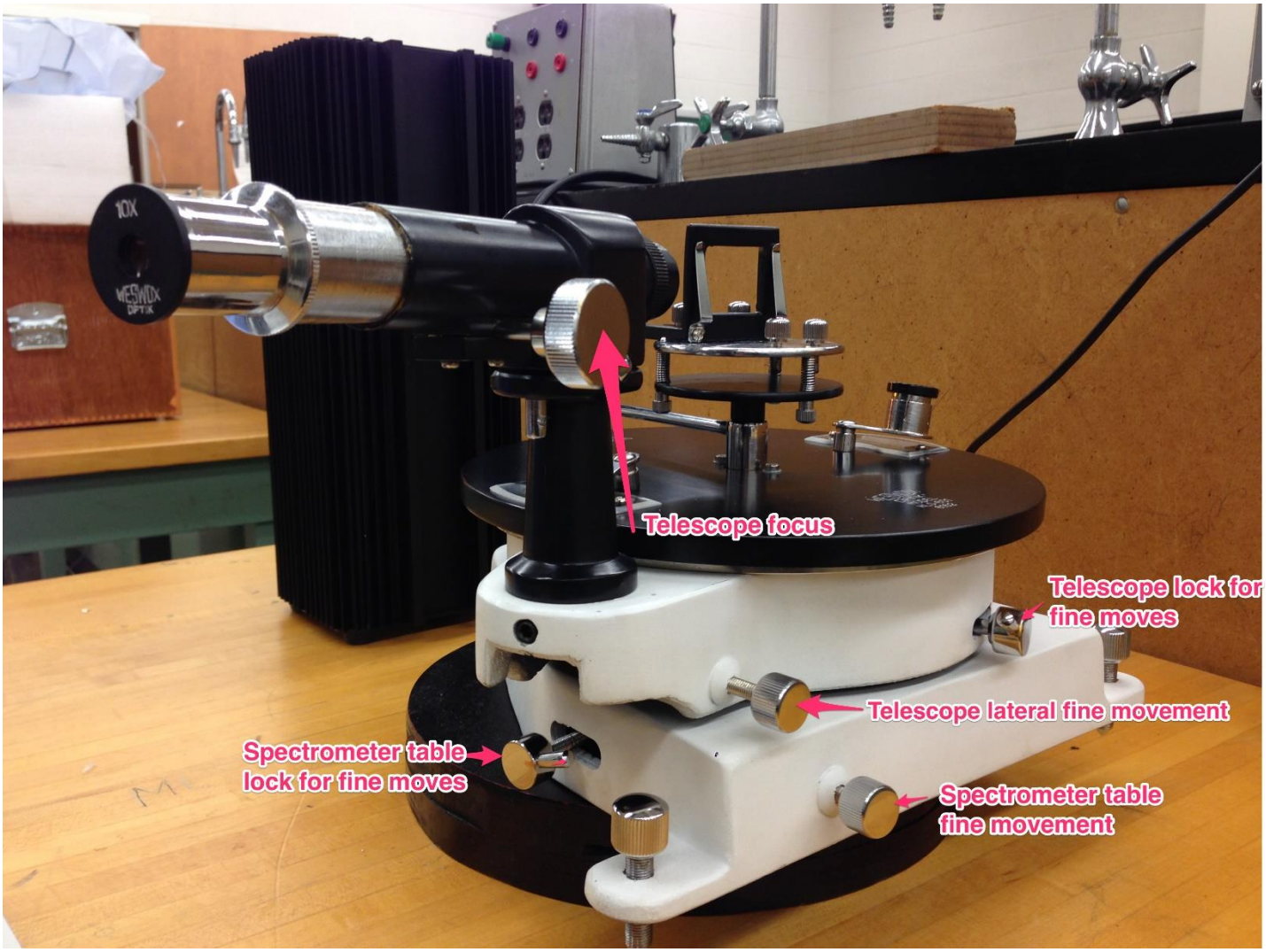


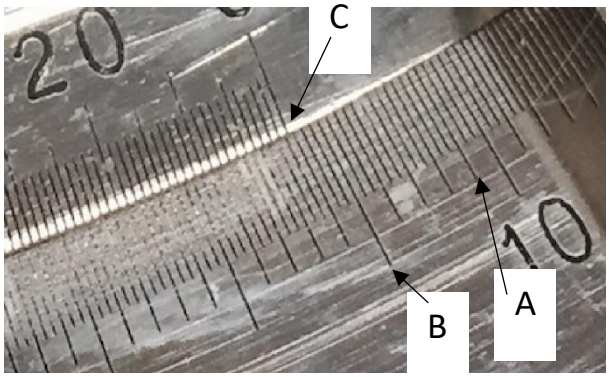
READING THE SPECTROMETER VERNIER SCALE

The spectrometer vernier scale is graduated in degrees, arc minutes, and arc seconds. The conversion factors are:

$1^\circ = 60'$ (*in words*: 1 degree = 60 arc minutes)

$1' = 60''$ (*in words*: 1 arc minute = 60 arc seconds)

On the bottom scale shown above, the region between 10° to 20° is divided into 60 divisions. Thus, the smallest division is: $\frac{(20^\circ - 10^\circ)}{60} \times \frac{60'}{1^\circ} = 10'$.



Thus, minor division A is $30'$ (the dial reading at A would be $10^\circ 30'$), and the major division B is $150'$ (the dial reading at B would be $10^\circ 150'$). The actual reading for this measurement is at C and would then be $10^\circ + 150' + 30' +$ a little more in arc seconds. To find the number of arc seconds, we must examine the graduations on the upper scale (see below). Each division of the upper scale is $10''$ (thus the **20** on the upper scale is $200''$). Carefully look for where a line in the upper scale lines up with a line at the bottom scale.

The bottom and the top graduations appear to line up at D. This point is at

$$45\times 10'' = 450''.$$

The final reading for the spectrometer vernier scale would then be:

$$10^\circ + 150' + 30' + 450'' = 10^\circ 180'\ 450''$$

To convert this all into degrees, use the conversion factors above:

$$10^\circ + 180' \times \frac{1^\circ}{60'} + 450'' \times \frac{1^\circ}{3600''} = 10^\circ + 3^\circ + 0.125^\circ = 13.125^\circ$$