Assignment VIII, PHYS 459 (Cloud and Precipitation Physics)
Fall 2019 Due Thursday, October 31st, 2019 at beginning of class

This homework is going to be a little weird. There's only one question, and it is an essay. I am looking for you to construct a well thought out and complete narrative. I'm still expecting you to spend a substantial amount of time with this homework assignment. Please type your response, and spend some serious time crafting this; just giving me a bunch of facts and ideas loosely connected together won't be enough to earn substantial credit. It may be worth developing an outline and doing some prewriting before trying to tackle this, because the task I ask isn't easy.

1. We have been studying the mechanisms by which airborne cloud drops and ice crystals grow for quite a few weeks now and – whenever a class spends that long on a topic – it is sometimes hard to make sure you have an appropriate understanding of the "big picture." I've tried to emphasize this where I can through the process, but keeping any narrative thread through weeks of lecture and discussion is always a challenge.

   The average middle-school level understanding of precipitation development goes something like this: water evaporates from the ocean surface, then condenses into clouds, and finally falls back down as rain or snow. We now can say a whole lot more about all parts of this process.

   Describe – in detail – the different processes that occur starting from surface evaporation and continuing all the way through the arrival of a fully grown raindrop on the ground.

   Although there is no formal required page length for this problem, a 3-5 page typed answer would be appropriate.

   Your intended audience for your essay would be someone who has a degree in Physics, but no background in atmospheric stuff. (Think of your professors that are really smart people, but don't likely know much of anything about atmospheric science.) Give a concise but complete explanation (with that audience in mind) of what you've learned in the last month or so.

   Your essay should include a discussion of all of the following topics: homogeneous and heterogeneous nucleation of liquid water and ice, Köhler Theory, deliquescence, condensational growth of liquid water and ice, coagulation (perhaps in a variety of contexts), the Wegener-Bergeron-Findeisen process, and Saffman-Turner theory. The essay *should not* just be a collection of defining these different phenomena. You are trying to tell a coherent story about the processes water goes through as it grows in the atmosphere.

   Incidentally, CofC is well known for its liberal arts tradition. We expect our students to be more accomplished writers than your average college student. It is also possible that many of you will someday ask me for a letter of recommendation for graduate school or a job; the best recommendation letters are able to draw on significant events or stories that clearly convey a strength in your portfolio that may not exist in your GRE scores and/or your grades. This essay is a chance to impress me. If you do a good job on this, I'll remember.