Bare Bones

Looking for a basic list of the most important things you should be doing for each unit? And what basic knowledge students should have mastered before coming in to the unit? We've got your back. If what you need is a day-by-day outline of what to teach, go back to the wiki and choose the document entitled 'Unit Plans'.

Student Brain Base is what we expect students to know so well from PAP that we don't have to reteach it. Because of that, topics that were covered in class in a previous unit are NOT included under *Student Brain Base*. It can be assigned as review homework prior to addressing it in class if you're worried about student ability.

Main Topics are arranged by unit, dovetailing with the units as listed on the wiki. FYI, we've annotated the topics with a few notes as listed below:
- * this topic is a good choice to cut if you're having timing issues
- **topic is super important**

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Unit 1 - Chemical Foundations
- anticipated end date 8/26 (10 days)

Student Brain Base:
- dimensional analysis
- units for measurements (i.e. energy is measured in Joules, volume is measured in Liters or cubic meters, etc)
- density
- molar mass

Main Topics:
- preassessment
- sig figs, measurement, accuracy and precision
- history*
- subatomic particles*
- basic bonding stuff
    - ionic v covalent
    - polar v nonpolar
- **ions v atoms**
- **nomenclature**
    - law of definite and multiple proportions fits here and/or in Unit 2: Stoichiometry
- isotopes, isotopic notation, and mass spec
    - fits here and/or in Unit 2: Stoichiometry
- periodic table anatomy
    - fits here and/or in Unit 9: Atomic Structure
- **5 types of reactions/balancing equations/conservation of matter**
    - fits here and/or in Unit 2: Stoichiometry

Unit 2 - Stoichiometry and Solution Stoichiometry

- anticipated end date 9/23

If desired, this unit can be split into two smaller units: Unit 2A -Stoichiometry and Unit 2B - Solution Stoichiometry.

Students Brain Base:
- molar mass
- simple mass, mole, and particle conversions
- density
- strong acids and bases

Main Topics: Stoichiometry
- If not done in Unit 1:
    - isotopes, isotopic notation, mass spec
    - law of definite and multiple proportions
    - 5 types of reactions/balancing equations/conservation of mass
- **empirical/molecular formula**
- percent composition
- hydrates
- **limiting and excess reactant calculations**
- percent yield calculations

Main Topics: Solutions
- **bonding, IMF's and polarity**
    - **explain why properties are what they are**
- **particulate views**
- separation techniques and why they work
- factors affecting solubility
- predicting products
- **balancing by the half reaction method**
- **molarity**
- preparing a standard solution
- dilution calculations
- **net ionic equations**
- Beer's law graphing
    - fits here and/or with Unit 6: Kinetics
- titration

Unit 3 - States of Matter/ IMFs /Gas Laws
- anticipated end date 10/14

Main Topics:
- general properties of the different states of matter
    - focusing on solids, liquids, gases
- **bonding, IMF's and polarity**
    - **explain why properties are what they are**
- **particulate views**
- alloys
- vapor pressure of liquids
- gases
    - **kinetic molecular theory**
    - pressure conversions
    - **combined gas law and calculations**
    - **ideal gas law and calculations**
        - non-ideal gas conditions (conceptual only; no calculations)
    - **graphing the variables**
    - **Dalton's law and calculations**
    - reasoning with Graham's law
        - effusion v diffusion
    - **molar mass kitty**

Unit 4 - Thermodynamics and Thermochemistry
- anticipated end date 11/1

Main Topics:
- Define and calculate:
    - enthalpy
    - entropy
    - Gibbs free energy
- **Hess's Law (with enthalpy, entropy, Gibbs free energy, and bond energies)**
- **calorimetry procedures and calculations**
- discussing the change of state diagram
- reaction diagrams (endo vs exothermic)
- **predicting and calculating spontaneity (G = H - TS)**
- G = –RTlnK calculations

Unit 5 - General Equilibrium
- anticipated end date 11/18

Main Topics:
- **Writing and Calculating with Equilibrium expression (finding K and concentrations)**
- Manipulating K*
- Kp to Kc*
- **Comparing K and Q to predict reaction direction**
- **RICE table calculations**
- **Using and explaining Le Chatelier's Principle to predict reaction direction**
- describing Ksp
- Using Ksp to find concentrations
- Common ion effect
- Ksp vs Q to find if a precipitate forms

Unit 6 - Electrochemistry
- anticipated end date 12/8

Main Topics:
- **galvanic cells (drawing and labeling)**
- **electrolytic cells (drawing and labeling)**
- **explaining the salt bridge**
- **calculating voltage**
- how concentration affects voltage
- electrolytic plating calculations

[Unit 7 - Acid/Base Equilibrium](#)
- anticipated end date 1/25

If desired, this unit can be split into Unit 8A - Acids and Bases and Unit 8B - Buffers
Student Brain Base:
- strong acids and bases

Main Topics: Acids and Bases
- properties
- Arrhenius acids and bases
- **conjugate acid/base pairs**
- **dissociation of strong v weak**
    - **particulate views**
- **equilibrium concentrations of weak acids/bases**
- **pH, pOH, and molarity of hydronium/hydroxide calculations**
- **salts and pH**
- **titration curves of SA/SB, WA/SB, SA/WB**
    - **including with either chemical in the buret**
- **common ion effect and calculations**

Main Topics: Buffers
- **what buffers are and what they do**
- **calculate pH of buffer solutions**
- **titration curves of buffers**
- calculate pH at any point on titration curve

[Unit 8 - Kinetics](#)
- anticipated end date 2/10

Main Topics:
- variables that affect reaction rate
- **collision theory**
    - **orientation**
    - **activation energy**
- reaction profiles of endo and exothermic reactions
- differential rate law
- **orders**
- **integrated rate law**
- Beer's law graphing
- half-life*
- creating a graph from data sets
- **reasoning with graphs**
- mechanisms

Unit 9 - Atomic Structure
- anticipated end date 3/3

Student Brain Base:
- all about subatomic particles
- Bohr model of the H atom

Main Topics:
- quantum model with energy levels and orbitals (s, p, d, f)
- aufbau, Hund's, Pauli exclusion and uncertainty
- **electron configuration of atoms and ions**
- periodic table and electron configurations
- **interpreting a PES diagram**
- atomic emission spectra and changes in electron energy
- energy, wavelength, and frequency calculations
- **Coulomb's law and attractive forces between nucleus and electrons**
- **Coulomb's law and relation to electron energies**
- **shielding electrons and effective nuclear charge**
- valence electrons and chemical properties
- **explain periodic trends:**
  - **ionization energies**
  - **electronegativities**
  - **atomic/ionic radius**

Unit 10 - Bonding
- anticipated end date 4/4

Main Topics:
- Coulomb's Law
- how electronegativity affects bonding
- **when and how ionic bonding happens**
- **when and how covalent bonding happens**
- distinguish between double, single, and triple bonds in terms of energy and length
- **drawing Lewis structures (including octet rule exceptions and resonance structures)**
- explain VSPER and its effect on molecular structure
- **predict molecular geometry, bond angles, and polarity of molecules**