BACKGROUND
Introductory Chemistry is a one term, 6 Units of Credit, chemistry course for students with no, or very limited, background in high school chemistry.

OBJECTIVES OF CHEM1001
The course will provide basic descriptions of atomic and molecular structure, nomenclature, the periodic table, stoichiometry, equilibrium, kinetics, common reaction types, acids and bases, fundamentals of organic chemistry.

REQUIREMENTS
There is no formal assumed knowledge for CHEM1001.

ASSESSMENT
The formal assessment components of the course and the proportion of your final grade allocated to each is as follows:
- Laboratory Assessment: 20%
- Moodle Revision Quizzes: 10%
- Mid-Session Test: 10%
- Final Examination: 60%

A pass in CHEM1001 requires:
- a course mark of at least 50, and
- you attend at least 6 out of 8 laboratory classes, and
- all core laboratory skills are awarded (see laboratory manual for more details), and
- a weighted test/examination mark of at least 35.0% (i.e., 24.5 out of 70.0).

ARRANGEMENT of CLASSES and TIMETABLE
There are 8 hours of class contact per week for the majority of this course. Over the term there are approximately 36 lectures, 9 tutorial classes and 24 hours of practical work. These classes are organised as follows:

<table>
<thead>
<tr>
<th>Week</th>
<th>Lectures (hours/week)</th>
<th>Tutorials (hour/week)</th>
<th>Laboratory (hours/week)</th>
<th>Revision Quizzes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>–</td>
<td>3</td>
<td>yes</td>
</tr>
<tr>
<td>Weeks 2 – 4</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>yes</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>yes</td>
</tr>
<tr>
<td>Week 6</td>
<td>-</td>
<td>1</td>
<td>(make-up lab only)</td>
<td>no</td>
</tr>
<tr>
<td>Weeks 7</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>yes</td>
</tr>
<tr>
<td>Week 8</td>
<td>2*</td>
<td>1</td>
<td>3</td>
<td>yes</td>
</tr>
<tr>
<td>Week 9</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>yes</td>
</tr>
<tr>
<td>Week 10</td>
<td>4</td>
<td>1</td>
<td>(make-up lab only)</td>
<td>yes</td>
</tr>
</tbody>
</table>

* In Week 8, Monday is a Public Holiday. As a result, classes on these days will not be running. To compensate, some of these classes may be rescheduled as online lessons and or videos, see Moodle for details.

The times and locations of classes can be found on myUNSW. You MUST attend the tutorial and laboratory time shown on your official timetable. Students with a timetable clash should submit a “Timetable Clash Request” form available from (http://unsw.to/webforms).

CLASS LOCATIONS MAY BE CHANGED IN RESPONSE TO CHANGES IN STUDENT NUMBERS.
DOWNLOAD A FRESH TIMETABLE FROM MyUNSW OFTEN NEAR THE START OF TERM
ATTENDANCE
Students are expected to attend all their scheduled, synchronous classes (lectures, tutorials and laboratories) in all first-year chemistry courses. Attendance will be recorded at laboratory and tutorial classes. In particular, you must attend at least 6 out of 8 of laboratory classes for a satisfactory performance in the laboratory component of the course.

IF YOU MISS MORE THAN FOUR LABORATORY CLASSES YOU WILL AUTOMATICALLY FAIL THE COURSE.

See the Laboratory Manual (on Moodle, hardcopies are available for purchase in the UNSW bookshop) for more details on attendance and all other aspects of the laboratory classes.

WORKLOAD
A guide to the workload for this course is that you should spend an hour of independent study for each contact hour. The bulk of the time during term should be spent preparing tutorial problems and preparing and writing up laboratory reports. Closer to the examination, more time should be spent reviewing lecture material.

STUDENT INFORMATION and COMMUNICATION with STUDENTS
Announcements relevant to the course will be made on Moodle via the “Important Announcements” Section. You should check the course Moodle page regularly; this is where all course material will be made available to you. Communication via your student email account (z1234567@unsw.edu.au) will be used for important announcements and late changes to arrangements. It is your responsibility to check your email at least every two days and make sure that your account does not become ‘over-quota’ (i.e., full) or, if you have messages redirected, that the redirection is functioning.

CHECK YOUR UNSW EMAIL AT LEAST EVERY TWO DAYS!

ASSESSMENT COMPONENTS

Laboratory Assessment
This is described in the laboratory manual.

Revision Quizzes
There are online Revision Quizzes most weeks during the term. The topics and opening and closing dates can be found on Moodle.

- To attempt a quiz, logon to Moodle (https://moodle.telt.unsw.edu.au/), select CHEM1001, and select the ‘Revision Quizzes’ section.
- Select the relevant quiz you wish to attempt. In most cases, only one quiz will be available to you at any given time.
- In most cases, quizzes are open for one week only. They generally open at 12:01am on Monday morning, and close at 11:59 pm on Sunday night. These details are displayed in the quiz itself, before you make an attempt. During this time, you can make up to three attempts to answer the quiz questions (using any help you desire, taking as long as you want up until the quiz close time). You will most likely get a different version of the question on each attempt.
- You must get full marks on one of your three possible attempts at each quiz to get 1 added to your total quiz score. If you do not get full marks in any of your attempts, you will be awarded a score of zero for that quiz. At the end of the term, your best 8 quiz marks will be added together then scaled to give a mark out of 10, which will account for 10% of your final overall mark for this course.
- After the period for answering a quiz has closed, you will no longer be able to attempt the quiz. However, you will be given feedback and hints on how to answer the questions in the quiz.
- The Revision Quizzes are primarily designed to provide you with feedback on your learning progression, not as an assessment process.

Mid-Session Test
A test of 45 minutes’ duration will be held near the middle of the term (see Page 6 for more details). Material to be covered in the mid-session test will be notified closer to the test time. Information about how mid-session tests are conducted is provided later in this document. You need to read this information because it explains your responsibilities with regards to these tests.

Final Examination
The final examination will cover the entire contents of the course including content from lectures, tutorials and the laboratory component. As a guide, the amount of material on a syllabus topic in the exam will be in proportion to the number of lectures given for that topic. The final examination will be of 2 hours’ duration and will contain multiple-choice questions and questions requiring extended answers and calculations.
COURSE COMPONENTS

Lectures and course materials
The lectures and course materials provide the theoretical and conceptual material of the course while placing chemistry in real world contexts and applications. They define the scope of the topic under discussion and provide you the opportunity to work through problems and check your understanding under the guidance of the lecturer. The lectures and course materials in this course are delivered online through Moodle. Their format will be a combination of online materials, lessons, and live lecture sessions – your lecturer for each topic will advise you how they will be presenting the material for their section. You should aim to keep up to date each week with this material and use the live sessions as opportunity to interact with your peers and lecturer.

Live lectures are recorded, and these recordings will be made available via Moodle. However, there is no guarantee that the lecture recording technology will capture the class correctly or even at all. Hence missing live lectures, or arriving late, may cause you considerable difficulties.

Tutorials
Tutorial classes are compulsory. Tutorials provide an opportunity for students to revise and expand on the material of the course. The tutorial notes contain a core set of typical problems associated with the course topics as well as valuable post tutorial focus questions. The tutorial problems are those necessary to master the material in the course. To maximise the benefit of tutorials you should pre-read the questions and come to the tutorial prepared to do work in a collaborative environment. Worked answers will not be provided online and thus attendance is an essential component of the course. Questions in the final examination will be very similar in style and content to those in the tutorials. Please note that tutorial classes are NOT recorded.

Laboratory Classes
The laboratory classes provide an opportunity to learn the concepts and practice the calculations presented in lectures. Laboratory classes are also the place to learn practical skills and they are also the place where those skills are assessed and hence they are a compulsory component of all first year chemistry courses.

No students with an unsatisfactory laboratory record (either due to poor laboratory work or to inadequate attendance) will be considered for a pass in the course. You must attend at least 6 out of 8 of the scheduled laboratory classes in the term. Medical certificates or other documentation do not compensate for absences.

You must READ THE INTRODUCTION IN THE LABORATORY MANUAL to be aware of all the requirements for passing the laboratory component of this course. Here are some of the main points regarding laboratory classes:

- **Safety eyewear must be worn at all times in the laboratory.**
- A laboratory coat and fully enclosed footwear must be worn in the laboratory. You will not be permitted to work in thongs or open-top shoes or sandals or without a laboratory coat and safety eyewear.
- The schedule of experiments can be found on page 4 of the lab manual.
- Most experiments have pre-lab work. Pre-lab work must be completed before your lab class.
- You must attend the laboratory class shown on your official timetable.
- You must arrive at the laboratory on time or you will be excluded from the class.
- Repeat students must apply to the First Year Laboratory Coordinator if they want exemption from laboratory classes. Exemption is not automatic and is decided on a case-by-case basis.

SEE THE LABORATORY MANUAL FOR MORE DETAILS, including what to do if you are unavoidably absent from a lab class, how to submit reports, and the criteria for grading your laboratory work.
SPECIAL CONSIDERATION

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to advise the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration Important note: UNSW has a “fit to sit/submit” rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control which affect your ability to study, you do not sit an examination or submit an assessment which does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

If you are excluded from attending a face-to-face class because you have been instructed to self-isolate due to COVID-19 (including if you live in an area that has been locked down) you are advised to apply for special consideration if it means that you will miss one or more laboratory class as a precaution. However, please carefully read the attendance requirement for the laboratory component in the section above as special consideration does not exempt you from this requirement.

You will be required to provide evidence to support your Special Consideration application and it is likely that a back to source check will be carried out on your documentation.

SUPPLEMENTARY ASSESSMENTS

A supplementary examination may be offered in cases where you have applied for and received special consideration. The supplementary exam period for this term is Monday 24 May – Friday 28 May inclusive. The time, date and venue of your test will be confirmed via student email approximately 1 week before the exam date. All students granted a supplementary exam are expected to make themselves available to attend. No alternative dates or times will be guaranteed. A supplementary examination may consist of a written paper and in some cases an oral examination. Averages will not be given in place of a final exam mark or supplementary exam mark.

NEED HELP?

There are several people who can help you with problems. The appropriate person may differ depending on the problem.

- For problems relating to lectures and course material – see your lecturer (asking questions during live sessions is best, or posting questions on the Moodle Q and A forum).
- For tutorial problems – see your tutor.
- For laboratory problems – see your demonstrator, or alternatively ask your tutor (if time permits) in tutorials.
- For help with answering questions (tutorials problems, lab exercises, etc) – The Moodle forum is an excellent platform to raise questions and receive answers from your peers and teaching staff.
- For course related and/or personal difficulties that may be affecting your performance in first year chemistry – see the Chemistry Student Centre, (Room 105, Dalton Building).
- For all other enquires (including Moodle issues) – contact Trinah De Leon, the Teaching Support Officer (trinah@unsw.edu.au).

RESOURCES

Suggested Text Books

- CHEM1001 lab Manual, School of Chemistry, UNSW (On sale at the UNSW Bookshop).
MID-SESSION TEST

**Dates, Times and Locations**

The mid-session test for this course is currently planned for **Week 4** during your regular scheduled lecture time on **Thursday 2pm-3pm 11th March 2021**. However, this is subject to change based on enrolment numbers and will be confirmed early in the term via Moodle announcement. If you cannot attend this lecture time due to a permitted timetable clash, please contact trinah@unsw.edu.au as soon as possible. **Permitted clashes do not automatically excuse absences from the test.**

The official details will be posted on Moodle approximately 1–2 weeks before the date of the examination.

- **IT IS ENTIRELY YOUR RESPONSIBILITY TO ASCERTAIN THESE DETAILS.**
- No information regarding time and location will be given over the telephone.

**Feedback**

- The mark you obtain for the Mid-Session Test will be returned via Moodle within 10 working days, including the average mark for the test across the entire course and details of the learning outcome that were incorrectly answered in the test (if any). Please note that tests and exam are summative assessments and attempts will not be returned to students.

**ACADEMIC MISCONDUCT**

Students and staff are, of course, governed by the normal laws which regulate our everyday lives. But in addition, the University has its own code of rules and conduct and can impose heavy penalties on students who breach them. Penalties range from failure in a subject, loss of privileges, fines, payment of compensation, and suspension, to exclusion from study for a certain period or even permanent expulsion from the University.

It is important to realise, however, that misconduct within the University covers a much wider field than simply behaviour which is offensive or unruly, or which may cause damage to other people or property. Misconduct which may lead to a student being disciplined within the University includes anything regarded as **academic misconduct according to current academic usage**, as well as any conduct which impairs the reasonable freedom of other persons to pursue their studies or research or to participate in University life.

It is most important that students realise just how broad the definition of Academic misconduct may be. It certainly covers practices such as cheating or copying or using another person's work. Sometimes, however, practices which may have been acceptable at school are considered to be misconduct according to current Academic usage within a University. For example, academic misconduct can occur where you fail to acknowledge adequately the use you have made of ideas or material from other sources (see the UNSW Student Guide for examples).

The following are some of the actions which have resulted in students being found guilty of academic misconduct in recent years:

- impersonation in examinations.
- failing to acknowledge the source of material in an assignment and or test/exam.
- collusion with other students during examinations.
- submitting work for assessment knowing it to be the work of another person.
- improperly obtaining prior knowledge of an examination paper and using that knowledge in the examination.

Students found guilty of academic misconduct are usually excluded from the University for two years. Because of the circumstances in individual cases, the period of exclusion can range from one term to permanent exclusion from the University.
## CHEM1001 Introductory Chemistry

### Lecture content and learning objectives by week

#### Recommended Texts

The topics listed in this syllabus, the exercises in the tutorial sets, and assignments in the laboratory programme define the examinable material. The ‘Refs’ column lists section numbers from the textbook (*Zumdahl, et al. ‘Introductory Chemistry’) which provide relevant reading material.

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Content</th>
<th>Refs</th>
<th>Learning objectives.</th>
</tr>
</thead>
</table>
| 1    | ▪ What is Chemistry?  
▪ Measurement in science: SI units, prefixes.  
▪ Proportionality.  
▪ Classification of matter: elements, compounds, mixtures. Allotropes.  
▪ Conservation of mass  
▪ Classification of the elements: metals, non-metals.  
▪ Atomic structure: atomic number, mass number. Relative atomic weight. Isotopes. | 1.1 – 1.4  
2.1-2.7  
3.1-3.4  
4.1-4.7 | □ Recognise and use common unit abbreviations and prefixes.  
□ Classify substances as elements, compounds or mixtures.  
□ Identify changes to substances as chemical or physical.  
□ Understand the implications of conservation of mass.  
□ List the properties of metallic and non–metallic substances.  
□ Name the constituent parts of an atom, together with their relative masses and charges.  
□ Calculate numbers of protons, neutrons, electrons in atoms and ions of a particular element. |
| 2    | ▪ Nomenclature of simple chemical compounds.  
▪ Chemical formulae.  
▪ Writing and balancing chemical equations; use of phase descriptors.  
▪ Formula (molecular) weight.  
▪ The Avogadro number.  
▪ The mole.  
▪ Empirical and molecular formulae and % Composition.  
▪ Calculations of mass, moles and yields from equations.  
▪ Identifying limiting reagents. | 5.1-5.7  
6.2-6.3  
8.1-8.9  
9.1-9.6 | □ Name simple inorganic compounds and write the formulae for simple compounds from their name.  
□ Write and balance simple chemical equations.  
□ Calculate molecular weight from chemical formula.  
□ Calculate % by mass of each element in a compound.  
□ Determine empirical formula from % by mass.  
□ Calculate yield in a chemical reaction.  
□ Determine the limiting reagent. |
Conversion between concentration measures. Mixing solutions - mutual dilution. Solution stoichiometry.  
▪ Precision and uncertainty  
▪ Significant figures.  
*(end of Dr Ron Haines’ lectures)* | 15.1-15.6 | □ Use the terms solvent, solute, and solution in their appropriate context.  
□ Calculate the concentration of solutions in various units.  
□ Calculate the concentration of solutions after the addition of more solvent to a solution or when mixing solutions.  
□ Use the correct number of significant figures in measurements and calculated results. |
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Content</th>
<th>Refs</th>
<th>Learning objectives.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(At the end of this week you should be able to…)</td>
</tr>
</tbody>
</table>
| 3    | The Periodic Table; 'families' of elements, groups, and periods; names of groups, numbering, metals, non-metals, metalloids. Where does H fit? | 4.8  
12.1  
12.6-12.7 | □ Identify the names of common groups in the periodic table.  
□ Describe what a chemical bond is and identify covalent, ionic and metallic bonds.  
□ Draw Lewis diagrams for simple molecules. |
|      | Bonding. What is a chemical bond? Ionic, covalent, and metallic bonding and the properties of such substances. |      |                      |
|      | Representing molecules: Lewis diagrams. Single, double, and triple bonds, lone pairs. Pictures of molecules: ball and stick models, space filling models. |      |                      |
| 4    | Electronegativity and Polarity of bonds. | 12.2-12.5  
12.3  
13.1-13.5 | □ Identify the trends in electronegativity across the periodic table.  
□ Relate the difference in electronegativity between two elements to the type of bond formed between them.  
□ Identify common polar molecules.  
□ Predict the types of intermolecular forces between two substances. Predict if two substances are miscible.  
□ Distinguish between electrolytes and non-electrolytes.  
□ Describe the properties which distinguish gases from other states of matter.  
□ Calculate properties of gases using the ideal gas equation. |
|      | Trends in bond type relative to position on Periodic Table. |      |                      |
|      | Solutes, solvents, solutions. Aqueous solutions – water as a unique solvent. Dissociation of ionic compounds; electrolytes and non-electrolytes. |      |                      |
|      | Intermolecular forces and the 'like dissolves like' principle. |      |                      |
|      | Gases – properties (density, poor thermal conductivity; temperature and pressure dependence of density); diffusion. |      |                      |
|      | The ideal gas equation and its applications. |      |                      |
|      | mid–semester test (TBC) |      |                      |
| 5    | Reduction and oxidation: origins of these terms. Oxidation number, Electron transfer reactions | 18.1-18.8 | □ Calculate oxidation numbers of elements and use change in oxidation number to determine species that have been oxidized and reduced.  
□ Identify reactions where oxidation and reduction occur (redox reactions) and identify the oxidising and reducing reagents.  
□ Balance redox equations in aqueous solutions using the half–equation method  
□ Construct a conventional galvanic cell schematic diagram and label the anode, cathode, salt bridge and direction of electron flow.  
□ Use standard reduction potentials to calculate the cell potential and overall redox reaction for a galvanic cell from two half cells. |
<p>|      | Redox equations – balancing equations using half equations. |      |                      |
|      | Reactions involving common oxidants and reductants. |      |                      |
|      | Galvanic cells: physical construction, dependence of emf on substances used, temperature, concentration. |      |                      |
|      | Standard reduction potential and calculating cell potentials. |      |                      |
|      | Applications of electrochemistry: Batteries. Corrosion. |      |                      |</p>
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Content</th>
<th>Refs</th>
<th>Learning objectives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Flexibility week – no new content</td>
<td></td>
<td>(At the end of this week you should be able to…)</td>
</tr>
</tbody>
</table>
| 7    | ▪ Common reaction types: Acid–base  
▪ Bronsted. pH scale and PH calculations. Neutralisation and salts  
▪ Titrations and indicators; endpoint and equivalence point. | 16.1-16.5 | ☑ Define acids and bases using Bronsted-Lowry definition.  
☑ Recognise the names and formulae of common acids and bases.  
☑ Predict the product of the reaction of an acid and a base, an acid and a metal and an acid and a carbonate.  
☑ Calculate the pH of a strong acid or base solution.  
☑ describe acid–base titrations and perform calculations to calculate the concentration of unknown monoprotic acid solutions. |

*(end of Dr Shannan Maisey’s lectures)*

| 8    | ▪ Equilibrium.  
▪ Le Chatelier’s principle  
▪ Solubility of gases (CO₂) as an equilibrium process.  
▪ Solubility equilibria.  
▪ Acids as strong and weak  
▪ Precipitation reactions.  
▪ Solubility; solubility rules for common compounds. Net ionic equations.  
▪ Common inorganic compounds and their reactions. Oxides, hydroxides, hydrides, and halides. Reactions with water.  
▪ Basic energy concepts and thermochemistry.  
▪ Heat capacity; calorimetry.  
▪ Endothermic and exothermic | 17.1-17.8 | ☑ Describe concept of chemical equilibrium in terms of rates of forward and reverse reactions.  
☑ Determine the equilibrium expression of homogenous and heterogenous reactions.  
☑ Apply Le Chatelier's principle to systems at equilibrium to predict the direction of change.  
☑ Apply general equilibrium concepts to the specific cases of acid-base and solubility equilibria.  
☑ Use the terms solubility and saturated solution in their appropriate contexts.  
☑ Predict whether a precipitate will form when two solutions are mixed.  
☑ Identify the names, formulae, and reactions with water of the oxides, hydroxides, hydrides, and halides of the main group elements.  
☑ Use the terms heat, heat capacity, endothermic and exothermic in their appropriate contexts.  
☑ Identify if a reaction is endothermic or exothermic.  
☑ Calculate the heat associated with a chemical reaction carried out in a calorimeter. |
|      |                     | 10.1-10.6 |                          |
▪ Functional groups: alkenes, alkynes, alcohols, alkyl halides, aldehydes, ketones, carboxylic acids, esters, amides | **Kinetics**  
20.2-20.4  
20.1-20.15 | ☑ Define the rate of a chemical reaction.  
☑ List the factors which influence the rate of a reaction.  
☑ Describe the action of catalysts.  
☑ Give the names of the straight-chain alkanes with one to ten carbons.  
☑ Name branched chain alkanes and identify constitutional isomers.  
☑ Identify the formulae of common functional groups and the names of simple compounds containing these groups. |
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Content</th>
<th>Refs</th>
<th>Learning objectives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Some basic organic reactions:</td>
<td>20.6</td>
<td>- Give the products of the combustion of hydrocarbons.</td>
</tr>
<tr>
<td></td>
<td>- Combustion of hydrocarbons</td>
<td></td>
<td>- Predict the products formed in addition reactions of hydrogen, bromine, and hydrogen halides to alkenes and alkynes.</td>
</tr>
<tr>
<td></td>
<td>- Addition to alkenes (hydrogenation, bromine)</td>
<td></td>
<td>- Describe polymerization reactions and the relationship between the structure and properties of polymers.</td>
</tr>
<tr>
<td></td>
<td>- Addition of HX</td>
<td></td>
<td>- Predict the products of oxidation of alcohols.</td>
</tr>
<tr>
<td></td>
<td>- Polymerisation</td>
<td></td>
<td>- List the common reactions of organic acids.</td>
</tr>
<tr>
<td></td>
<td>- Alcohols – oxidation</td>
<td></td>
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<tr>
<td></td>
<td>- Redox in organic chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Formation of esters</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Carboxylic acids: acidity, formation of salts.</td>
<td></td>
<td></td>
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</tbody>
</table>

*(end of Dr Scott Sulway’s lectures)*