Question 1

In the attached bag you will find three grooming items: 1 comb and 2 hair clips. The first question is regarding the comb.

1. The comb was obviously injection molded. Sketch it and show where the gates, ejector pins and parting lines are.
2. The comb says "unbreakable." What aspect of the manufacturing process do you think makes it so?
3. The company decides to double the length of the comb. The other dimensions remain the same, and the number of teeth is doubled. How would this impact the injection-molding machine and the cycle time?
4. The company changes its mind and considers reducing the gap between the teeth to nearly zero, keeping the tooth width the same. The application is as for catching lice. What impact will this have on the injection-molding machine and the cycle time?
5. Changing its mind once again, the company decides to double the thickness of the teeth while keeping all other dimensions the same. The thickness is the dimension of the teeth perpendicular to the sheet. The thickness of the spine stays the same. What impact will this have on the injection-molding machine and the cycle time?
6. Finally, consider doubling the thickness of the whole comb. What impact will this have on the injection-molding machine and the cycle time?

Question 2

Consider the 2 hairclips. They work differently, and have subtly different manufacturing processes. How were they manufactured?
Question 3

Consider an end-milling tool. Does it need to be tough or hard? Which of these requirements do modern coated cutting tools address, and how do they deliver the right combination?

Question 4

If the relationship between cutting speed and tool life is for high-speed steel machining of cast iron is $VT^{0.111} = 185$, determine the cutting speed so that the tool life is 45 minutes ($V$ in feet per minute, $t$ in minutes.) If the cost of tools is $10, the profit from a part is $1, and it takes about 100 feet of machining to make a part, then what is the optimal cutting speed?