Open Ended Problem #4 Escape From a Collapsing Dam *GROUP WORK OKAY*, Due 10/9/24 at beginning of class (Don't be afraid to "Google" good assumptions!)

https://www.youtube.com/watch?v=au9vdymQV4g

The fearless Flynn Rider escapes (with significant help from Rapunzel) from the soldiers and thieves only to face the surging water from a collapsing dam. With much fanfare, finesse, and a few less-than-manly squeals, they dash to the nearby cave and into safety mere seconds before a falling rock column traps them inside. Ignoring the falling rock formation (for now) could they have realistically escaped from the cascading water from the dam breaking? (DO NOT ASSUME A WATER VELOCITY!!!)

1) What is this problem actually asking for? (Be specific, and answer in terms of things you can actually solve for!)

- 2) Draw a sketch depicting the conditions of interest.
- 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? (*HINT – I have posted a youtube version of this clip so that you can accurately estimate the distances and heights, etc.*)

a) List ALL the assumptions that you need to in order to solve the problem.
(Hint – assume <u>INITALLY, that the rock formation is broken by the water</u>)
b) Justify your assumptions (references, reasoning, judgment, common sense, etc. where possible, use numbers and *quick* calculations)

- 5) What are the physical properties you used in this problem?
- 6) Calculate the quantity that you listed in part 1 (be sure to include intermediate values).
- 7) Verify your answer... Does it look reasonable? Anything odd about the calculation?
 - a) How fast do they need to run in order to make it to the cave? Is this realistic?
 - b) Assuming the rock didn't block the cave entrance,
 - i) At what velocity would the water hit Flynn and Rapunzel?
 - ii) What is the force associated with this velocity?
 - iii) Was going into the cave a good idea, (assuming the rock didn't fall?)

c) Now assume that the rock formation DOES get hit by the water... what force (stagnation) acts upon the rock?

d) Would this force realistically be enough to break the rock?