5. Please select a material for a cutting die ! The die is subjected to pressure and bending, Required hardness 60 HRc. The tool cuts washer rings from a 10 mm thick sheet. The tool is subjected to quamechanical stress and is produced in small series.	
5.1 What is the purpose of a cutting die ? (2 points)	General questions. Answer the following questions in a couple of sentences each.
	1.1 Please write down the reaction equation for the direct reaction in a blast furnace. (4 points)
5.2 What are the main loads ? (2 points)	1.2 What is the through hardening diameter? (4 points)
5.3 Which material group do you select and why? (2 points)	1.3 Please interpret the material designation S 355 K2 ! (4 points)
5.4 Which specific material grade(s) do you recommend? (2 points)	1.4 Please list the tool steel groups you know (4 points)
5.5 Please sketch the temperature (T) - time (t) diagram of the proposed heat treatment. (5 points)	1.5 Please describe the case hardening steels (main alloys, expected properties, applications)
	(4 points)
	1.6 Please describe the austenitic stainless steels (main alloys, expected properties, applications) (4 points)
	1.7 Please interpret the cast iron designation Grade 60-40-18 . (4 points)
5.6 Please outline the manufacturing process of the part. (2 points)	1.8 Please interpret the material designation Al6061 ! (4 points)
	1.9 Please briefly describe what is the function of the runner during sand moulding (4 points)
Choice of materials: C45U, C70U, C80U, C90U, C105U, C120U, 105V, 50WCrV8, 60WCrV8,	1. 10 Please list the main steps of investment (precision) casting. (4 points)
102Cr6, 21MnCr5, 70MnMoCr8, 90MnCrV8, 95MnWCr5, X100CrMoV5, X153CrMoV12, X210CM2, X210CrW12, 35CrMo7, 40CrMnNiMo8-6-4, 45NiCrMo16, X40Cr14, X38CrMo16-9; 55NiCrMoV7, 32CrMoV12-28, X37CrMoV5-1, X38CrMoV5-3, X40CrMoV5-1, 50CrMoV13-15, X30WCrV9-3, X35CWMoV5, 38CrCoWV18-17-17;HS10-4-1, HS18-0-1, HS3-3-2, HS6-5-3-8, HS10-4-3-10.	
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2. Technology. Describe the technology of deep drawing, naming the elements of the process.2.1 Sketch, description of the elements of the procedure (9 points)		 Please select a material for a bevel gear! The gear has an outer diameter of 50 mm, a width of 50 mm and an inner bore diameter of 20 mm. The gear is subject to medium dynamic stresses, the surface hardness is min. 60 HRc, produced in large series. What is the purpose of a bevel gear? (2 points)
		4.2 What are the main loads? (2 points)
2.2 On the sketch above, also mark the blankholder ! Please explain in more detail why it is a problem if the blankhoder force is different from the optimum. (3 points)		4.3 Which material group do you select and why? (2 points)
		4.4 Which specific material grade(s) do you recommend? (2 points)
2.3 What is the main difference between deep drawing and impact extrusion ? (3 points)		4.5 Please sketch the temperature (T) - time (t) diagram of the proposed heat treatment. (5 points)
3. Welding. Oxyfuel-gas welding. 3.1 Skecth, elements of the procedure (9 points)		
3.2 Please compare (including sketch) the process of welding to left and right directions (6 points)		4.6 Please outline the manufacturing process of the part. (2 points)
		Choice of materials: C25, C35, C60, 28Mn6, 38Cr2, 41Cr4, 41CrMo4, 50CrMo4, 34CrNiMo6, 36NiCrMo16, 51CrV4; 24CrMo13-4, 31CrMo12, 41CrAlMo7-10, 40CrMoV13-9; C10E, C15E, 17Cr3, 10NiCr5-4, 20MnCr5, 17NiCrMo6-4; X10CrNi18-8, X2CrNi19-11, X5CrNi18-10, X8CrNiS18-9; X2CrNi12, X6Cr13, X6Cr17, X2CrTi17; X30Cr13, X29CrS13, X39Cr13, X46Cr13; C120U, 105V, 50WCrV8, 60WCrV8, 102Cr6; 55NiCrMoV7, 32CrMoV12-28, X37CrMoV5-1; HS10-4-1, HS18-0-1, HS3-3-2; EN-GJL-200, EN-GJL-250, EN-GJL-300; EN-GJS-450-10U, EN-GJS-500-7U, EN-GJS-600-3U; EN-GJMW-450-7U, EN-GJMB-350-10U, EN-GJMP-450-6U.
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