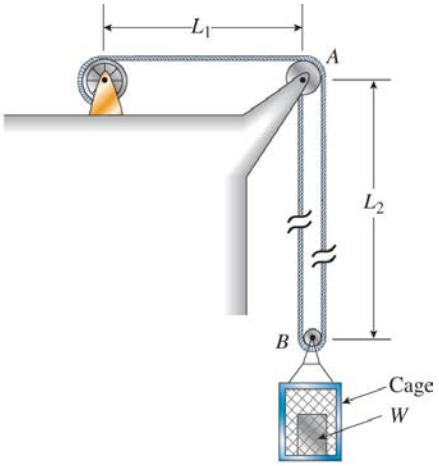
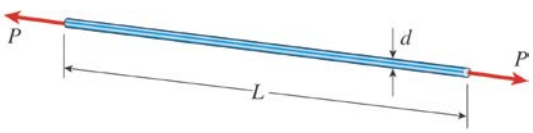
材料力學　作業 3

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



2.2-4 By what distance *h* does the cage shown in the figure move downward when the weight *W* is placed inside it? (See the figure)

Consider only the effects of the stretching of the cable, which has axial rigidity $EA = 10,700$ kN. The pulley at *A* has diameter $d_A = 300$ mm and the pulley at *B* has diameter $d_B = 150$ mm. Also, the distance $L_1 = 4.6$ m, the distance $L_2 = 10.5$ m, and the weight $W = 22$ kN. (*Note*: When calculating the length of the cable, include the parts of the cable that go around the pulleys at *A* and *B*.)



2.2-9 An aluminum wire having a diameter $d = 2$ mm and length $L = 3.8$ m is subjected to a tensile load *P* (see figure). The aluminum has modulus of elasticity $E = 75$ GPa.

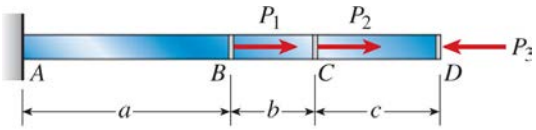
If the maximum permissible elongation of the wire is 3 mm and the allowable stress in tension is 60 MPa, what is the allowable load P_{max} ?

2.3-3 An aluminum bar *AD* (see figure) has a crosssectional area of $A = 250 mm^2$ and is loaded by forces $P_1 = 7560$ N, $P_2 = 5340$ N, and $P_3 = 5780$ N. The lengths of the segments of the bar are $a = 1525$ mm, $b = 610$ mm, and $c = 910$ mm.

(a) Assuming that the modulus of elasticity $E = 72$ GPa, calculate the change in length of the bar. Does the bar elongate or shorten?

(b) By what amount *P* should the load P_3 be increased so that the bar does not change in length when the three loads are applied?

(c) If P_3 remains at 5780 N, what revised cross-sectional area for segment *AB* will result in no change of length when all three loads are applied?

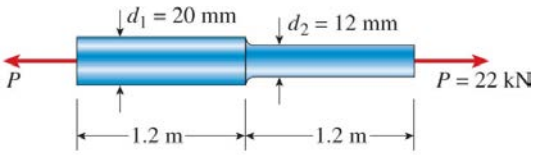


2.3-7 A steel bar 2.4 m long has a circular cross section of diameter $d_1 = 20$ mm over one-half of its length and diameter $d_2 = 12$ mm over the other half (see figure part a). The modulus of elasticity $E = 205$ GPa.

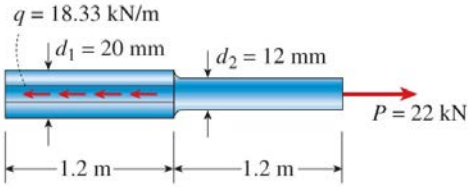
(a) How much will the bar elongate under a tensile load $P = 22$ kN?

(b) If the same volume of material is made into a bar of constant diameter *d* and length 2.4 m, what will be the elongation under the same load *P*?

(c) If the uniform axial centroidal load $q = 18.33$ kN/m is applied to the left over segment 1 (see figure part b), find the ratio of the total elongation of the bar to that in parts (a) and (b).



(a)



(b)

2.3-9 A wood pile, driven into the earth, supports a load P entirely by friction along its sides (see figure part a). The friction force f per unit length of pile is assumed to be uniformly distributed over the surface of the pile. The pile has length L, cross-sectional area A, and modulus of elasticity E.

(a) Derive a formula for the shortening δ of the pile in terms of P, L, E, and A.

(b) Draw a diagram showing how the compressive stress σ_c varies throughout the length of the pile.

(c) Repeat parts (a) and (b) if skin friction f varies linearly