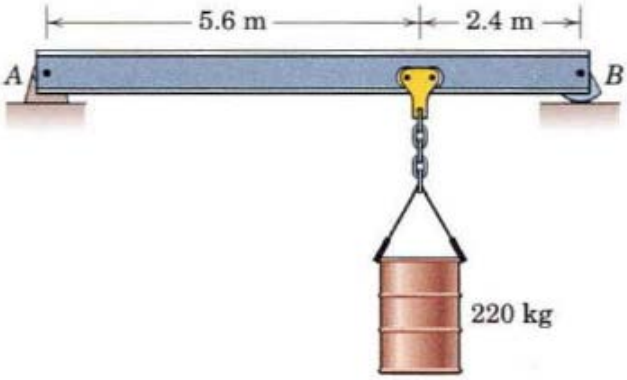
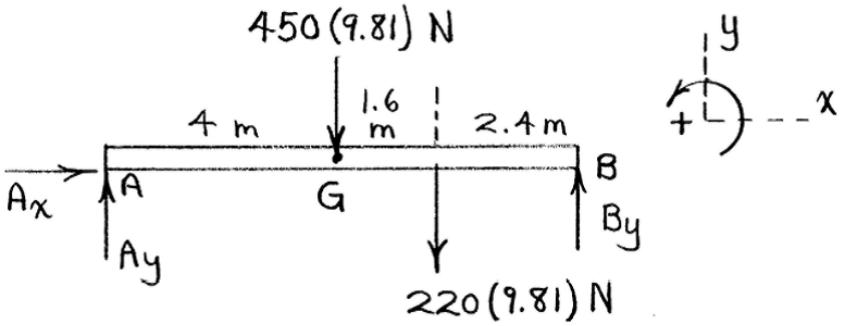
Problem 6

The 450-kg uniform I-beam supports the load shown. Determine the reactions at the supports



Solution



From $\Sigma F_x = 0$, $A_x = 0$

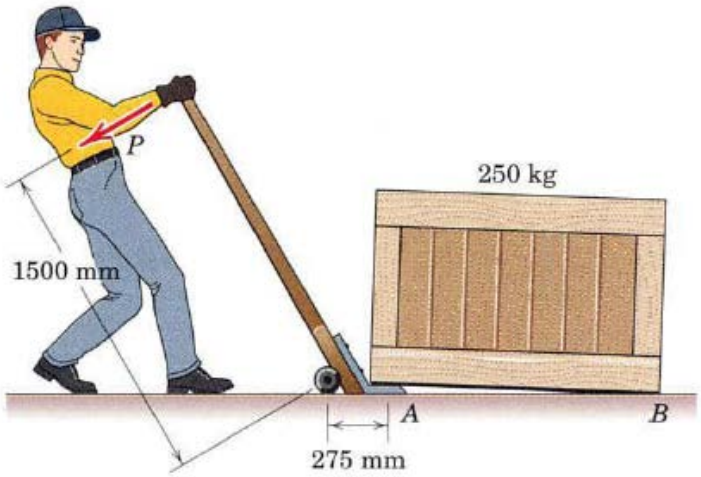
$\Sigma M_A = 0$: $-450(9.81)4 - 220(9.81)(5.6) + B_y(8) = 0$, $\underline{B_y = 3720\ N}$

$\Sigma F_y = 0$: $A_y - 450(9.81) - 220(9.81) + 3720 = 0$

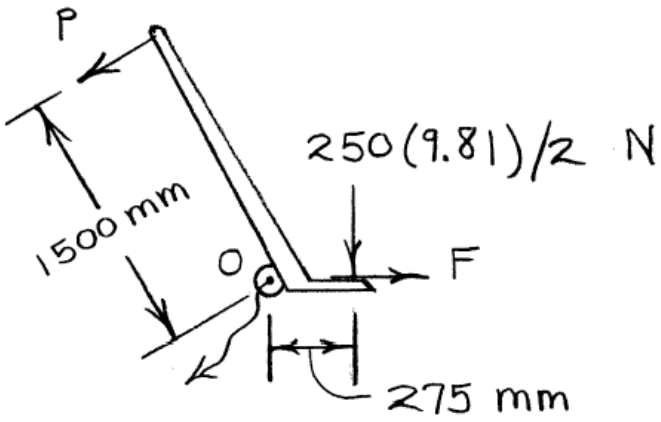
$\underline{A_y = 2850\ N}$

Problem 7

Determine the force magnitude P required to lift one end of the 250 kg crate with the lever dolly as shown. State any assumptions.



Solution

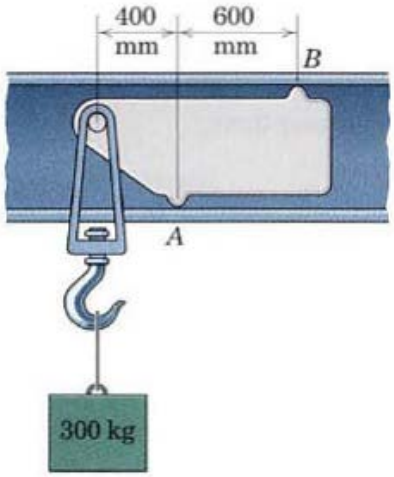


$$\curvearrowleft + \Sigma M_O = 0 : \quad P(1500) - \tfrac{1}{2}(250)(9.81)(275) = 0$$

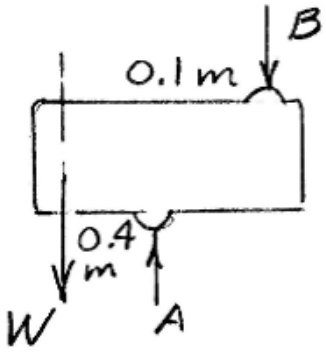
$$P = 225 \text{ N}$$

Problem 8

To facilitate shifting the position of a lifting hook when it is not under load, the sliding hanger shown is used. The project ions at A and B engage the flanges of a box beam when a load is supported, an d the hook projects through a horizontal slot in the beam. Compute the forces at A and B when the hook supports a 300-kg mass.



Solution



$W = 300(9.81) = 2943\ N$

$\Sigma M_A = 0;\ 2943(0.4) - B(0.6) = 0$

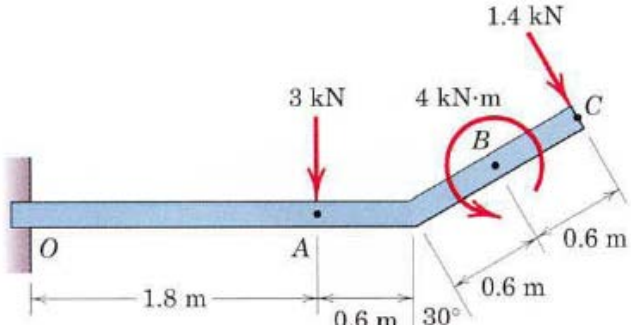
$B = 1962\ N$ or $1.962\ kN$

$\Sigma F = 0;\quad A = 2943 + 1962$

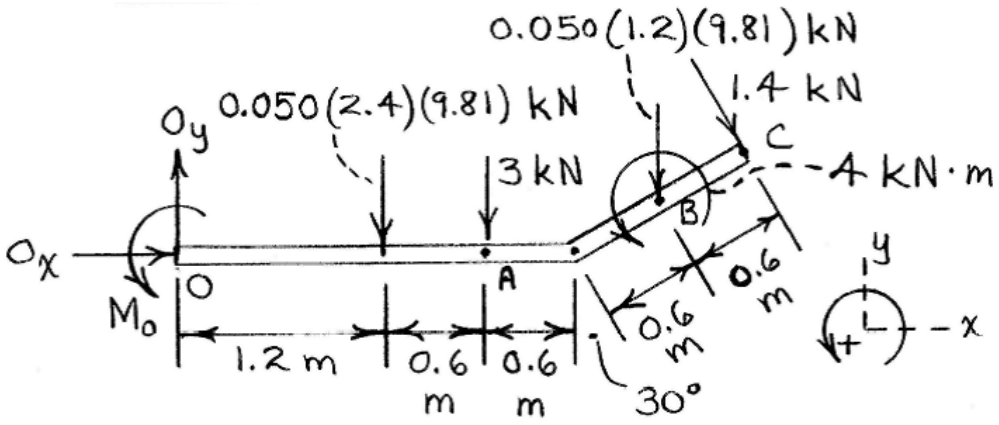
$= 4910\ N$ or $4.91\ kN$

Problem 9

The uniform beam has a mass of 50 kg per meter of length. Compute the reaction s at the support O. The force loads shown lie in a vertical plane.



Solution



$\Sigma F_x = 0: \quad O_x + 1.4 \sin 30° = 0$

$O_x = -0.7 \text{ kN}$

$\Sigma F_y = 0: \quad O_y - 0.050(2.4)(9.81) - 3 - 1.4 \cos 30°$

$-0.050(1.2)(9.81) = 0, \quad O_y = 5.98 \text{ kN}$

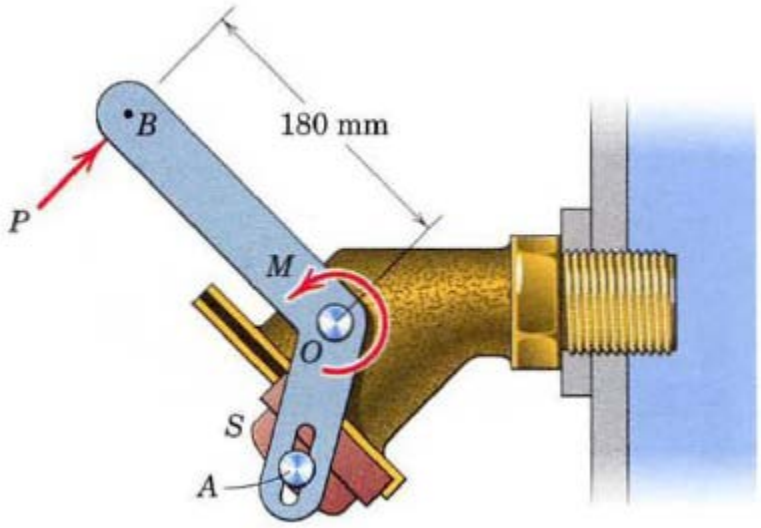
$\Sigma M_o = 0: \quad M_o - 0.050(2.4)(9.81)(1.2) - 3(1.8)$

$-0.050(1.2)(9.81)(2.4 + 0.6 \cos 30°) + 4$

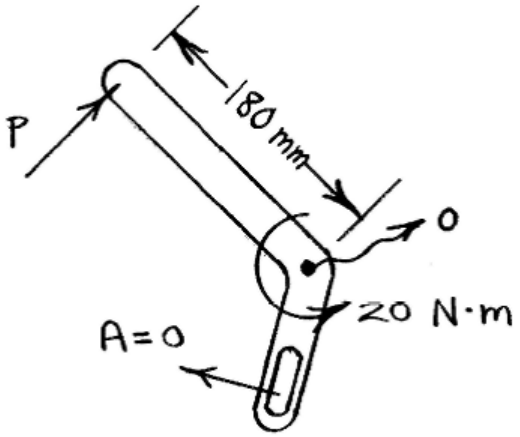
$-1.4(2.4 \cos 30° + 1.2) = 0, \quad M_o = 9.12 \text{ kN·m}$

Problem 10

The elements of a heavy-duty fluid valve are shown in the figure. When the member DB rotates clockwise about the fixed pivot O under the action of the force P the element S slides freely upward in its slot, releasing the flow. If an internal torsional spring exerts a moment M = 20 N·m as shown, determine the force P required to open the valve. Neglect all friction.



Solution



$$+\circlearrowleft \sum M_O = 0: \quad 20 - P(0.180) = 0, \quad P = 111.1 \text{ N}$$