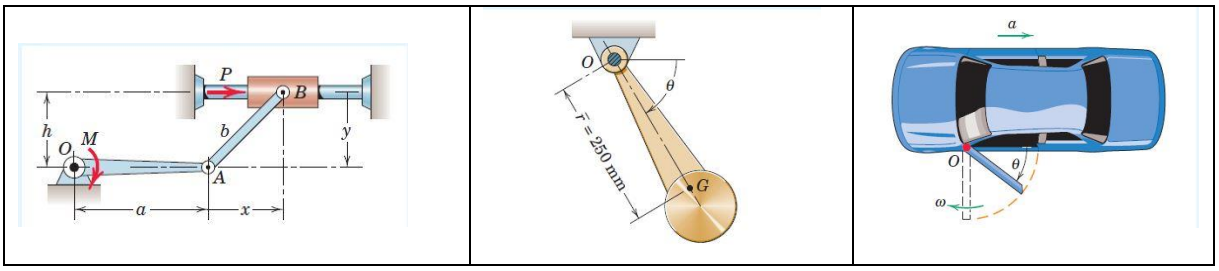
Tutorial - 11

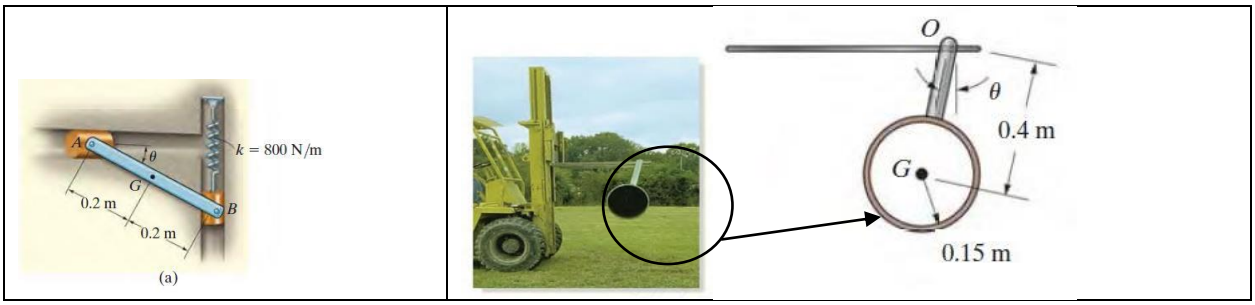
ME 101: Tutorial Sheet on Kinetics of Rigid Body

Q1: For link *OA* in the horizontal position shown, determine the force *P* on the sliding collar which will prevent *OA* from rotating under the action of the couple *M*. Neglect the mass of the moving parts.



Q2: The pendulum has a mass of 7.5 kg with center of mass at *G* and has a radius of gyration about the pivot *O* of 295 mm. If the pendulum is released from rest at $\theta = 0^\circ$, determine the total force supported by the bearing at the instant when $\theta = 60^\circ$. Friction in the bearing is negligible.

Q3: A car door is inadvertently left slightly open when the brakes are applied to give the car a constant rearward acceleration *a*. Derive expressions for the angular velocity of the door as it swings past the 90° position and the components of the hinge reactions for any value of θ. The mass of the door is *m*, its mass center is at a distance $\bar{r}$ from the hinge axis *O*, and the radius of gyration about *O* is k_O.



Q4**:** The 10 kg rod *AB* shown in Fig. is confined so that its ends move in the horizontal and vertical slots. The spring has a stiffness of $k = 800\,\text{N/m}$ and is unstretched when $\theta = 0^\circ$. Determine the angular velocity of *AB* when $\theta = 0^\circ$, if the rod is released from rest when $\theta = 30^\circ$. Neglect the mass of the slider blocks.

Q5: The 700 kg pipe is equally suspended from the two lines of the fork lift shown in the photo. It is undergoing a swinging motion such that when $\theta = 30^\circ$, it is momentarily at rest. Determine the normal and frictional forces acting on each line which are needed to support the pipe, at the instant

$\theta = 0^{\circ}$. Measurements of the pipe and the suspender are shown in Fig. Neglect the mass of the suspender and thickness of the pipe