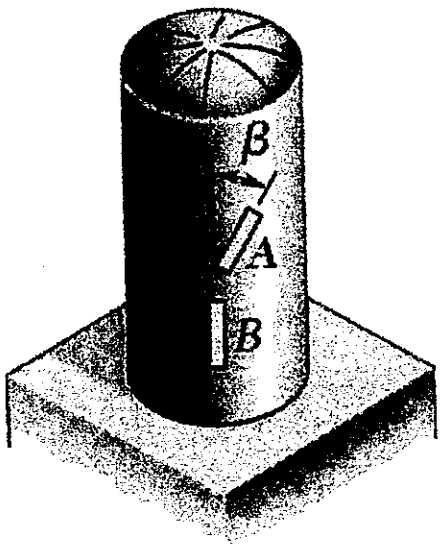
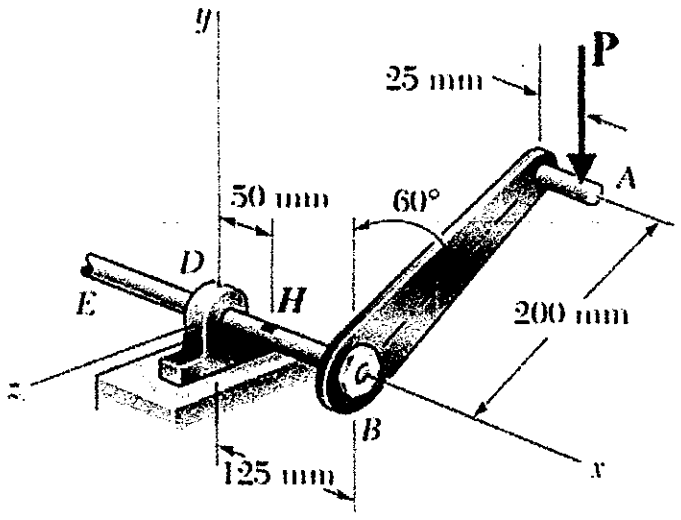
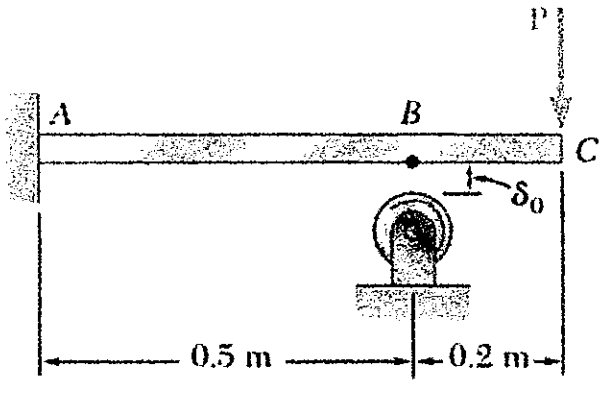
1. (25 Points) A single strain gage forming an angle $\beta = 30°$ with the verticle is used to determine the gage pressure in the cylindrical steel tank shown. The cylindrical wall of the tank is 0.375 inch thick, has a 36-inch inner diameter, and is made of a steel with $E = 29 \times 10^6$ psi and $\nu = 0.30$. Determine the pressure in the tank corresponding to a gage reading of 220×10^{-6} inch/inch.
2. (25 Points) A vertical force **P** of magnitude 250 N is applied to the crank at point *A*. Knowing that the shaft *BDE* has a diameter of 18 mm, determine the principal stresses and the maximum shearing stress at point *H*.
3. (25 Points) Before the load **P** was applied, a gap $\delta_0 = 0.5$ mm existed between the cantilever beam *AC* and the support at *B*. Knowing that $E = 200$ GPa, determine the magnitude of **P** for which the deflection at *C* is 1 mm.
4. (25 Points) A narrow bar of aluminum is bonded to the side of a thick steel plate as shown. Initially at $T_1 = 20°C$, all stresses are zero. Knowing that the temperature will be slowly raised to T_2 and then reduced to T_1, determine (a) the highest temperature T_2 that does not result in residual stresses, (b) the temperature T_2 that will result in a residual stress in the aluminum equal to 100 MPa. Assume $\alpha_a = 23.6 \times 10^{-6}/°C$ for the aluminum and $\alpha_s = 11.7 \times 10^{-6}/°C$ for the steel. Further assume that the aluminum is elastic-plastic, with $E = 70$ GPa and $\sigma_Y = 100$ MPa. (*Hint: Neglect the small stresses in the plate.*)



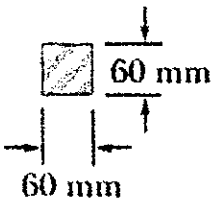
Problem 1

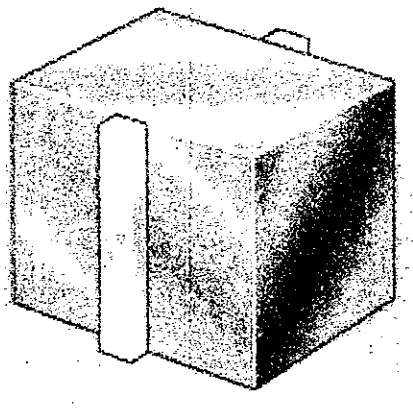


Problem 2



Problem 3





Problem 4

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