

MATERIALS ENGINEERING - HOMEWORK 2

100	Splined shaft	16MnCr5	Diameter 50 mm, produced in large series. Part subjected to very significant repetitive and shock loads, with high surface hardness at a depth of 1 mm.
101	Straight bevel gear	C45	22-tooth, 35 mm diameter bevel gear for large-scale production for low torque transmission.
102	Gear without hub	42CrMo4	It operates as a component exposed to medium bending stress ($\sigma_{\max}=500$ MPa), the abrasion effect on the tooth surfaces is not significant. Its diameter is 80 mm, height is 25 mm, and it is produced in large series.
103	Drive rod, crank arm for internal engine	51CrV4	It is characterized by high repetitive and shock-like tensile, compressive and bending stress. The required tensile strength is 1000 MPa. Its thickness is 20 mm, and it is produced in large series.
104	Shear blade	95MnWCrV5	It is being produced in large series.
105	Car transmission gear	16MnCr5	It is produced in very large series. The tooth surface is heavily worn and receives high contact pressure, while the core of the gear cannot be brittle.
106	Splined shaft	20MnCr5	It is produced in large series. It bears significant repetitive and shock loads.
107	Camshaft	42CrMo4	It is produced in medium series. The cam surfaces should be wear-resistant, and the shaft should be of high strength.

108	Drill for machining steels	HS6-5-2	It is being produced in large series.
109	Cutting die for thick steel sheet	X153CrMoV12	It is made in small series.
110	Forging die	55NiCrMoV7	A custom-made, large-sized tool. Its operating temperature can rise to 400-500 °C.
111	Turning tool for machining light metals	HS6-5-3	For machining Al and Cu alloys. Required 62-64 HRc. Produced in large series.
112	Boraching	HS10-4-3-10	CuZn alloy lock insert for keyway design of cylinders. Required 62-64 HRc. Made in small series
113	Gear hob	HS2-9-1-8	For the production of medium-sized spur gears. Required 62-63 HRc. Produced in small series.
114	Crankshaft	42CrMo4	Crankshaft for an internal combustion engine with a displacement of 1600 cm ³ , produced in large series. The required surface hardness is at least 50 HRc.
115	Drive rod	50CrMo4	Connecting rod for a 1600 cm ³ internal combustion engine, produced in large series.
116	Cold extrusion punch	X153CrMoV12	For forward, backward or combined joining of light metal pieces, produced in small series.

117	Pin	17NiCrMo6-4	A solid or hollow pin that provides a mechanical connection between the piston and the connecting rod of an internal combustion engine (1600 cm ³). It is subjected to significant repetitive and dynamic mechanical loads (bending and shearing). Its diameter is 15 mm. It must be wear-resistant (min. 55 HRc on the surface).
118	Thread rolling die	X100CrMoV5	It is used for the large-scale production of standard threaded mass products (e.g. hexagon head screws). The required surface hardness is 62-64 HRc.
119	Thread rolling die	HS10-4-1	It is used for the large-scale production of standard threaded mass products (e.g. hexagon head screws). The required surface hardness is 62-64 HRc.
120	Crankwheel	50CrMo4	It is characterized by significant shock and repetitive torsional and bending stress, the required strength is at least 1000 MPa. The bearing surfaces must withstand high abrasion. Its diameter is 100 mm, produced in small series
121	Drive rod	34CrNiMo6	It is characterized by high repetitive and shock-like tensile, compressive and bending stress. The required tensile strength is 1000 MPa. Its thickness is 80 mm, and it is produced in large series.
122	Cutting die	C105	For cutting steel. The dimensions of the stamp are diameter 20, length 120 mm. The number of pieces to be cut is 15,000 pieces. Hardness requirement 60-63 HRC.
123	Cutting blade	C120	For cutting tool. Diameter 50, height 30 mm, the disc to be cut is 15 mm in diameter, 0.8 mm thick steel plate, the number of pieces to be cut is 20 thousand pieces. Resharpener is possible.
124	Upsetting die for screw head	X153CrMoV12	Diameter 50 mm, length 85 mm, bore 10 mm. Required hardness at least 60 HRC.

125	Parting tool	HS2-9-1-8	High cutting speed, wear resistance. For cutting difficult-to-machine steels. Size: 5x12x180 mm. Required hardness min. 64HRC. Produced in medium series.
126	Cold extrusion punch	X210CrW12	Size: Ø40×200 mm. Required hardness: 60-63 HRC. Made to order.
127	Pin	C45	The surface should be very hard (at least 60 HRC), wear-resistant. It should withstand medium dynamic stress ($\sigma_{\max}=400$ MPa). The diameter is 5 mm, it is produced in very large series
128	Gear for crane	42CrMo4	Dynamic stress, wear, small series, some corrosion resistance
129	Injection molding die	38CrMoAl	High strength, wear and heat resistance
130	Extruder die	34CrAlMo5	High strength, high resistance to abrasion and frictional stress of polymers
131	Extruder die	X155CrVMo12-1	High strength, high resistance to abrasion and frictional stress of polymers
132	Hip implant - femoral stem	Ti-6Al-4V ELI (Grade 23)	Cementless hip implant femoral stem. Length approx. 140 mm, largest cross-sectional dimension approx. 35 mm. Subject to repeated bending and compression loads, high fatigue strength and biocompatibility required. Produced in medium/large series, requires a preform close to the final shape.

133	Car axle shaft	42CrMo4	A half shaft with a nominal diameter of approximately 32 mm and a length of 450 mm, produced in large series. It is subjected to significant alternating torsional and bending stresses, and occasionally to shock loads. The required tensile strength is at least 900–1000 MPa.
134	Ball bearing outer ring	100Cr6	Outer diameter approx. 90 mm, ring width approx. 20 mm. Produced in large series. The raceway is exposed to high Hertzian contact stress and repetitive rolling stress, therefore very high hardness and wear resistance are required.
135	Cup / beer can	AA3104-H19	Coke can shell (diam. 66mm). Internal pressure (CO ₂), room temperature. Large series production (e.g.: 2000 pcs/min)
136	Gear	20MnCr5	Outer diameter approx. 120 mm, tooth width 35 mm, large series. Repetitive tooth loading, good core toughness and high surface wear resistance required; effective crust depth approx. 0.8–1.2 mm.
137	Pin	C45	Ø10 mm, very large series. Medium dynamic load, surface hardness 55–60 HRC and wear-resistant.
138	Gear	41CrAlMo7-10	It is produced in small to medium series. High dimensional accuracy, high surface wear resistance and low heat treatment distortion are required.
139	Hot forming tool for aluminum casting	X38CrMoV5-1	Small series tool. Repeated thermal cycles, thermal fatigue, erosion and high mechanical stress.
140	flat spring	51CrV4	8×60 mm cross-section leaf spring, medium series. High elastic deformation, repetitive loading, fatigue resistance required.

141	Coil spring	50CrV4	Wire diameter 12 mm, medium series. High cycle repetitive load, good fatigue properties required.
142	Motor vehicle wheel hub	42CrMo4	Outer diameter approx. 160 mm, large series. High dynamic and fatigue loads; good surface condition required for bearing seats.
143	Cast iron gear	EN-GJS-500-7	Ø350 mm, small series. Medium mechanical load, complex shape, good vibration damping and economical production required.
144	Chemical tank jacket	X2CrNiMo17-12-2	3 mm plate, welded construction, small to medium series. Wet media containing chlorides, good corrosion resistance; high hardness is not required.
145	Aluminum motor - piston	EN AC-AISi12CuNiMg	For passenger cars, large series. Low weight, good castability, heat load, wear and dimensional stability are required.
146	Copper current conducting rail	Cu-ETP	10×80 mm cross-section, large series. High electrical conductivity, good bendability and connectivity are required.
147	Excavator bucket plate	42CrMo4	40 mm thick edge, small-medium series. Strong abrasive wear and impacts, but also safety against breakage is required.
148	Cheap thread drill	C105	For M6 thread, min. 60 HRc, for manual tapping (low cutting speed, mild steel workpiece). Produced in large quantities.
149	Hand sheel metal shear	C90U	For cutting mild steel sheet, for tinsmithing, max. 2 mm sheet thickness, produced in large series