Unit I. Why is the Climate Changing?

Macroscopic, Symbolic, and Atomic-Molecular View of Chemistry

How to use this calendar:

- Set aside 30 mins - 1 hour ***before*** each class to **identify the Activities or Labs we will do that day.**
- In your course packet, look over the scheduled **Activity** for the day and complete any background readings or pre-activity questions as described in the course packet and/or on Google Classroom.
- For **Labs**, prepare to do the lab during class by reading over the entire procedure in your course packet. In your lab notebook, create a new entry with a title and date, and write out the Purpose and Method sections *before* coming to class. Consider outlining the "Actions" or creating a "lab plan".
- **Textbook Readings:** Preview these before class. Look for connections to that day's labs and activities. After class read that textbook section, take written notes, write and work through example problems, and write down any remaining questions you have.
- **Lab reports will always be due next class period,** unless otherwise indicated by your instructor.
- **Quizzes will always be on Fridays**.

Week 1 topics: practice analyzing graphical data, properties of gases, measurements and significant figures, keeping a lab notebook, data analysis.

1/23 M
Course Introduction
Activity 1: How much is the climate changing?

1/25 W
Textbook Readings: **OpenStax Textbook Sections 1.4 (Measurements), 1.5 (Significant Figures, Examples 1.3, 1.4, 1.5, and 1.6), 9.1 (Gas Pressure - just up to Table 1).**
In Class: Lab check-in and lab notebook set up
Lab 1: How much does air weigh?

1/27 F
In Class: Recap Lab 1: How much does air weigh?
Quiz 1 (analyzing climate change data, significant figures)

Week 2 topics: ideal gas law (relationship between properties of gases), covalent bonds and Lewis dot structures, molecular shape (VSEPR).

1/30 M
Textbook Readings: **Section 2.3 (Atomic Structure and Symbols), 2.4 (Chemical Formulas) 7.3-7.4 (Lewis formulas, Example 7.4). 9.2 (Ideal gas law, especially Figures 9.10-9.13, focus on relationships, not calcs), 9.5 (Kinetic-Molecular Theory).**
Printing Tutorial from LITS
Activity 2: How are the atoms connected within gas molecules?
Lab 2: How are gas volume and pressure related?
Lab 3: How are gas volume and temperature related?

2/1 W
Textbook Readings: **Section 7.6 (VSEPR, Example 7.11-7.16).**
Activity 3: What are the shapes of atmospheric gas molecules?
Begin *Activity 4: What are sources and sinks of greenhouse gases?*

2/3 F
Textbook Readings: **Figure 6.3** in Section 6.1 (Electromagnetic Energy)**, 7.2 (Covalent Bonding), 7.6 (subsection Molecular Polarity and Dipole Moment)**
Lab 4: Which gases absorb infrared waves?
Continue *Activity 4: What are sources and sinks of greenhouse gases?*
Quiz 2 (sig figs, Lewis formulas, gas property relationships)

Week 3 topics: IR spectroscopy, greenhouse gases, covalent bonding, electronegativity, and polarity. balancing equations, sources and sinks of greenhouse gases, dimensional analysis.

2/6 M Textbook Readings: **4.1 and 4.3 (Balancing Equations and Stoichiometry).**
Lab 5: What happens when you breathe into water?
Activity 5: How do we balance source and sink equations?

2/8 W Textbook Readings: **1.6 ("Mathematical ..." aka dimensional analysis, Examples 1.8-1.10), 3.1 (moles) 4.4 (Reaction Yields- focus on limiting reactant), 2.6 (ionic compounds).**
Lab 6: Which recipe makes the most precipitate?

2/10 F **Quiz 3** (Lewis Dot and VSEPR, IR spectroscopy, electronegativity, greenhouse gas)
Chemistry Culture Activity 1 - Climate Change podcast

Week 4 topics: dimensional analysis, stoichiometry, moles, limiting reactant, precipitation reaction.

2/13 M Textbook Readings: Review **1.6 ("Mathematical ..." aka dimensional analysis, Examples 1.8-1.10), 3.1 (moles)**
Activity 6: How much do sources and sinks contribute to rising greenhouse gas concentrations?
Demo: Mole of CO_2

2/15 W Review textbook sections 1.6 and 3.1.
Activity 7: What are your personal contributions to CO_2 emissions?
Lab 7: How much CO_2 do you exhale per year?

2/17 F **Quiz 4**
Chemistry Culture Activity 2 - Geologist's perspective on climate change

Unit II. Food and Fuel: Which Energy Sources Should We Use?

Covalent Molecules and How They Are Transformed Through Chemical Reactions

Week 5 topics: organic chemistry - molecular representations and functional groups, thermodynamics, energy transfer, calorimetry.

2/20 M Textbook Readings: **2.4 (Chemical formulas), 20.1-20.3 (skim organic functional groups and work through Example 20.1, 20.2).**
Activity 8: How do chemists represent the structure of molecules?

2/22 W Textbook Readings: **5.1-5.2 (Energy and Calorimetry, work through Example 5.1, 5.2).**
Activity 9: How much heat is released upon fuel combustion?
Lab 8: Fuel Calorimetry

2/24 F Textbook Readings: **7.5 (Bond Strengths and Energies).**
Begin *Activity 10: Why do we make so much CO_2?*
Quiz 5

Week 6 topics: thermodynamics, energy transfer, bond energies, acids and bases.

2/27 M Textbook Readings: **7.5 (Bond Strengths and Energies).**
Continue *Activity 10: Why do we make so much CO_2?*

3/1 W Textbook Readings: **4.2 (focus on Acid-Base reactions).**
Activity 11: What functional groups are in food?
Lab 9: Which household chemicals react the same way?

3/3 F **Quiz 6**
Lab 10: Can "like-attracts-like" be used to rank polarity?
Chemistry Culture Activity 3

Week 7 topics: polarity, intermolecular forces**.**

3/6 M Textbook Readings: **10.1 (Intermolecular Forces).**
Activity 12: How are functional groups, molecular sizes, and boiling points related?

3/8 W Textbook Readings: **10.1 (Intermolecular Forces).**
Activity 13: What is hydraulic fracking?

3/10 F **Quiz 7**

Week 8 M 3/13 – F 3/17 SPRING BREAK

Integrative Project 1 - Synthesis and Analysis: Is My Aspirin Pure?

Week 9 topics: synthesis, functional groups, titration, spectroscopy.

3/20 M **Lab 11**: Synthesis of Aspirin

3/22 W Textbook Readings: **4.4 (Percent Yield).**
Lab 12: IR spectroscopy of reference samples and synthesized aspirin
Lab 13: Part 1 Titration of aspirin tablet

3/24 F **Lab 13:** Part 2. Titration of synthesized aspirin
Lab 14: NMR spectroscopy of reference samples and synthesized aspirin

Week 10 topics: scientific literature, scientific writing.

3/27 M *Finish any lab work.*
Discuss aspirin report and searching the literature for journal articles.

3/29 W Peer review aspirin reports

3/31 F **Quiz 8** (NMR, IR)

Unit III. What Changes Can We Make to Reduce Our Environmental Impact?

Chemical Periodicity, Solids, Metals and Ions, and Interaction of Light with Matter

Week 11 topics: inorganic chemistry - solid structures, metals, ions, atomic energy levels and transitions, solubility rules, precipitation reactions and net ionic equations. Emission spectroscopy.

4/3 M Textbook Readings: **10.5 (subsection Metallic Solids).**
meet at the Logan Museum
Activity 14: Why have metals been used through the ages?
Activity 15: Alternative Fuels (17.5 batteries and fuel cells)

4/5 W Textbook Readings: Lighting background readings (Google Classroom), review **6.1 (Electromagnetic Energy),** read **6.2 (Bohr model).**
Activity 16: What are the three ways we make light?
Lab 15: How can you identify different sources of light?

4/7 F Chemistry Culture 4 -Alternative Fuels mini-presentations
Quiz 9

Week 12 topics: metals, ions and precipitation reactions, structure and properties of solids.

4/10 M Textbook Readings: **4.1 (subsection Equations for Ionic Reactions, Example 4.2) 4.2 (subsection Precipitation Reactions and Solubility rules), 4.6 (Molecular and Ionic Compounds - use Figure 2.29, Table 2.5 and Table 2.6 as reference).**
Activity 17: Which elements in the periodic table are metals?
Lab 16: What is the net ionic equation?

4/12 W Textbook Readings: **7.1 (Ionic Bonding), 10.5-10.6 (Solids), 18.2 (subsection Carbon).**
Activity 18: How can we represent solids?
Lab 17: How are structure and properties of solids related?

4/14 F continue **Lab 17**: How are structure and properties of solids related?
Quiz 10

Week 13 topics: structure and properties of solids, periodic properties, electromagnetic spectrum, semiconductors and bandgap energies.

4/17 M Textbook Readings: **6.5 (Periodic Variations in Element Properties).**
Activity 19: What controls the properties of elements?
Activity 20: How can you get a specific color of light from a solid LEDs?

4/19 W **Lab 18**: Periodic Properties and LEDs
Activity 22: Project Design: Is My Soil Poisoned?
Chemistry Culture Activity 5

4/21 F **Quiz 11**
Lab 19: Collect Soil Samples

Integrative Project 2 – Is my soil poisoned?

Week 14 topics: application of quantitative lab techniques and atomic absorption spectroscopy to a new environmental problem.

4/24 M **Lab 20**: Preparation of Lead Samples and Standard

4/26 W **SPRING DAY**

4/28 F **Lab 21:** Atomic Absorption Spectroscopy of Lead Samples & Standards

Week 15 topics: scientific writing, science communication, data analysis.

5/1 M Discuss lead letter and data workup.
Lab check out
Lab 22: Atomic Absorption Spectroscopy of Lead Samples & Standards

5/3 W Work on or peer review lead letters.
Course review, wrap up, course evals.

Final Exam Period Section 01 Tues 5/9 9am-noon Section 02 Sat 5/6 2-5 pm	**Quiz 12** (40 points) *All lead letters will be due during Final Exam Period - bring one printed copy per group.*