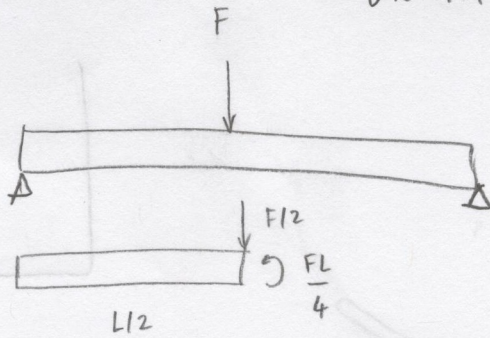


# BREAKING FORCE

$$L = 1,04 \text{ m}$$



$$I = \frac{\pi D^4}{64} = \frac{\pi}{64} (D_{out}^4 - D_{in}^4)$$

$$\sigma_{max} = \frac{M y_{max}}{I} = \frac{M D_{out}}{2I} = \frac{FL D_{out}}{16I} = \frac{4 FL D_{out}}{\pi (D_{out}^4 - D_{in}^4)}$$

$$F_y = \sigma_y \frac{\pi (D_{out}^4 - D_{in}^4)}{4 L D_{out}}$$

	$\sigma_y$ (MPa)	$\sigma_{max}$ (MPa)	$D_{in}$ (m)	$D_{out}$ (m)	$F_y$ (N)
polypropylene	30	60	0,028	0,055	3516
wood	50	80	0,0519	0,055	1301
aluminium	400	500	0,0546	0,055	1446
titanium	820	820	0,0146	0,026	885
					98



this is the force that we need to apply to have plastic deformation.