

## Daily Assignments Calendar

### I. Why is the Climate Changing?

*Macroscopic, symbolic, and atomic-molecular view of chemistry*

- Textbook by Gilbert et al (**fifth edition!**)
- Course materials needed in class every day.
  - A bound composition book to use as a lab notebook (quadrille ruled makes data tables easier).
  - A 3-ring binder with class handouts and activities
  - Scientific calculator for use during quizzes (and homework)

(1) For Monday August 26, 2019

*Activity 1: How much is the climate changing?*

- We will work on Activity 1 on climate change in class and talk about course goals, structure, and processes.
- We will check in to lab and set up lab notebooks.

(2) For Wednesday August 28, 2019

**Lab 1: How much does air weigh?**

- **Hand in your “Scientific Autobiography” from Monday.**
- Read “Learning Chemistry By Doing What Chemists Do” and “Keeping Your Laboratory Notebook” in the course packet.
- Read and take notes on textbook Section 1.8 and p. 23-26 (**units and significant figures**).
- Do problems 1.65, 1.67, 1.69 at the end of the chapter. Check answers at the back of the book. Ask questions at the beginning of class if you do not understand how to get the answers.
- Prepare for lab by reading “How much does air weigh?” and **writing a draft of Purpose and Method in your laboratory notebook**. Being able to read directions and think through lab steps is an important course goal.

(3) For Friday August 30, 2019

*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?**

- Read textbook Sections 8.2 (**Lewis dot symbols**) and do problems 8.27, 8.29, 8.37, 8.41 at the end of the chapter. Check answers at the back of the book. Ask questions at the beginning of class if you do not understand how to get the answers.
- Prepare for lab by reading “How are gas volume and pressure related?” and “How are gas volume and temperature related?” and **writing Purpose and Method in your laboratory notebook** for both experiments. Being able to read directions and think through lab steps is an important course goal.
- Study Figures 6.13, 6.14 and 6.18 in your text (**kinetic-molecular theory of gases**). Which two variables are studied in the figure? How are these two variables measured? How are the other two variables kept constant?
- **At the end of class hand in your lab notebook for grading** of “How much does air weigh?”

(4) For Monday September 2, 2019

*Activity 3: What are the shapes of atmospheric gas molecules?*

**Lab 4: Which gases absorb infrared waves?**

- Read Activity 3 and text Sections 9.1-9.2 (**VSEPR theory and molecular shape**) and do problems 9.25, 9.31, and 9.39. Check answers at the back of the book.
- How equally are electrons shared in a bond? Read text Section 8.3 (**electronegativity and bond polarity**), and text Section 8.5 (**formal charges**) and do problems 8.57, 8.63, 8.85, and 8.91. Check answers.
- Prepare for lab by reading “Which gases absorb infrared waves?” Find the infrared portion of the **electromagnetic spectrum** in text Figure 7.7
- During class, post your infrared spectra on the whiteboard in the hallway in order to share data.
- **At the end of class hand in the Lab worksheet** for “Which gases absorb infrared waves?”

(5) For Wednesday September 4, 2019

*Activity 4: What are the sources and sinks of greenhouse gases?*

**Demonstration: What happens when you breathe into water?**

- Do problem 8.55 and check your answer at the back of the book.
- Read Activity 4 and **before class fill in the table**, “What do atmospheric concentrations tell us?”
- **Quiz #1** (bring calculator)

(6) For Friday September 6, 2019

Activity 5: How do we balance source and sink equations?

**Lab 5: Which recipe gives the most precipitate?**

- Read text Section 3.2 (**moles: the macro-particulate connection**); make sure to carefully follow the sample exercises by taking written notes. Do problems 3.23, 3.27, 3.33, 3.35, and 3.109
- Read text Section 3.3 (**balancing chemical equations**) and do problems 3.55 and 3.61a
- Read Activity 5 and *balance the equations for your assigned questions* in Activity 5.
- **Prepare for lab by writing the purpose and method** in your lab notebook for “Which recipe gives the most precipitate?”
- **Hand in your lab notebook for grading** of “How are gas volume and pressure related?” or “How are gas volume and temperature related?”

(7) For Monday, September 9, 2019Activity 6: What are your personal contributions to CO<sub>2</sub> emissions?**Lab 6: How much carbon dioxide do you exhale in a year?**

- Read text Sections 1.9 (**dimensional analysis**) and do problems 1.59 and 1.43
- Read Calculations Reference handout (in the course packet before Activity 6).
- Read text Sections 3.4-3.5 (**combustion and stoichiometric calculations**) and do problems 3.61b and 3.67
- **Prepare for lab by writing the purpose and method** in your lab notebook for “How much carbon dioxide do you exhale in a year?” How will you measure volume? How will you measure time?

(8) For Wednesday, September 11, 2019**Demonstration: A Mole of CO<sub>2</sub>**

Activity 7: How much do your daily activities contribute to rising greenhouse gas concentrations?

- Bring your **completed Lab 6 calculations** for posting and class discussion.
- **Quiz #2**

(9) For Friday, September 13, 2019

Activity 8: How should we keep cool? Climate Change Concluding Activity

- Read text Section 6.4 (**Ideal Gas Law**) and do problems 6.75 and 6.79
- Read articles about refrigerants on the course web site (summary Activity 8.) **Write a paragraph summarizing what is most important and/or interesting about the readings.** In class we will do and hand in a group exercise on refrigerants and their connection to climate change.
- **Hand in lab notebook for grading** of “Which recipe gives the most precipitate?” and “How much carbon dioxide do you exhale in a year?”

**Integrative Project 1 – What is the empirical formula of my cool blue copper compound?***Synthesis, stoichiometry, and spectroscopy*(10) For Monday September 16, 2019**Lab 7: Synthesis of a Copper-Ammonia Complex**

- Read textbook Section 3.6 (**Determining Empirical Formula**), take notes as you work through the Sample Exercises and do problems 3.77 and 3.85
- Read “Synthesis of a Copper-Ammonia Complex,” **complete pre-lab questions**, and **write purpose and method for the synthesis** in your notebook.

(11) For Wednesday September 18, 2019**Lab 8: Ammonia Analysis via Titration**

- Read textbook Section 4.6 (**determine by titration the amount of product produced**).
- Read “Ammonia Analysis via Titration,” **complete pre-lab questions**, and **write purpose and method for the ammonia analysis** in your notebook.

(12) For Friday September 20, 2019**Lab 9: Copper Analysis using Absorbance Spectroscopy**

- Read textbook p. 156-157 (Determining Concentration Using **Beer’s Law**)
- Read “Copper Analysis using Absorbance Spectroscopy,” **complete pre-lab questions**, and **write purpose and method for the copper analysis** in your notebook.

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

*Covalent molecules and how they are transformed through chemical reactions*

(13) For Monday September 23, 2019      *Activity 9: How do chemists represent the structure of molecules?*

- **Hand in your Copper Lab Report (Labs 7, 8, and 9).**
- Read Activity 9. We will work on the Chemical Notation Worksheet during class.
- Read text Section 2.8 (**organic compounds and functional groups**) and the first part of 5.9 (**alkanes**).

(14) For Wednesday September 25, 2019      *Activity 10: How much heat is released upon fuel combustion?*

### Lab 10: Fuel calorimetry

- Read text Section 5.1 and 5.5 (**Energy transfer and heat capacity**) and do problems 5.47, 5.51, and 5.53
- Review Section 3.4 (**combustion reactions**)
- Read Activity 10 and *answer questions 1-5* in your lab notebook as a pre-laboratory for “Fuel calorimetry.”
- **Prepare for lab by writing the purpose and method** in your lab notebook for “Fuel calorimetry.”

(15) For Friday September 27, 2019      *Activity 11: Why do we make so much CO<sub>2</sub>?*

### Bond Enthalpies Worksheets

- Read text Sections 5.9 and 8.7 (**fuel & food values and length & strength of bonds**), and do problems 5.99, 8.127, and 8.129
- Read the first page of Activity 11. In class we will complete the Activity 11 worksheets for several molecules. **The Summary Table and Questions 1-9 will be due at the end of class.**
- **Hand in lab notebook for grading** of “Fuel Calorimetry.”

(16) For Monday September 30, 2019      *Activity 12: What are some of the alternative fuels we could use?*

### Lab 11: Hydrogen Fuel Cell

- Skim text Section 18.10 (**fuel cells**) and do problem 18.13
- Read text Section 13.1 (**cars and air quality**) and p. 676 (**catalysts and catalytic converters**)
- **Prepare for lab by writing the purpose and method** in your lab notebook for the “Hydrogen fuel cell” lab.
- **Quiz #3**

(17) For Wednesday October 2, 2019      *Activity 13: What functional groups are in food?*

### Lab 12: Which household chemicals react the same way?

- **Prepare for lab by writing the purpose and method** in your lab notebook for “Which household chemicals react the same way?”
- Read text Sections 4.5, 15.1 (**acids & bases**), p. 749-751 (**pH**) and do problems 15.31 and 15.93
- Review Table 5.1 (**functional groups**) and do problem 9.81
- Read Activity 13. **Complete Question 1 (circle and label as many functional groups as you can)** and bring to class. Be prepared to discuss questions 2-5 (**recognizing functional groups**).

(18) For Friday October 4, 2019

*Activity 14: How are functional groups, molecular sizes, and boiling points related?*

### Lab 13: Can like attracts like be used to rank polarity?

- Read text Sections 10.1-10.4 (**intermolecular forces between molecules, solubility**) and do problems 10.9, 10.13, 10.27, 10.37, 10.41, and 10.47
- Review functional groups for Activity 14.
- **Prepare for lab by writing the purpose and method** in your lab notebook for “Can like attracts like be used to rank polarity?”
- **Hand in lab notebook for grading** of “Hydrogen fuel cell” lab, “Which household chemicals react the same way?” and “Can like attracts like be used to rank polarity?”

(19) For Monday October 7, 2019

*Activity 15: What is Hydraulic Fracturing?*

### Intermolecular Forces Demonstrations

- Read the first page of Activity 15. In class we will complete the Activity 15 worksheets.
- Review text section 10.4 on **intermolecular forces** between molecules

(20) For Wednesday October 9, 2019

*Activity 16: What is the difference between a fat and an oil?*

**Lab 14: How does vegetable oil change when hydrogenated?**

- In class, we will work on Activity 16, ‘What is the difference between a fat and an oil?’
- Read text section 20.6 (**lipids**) and do problem 20.3 and 20.65
- **Prepare for lab by writing the purpose and method** in your lab notebook for “How does vegetable oil change when hydrogenated?” Include the chemical reaction scheme.

(21) For Friday October 11, 2019 (MACTLAC)

- **Quiz #4**
- **Hand in lab notebook for grading** of “How does vegetable oil change when hydrogenated?”

MIDTERM BREAK

**Integrative Project 2 - Synthesis And Analysis: Is My Aspirin Pure?**

*Applying functional groups, molecular structure, and spectroscopy*

(22) For Monday October 21, 2019

**Lab 15: Aspirin Synthesis Project**

- Review text Section 3.9, especially p.126 (**percent yield**) and do problems 3.117 and 3.115
- **Prepare for lab by writing the purpose and method** for the Aspirin Synthesis. Read through the lab procedure carefully and outline your actions in your lab notebook, saving plenty of space for additions, corrections, and observations. Be prepared to start lab work as soon as you get to class and work efficiently.

(23) For Wednesday October 23, 2019

**Lab 16: NMR and IR of standards, % yield, color test**

- **Hand in Lab 15 homework problem** at the beginning of class.
- Review IR spectroscopy using your notes.
- Post NMR spectra and IR spectra for reference compounds outside the classroom. Begin the Lab 16B NMR Worksheet and Lab 16C IR Worksheet.

(24) For Friday October 25, 2019

**Lab 17: Aspirin NMR and IR and aspirin product titration**

- During class obtain IR and NMR of your synthesized aspirin.
- Review textbook section Section 4.6 (**determine by titration the amount of product produced**).
- During class titrate your product until two trials agree for the molecular weight of the aspirin. (Do the calculations in lab!)
- **Hand in Lab 16B NMR Worksheet and Lab 16C IR Worksheets by the end of class.**

(25) For Monday October 28, 2019

*Writing a scientific report*

- **Bring completed % yield and molecular weight calculations.**
- **Bring a printed draft of your experimental section for peer review.**
- **Bring the Tables and Figures for your aspirin paper.**

(26) For Wednesday October 30, 2019

**Lab 18: Is My Aspirin Stable?**

- **Prepare for lab by writing the purpose and method** in your lab notebook for “Is My Aspirin Stable?” Read through the lab procedure carefully and outline your actions in your lab notebook, saving plenty of space for additions and corrections to your actions, and for observations. Be prepared to start lab work as soon as you get to class and work efficiently.

**III. What changes can we make to reduce our environmental impact?**

*Chemical periodicity, metals and ions, and interaction of light with matter*

(27) Friday November 1, 2019

*Activity 17: Why have metals been used through the ages? (Logan Museum)*

**Lab 19: How well do different materials conduct heat?**

- **Class will start in the Logan Museum** (meet at the entrance to the museum for Activity 17)
- Read text Section 2.5 (**periodic table**) and 12.3 (**alloys**) and Table 8.1 (p. 390).
- **Prepare for lab by writing the purpose and method** in your lab notebook for “How well do different materials conduct heat?”
- **Hand in Aspirin paper (Labs 15, 16, and 17).**

(28) For Monday November 4, 2019

Activity 18: How should we make light?

- **Hand in “Is My Aspirin Stable?” worksheet.**
- Read text Section 7.1 (**light waves**), Fig. 7.7 and Fig. 7.14 (**energy level diagrams**).
- Read Activity 18. During class, groups will work on the problems.
- Read your assigned online article set (AGL, BJM, CKN, DEH, or FIO) and **write a summary paragraph or page of notes**. During class groups will fill out the table “What lighting options are currently available?”

(29) For Wednesday November 6, 2019

Activity 19: Which elements in the periodic table are metals?

**Lab 20: How can you identify different sources of light?**

- Read Activity 19 and using the videos on course website **complete Question 1, Which elements conduct electricity?** In your course packet before class.
- Read “How can you identify different sources of light?” After lab, your **answers to questions 1-6 will be due at end of class**.
- Read textbook sections 12.1 (**solid state**) and p. 480-483 (**bands and band gap**)

(30) For Friday November 8, 2019**Lab 21: What is the net ionic equation?**

- Read text p. 63-64 (**naming ionic compounds**) and text section 4.7 (**precipitation reactions**).
- **Quiz #5**

(31) For Monday November 11, 2019

Activity 20: How can we represent solids?

**Lab 22: How are structure and properties of solids related? (Solid State Model Building)**

- Finish ionic precipitate laboratory by writing balanced chemical equations for reactions where a precipitate is observed, *leaving out the spectator ions*.
- Examine **ionic radii** in text Figure 7.38. Are positive ions or negative ions bigger?
- Read Activity 20, especially the sections on **Counting Atoms** and **Layer Sequences**.
- Read text p. 596-597 (**unit cells**) and review Table 8.1
- **Hand in lab notebook for grading** of “How well do different materials conduct heat?” and “What is the net ionic equation?”

(32) For Wednesday November 13, 2019

Activity 21: What controls the properties of elements?

**Lab 22: How are structure and properties of solids related? (Solid State Model Building)**

- Read textbook Sections 7.10-7.12 (**periodic properties**).
- Read Periodic Properties Activity 21 and **bring your finished worksheet (problems 1-8) to class**.
- What happens at the macroscopic and at the atomic-molecular level in metallic, ionic, and covalent network solids when you bend such a material? Be sure that you have built models that represent each type of bonding as you do your structure and properties lab.

(33) For Friday November 15, 2019**Lab 23: How can you get a specific color of light from a solid? (LED)**

- **Hand in the Model Building Report worksheet if you did not hand it in on Wednesday.**
- Prepare for lab by reading the introduction and procedure for “How can you get a specific color of light from a solid?”
- **Answer the Pre-Lab Exercises (questions 1-8) in your lab notebook.**

(34) For Monday November 18, 2019**Lab 24: How do we know how atoms are arranged in solids?****Lab 25: Synthesis and characterization of Solid Solution Perovskite Semiconductors  $\text{CH}_3\text{NH}_3\text{Pb}(\text{I}_{1-x}\text{Br}_x)_3$** 

- **Prepare for lab by writing the purpose and method** in your lab notebook for both diffraction labs, one using visible light and your eyes as the detector, and the other involving x-rays and an instrument as the detector.
- In class we will introduce *Activity 23: Is my soil poisoned?*
- **Quiz #6**

Wednesday November 20, 2019**International Symposium**(35) For Friday November 22, 2019

Activity 22: New Kinds of LED Lighting Summary Exercise

- The results from Labs 20, 22, 23 and 24/25 will be needed for the Lighting Summary Activity 22. Most of you should almost get this finished in class, but it will be due Monday.
- Begin the online Background Readings in preparation for *Activity 23* on Monday.

**Integrative Project 3 - Is my soil poisoned?***Applying quantitative lab techniques and atomic spectroscopy to a new environmental problem**(36) For Monday November 25, 2019**Activity 23: Project Design: Is my soil poisoned?*

- **Hand in the answers to the questions in Activity 22 if you did not hand it in Friday.** Use complete sentences.
- Read Activity 23 ‘Is my soil poisoned?’ in your course packet *and* the background readings on the course website. **Write a paragraph summarizing what you read and providing references.** Where might you find lead in Beloit? An important component of the final project is choosing a reasonable site, backing up that choice with literature references, and designing a sampling strategy that tests your hypothesis.
- We will collect and document soil samples for analysis, return to the lab and put the samples in the oven to dry.

*(37) For Wednesday, November 27, 2019***Reflection**Thanksgiving*(38) For Monday December 2, 2018***Lab 26: Preparation of Lead Samples and Standards**

- **Prepare for lab by writing the purpose and method** in your lab notebook for “Preparation of Lead Samples and Standards.” Read through the lab procedure carefully and outline your actions in your lab notebook, saving plenty of space for additions, corrections, and observations. Be prepared to start lab work as soon as you get to class and work efficiently.

*(39) For Wednesday December 4, 2019***Lab 27: Atomic Absorption Spectroscopy of Lead Samples & Standards**

- **Hand in Lead Lab 26 Homework** at the beginning of class.
- In class you will do atomic absorption spectroscopy analysis of your sample and standard solutions.

*(40) For Friday December 6, 2019**Lead Project Data and Calculations*

- **Hand in Lead Lab 27 Homework** at the beginning of class.
- Finish atomic absorption spectroscopy analysis of your sample and standard solutions if needed.
- Complete lead concentration calculations for all soil samples you have analyzed.
- We will compile class data for our site map.

*(41) For Monday December 9, 2019**Lead Letter Peer Review*

- **Bring a printed draft of your Lead Project Letter** for peer review (**one copy for each group member**).
- Check out of lab and complete course evaluation during class.
- **Quiz #7**

*(42) For Wednesday December 11, 2019***Lab 28: Synthesis of an Aqueous-Based Ferrofluid**

- **Submit your Lead Project Letter (one copy per group).**
- Prepare for lab by reading “Synthesis of an Aqueous-Based Ferrofluid.”
- **Hand in the Ferrofluid lab worksheet at end of class.**