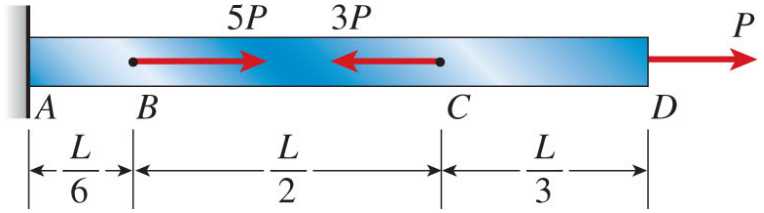
材料力學　作業 6

學號：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿　　姓名：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

2.7-1 A prismatic bar *AD* of length *L*, cross-sectional area *A*, and modulus of elasticity *E* is subjected to loads 5*P*, 3*P*, and *P* acting at points *B*, *C*, and *D*, respectively (see figure). Segments *AB*, *BC*, and *CD* have lengths *L*/6, *L*/2, and *L*/3, respectively.

(a) Obtain a formula for the strain energy *U* of the bar.

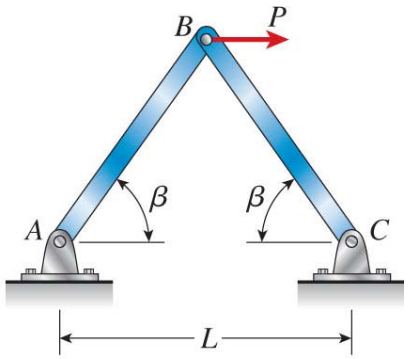
(b) Calculate the strain energy if $P = 27$ kN, $L = 130$ cm, $A = 18 cm^2$, and the material is aluminum with *72* GPa.



2.7-6 The truss *ABC* shown in the figure is subjected to a horizontal load *P* at joint *B*. The two bars are identical with cross-sectional area *A* and modulus of elasticity *E*.

(a) Determine the strain energy *U* of the truss if the angle $\beta = 60^\circ$.

(b) Determine the horizontal displacement δ_B of joint *B* by equating the strain energy of the truss to the work done by the load.

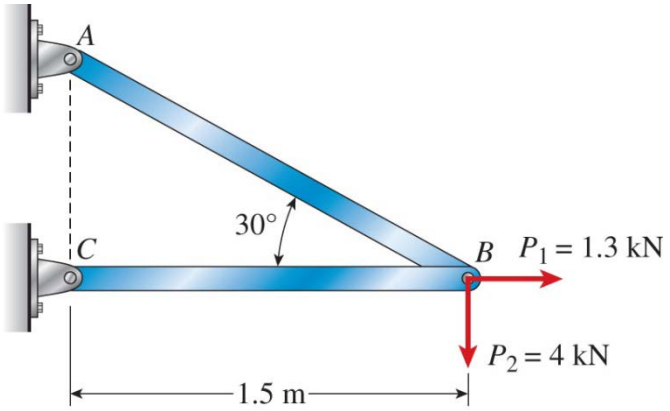


2.7-7 The truss *ABC* shown in the figure supports a horizontal load $P_1 = 1.3\,\text{kN}$ and a vertical load $P_2 = 4\,\text{kN}$. Both bars have cross-sectional area $A = 1500 mm^2$ and are made of steel with $E = 200 GPa$.

(a) Determine the strain energy U_1 of the truss when the load P_1 acts alone ($P_2 = 0$).

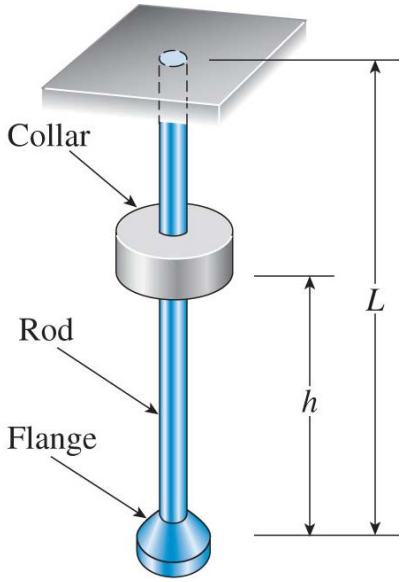
(b) Determine the strain energy U_2 when the load P_2 acts alone ($P_1 = 0$).

(c) Determine the strain energy U_3 when both loads act simultaneously.

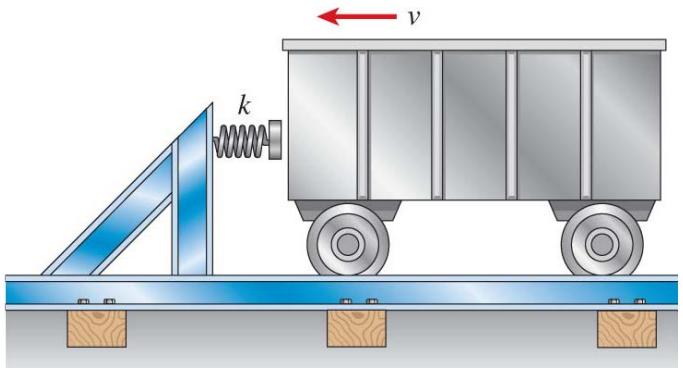


2.8-1 A sliding collar of weight $W = 650\,\text{N}$ falls from a height $h = 50mm$ onto a flange at the bottom of a slender vertical rod (see figure). The rod has length $L = 1.2\,\text{m}$, cross-sectional area $A = 5cm^2$, and modulus of elasticity $E = 210\,\text{GPa}$.

Calculate the following quantities: (a) the maximum downward displacement of the flange, (b) the maximum tensile stress in the rod, and (c) the impact factor.



2.8-11 A bumper for a mine car is constructed with a spring of stiffness $k = 176$ kN/m (see figure). If a car weighing 14 kN is traveling at velocity $v = 8$ km/h when it strikes the spring, what is the maximum shortening of the spring?



2.8-12 A bungee jumper having a mass of 55 kg leaps from a bridge, braking her fall with a long elastic shock cord having axial rigidity $EA = 2.3\,\text{kN}$ (see figure).

If the jumpoff point is 60 m above the water, and if it is desired to maintain a clearance of 10 m between the jumper and the water, what length L of cord should be used?