

## Level 2 Industrial Case Study: Chainsaw—12 Problems for Self-Exploration

1. Consider you must work with a chainsaw for a couple of hours. What are your main materials-related limitations? What would help you to work with a chainsaw for longer times?
2. Which properties are important for the design process of a chainsaw blade? (Case Study Paper)
3. What are the two main force directions that have to be considered during a cutting process? (Case Study Paper)
4. Which parameter of the chainsaw blade is design-limiting (should be maximized) in material design process, stiffness or strength? (Case Study Paper)
5. Which standard geometry can you use in the table of performance indices? What kind of function best represents the blade? (Case Study Paper/Granta EduPack Help)
6. In the table showing *Deflection of beams*, is it reasonable to assume that the actual load on a chainsaw blade (distributed load along a section of the blade) has the same format as the point load? Would the C then be different? (Case Study Paper/intuition)
7. What additional mechanical properties would you choose as constraints when screening for design requirements? (Experience)
8. Consider a Chainsaw that is ~1m long with a total mass of 5 kg centered 40 cm off your hand. How big is the torque you have to apply to keep it pointing straight away from you? (Center of mass, lever, basic mechanics)
9. How do you explain that Al, Mg and stainless steels have higher values in the cost-performance diagram than plastic materials, even though in the Granta EduPack the prices of the polymers per kilo are significantly lower than those of the metals & alloys? (Case Study & Granta EduPack)
10. What could be the reason why the chain guide rails on the inner metal frame of the blade are not yet made of CFRP? Although this is the best material in the E- $\rho$ -diagram and also ranks as medium in terms of cost (Case study Paper+blade picture therein)
11. Which different types of chainsaw blades are currently available on the market? What are these different from? Compare the used materials and their manufacturing processes. (Internet Research)
12. A real chainsaw blade is structurally similar to a sandwich structure but, try to use the results of this case study to suggest materials to fill the actual