Making a solargraph with a shadow stick (An alternative to using Illford's photographic paper)

The altitude of the Sun can be determined accurately by using a shadow stick. For example, in the image below, a pencil was used as the gnomon to cast a shadow. The length of the shadow becomes too long early in the morning or late in the afternoon, so measurements need to be collected at appropriate times. The altitude of the Sun (Ø) in the image below was calculated as 45.4°at 9:25 am. This was determined by measuring the length of the shadow (163 mm) and the height of the gnomon (165 mm), then using the *tan* ratio.

$$\tan(\emptyset) = \frac{opp}{adj}$$

$$\tan(\emptyset) = \frac{165}{163}$$

$$\emptyset = tan^{-1}(\frac{165}{163})$$

$$\emptyset = 45.4°$$

Figure 1: Shadow stick (a pencil) used to determine the altitude of the Sun

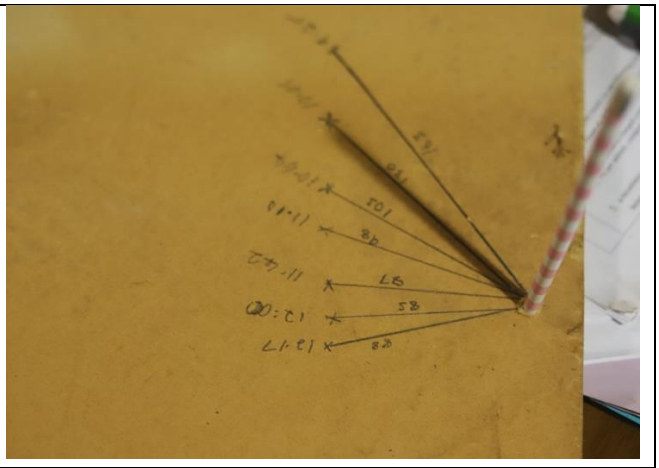
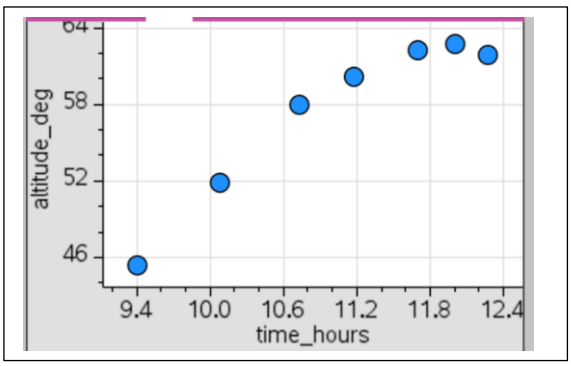


Figure 2: Times with shadow lengths shown measured. The altitudes of the Sun are listed in table 1

Time	Shadow length (mm)	Altitude Sun (degrees)
9:25	163	45.4°
10:05	130	51.8°
10:44	103	58.0°
11:10	98	59.3°
11:42	87	62.2°
12:00	85	62.7°
12:17	88	61.9°
etc	etc	etc

Table 1: Time and altitude data

Plotting time v altitude will produce a solargraph. Below is a partial solargraph for the above data set. You will need to collect enough data for a complete solargraph.



Next, make a complete solargraph. Be sure to include your latitude, so that your solargraph can be checked for accuracy.