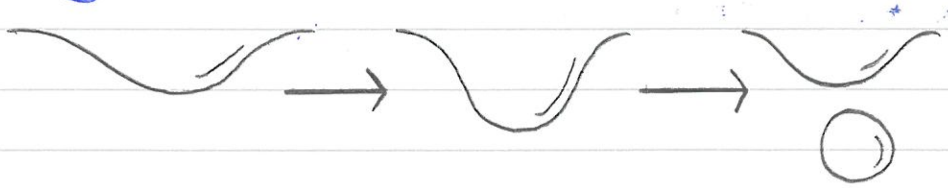
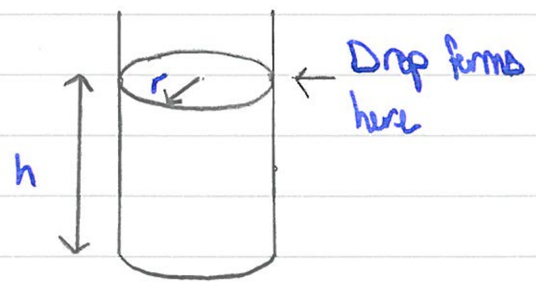
Estimate the surface tension of water (in air) σ.

Surface tension has a number of effects. It sets the curvature of a meniscus or a droplet. It allows some insects to skate across the surface of a pond. It influences the properties of some waves. I think the easiest way to estimate the size of the surface tension is to consider a dripping tap — this involves the least unknowns.

Consider some water on the underside of an object, it starts to bulge into a droplet (an example of the Rayleigh-Taylor instability), and at some point a droplet breaks off.



This happens when surface tension is no longer a match for gravity. Let us make a very simple model of the drip as a cylinder of water.



The weight of the water that will form the drop is

$$F_g = \pi r^2 h \rho g$$

Here ρ is the density of water ($10^3\ kg\ m^{-3}$) and g the acceleration due to gravity ($\sim 10\ ms^{-2}$). The surface tension contributes a force

$$F_s = 2\pi r \sigma$$

Equating these

$$F_s = F_g$$

$$2\pi r \sigma = \pi r^2 h \rho g$$

$$\sigma = \frac{rh\rho g}{2}$$

We just need r and h. Luckily I have some water to hand. Making only a small mess, I estimate $r \approx 2$ mm and $h \approx 5$mm. Therefore, our model gives

$$\sigma \sim \frac{(2\times10^{-3})(5\times10^{-3})(10^{3})(10)}{2}$$

$$\sim \underline{50\times10^{-3}\ \mathrm{Nm^{-1}}}$$

[Exact: $72.86\times10^{-3}\ \mathrm{Nm^{-1}}$ (20°C)]