

AP Chemistry Syllabus 2018-2019

Pace: This class is intended to cover the same amount of material one would expect in a year of freshman college chemistry. Therefore, it is a much faster pace than that which you may be accustomed. As in college, it is assumed that you are entering this class with a fundamental knowledge of chemistry equivalent to that of a first year high school chemistry course. We must stick to the schedule. We will not have time in class to pause or go back to cover material with which you are having trouble. I am, however, available for extra help before and after school. I would expect to see everyone for extra help at least once per unit. Please use my office hours.

Notes: Lecture notes will be available on the class website (PowerSchool) at the beginning of each unit. In many cases this will include both a PowerPoint and the corresponding Word document. You are expected to print these and bring them to class to fill in as we lecture. In special circumstances, you **may** be allowed to take notes on your laptop. I will not routinely print these. It is your responsibility to be prepared to take notes in a manner that is not disruptive to the rest of the class (e.g. don't ask the teacher to slow down so you can write everything on the slide when it's already available on the document). It is also highly recommended that you read through the notes/outline/textbook prior to the lecture so you will get more out of the lecture. Some lectures will be recorded and posted on PowerSchool for viewing at home or on your own. Viewing these is required and will typically include a short quiz at the end.

Labs: We will be doing labs almost every week. Some of these experiments take more time than we have in class. Please dress appropriately and plan on spending extra time after school, lunch, or some other time finishing these labs.

Homework: We will be using an online homework site (Mastering Chemistry) for most of the homework in this class. You should have already created an account but you will receive more information on this later.

Text used:

Brown, LeMay & Bursten, *Chemistry: The Central Science* 13th edition, Prentice Hall, 2015

Laboratory manuals used:

College Board, *AP Chemistry Guided-Inquiry Experiments: Applying the Science Practices*, The College Board, 2013

Sally Vonderbrink, *Laboratory Experiments for AP Chemistry* 2nd edition, Flinn Scientific, Inc., 2006

Jack Randall, et. al, *Advanced Chemistry with Vernier*, Vernier Software & Technology, 2006

Course Outline:

1. Review of Chem 1

Reference: Brown & LeMay **Chapters 1, 2, 3, & 4**

Time allotted: summer assignment

- Matter, measurement, and math (dimensional analysis, sig figs, accuracy vs. precision, scientific notation, metric system), & problem solving
- Mixtures, molecules, and compounds; separations
- History of Atomic Theory
- Atoms and elements
 - Ions and Molecules
 - Nomenclature
 - Isotopes & Avg. Atomic Mass
 - Atomic Number & Mass Number
 - Laws of Mult. Proportions & Def. Proportions
- Equations & Stoichiometry
 - Balancing Equations
 - Net Ionic Equations
 - Moles, Molar Mass, and Molarity
 - Theoretical & Percent Yield
 - Empirical, Molecular Formulas, & Percent Composition
- Chemical reactions in aqueous solution – overview of Acid/Base; Ppt; Redox, Single & Double-Replacement

2. Gases

Reference: Brown & LeMay **Chapter 10**

Time Allotted: 4 days

- Kinetic molecular theory
- History of gas laws – Boyles, Charles, Gay-Lussac, Graham, Avogadro, & Dalton's Partial Pressure
- The Ideal gas law
- Non-ideal behavior
- Van der Waals factors

Labs: Investigation of the Gas Laws
Molar Mass of a Volatile Liquid

3. General Equilibrium

Reference: Brown & LeMay **Chapter 15**

Time allotted: 3 weeks

- Equilibrium definition, types, & conditions
- Reaction Quotient & equilibrium constant
- K_c vs. K_p
- Calculations using the equilibrium constant & reaction quotient
- Disturbing equilibrium – LeChatelier's Principle

Labs: Equilibrium & LeChatelier's Principle
Determination of the K_{eq} for the Formation of $FeSCN^{2+}$

4. Acids and Bases

Reference: Brown & LeMay **Chapters 16 & 17**

Time Allotted: 3 weeks

- Definitions of acids & bases
- pH scale
- Equilibrium concepts of acid base chemistry
- Acid base strength – K_a & K_b
- Bonding & acid strength
- Acid base reactions
- Salt hydrolysis
- Buffers
- Titrations

Labs: Determination of the K_a of Weak Acids
Determination of the Equivalent Mass & pK_a of an Unknown Acid
Buffer Competition

5. Precipitation reactions

Reference: Brown & LeMay **Chapter 17**

Time Allotted: 2 weeks

- Solubility & K_{sp}
- Common Ion Effect
- Ion separations
- Effects of pH, & other simultaneous equilibria

Labs: Determination of the K_{sp} of an Ionic Compound
Determination of the K_{sp} of $Ca(OH)_2$ by Titration

6. Thermochemistry & Thermodynamics

Reference: Brown & LeMay **Chapters 5 & 19**

Time Allotted: 3 weeks

- Review of thermochemistry
 - Energy
 - State functions
 - Specific heat
 - Enthalpy – Hess's Law
 - Calorimetry
 - 1st Law of Thermodynamics

- Spontaneity & entropy
- 2nd & 3rd Laws of Thermodynamics
- Entropy changes of physical & chemical processes
- Gibb's free energy (ΔG)
- Temperature effects on ΔG
- ΔG & K_{eq}

Lab: Thermochemistry & Hess's Law

7. Redox and Electrochemistry

Reference: Brown & LeMay **Chapters 4 & 20**

Time Allotted: 3.5 weeks

- Redox reactions & oxidation states
- Balancing redox reactions
- Voltaic cells
- Using standard reduction potentials
- Non-standard conditions
- Cell potential, ΔG , & K_{eq}
- Electrolytic cells & counting electrons

Labs: An Activity Series

Analysis by Redox Titration
Electrochemical Cells

8. Chemical Kinetics

Reference: Brown & LeMay **Chapter 14**

Time Allotted: 3 weeks

- Reaction rate & rate equations; particulate model of reaction rates (collision theory)
- Rate & the effects of concentration, temperature, pressure/volume, & catalysis
- Order of reaction – graphic and arithmetic analysis
- Integrated rate laws
- Time vs. concentration calculations
- Activation energy
- Reaction mechanisms

Labs: Study of the Kinetics of a Reaction

9. Atomic structure, Electron configurations, & Chemical periodicity

Reference: Brown & LeMay **Chapters 6 & 7**

Time Allotted: 1.5 week

- Electromagnetic radiation and energy
- Wave/particle duality & the behavior of electrons
- Emission & absorption spectra
- The quantum model & quantum numbers
- Orbital shapes
- Electron configurations
- Periodic trends – atomic radii, ionization energies, electron affinity, electronegativity
- Photoelectron Spectroscopy (PES)

Labs: Atomic Spectrum of Hydrogen

10. Bonding and Molecular Structure (Lewis structures, VSEPR theory, hybridization)

Reference: Brown & LeMay **Chapters 8 & 9**

Time Allotted: 2.5 weeks

- Electron configuration & bonding – ionic, metallic, covalent
- Lewis dot structures
- Octet rule and exceptions to the octet rule
- Hybrid structures
- Formal charge & polarity
- Bond order – σ & π bonds
- Orbital hybridization
- VSEPR theory & geometry
- Valence Bond Theory

- MO Theory
- Bond energy (including Lattice Energy)

Labs: Electron Dot Structures Lab
Molecular Modeling

11. Intermolecular forces in liquids & solids

Reference: Brown & LeMay **Chapter 11**

Time Allotted: 3 days

- Kinetic molecular theory
- Phases of matter
- Types of intermolecular forces – dipole-dipole, dipole-induced dipole, induced dipole-induced dipole, H-bonding, Van der Waals
- Properties of liquids
- Properties of solids
 - Electron-sea model vs. MO Theory
- Phase diagrams – phase changes and thermodynamics

Lab: Paper Chromatography

12. Organic Chemistry

Reference: Brown & LeMay **Chapter 25**

Time Allotted: 1 week (spring break self-study)

- Nomenclature
- Functional groups
- Typical reactions
- Cis-trans isomerism
- Other structural isomerism

13. Main Group & Transition elements

Reference: Brown & LeMay **Chapters 22 & 23**

Time Allotted: 3 days

- Properties and typical compounds of each group
- Coordination compounds – geometry & structure

Labs: Qualitative Analysis of Cations
Qualitative Analysis of Anions

AP Exam: The AP Exam will be administered on **May 9, 2019**. Prior to this, we will take several practice tests in class & possibly outside of class time.

Chemistry Classroom Policies & Procedures

General Behavior

1. Only those items necessary for the lesson should be out. Cell phones, mp3 players, and other unnecessary items, if visible, will be confiscated and may be redeemed by your parent or legal guardian.
2. Ask before getting up to use the restroom.
3. Class begins when the bell rings. Please try to use break time for getting a drink, using the restroom, etc. You will wait until I dismiss the class before leaving.
4. For health safety reasons, food is strictly forbidden from the classroom. This applies to eating, as well as any open container of food. It is acceptable to have your lunch, for example, in your lunch bag or backpack.
5. Behave yourself. You will be expected to adhere to the STEM student code of conduct.

Required Materials

1. Pencils with erasers
2. Scientific calculator – Doesn't have to be expensive. Just needs to have a "log" & "ln" buttons. You should expect to use your calculator every day. AP Chemistry is an applied math class. You will be allowed to use any kind of calculator for part of the AP exam in May, as long as it doesn't have a "QWERTY" keypad. It is in your best interest to have your own calculator – one that you are familiar with – to decrease your own personal stress. Additionally, **borrowing a calculator on a test will result in a 5% deduction on that test score.**
3. Cloth-bound **dedicated** lab notebook – all lab reports should be written in this.

Laptop Policy & Expectations

1. Laptops will only be used at the direction of the teacher – mostly for lab work. Otherwise, computers must be turned off and put away.
2. Students are expected to bring their laptops to class every day **charged and ready to go**. If there is a problem with your laptop (it is lost, stolen, broken, forgotten, etc.) you must inform the teacher by email prior to class or bring in a signed note from your parents.
3. Students will be expected to be doing work for this class only, and will not be permitted to have any other windows open on their desktop other than what is necessary for this class.
4. Students are not permitted to access instant messaging programs, Skype, email, etc., while in class, unless otherwise directed by the teacher.
5. Failure to comply with these policies and expectations will result in consequences ranging from detention to having laptops temporarily confiscated.

Lab Rules

1. Students will be assigned a lab station. Each lab team is responsible for cleaning the area after a lab. Part of your lab grade will be dependent on your participation in the activity and clean-up.
2. Safety procedures are to be followed at all times. See separate "Safety Contract".
3. Damaged or broken items of any kind resulting from carelessness or neglect will be paid for by those involved.
4. Dangerous and/or irresponsible behavior will result in removal from the room and a zero earned on the lab. Responsible behavior is an absolute must for personal safety and the safety of others.

Assignments and Tests

1. **Homework** will typically be completed on MasteringChemistry. These will normally be due 30 minutes before the start of class. Any other assignments will be collected at the beginning of class.
2. **Lab reports** will be written in a composition book. I will collect these periodically throughout the year.
3. **Lab grades** will be based on your participation in the lab and the lab report. Participation includes being actively involved in the experiment, safety considerations, and cleaning all equipment and the lab station. If you fail to comply with any lab safety guidelines, you will be asked to leave the lab and will receive a zero for that activity.
4. **Late work** will be accepted but will lose **10%** of the possible points **for every day** it is late. For paper assignments (e.g. lab reports), you must fill out a "**Late Assignment**" form for each item turned in late. For MasteringChemistry assignments, simply send an extension request to me via email. In the event of an absence, all paper assignments must be turned in the day of your return to class. Under certain circumstances, a computer assignment may avoid penalty if turned in on your return date IF you send an extension request beforehand. You will be responsible for checking the class webpage (PowerSchool) and the MasteringChemistry page to see what you have missed.

Nikola Tesla STEM HS AP Chemistry 2018-19

- Attendance** is critical to learning in this classroom. Some things, like class discussions or labs, cannot be made-up. Therefore, I will follow the school policies concerning attendance, tardies, detention and loss of credit.
- If you are absent it is **your** responsibility to find out what was missed. Upon your return to class, you must make arrangements with me to make-up any missed labs or exams. If your absence is planned (basketball tournament, MUN, etc.) please make arrangements before the absence occurs.
- Test grades** – Because most tests consist of AP-style questions, exams will be graded in a similar manner. What this means to you is that the grade entered into the gradebook will be adjusted (upward) from your raw score. You're welcome.
- Academic fraud (cheating)** – Academic fraud is any attempt by a student to misrepresent his/her level of achievement or aid another student in such an attempt. **It is the ultimate crime in an academic setting, and will not be tolerated in any form.** Examples of cheating include: copying from a published source and/or the internet (plagiarism), copying from another student, letting another student copy your work, referring to unauthorized materials during a test, giving unauthorized assistance during a test, acquiring a copy of a test before you are scheduled to receive it, falsifying experimental data, purchasing papers or other work from students or the internet.

There may be other examples of academic fraud. A good basic rule is as follows: **Under no circumstances is it permissible to transfer to your test, paper, or project something that has been written or stated by somebody else to receive credit for it.** If you are unsure whether something would be considered cheating, ask the instructor. You will not be penalized for asking such a question.

School policy will be followed as described in the student rights and responsibilities. A first offense will result in loss of credit for that assignment and notification of parents. A second offense, regardless of the subject, will result in loss of credit for the semester and parent notification. Students who are aware of cheating and do not report it or attempt to stop it will also be disciplined.

Grading

Your grade will be based on tests, lab reports, homework, and in-class participation. All work is graded on a percent scale. Your overall grade will be calculated by multiplying by the following "weight factors:"

| Assignment | Percent |
|-----------------|---------|
| Tests & Quizzes | 50% |
| Homework | 15% |
| Labs | 35% |

The grading scale is as follows:

| Grade | % Score |
|-------|--------------|
| A | 90.0 - 100% |
| B+ | 87.0 – 89.9% |
| B | 83.0 – 86.9% |
| B- | 80.0 - 82.9% |

| Grade | % Score |
|-------|--------------|
| C+ | 77.0 – 79.9% |
| C | 73.0 – 76.9% |
| C- | 70.0 – 72.9% |
| NC | 00.0 – 69.9% |

Office hours

I am available Monday through Friday 6:30 – 7:30. I may also be available other times, by arrangement. Please make use of my help.

Please sign and return to the teacher.

I have read and understand the classroom policies and procedures for AP Chemistry at Tesla – STEM.

Student Name: _____ Student Signature _____

Date _____

Parent Name: _____ Parent Signature: _____

Date _____