2022 Che3460 – Assignment #1: Textbook Figure

Due on Oct. 3rd at midnight

Upload to Rater in "Assignment One: Textbook" (password: textbook)

For this assignment, you are asked to make a diagram describing part of your chosen scientific grant proposal. For each proposal, you are given a brief written description and a very rough sketch (imagine that your boss/advisor ran into your office, briefly described a diagram you needed to make, and then quickly drew a rough sketch of what he had in mind before leaving and getting on a plane).

The diagram must be exactly 1200x720 pixels, and may contain words as well as images. Assume the diagram will span the entire width of a standard 8.5" x 11" page (that has 1" margins, so the image itself would only be 6.5" across). There is no caption associated with this diagram, so all text must be part of the diagram itself.

The image you submit for this assignment should be as self-explanatory as possible. Imagine it is going into a high-school science textbook, where interested students with no special background can understand the concept you are depicting. Words are allowed within the image, so make use of that degree of freedom to explain anything that isn't obvious from the pictures alone.

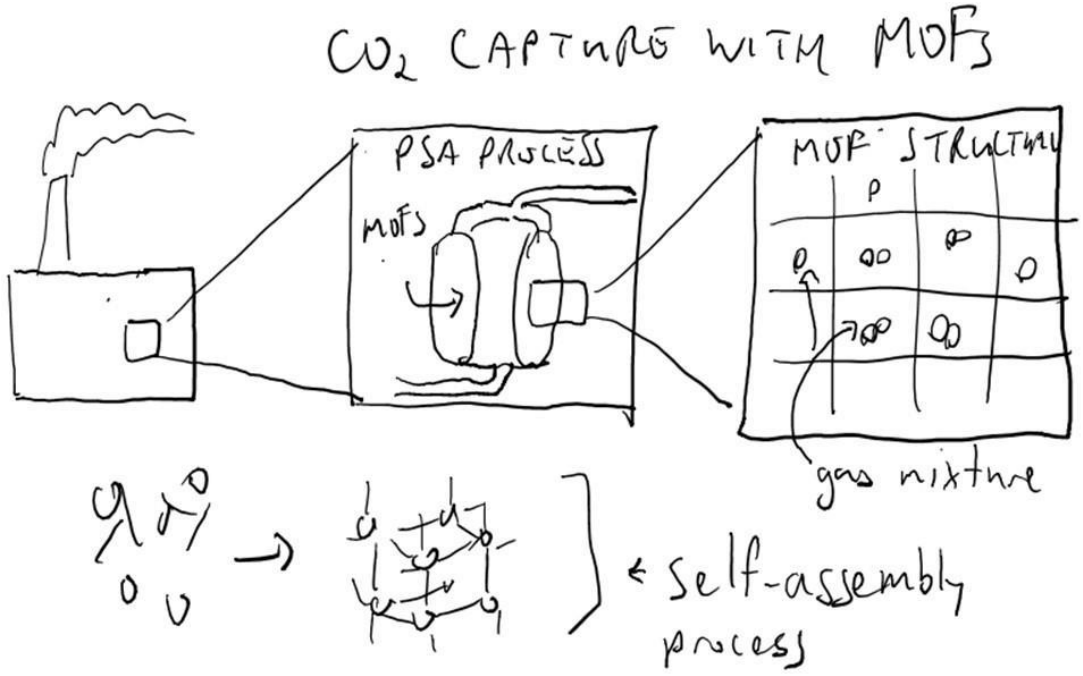
Pro tip: Show your image to friends, family, and strangers to get feedback before submitting it in class. Anything that is very unclear will come up and then you can resolve those issues.

For all assignments in this course, you can use any software you like. In principle, you can even hand draw your diagrams (and then scan them), but unless you have exceptional hand-drawing skills this is strongly not recommended

Proposal #1:

"I need a diagram that gives an overview of how MOFs are used to capture CO_2 in a coal power plant. Look up a typical CO_2 capture process and just replace whatever they use now with MOFs. Make sure it's clear that we're proposing a pressure-swing adsorption (PSA) process. Capture the essential details but don't clutter it with unrelated processes/details (e.g., the SO2 and mercury scrubbers). Show where the CO_2 capture unit is located in the whole plant (google a plant schematic). Show where the MOFs are located in the CO_2 capture unit. Also show a unit cell of a typical MOF. Finally, explain very briefly how MOFs self-assemble, and show a sub-diagram of MOFs self-assembling in solution. Explain in words whatever is not very clear in the images alone."

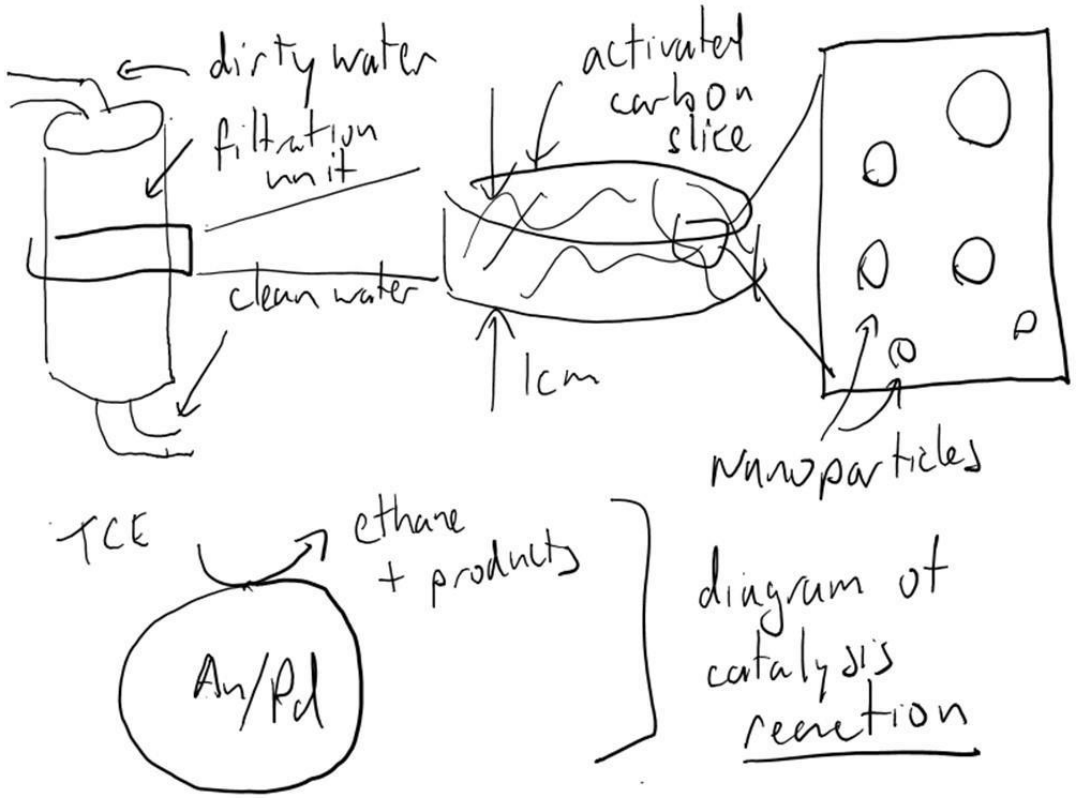
Whiteboard sketch:



Proposal #2:

"I need a diagram that gives an overview of how our catalyst works to remove TCE from water. Show a bimetallic Pd/Au nanoparticle catalyzing the conversion of TCE to ethane, including the adsorption, reaction, and desorption steps. Also show a basic schematic of a water filtration tank, where the filter unit has slices of activated carbon filters supporting the nanoparticles. This schematic needs to depict three different scales: the water filtration unit (with reasonable dimensions, it will probably be about the size of a human), the activated carbon slice (about 1 cm thick), and the nanoscale (~1-5 um) where nanoparticles are distributed randomly on the support. Explain in words whatever is not very clear in the images alone."

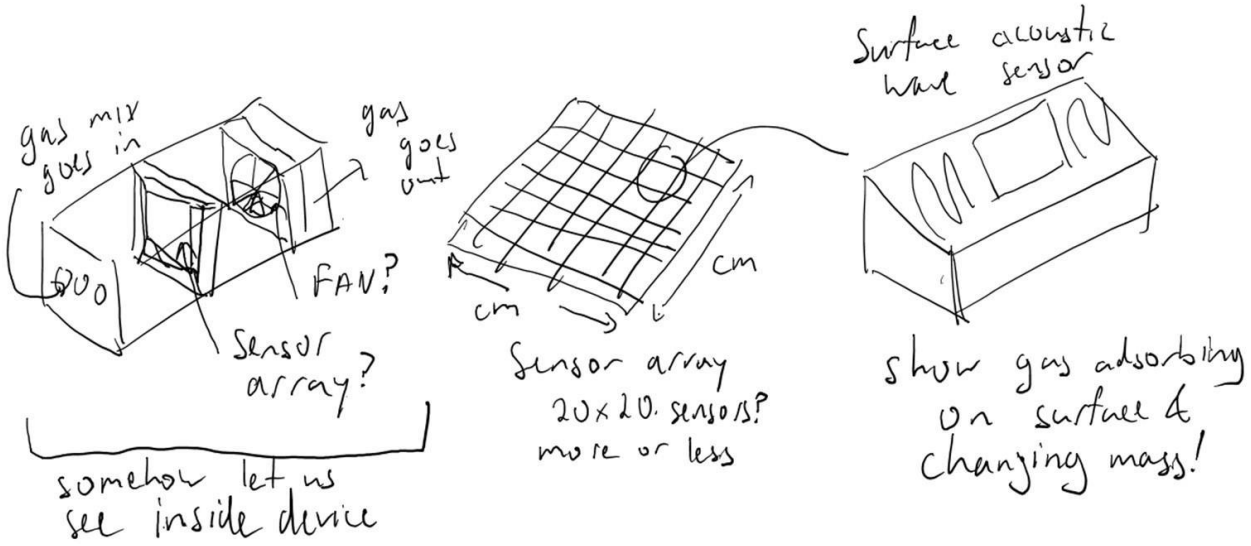
Whiteboard sketch:



Proposal #3:

"I need a diagram that shows what a complete gas sensor device might look like assuming all of the research works out, kind of like a mock-up of a finished product. We want the entire device to be something you could hold in your hand. Show how gas mixture enters and leaves the device, and where in the device the actual sensor array would be situated (and its approximate dimensions). Then 'zoom in' and show the sensor array, and then zoom in more to show a single surface acoustic wave sensor (and describe its various parts). Finally, show a gas molecule (or several) adsorbing on the surface and thus changing the surface mass. Explain in words whatever is not very clear in the images alone."

Whiteboard sketch:



Your own research

There's no fake-message-from-your-pretend-evil-advisor that I can write here since only you know the details of your research. Here are the things you need to keep in mind for this assignment if you are going to portray an aspect of your own research:

- The most important principle to adhere to is that this assignment should *help* your graduate research somehow. If there is a figure you already need to make for an upcoming paper, poster, or scientific presentation, work on that. There's no need to make pointless busy work for yourself – if there's nothing from your research you can think of to visualize / illustrate, just pick one of the other proposals.
- The image you submit for this assignment should be as self-explanatory as possible. Imagine it is going into a high-school science textbook, where interested students with no special background can understand the concept you are depicting.
- Recommendation (optional): Notice that the three other proposals request showing an object or process at three different scales. Researchers often focus on just one particular scale (say, at the molecular scale, or at scale of biological cells). However, to a non-specialist, including additional length scales can help put your research in an easy to understand context. For example, if you are designing novel electrodes for a battery, your research may focus on the atomic composition of the electrode, but showing where the electrode is located in a hypothetical battery, and also a hypothetical application for the battery (e.g., a space satellite that uses the battery) can make it easier for viewers to understand the purpose and motivation of your research.