Auxiliary Lab #91: Surface Tension

**Goal:** Measure the surface tension of water

**Equipment:** Torsion balance, weight set, hangers, adjustable lab jack

Surface tension $\sigma$ in a liquid arises from the attractive forces between molecules. On a free surface these forces cancel, however at the interface between the liquid and an object that represents a boundary there is a net force. This force is proportional to the length of the boundary and is characteristic (a ‘material constant’) of the liquid. The unit of surface tension is N/m.

In order to measure the surface tension of a liquid in an open container, we dip the edge of a microscope slide into the liquid. As we start to pull the slide vertically upwards, the surface tension resists with a downward force. This force increases as we continue to pull the slide up. We want to measure the force $F$ that acts just as the adhesion of the liquid lets go of the slide. This force is then related to the surface tension $\sigma$ by

$$ F = 2L\sigma, $$

(1)

where $L$ (in m) is the length of the slide. The factor of 2 arises from the fact that there is a boundary on either side of the slide.

To measure the force $F$ we use a torsion balance (see figure) that sits on a movable lab jack that allows us to move the balance up and down. With the weight pan empty, we make contact between the slide and the liquid surface. We then raise the balance slowly, carefully observing the position of the pointer K on the scale S. Determine the position at which the contact with the liquid breaks. Then, with the slide out of the liquid, add weights to the pan until the same position of the pointer is achieved. From the weights necessary we can then determine the force $F$. 

![Figure 1: Torsion balance](image)