

# Homework 1

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## 1. PROBLEM 2.10

Problem 2.10 was about using python to calculate an approximation of the binding energy for the binding energy of an atom's nucleus, and to determine which were the most stable. I used the following equation, and determined the most stable combinations using a for loop. Part D turned out to be the trickiest part of the assignment, and involved me spending a few hours trying to figure out how to properly order the lists creation an appending so that I was able to get the indices in order.

$$B = a_1 A - a_2 A^{2/3} - a_3 \frac{Z^2}{A^{1/3}} - a_4 \frac{(A - 2Z)^2}{A} + \frac{a_5}{A^{1/2}} \quad (1)$$

## 2. PROBLEM 2.13 A)

Problem 2.13 a) was probably the easiest and most straightforward, it was a recursive program to find Catalan numbers, which are a thing that not even wikipedia could explain to me, or Carter who I questioned. They're weird, but not overly difficult to find. We used the following equation:

$$C_1 = 1$$
$$C_n = \frac{4n - 2}{n + 1} C_{n-1}$$

## 3. PROBLEM 2.2

a) This problem was about calculating the height of a satellite in orbit, given it's orbital period. It was fairly straightforward, and just asked us to show how we get the following equation:

$$h = \left( \frac{GMT^2}{4\pi^2} \right)^{1/3} - R \quad (2)$$

To do this, I just used the following equations, setting them equal to each other:

$$V = \left( \frac{GM}{R'} \right)^{1/2}$$
$$= \frac{2\pi R'}{T}$$

This quickly gave us the answer we were looking for, given that

$$R' = h + R \quad (3)$$

b) I wrote a program to calculate the altitude in meters with an input of the orbital period in minutes. Pretty straightforward, set constants and had T be an input variable.

c) 45 minutes gave a negative height, so that was probably not possible due to it being a nonphysical measurement. 90 minutes gave a height of 200 km, which is a physically possible measurement. 90 minutes is a possible orbital time, 45 minutes is not.

d) My guess would be that because a full rotation of the earth is slightly less than 24 hours, that is the reason. The difference in a satellite height is roughly 82 kilometers. Not a whole lot when it's that high, but a noticeable difference.

## 4. SURVEY QUESTION

The homework took me probably 3 - 4 hours? Most of it was spent on problem 1 and just figuring out how to arrange the lists and stuff for indices, but it was still really fun compared to previous physics assignments. Weird. I think the hw was just right in terms of length, and if the rest are like this then the class is going to be really fun, and I look forward to it!