |
Student Consultation and Communication

University staff receive many emails each day. In order to enable them to respond to your emails appropriately and in a timely fashion, students are asked to observe basic requirements of professional communication:

Consider what the communication is about
- Is your question addressed elsewhere (e.g. in the subject outline or, on the eLearning site)?
- Is it something that is better discussed in person or by telephone? This may be the case if your query requires a lengthy response or a dialogue in order to address. If so, see consultation times above and/or schedule an appointment.
- Are you addressing your request to the most appropriate person?

Specific email subject title to enable easy identification of issue
- Identify the subject code of the subject you are enquiring about (as staff may be involved in more than one subject) put this in the email subject heading. Add a brief, specific query reference after the subject code where appropriate.

Professional courtesy
- Address the staff member appropriately by name (and formal title if you do not yet know them).
- Use full words (avoid ‘text-speak’ abbreviations), correct grammar and correct spelling.
- Be respectful and courteous.
- Allow 3 – 4 working days for a response before following up. If the matter is legitimately urgent, you may wish to try telephoning the staff member (and leaving a voicemail message if necessary) or inquiring at the School Office.
- Please ensure that you include your full name and student number and identify your practical class or tutorial group in your email so that staff know who they are communicating with and can follow-up personally where appropriate.
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Section A: General Information

Subject Learning Outcomes

On completion of this subject, students should be able to:

1. Use chemical language, symbols and concepts to describe and apply bonding models to molecular scale systems, analyse macroscale properties of materials on the basis of molecular characteristics, and apply basic thermodynamics, equilibrium and kinetics concepts to chemical and physical change.

2. Employ basic mathematics to solve quantitative chemical problems.

3. Perform basic chemical laboratory procedures from written instructions safely and effectively, and record, interpret and communicate results from these chemical procedures.

4. Have gained experience of communicating and working effectively in small groups.

Subject Description

The subject provides core chemical concepts reinforcing and building on senior chemistry, and providing the basis of further studies in Chemistry. Concepts include the fundamentals of quantity, mole and stoichiometric calculations, the properties and behaviour of matter on the molecular scale based on electron configuration, periodicity, chemical bonding and molecular shape. The subject continues with concepts concerning matter on the macroscale: gases, liquids, solids and solutions with properties determined by the molecular scale. Principles of thermodynamics, equilibrium and kinetics are used to describe, interpret and understand chemical and physical change. The topics presented in contemporary contexts exploring chemical phenomena relevant to a suite of applied disciplines as well as chemistry.

eLearning Space

This subject has materials and activities available via eLearning. To access eLearning you must have a UOW user account name and password, and be enrolled in the subject. eLearning is accessed via SOLS (student online services). Log on to SOLS and then click on the eLearning link in the menu column. For information regarding the eLearning spaces please use the following link: [http://uowblogs.com/moodlelab/files/2013/05/Moodle_StudentGuide-1petpo7.pdf](http://uowblogs.com/moodlelab/files/2013/05/Moodle_StudentGuide-1petpo7.pdf)

Lecture, Tutorial, Laboratory Times

All timetable information is subject to variation. Check latest timetabling information on the 'Current Student' webpage on UOW website or log into SOLS to view your personal timetable prior to attending classes.


Readings, References and Materials

Textbooks

The following text(s) will need to be purchased by students enrolled in this class.


(Alternative first year chemistry texts can be found in the Library at 540.)
Prescribed Readings (includes eReadings)
The following texts are prescribed for this subject, but students are not expected to purchase these. They are available to students through the library on the subjects eLearning site.

Zeegers “Essential Skills for Science and Technology” Oxford University Press

Materials
CHEM101 Subject Handbook (Unishop)
Laboratory coat
Safety glasses

Recommended Readings
The following references complement the prescribed readings and textbooks:

Nil

Recommended readings are not intended as an exhaustive list, students should use the Library catalogue and databases to locate additional resources.

Recent Changes to this Subject
i. Nil
List of Topics Covered

The following are examples of the topics to be covered in this course. This is not an exhaustive list and will be subject to change.

1. **Fundamentals: the language of chemistry, symbols, formulae, names of compounds, equations and calculations of amount.**
   
   *At the end of this section you should be able to:*
   
   1. Understand simple atomic structure, distinguishing electrons, protons and neutrons and the forms of matter as atoms, ions, molecules.
   2. Classify matter as element, compound, mixture and describing the basic characteristics of the states of matter at the macro and the molecular level.
   3. Use correct formulae and nomenclature for elements and compounds
   4. Write and balance chemical equations, recognising some basic reaction types as combination, decomposition and combustion reactions.
   5. Calculate molar mass, % composition, empirical, molecular formulae, molar and mass quantities.
   6. Recognise and balance examples of Acid-Base (AB), dissolution/precipitation (DP) and Redox reactions
   7. Solutions: Carry out quantity, concentration and dilution calculations. Describe the molecular nature of solutions in terms of atoms, ions and molecules; electrolytes and non-electrolytes.
   8. Carry out stoichiometric calculations for AB, DP and Redox reaction types, in both, mass and solution stoichiometry, identifying limiting reagents and calculating theoretical and % yield.

2. **Matter on a Molecular Scale: Atoms, ions and molecules**
   
   *At the end of this section you should be able to:*
   
   1. Predict quantum numbers, identify orbitals and describe orbital shape
   2. Predict electron configuration of elements, explain structure of the Periodic Table,
   3. Account for patterns of periodicity in atomic properties
   4. Describe ionic and covalent bonding, electronegativity and polar bonding.
   5. Develop Lewis structures for bonding, apply VSEPR and predict molecular shape and polarity.
   6. Distinguish hybridisation of and bonds; especially with respect to C-C and C=C, C=O, C≡N.
   7. Describe intermolecular forces and relate to ionic and polar species.
   8. Construct and interpret molecular orbital energy level diagrams for homonuclear diatomic species.

3. **Matter on a Macro Scale, Gases, Liquids, Solutions; Physical equilibria.**
   Recognising links between the macroscale and the molecular scale.
   
   *At the end of this section you should be able to:*
   
   1. Define gas pressure and carry out P calculations with unit conversion
   2. Apply the Gas Laws
   3. Explain the kinetic molecular theory of gases and relate this to PV=nRT, effusion, diffusion, Boltzmann-Maxwell distribution, temperature effects
   4. Explain deviations from ideality on a molecular basis.
   5. Account for intermolecular forces and relate them to material properties
   6. Describe phases and phase transitions as displayed on simple phase diagrams.
   7. Describe viscosity, surface tensions, vapour pressure.
8. Describe solutions, dissolution and apply Henry's Law.
9. Perform calculations for colligative properties.
10. Analyse the molecular scale interactions indicated by physical and colligative properties.

4. **Reactions: Thermodynamics – how likely**
   
   *At the end of this section you should be able to:*
   1. Give definitions of system, surroundings, work, heat, state functions and internal energy
   2. Calculate transfers of heat using heat capacity
   3. Define enthalpy and calculate enthalpies associated with both physical change and chemical reactions.
   4. Carry out thermochemical calculations with various applications of Hess's Law
   5. Understand the concept of entropy, and calculate the reaction entropy from standard entropies
   6. Calculate Gibbs Free energy changes for a reaction from enthalpy and entropy data
   7. Predict the spontaneity of reactions, taking into account temperature effects.

5. **Reactions: Kinetics – how fast**
   
   *At the end of this section you should be able to:*
   1. Define reaction rate, rate of appearance / disappearance, instantaneous and average reaction rate
   2. Express reaction rates in terms of each [reactant] or [product] using stoichiometry.
   3. Write a rate law expression and define the terms zero, first and second order reaction, used to show rate dependence on concentration.
   4. Determine a rate law, order of reaction and the rate constant for a reaction from experimental data.
   5. Relate the instantaneous and integrated form of rate laws for zero, first and second order reactions and use integrated rate laws to calculate concentration, time, rate constant and half-life.
   6. Recognize that a reaction consists of a set of elementary reactions, one being RDS.
   7. Understand the relationship of rate constant, activation energy and temperature shown in the Arrhenius equation. Use the Arrhenius equation for calculations involving rate constants, activation energy, and temperature. Draw a reaction energy profile.
   8. Define the term catalyst and identify the impact of a catalyst on a reaction rate in energetic (reaction profile) and molecular terms.

6. **Reactions: Chemical Equilibrium – how far**
   
   *At the end of this section you should be able to:*
   1. Describe the characteristics of chemical equilibrium.
   2. Write equilibrium constants for balanced equations using either concentration or pressure.
   3. Perform calculations for equilibrium conditions using equilibrium tables (ICE table).
   4. Apply Le Chatelier’s principle to predict reaction direction using reaction quotient.
## Section B: Assessment

### Assessment Summary

<table>
<thead>
<tr>
<th>Assessment Item</th>
<th>Form of Assessment</th>
<th>Due Date</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment 1</td>
<td>Laboratory Practical Reports</td>
<td>End of each laboratory class</td>
<td>15%</td>
</tr>
<tr>
<td>Assessment 2</td>
<td>Workshop Quick Quiz</td>
<td>End of each workshop class</td>
<td>10%</td>
</tr>
<tr>
<td>Assessment 3</td>
<td>Online Moodle Quiz</td>
<td>Friday 10pm on weeks 4, 6, 9, 11 and 13</td>
<td>15%</td>
</tr>
<tr>
<td>Assessment 4</td>
<td>Mid Term Test</td>
<td>Week 8</td>
<td>10%</td>
</tr>
<tr>
<td>Assessment 5</td>
<td>Final Examination</td>
<td>During exam period</td>
<td>50%</td>
</tr>
<tr>
<td>Assessment 6</td>
<td>SMAH Risk Management Unit</td>
<td>Completed by week 13</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Total Marks** 100%

### Details of Assessment Tasks

Assessment tasks will be marked using explicit criteria that will be provided to students prior to submission.

<table>
<thead>
<tr>
<th>Assessment 1</th>
<th>Laboratory Practical Reports</th>
<th>Due date</th>
<th>Weighting</th>
<th>Submission</th>
<th>Type of Collaboration</th>
<th>Length</th>
<th>Details</th>
<th>Style and format</th>
<th>Subject Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>End of each laboratory class</td>
<td>15%</td>
<td>Submit a hardcopy of your assessment to your tutor/demonstrator in class.</td>
<td>Individual Assessment</td>
<td>Templated Report (3-4 pages) done in class time.</td>
<td>Yellow pages in subject handbook</td>
<td>Report</td>
<td>1-4</td>
</tr>
</tbody>
</table>

| Assessment 2 | Workshop Quick Quiz          | End of each workshop class                   | 10%       | Submit a hardcopy of your assessment to your tutor/demonstrator in class.  | Individual Assessment       | One Page, 10 Minutes each      | 3-4 Questions per topic         | In-class test      | 1-4                      |

| Assessment 3 | Online Moodle Quiz           | Friday 10pm on weeks 4, 6, 9, 11 and 13     | 15%       | Submit an electronic copy of your assessment via eLearning                  | Individual Assessment       | Two page quiz, 20 Minutes each | 10 MCQ’s                       | Online quiz        | 1-4                      |
### Assessment 4

<table>
<thead>
<tr>
<th>Due date</th>
<th>Mid Term Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighting</td>
<td>10%</td>
</tr>
<tr>
<td>Submission</td>
<td>Submit a hardcopy of your assessment to your lecturer in class</td>
</tr>
<tr>
<td>Type of Collaboration</td>
<td>Individual Assessment</td>
</tr>
<tr>
<td>Length</td>
<td>5-6 Pages, 60 Minutes</td>
</tr>
<tr>
<td>Details</td>
<td>A series of MCQ’s and/or short answer questions on topics covered so far.</td>
</tr>
<tr>
<td>Style and format</td>
<td>In-class test</td>
</tr>
<tr>
<td>Subject Learning Outcomes</td>
<td>1-4</td>
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</table>

### Assessment 5

<table>
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<th>Due date</th>
<th>Final Examination</th>
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<tr>
<td>Weighting</td>
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<tr>
<td>Submission</td>
<td>Exam papers and answers must be submitted at the conclusion of the exam.</td>
</tr>
<tr>
<td>Type of Collaboration</td>
<td>Individual Assessment</td>
</tr>
<tr>
<td>Length</td>
<td>20 pages 3 hrs</td>
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<tr>
<td>Details</td>
<td>MCQ</td>
</tr>
<tr>
<td>Style and format</td>
<td>Final exam</td>
</tr>
<tr>
<td>Subject Learning Outcomes</td>
<td>1-4</td>
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</tbody>
</table>

### Assessment 6

<table>
<thead>
<tr>
<th>Due date</th>
<th>SMAH Risk Management Unit</th>
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</thead>
<tbody>
<tr>
<td>Weighting</td>
<td>0%</td>
</tr>
<tr>
<td>Submission</td>
<td>Online unit with 3 modules and tests 80% pass mark</td>
</tr>
<tr>
<td>Type of Collaboration</td>
<td>Individual Assessment</td>
</tr>
<tr>
<td>Length</td>
<td>30 Questions, 2 hrs</td>
</tr>
<tr>
<td>Details</td>
<td>MCQ</td>
</tr>
<tr>
<td>Style and format</td>
<td>Online quiz</td>
</tr>
<tr>
<td>Subject Learning Outcomes</td>
<td>1-4</td>
</tr>
</tbody>
</table>

**Minimum Requirements for a Pass in this Subject**

To receive a clear pass in this subject a total mark of 50% or more must be achieved. In addition, failure to meet any of the minimum performance requirements is grounds for awarding a Technical Fail (TF) in the subject, even where total marks accumulated are greater than 50%.

The minimum performance requirements for this subject are:

- Pass the final exam
- Obtain a total lab mark of at least 50%
- Pass the SMAH Risk Management Unit
- Meet the minimum participation and attendance requirements set out below

**Minimum Student Attendance and Participation**

It is expected that students will allocate 12 hours per week to this subject, including any required class attendance, completion of prescribed readings and assessment tasks.

Student attendance at practical’s and workshops is compulsory and students must attend 100% of classes. Absences will require the submission of an application for Academic Consideration via SOLS and the presentation of suitable documentation, for example a Medical Certificate, to Student Central as soon as practical. Only TWO absences from laboratory/workshop classes are permitted otherwise you will fail to comply with the minimum participation requirements. For further details about applying...
Scaling
Scaling will occur in this subject in the form of wave or broken stick scaling methods.

Late Submission
Late submission of an assessment task without an approved extension of the deadline is not acceptable. If you are unable to submit an assessment due to extenuating circumstances (e.g. medical grounds or compassionate grounds), you can make an application of academic consideration. Not all circumstances qualify for academic consideration. For further details about applying for academic consideration visit the Student Central webpage: http://www.uow.edu.au/student/central/academicconsideration/index.html

Lab reports are submitted at the end of each practical class. Online Moodle quizzes are submitted at the end of the week period allocated (cut off date and time). Late submissions are not available for these assessments. Any issues arising must be addressed with the subject coordinator as soon as possible.

Supplementary Assessments
Supplementary assessment may be offered to students whose performance in this subject is close to that required to pass the subject, and are otherwise identified as meriting an offer of a supplementary assessment. The precise form of supplementary assessment will be determined at the time the offer of a supplementary assessment is made.

Students can log on to SOLS and click on the link titled “Supplementary Assessment” to view any applicable offers or use the following link: http://www.uow.edu.au/student/exams/suppassess/index.html

System of Referencing Used for Written Work
The Author-Date (Harvard) referencing system should, unless otherwise specified for a particular assessment (check Details of Assessment Tasks), be utilised. A summary of the Harvard system can be accessed on the Library website at: http://public01.library.uow.edu.au/refcite/style-guides/html/

Use of Internet Sources
Students are able to use the Internet to access the most current information on relevant topics and information. Internet sources should only be used after careful critical analysis of the currency of the information, the role and standing of the sponsoring institution, reputation and credentials of the author, the clarity of the information and the extent to which the information can be supported or ratified by other authoritative sources.

Plagiarism
The full policy on Academic Integrity and Plagiarism is found in the Policy Directory on the UOW website.

“The University’s Academic Integrity and Plagiarism Policy, Faculty Handbooks and subject guides clearly set out the University’s expectation that students submit only their own original work for assessment and avoid plagiarising the work of others or cheating. Re-using any of your own work (either in part or in full) which you have submitted previously for assessment is not permitted without appropriate acknowledgement. Plagiarism can be detected and has led to students being expelled from the University.
The use by students of any website that provides access to essays or other assessment items (sometimes marketed as ‘resources’), is extremely unwise. Students who provide an assessment item (or provide access to an assessment item) to others, either directly or indirectly (for example by uploading an assessment item to a website) are considered by the university to be intentionally or recklessly helping other students to cheat. This is considered academic misconduct and students place themselves at risk of being expelled from the University.

Submission of Assessments
Refer to the submission requirements under the details of the individual assessments. Students should ensure that they receive a receipt/evidence acknowledging assessment submission. Students will be required to produce this in the event that an assessment task is considered to be lost. Students are also expected to keep a copy of all their submitted assignments in the event that re-submission is required.

Assessment Return
Students will be notified when they are able to view their marked assessment. In accordance with University Policy marked assignments will usually only be held for 21 days after the declaration of marks for that assignment.
Section C: General Advice

Students should refer to the Faculty of Science, Medicine and Health website for information on policies, learning and support services and other general advice.

University Policies

Students should be familiar with the following University policies:

a. Code of Practice – Teaching and Assessment

b. Code of Practice – Research, where relevant

c. Code of Practice – Honours, where relevant

d. Student Charter

e. Code of Practice – Student Professional Experience, where relevant

f. Academic Integrity and Plagiarism Policy

g. Student Academic Consideration Policy

h. Course Progress Policy

i. Graduate Qualities Policy

j. Academic Complaints Policy (Coursework and Honours Students)

k. Policy and Guidelines on Non-Discriminatory Language Practice and Presentation

l. Workplace Health and Safety, where relevant

m. Intellectual Property Policy

n. IP Student Assessment of Intellectual Property Policy, where relevant

o. Policy on Ethical Objection by Students to the Use of Animal and Animal Products in Coursework Subjects, where relevant

p. Human Research Ethics Guidelines, where relevant

q. Animal Research Guidelines, where relevant
r. Student Conduct Rules and accompanying Procedures or Research Misconduct Policy for research students

Student Support Services and Facilities
Students can access information on student support services and facilities at the following link. This includes information on “Academic Support”, “Starting at University,” “Help at University” as well as information and support on “Career’s and Jobs”. http://www.uow.edu.au/student/services/index.html

Peer Assisted Study Sessions (PASS)
Peer Assisted Study Sessions are available for CHEM101 in Autumn semester in 2016.

Whether you are a top performer or could use some improvement, you will benefit from the skills and understanding gained from attending PASS. Think “Super Group” learning! PASS sessions are facilitated by senior students who have excelled in this subject. Many students each year find this subject challenging, and PASS has a strong record of helping students to succeed. In 2015, students who attended PASS five or more times for CHEM101 achieved 8 better on average than non-attending students. None of the students that attended weekly failed. To find out more about the multi award winning PASS Program, or to see the PASS timetable, go to: http://www.uow.edu.au/student/services/pass

Student Etiquette
Guidelines on the use of email to contact teaching staff, mobile phone use in class and information on the university guide to eLearning ‘Netiquette’ can be found at http://www.uow.edu.au/student/elearning/netiquette/index.html

Version Control Table

<table>
<thead>
<tr>
<th>Version Control</th>
<th>Release Date</th>
<th>Author/Reviewer</th>
<th>Approved By</th>
<th>Amendment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20151216</td>
<td>Dr Glennys O'Brien – Subject Coordinator</td>
<td>Sonia Losinno - ADE Nominee</td>
<td>Final CHEM101 Autumn 2016 outline.</td>
</tr>
</tbody>
</table>

Hardcopies of this document are considered uncontrolled please refer to UOW website or eLearning for the latest version