**Laboratory Review for the 2020 AP Exam**

\*Student requirements are in red

Students: “File→ make a copy” of this document. Type your answers and definitions directly onto this document for submission to Google Classroom.

Yes, you can collaborate. BUT!! Your answers should not be identical (so..no copy and pasting!). I suggest trying every question by yourself first (either all of them or in chunks), and THEN comparing and discussing with your peers.

**Equipment to know (via the CED):**

**Students: for each piece of equipment, complete the following:**

1. **Describe its primary use(s) in the lab (for transferring, measuring, etc.)**
2. **Draw or insert a picture of the piece of equipment**

**Here is the list:**

* Beaker
* Volumetric Flask
* Erlenmyer flask
* Test tubes
* Crucibles
* Evaporating dishes\*
* Watch glasses
* Burners
* Plastic and glass tubing
* Stoppers
* Valves\*
* Spot plates
* Funnels
* Reagent bottles
* Wash bottles
* Droppers
* Balances
* Thermometers
* Barometers
* Graduated cylinders
* Burets
* Volumetric pipette
* Graduated pipette
* pH meters
* Spectrophotometers

**Processes and Procedures (there is overlap with the below experiments):**

Here is a list of procedures you may need to know for the AP exam. Define where noted.

* Synthesis of compounds (solid and gas)
* Separations
  + Precipitation and filtration (see gravimetric analysis below)
  + Dehydration--define
  + Centrifugation--define
  + Distillation--define
  + Chromatography (see chromatography below)
* Titration (below)
* Spectrophotometry (below)
* Gravimetric Analysis (below)--define

**Experiments with links to some of our labs (credit to many teachers from this group for many of these labs which I took and altered--Dan Reid, Linda Detwiler, and the list goes on):**

Students: review each of these labs and the data you collected. Envision the set-up for each lab, as it will help you with the questions in the next part of the document.

* Beer’s Law lab ([our concentration of blue dye in gatorade lab](https://drive.google.com/open?id=1ghoJF_7Qn7rkkEQEj41LAWDSLXiitdN1))
  + Set-up
  + Wavelength selection
  + Standard solutions to generate calibration curve or measure molar absorptivity
* Chromatography ([our food dye lab](https://drive.google.com/open?id=1vhIN1tSy-45zmL3DUY_JRp28E93WM6sv))
  + Relate to IMFs
  + Separate a mixture
  + Identify components of mixture
* Collecting an evolved gas or filtering and washing a solid (we did not collect a gas; we did filter and wash a precipitate--see below gravimetric analysis)
  + How to collect the product
  + How to mass the product
  + Determine reaction stoichiometry
* Gravimetric analysis ([our calcium carbonate lab](https://drive.google.com/open?id=1NHPoUNFdryqA92b986LLD_VKvmDrcQdMi3X1MpLRGn8))
  + Determine amount of analyte in mixture
  + Choose reagent that will selectively precipitate the chemical species
    - Relate to solubility rules
* Titration ([virtual lab during cyber school](https://docs.google.com/document/d/11lesS2zfOGdrwQNUXu0Wq7F9G777UyggkHU9CKKypfM/edit))
  + Determine endpoint
    - Indicator
    - Conductivity
  + Dispense from pipette
  + Dispense from burette
  + Determine analyte concentration
  + Determine pKa or pKb
* Rate law/kinetics ([bleaching of food dye lab](https://drive.google.com/open?id=1PRIslIZFdxXXrrROq6LesdBhlSgUTt0N))
  + Determine rate law from concentration vs time data or dependence of initial rate on initial concentrations
* Calorimetry
  + Identify system and surroundings
  + Determine amount of heat (q) exchanged
  + Determine enthalpy of process
* Le Chatelier’s Principle ([our color change lab with iodide](https://drive.google.com/open?id=1a5n_Wu9egtuwQp5QO-sUp_wV4gmL2hF-))
  + Determine factors that impact equilibrium position
  + Measure how disturbances impact the position of equilibrium

**Student Questions for each experiment:**

Students: answer the following questions for each lab. Type directly under each question in a DIFFERENT COLOR.

\*For the questions you are told to work, these are already part of your FRQ HW assignments due every Friday. Use these questions for targeted review of each lab.

➢Beer’s Law lab ([our concentration of blue dye in gatorade lab](https://drive.google.com/open?id=1ghoJF_7Qn7rkkEQEj41LAWDSLXiitdN1))

Practice exam FRQs on AP classroom (version B)

Questions:

* + How do you set this lab up (cuvette, spectrophotometer)
  + How and why do you blank the spectrophotometer?
  + How do you select the best wavelength of light for absorption of the dye?
  + How do you create a standard solution? What ranges should the absorption of your standard fall between? Why?
  + How do you generate a standard calibration curve? What are on the axes?
  + How do you then find the concentration of your unknown, using the curve
    - \*\*(you may want to refer back to your Google/Excel sheet with this data)
  + Describe a few sources of error in a spec lab (think about fingerprints on the cuvette, for example)

➢Chromatography ([our food dye lab](https://drive.google.com/open?id=1vhIN1tSy-45zmL3DUY_JRp28E93WM6sv))

Practice FRQ: [2017 #4](https://apcentral.collegeboard.org/pdf/ap-chemistry-frq-2017.pdf)

Questions:

* + Define stationary phase, mobile phase, solvent front, retention factor
  + What is the purpose of chromatography?
  + Explain how to set up a paper chromatography lab
  + If the stationary phase is more polar than the mobile phase, explain where you would find a polar vs. nonpolar mixture component along the stationary phase.
  + What is column chromatography? Why is it used, and how does it serve a purpose different from paper chromatography?
  + Define thin layer chromatography (TLC)

➢Collecting an evolved gas or filtering and washing a solid (we did not collect a gas; we did filter and wash a precipitate--see below gravimetric analysis)

Practice FRQ: [2015 #2a](https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap15_frq_chemistry.pdf)

Questions:

* + Explain and sketch the set-up for collecting a gas over water
  + What value must you subtract from the total pressure in the collection tube?
  + How would you expect pressure to deviate from the ideal gas law when collecting polar or larger gases in the collection tube?

➢Gravimetric analysis ([our calcium carbonate lab](https://drive.google.com/open?id=1NHPoUNFdryqA92b986LLD_VKvmDrcQdMi3X1MpLRGn8))

Practice FRQ: [2014 #1](https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap14_frq_chemisty.pdf)

Questions:

* + Explain how to set up a gravimetric analysis experiment (think back to your own sources of error when synthesizing calcium carbonate
  + List some possible sources of error when performing gravimetric analysis (i.e. incomplete transfer)

➢Titration ([virtual lab during cyber school](https://docs.google.com/document/d/11lesS2zfOGdrwQNUXu0Wq7F9G777UyggkHU9CKKypfM/edit))

Practice FRQs: [2015 #3](https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap15_frq_chemistry.pdf), [2018 #2 e-f](https://secure-media.collegeboard.org/ap/pdf/ap18-frq-chemistry.pdf), [2019 #7](https://apstudents.collegeboard.org/ap/pdf/ap19-frq-chemistry.pdf)

Questions:

* + Define the endpoint and the equivalence point of a titration.
  + Define titrant and titrand
  + EXPLAIN how to find the concentration of the analyte
  + What is the purpose of an indicator?
  + Why must the pipette and burette be rinsed before beginning a titration?
  + What error will result if you overshoot the endpoint?
  + What error will result if you have contaminants in the pipette?
  + What error will result if you have contaminants in the burette?

➢Rate laws/kinetics ([our bleaching of food dye lab](https://drive.google.com/open?id=1PRIslIZFdxXXrrROq6LesdBhlSgUTt0N))

Practice FRQ: [2015 #5](https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap15_frq_chemistry.pdf), [2016#5](https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap16_frq_chemistry.pdf)

Questions:

* + Explain how to collect absorbance vs. time data using a spectrophotometer
    - How does this data relate to concentration vs. time data?
  + Sketch the graphs for 0th, first, and second order reactions
    - Label all axes

➢Calorimetry

Practice FRQ: [2016 #1a (both parts of a)](https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap16_frq_chemistry.pdf), [2018 #1 d-g](https://secure-media.collegeboard.org/ap/pdf/ap18-frq-chemistry.pdf), [2019 #1e](https://apstudents.collegeboard.org/ap/pdf/ap19-frq-chemistry.pdf)

Questions:

* + For both of the above FRQs, Identify the system and surroundings

➢Le Chatelier’s Principle ([our color change lab with iodide](https://drive.google.com/open?id=1a5n_Wu9egtuwQp5QO-sUp_wV4gmL2hF-))

Practice FRQ: [2018 #2 b-c](https://secure-media.collegeboard.org/ap/pdf/ap18-frq-chemistry.pdf)

Questions:

* + Write out the reaction from the lab we completed (linked above)
    - How did you know which direction was endo/exothermic based on observable color changes?

➢Read and review this [post](https://l.facebook.com/l.php?u=https%3A%2F%2Fwww.adriandingleschemistrypages.com%2Flabs%2Flab-situations-ap-chemistry-exam%2F%3Ffbclid%3DIwAR0QMKKKVZ4_yKYsJSzfsgQ-YJ6eC9AQ3B7g1z4bHUgKbASb_WLlBEoNT0A&h=AT1Z6AQBA8THDqJxYpauJ8xDxyOAEkstT5OlvTUwP0rqhwxFTQvkwda_E1I0M3FkM05FIxptzxKu_LqNwS3VwSw5kNqRJqn77-oeED4rfdPuwYYbDk5BZBCGZ1bwjV2a4gtKSBFJsldpRwg21VTUSW7xIULmfhVLdJdLGQ) (Adrian Dingle’s blog post)

➢You are almost finished….Students: highlight any questions you were not able to answer. Highlight these questions in yellow. For example, if you did not know the answer to the last question, it should be highlighted, as follows: How did you know which direction was endo/exothermic based on observable color changes?

➢Lastly, submit your document to the assignment on Google classroom!