First of all, please don't think of this as an easy-A. This will require a serious effort, though I don't expect it will take an unreasonable amount of time. This is an optional assignment such that if you complete it and you score above your lowest quiz grade, this assignment grade will replace that lowest quiz grade. **This only applies to the first two-quizzes, not to the third quiz.** This is an **optional** assignment, if you are satisfied with your current quiz grades, you *do not need to complete this assignment.* Complete **one** of the four options:

1. **Question 1: Suppose we have a bunch of deutorons and alpha particles, how can we separate them if they have the same cyclotron radius?**
   - Support your proposal with a few equations that demonstrate it works.
   - Design a way to separate these particles in a quick efficient way using your theory.
   - What might go wrong? How practical is this?
   - Your report should be about a page long (double-spaced 12 pt font if typed) and supported by drawings.
   - Your concept should be reasonable and make physical sense and show an understanding of physics and/or chemistry.
2. **Question 2: Why isn't cyclotron radius a good way to isolate U-235 from U-238, and what are better ways to do so?**
   - This should include words, a few simple equations, and drawings.
   - You should begin by summarizing why it is important to be able to separate U-235 from U-238. A brief summary of fission would also be important–why U-238 is safe and U-235 is not.
   - You should give an overview of the different ways of separating U-235 from U-238.
   - What did the Manhattan project use? What do modern advanced nations use?
   - A summary of the physics of each is important and should show an understanding of the basic concepts.
   - This should be a two page report if typed and double-spaced, including figures, but don't go overboard with the figures in order to not have to write much text.
   - Close by discussing how your research has better helped you understand what is going on with Iran regarding uranium enrichment.
   - This is the easiest assignment, and thus will be graded the strictest. Your diagrams and words need to be clear and properly relay the concepts, and a few Physics I and Physics II equations should be used to describe the various methods.
   - At least three citations should be included on a separate piece of paper. Google is your friend, but not your partner. You may include wikipedia as one source, although please note that this is usually not allowed on academic essays.
3. **Question 3: The derivation of velocity in problem 3 using the moment of inertia for a rod and the kinematic equations is off, can you find out why?**
   - Compare the correct formula to the incorrect formula. It is missing a $1/\sqrt{3}$.
   - If you can find it and derive the correct formula using the kinematic equations, that is all you need to do!
   - However, your solution should be clear and concise and the derivation should be self-contained–don't just show where the solution derivation went wrong, derive it the right way.
   - Do not google this.
4. **Question 4: Obtain an equation describing the magnetic field of a coaxial cable using the Biot-Savert law.**
   - This is tough and will require some serious geometry and calculus.
   - Do not google this.