Open Ended Problem #3
Congo
Group Work Okay, Due 9/27/23 at beginning of class
(Don't be afraid to "Google" for reasonable assumptions; just provide references!)

Flawless Diamonds for Lasers

Whoa… did you see those epic 1990's special effects? …cough, cough… I mean, apparently, there is a flawless blue diamond that facilitates high energy, high efficiency laser weapons, hidden in a mine deep in the African Congo! Unfortunately, this diamond mine full of blue diamonds is guarded by trained, killer, giant white gorillas. We don't really want to go there. So, let's see if we NEED those diamonds. The only problem with using regular diamonds is that they must be flawless (for the sake of realities, we'll say that flawless means only 100 vacancy point defects or less per gem). At what temperature would a real diamond reach this level of perfection? After all, we really don't want to mess with those vicious white apes…

1) What is this problem actually asking for? What is the final value you are being asked to find?

2) Draw a sketch that indicates the actual problem.

3) a) What physical laws apply to this problem?
   b) Indicate equations, correlations, and/or formulae that can model these laws.
   c) What are the potential limitations of these equations?

4) What assumptions should be made to utilize the equations/correlations/formulae listed in part 3b?
        a) List ALL the assumptions that you need to in order to solve the problem.

        b) Justify your assumptions (**references**, reasoning, judgment, common sense, etc.)

5) What are the physical properties (list assumed or referenced values) used in this problem?

6) At what temperature does diamond begin to reach the level of perfection required for the lasers (100 vacancies or less)?

7) Verify your answer... Does it look reasonable? Anything odd about the calculation?
        a) Is it realistic to reach this temperature?
        b) Is looking at vacancies only a reliable approach to this problem? Why or why not?
        c) How would linear or area defects influence this analysis?
        d) How could you eliminate area defects for a diamond like this?