Beam deflection - compare force of gravity to force of surface tension:

Let's say you have a thin cantilever beam: length L, width b, thickness h. A large square mass is attached at the end of the cantilever, sides s and thickness h. This kind of thing might be used in a MEMS accelerometer. Making some very simple assumptions, please calculate:

1. What will be force on the cantilever due to gravity? (Assume that the mass is concentrated at a point on the end of the cantilever.) Calculate the deflection at the end of the cantilever due to gravity.

2. What is the force on the cantilever due to capillary forces (assume also that the forces are concentrated at the mass on the end)? Surface tension plays a role after wet etching of the sacrificial layer under the cantilever, for example, when a liquid meniscus forms between the newly-released structure and the substrate. The liquid has surface tension γ, the gap between the substrate and cantilever is d, and the contact angle θ between the liquid and solid surfaces is the same for substrate and cantilever.

Also, calculate the ratio between force due to gravity and capillary forces.

E = 170 GPa, ρ = 2330 kg/m^3
L = 300 μm
b = 2 μm
h = 2 μm
s = 150 μm
γ = 0.07 N/m
d = 2 μm
$\theta = 75^\circ$