

# WOODSIDE PRIORY SCHOOL

## COURSE OUTLINE – HONOUR CHEMISTRY (*Distant Learning*)

**Instructor:** Mr. G. Tang

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**Office Hours:** *Mondays to Thursdays: 4:30 to 6:00 PM and 8:00 to 10:00 PM; Fridays: 3:30 to 5:30 PM*

**Required Text:** Chang, Raymond. *General Chemistry: The Essential Concepts*. 5<sup>th</sup> ed. McGraw-Hill, 2008  
(ISBN: 978-0-07-304851-2)

**Required Material:** Graphing Calculator, Organized Google Drive Folders or Computer Folders (or 3-inch 3-ring Binder with Dividers)

### Course Content and Tentative Timeline

In some cases, the concepts listed below correspond to another chapter in the textbook. A detailed reading list and assigned problems will be available at the beginning of each unit.

#### Unit 1: Basic Chemistry

##### **Chapters 1 Introduction**

**1.0 week**

Lab Safety, Metric System, Uncertainty, Significant Figures, Density, Temperature, Unit Analysis, Conversion of Complex Units

##### **Chapters 2 Atoms, Molecules, and Ions**

**1.5 weeks**

Classification of Matter, Solutions, Elements and Compounds, Physical Change and Chemical Reactions  
Models of the Atom, Structure of a Nuclear Atom, Periodic Table of Elements, Metals and Nonmetals, Groups and Periods, Atomic Orbitals, Properties of Ionic and Molecular Compounds, Introduction to Ionic and Covalent Bondings, Nomenclature of Ionic and Molecular Compounds, Polyatomic Ions, Acids Nomenclature

##### **Chapter 3: Stoichiometry**

**2.0 weeks**

Atomic Mass and Average Atomic Mass, Avogadro's Number, Mole, Molar Mass, Mole-Mass Conversions, Mass Spectrometer, Percent Mass Composition, Empirical and Molecular Formulas, Evidences and Types of Chemical Reactions, Predicting Reactants and Products, Writing and Balancing Chemical Reactions, Percent Composition, Gravimetric Stoichiometry, Limiting Reagents, Percentage Yield

#### Unit 2: Matter as Solutions and Gases

##### **Chapter 4: Reactions in Aqueous Solutions**

**1.0 week**

Properties of Water, Solute and Solvent, Process of Solution, Electrolytes and Non-Electrolytes, Solubility Rules and Table, Precipitation Reactions, Acid-Base Reactions, Concentration, Mole-Concentration Conversions, Molarity, Solution Stoichiometry

##### **Chapter 5: Gases**

**1.5 weeks**

Pressures, Boyle's, Charles's, Gay-Lussac's and Avogadro Gas Laws, Combined Gas Law, Ideal Gas Law, Avogadro's Law, STP and SATP, Gas Stoichiometry, Kinetic Molecular Theory of Matter, Real Gases, Dalton's Law of Partial Pressure, Graham's Law of Effusion, Vapour Pressure,

##### **Chapter 13: Physical Properties of Solutions**

**1.5 weeks**

Different Type of Solutions, Solution Process, Concentration Units (Percent by Mass and Volume, Molarity, Molality), Factors affecting Solubility, Henry's Law of Solubility of Gas, Colligative Properties (Freezing Point Depression and Boiling Point Elevation)

#### Semester 1 Final Exam Review

**1.0 week**

Students will review old unit tests, with the emphasis on the last 2 units of the course.

### Unit 3: Quantum Chemistry and Chemical Bonding

#### **Chapter 7: Electronic Structure of Atoms**

**2.0 weeks**

Photoelectric Effects, Bohr Theory and the Emission Spectrum of the Hydrogen Atom, Dual Nature of the Electron, Quantum Model and Number, Atomic Orbital, Electron Configurations, Pauli and Aufbau Principle, Hund's Rule

#### **Chapter 8: Chemical Periodicity**

**1.0 week**

Effective Nuclear Charge, Periodic Trends in Atomic and Ionic Radii, Ionization Energy, Electron Affinity, and Electronegativity

#### **Chapter 9 & 10: Chemical Bonding: The Covalent Bond & Molecular Geometry**

**2.5 weeks**

Valence Electrons, Octet Rule, Electron Configurations of Cations and Anions, Lewis Structures, Ionic Bonds and Properties, Electronegativity, Single Covalent Bonds, Double and Triple Covalent Bonds, Exceptions to Octet Rule, VSEPR Model, Properties of Covalent Bonds

#### **Chapter 12: Intermolecular Forces**

**1.5 weeks**

Bond Polarity, Polar Molecules, Intermolecular Bonds (van der Waals Forces – [London Forces, Dipole-Dipole Interactions] and Hydrogen Bonding), Phase Diagrams

### Unit 4: Thermochemistry and Nuclear Chemistry

#### **Chapter 6: Energy Relationships in Chemical Reactions**

**3.0 weeks**

Enthalpy, Thermochemical Equations, Heats of Formation, Potential Energy Diagrams, Heats of Reactions, Hess's Law, Calorimetry

#### **Chapter 21: Nuclear Chemistry**

**1.0 week**

Isotopes, Radioactive Decay, Nuclear Transformations, Nuclear Equations, Half-lives, Nuclear Particle Emission, Fission and Fusion, Nuclear Energy Production

### Unit 5: Chemical Kinetics and Equilibria

#### **Chapter 14 & 15: Reaction Rates and Chemical Equilibrium**

**3.0 weeks**

Collision Theory, Activation Energy, Factors affecting Reaction Rates, Catalysts, Reversible Reactions, Le Châtelier's Principle, Equilibrium Expressions, Constants and Concentrations, Solving Simple Equilibrium Problems

### Unit 6: Acids and Bases

#### **Chapter 16: Acids and Bases**

**2.0 weeks**

Physical Properties of Acids and Bases, Arrhenius, Brønsted-Lowry and Lewis Definitions, Strong and Weak Acids and Bases, pH and pOH,  $K_a$  and  $K_b$  Expressions,  $K_w$ , Degree of Ionization / Dissociations, Polyprotic Acids and Bases

#### **Chapter 17: Acid-Base Equilibria and Solubility Equilibria**

**2.0 weeks**

Amphiprotic Acids and Bases, Writing Complete and Net-Ionic Neutralization Reactions, Titrations and pH Curves, Indicators, Equivalent Points and Endpoints, Buffer Solutions, Salt Hydrolysis, Solubility Equilibria and Solubility Product

### Unit 7: Electrochemistry (Optional if Time Permits)

#### **Chapter 19: Redox Reactions and Electrochemistry**

**3.5 weeks**

Oxidation and Reduction Definitions, Oxidizing and Reducing Agents, Writing and Balancing Oxidation and Reduction Half Reactions, Strengths of Redox Reagents, Oxidation Numbers, Balancing Half Reactions Using Oxidation Number in Acid / Base Solutions, Redox Titration, Standard and Net Electric Potentials, Electrochemical (Voltaic / Galvanic) Cells, Electrolytic Cells, Faraday's Laws

### Semester 2 Final Exam Review

**1.0 – 2.0 weeks**

Students will review old unit tests, with the emphasis on the last 4 units of the course.

## Semester One (September to December)

<u>Units</u>	<u>Weight</u>
Unit 1: Basic Chemistry	42.5%
Unit 2: Matter as Solutions and Gases	42.5%
<i>Semester 1 Final Exam (December)</i>	<i>15.0%</i>
<b>Total Course Mark</b>	<b>100%</b>

\*The 1<sup>st</sup> Quarter Mark will consist of Unit 1. The 2<sup>nd</sup> Quarter Mark will consist of Units 2.

## Semester Two (January to June)

<u>Units</u>	<u>Weight</u>
Unit 3: Quantum Theory, Periodicity & Chemical Bonding	24%
Unit 4: Thermochemistry and Nuclear Chemistry	24%
Unit 5: Chemical Kinetics and Equilibria	18%
Unit 6: Acids and Bases	19%
<i>Semester 2 Final Exam (Beginning of June)</i>	<i>15%</i>
<b>Total Course Mark</b>	<b>100%</b>

\*\*The 3<sup>rd</sup> Quarter Mark will consist of Units 3 & 4. The 4<sup>th</sup> Quarter Mark will consist of Units 5 & 6.

<u>Unit Components</u>	<u>Weight</u>
Homework / Notebook	20%
Formal Labs & Lab Activities	30%
Quizzes	15%
Unit Test	35%
<b>Total Unit Mark</b>	<b>100%</b>

### Unit Preparation

At the beginning of each unit, a detailed timeline of readings and problems are given out to students. This is to allow students the opportunity to better manage their studying schedule.

### Distant Learning Classroom Expectations:

As long as the school remains closed due to the current pandemic, I will be running the course as a **Flip Class**. This means ***you will do the initial learning*** of the material ***asynchronously*** by ***watching the Video Lessons*** and ***writing down the answers to the examples in the notes***. ***My job is to help you as a facilitator if you have problems.***

***Classes are conducted as Homework sessions.*** If you have questions about the video lessons, bring them to class. After that, I will break the class into groups to do the Homework Questions. We will reconvene before the end of the class for a quick discussion.

When you do distant education, it will seem daunting at first. It might be helpful to try the following.

1. ***Read the notes first.*** The answers to the examples are in the notes files found under each Unit Topic.
2. If you don't understand a certain part of your notes, ***watch the corresponding explanation in that video lesson. Do NOT watch the entire video lesson. Only watch the parts that are helpful.*** The video lessons on Blackbaud are compressed to a point where the quality is super bad. Please ***go to my website at www.doctortang.com*** (*Honour Chemistry – New Textbook Chang*). The video lessons there are of much higher quality.
3. ***Fill in the answers to the example in the notes.*** You might want to ***download the Unit Notes document*** in each Topic to follow along. Write down any questions you have about the lesson.
4. ***Ask questions in class.*** Work together with your classmates and do the Homework.
5. ***Come to Extra Help / Office Hours*** if your questions are not addressed in class. ***DO NOT SUFFER ALONE!!***

## Homework

Homework will be assigned every class. On Blackbaud, I have posted all answers to assigned problems. Students are encouraged to ask questions they do not understand during the next class meeting. ***You must show ALL your work! Incomplete work or when there is no work shown will count as zero.*** ***Homework submissions in PDF are via Blackbaud.*** *(If you write out your homework, you have to take a picture of your work and turn it into a PDF before submitting it on Blackbaud.)* Students must do the minimum assigned problems to self-evaluate their understanding of the material taught.

## Notebook or Computer Folder

An organized notebook or computer folder is the key to success in any course. ***Computer files should be appropriately named.*** It is best if you have a consistent naming method to differentiate one file from another. This applies to notes, homework, labs, and assessments.

If you would like to have your work physically, you should print out your unit outline, notes, and lab handouts. Students are to keep their current chapter's work in a 3-inch 3-ring binder. It should have several dividers. The chapter outline will be placed at the beginning, followed by class notes with all answers to the examples filled out. After that comes the homework section, and finally, chapter quizzes and unit tests that are corrected.

You have to ***submit your completed notes during the chapter test.*** *(You can either write the answers to the example problems after you print out the unit notes file or copy the example questions on a blank paper with your written in solutions. Then, you will take pictures of the work and turn them into a single PDF file for submission.)*

## Labs

Labs will be conducted either by simulation or online video in each unit. Despite the current distant learning format, we will learn about proper lab techniques. Students are to read up on the lab procedure before the lab period or the assigned lab video.

There are about 9 to 11 labs within this course. They constitute a crucial component of the Chemistry program. ***Students have to write and hand in their lab reports.*** You can write out the lab report or type it up. Similar to homework, labs in PDF are submitted online via Blackbaud. The lab write-up must have all works, calculations, and units shown! You must include your name, class, and date in the lab report.

**Note:** Proper word processing techniques, such as subscripts, superscripts, arrows, double arrows, and math equations, should be used if you choose to type your lab report. Because of the number of mathematical calculations involved in these labs, students are strongly encouraged to write up their lab reports instead.

## Formal Lab Report Format

- 1. Title and Date:** A Short Description of the experiment
- 2. Objective:** Describe the Background and the Purpose of the experiment. What is it that we are expected to learn and accomplish from this experiment?
- 3. Hypothesis:** An Educated Guess of the result of the experiment. Predict any observations. This is also the section where you will answer any pre-lab questions.
- 4. Materials:** A Detailed List of all Equipment and Amounts of Chemicals Used. The list can be found in the lab itself.
- 5. Procedure:** Even though the procedure is provided in the lab, students should not merely copy the steps. The procedure is to be paraphrased into your lab report. All universities and colleges are against any form of plagiarism. All quotes and materials must be properly referenced.
- 6. Observations:** All relevant Quantitative Data must be recorded. The measurements that need to be taken should have been conveyed in the objective, hypothesis and procedure. All Qualitative Data must be recorded as well.
- 7. Analysis:** This section consists of any calculations and graphs from the Experimental Data. All calculations must include proper units and all parts of any graphs are properly labeled. Any Inferences from the Qualitative Data should also be included.
- 8. Conclusion:** Finally, comment on whether you have met the objective and what have you learned from this lab. A statement of understanding must be included in the conclusion.

*The first five sections (title to procedure) and the list of measurements needed for the observation must be completed prior to any lab periods or lab videos. This is to ensure students have read and understood the lab before hand.*

## Informal Labs (Activities and Demos)

Sometimes, we will do a smaller activity, or I will do a short demo in class. Students are to compose a statement of understanding. This statement paragraph should include evidence and observations, logical particle reasoning in text, pictorial, or mathematical form. It should finish with a claim that summarizes the chemical phenomenon involved. Questions from quizzes and unit tests might refer to these activities.

## Quizzes

A quiz is given at the end of each chapter or in the middle of a chapter. It serves as an interim assessment of material taught. Students are encouraged to study and learn from the quizzes' mistakes to make better preparation for the unit test. ***While we are in distant learning mode, all quizzes are open-book and open-notes.***

## Unit Test

There will be a unit test given at the end of each unit. These are comprehensive tests that will cover all components taught (including labs performed) within a unit. Most unit tests will be in the same style and format for the final exam. ***All unit tests will be open-book and open-notes as long as we are in distant learning.***

### \*\*Procedure for Missed Test/Quiz:

***Both the student and parent would receive emails concerning a missed quiz or a test. Please note that students' attendance in this class will be kept up-to-date. When students regularly miss classes on test/quiz dates, I will notify the administration. A phone call home is extremely likely. Students who missed a test/quiz are to make it up on the very next school day (not class day) when they return. You can arrange to take the missed test/quiz after school. Failure to do so will result in a score of zero on that assessment. Please do not email me the day before an assessment and ask for the test/quiz to be delayed. Tests and quizzes are always scheduled at least a week in advance, so you should organize your time to prepare them accordingly.***

## Semester 1 Final Exam

The Semester 1 Final Exam will be held in December prior to the Christmas Break. It will cover the first 3 units of this course.

## Semester 2 Final Exam

The Semester 2 Final Exam will be held at the beginning of June. Although all units will be tested, this final exam will focus the last 5 units of the semester.

## Academic Integrity

It is expected that students follow the rules regarding academic integrity as outlined in the Parents and Students Handbook.

“Students who are unclear about what constitute cheating or plagiarism should discuss it with a teacher or advisor. Infractions of the Academic Integrity guidelines are cumulative through a student’s High School years at the Priory.”

### Homework and Lab Reports:

***All homework must be the student's own work. It is cheating to:***

- ***Submit work copied from any outside source (text or electronic) without proper footnotes or references. (If you are copying from a passage or obtain information from other textbooks or the Internet, you MUST state the sources either as footnotes or references in the bibliography.)***
- ***Submit work copied from a friend or someone else.***
- ***Give the work to a friend or someone else for copying.***
- ***Submit work overly reliant on outside assistance from a tutor, mentor or a parent.***

***\* In labs and homework, collaborations are encouraged but only limited to discussion. All final work must be from the student's own words.***

### Quizzes, Tests and Exams:

***Students must adhere to the rules of classroom assessments such as quizzes, tests, and exams. It is cheating to:***

- ***Copy answers from another student's test.***
- ***Consult any unauthorized notes during the test. (Only Textbook, Class Notes, Labs are allowed.)***
- ***Use or share any kind of electronic devices without specific and explicit permissions. (In most tests, scientific or graphing calculators are allowed.)***
- ***Solicit specific information about a test that the student has not yet taken from someone who has taken it. (This is always a problem. If someone asked you what's on the test, just state the chapters the test covers.)***
- ***Give answers to another student or knowingly assist another student to cheat.***

***Students who compromise their academic integrity by violating the above rules will receive an automatic zero for the assignment or test. In addition, the incident will be reported to the Academic Dean for further considerations.***

### Late Work:

***A deduction of 10% Per CALENDAR DAY applies to any late Homework or Lab! Please submit your work ON TIME!***

### Attendance:

***In accordance to the policy of this school, as quoted in the Upper School Parents Students Handbook,***

***“Absences from more than 10 classes a semester for any non-medical reason (such as college visits and family trips) in any course may result in REDUCTION of the student's grade by a FULL Letter Grade. Absence from more than sixteen classes may result in no credit for the course. Absence is defined to include being more than twenty minutes late for class.”***

***The above policy is strictly enforced in this class.***