

# Determining Heights of Lunar Features

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## Procedure:

1. Take images of the moon in crescent phase or near first quarter phase. Especially look for regions near the terminator with prominent shadows of mountains and crater rims.  
Define terminator:
2. Use a lunar map and a lunar atlas (Rukl's is especially useful) to identify all the large craters and mountains in your clearest image. Make a circle or other mark around any clear sharp shadows of mountains or of crater rims.  
Sketch in the terminator and note any craters right on the terminator.
3. On a spreadsheet list the names of all the craters and other features with sharp shadows.
4. Use a millimeter ruler to measure on the image the diameter of each of these craters which has information in the atlas. (These will determine the scale of your image.)  
Also measure the length of each shadow on the image.

## Analysis:

5. Using the atlas, add to the spreadsheet the latitude and longitude of each feature which casts a shadow, that is, measure the position of the base of the shadow.
6. Use the craters with known diameters in km, and measured diameters in cm on the image to determine the scale of the image.  
Describe the most reliable method to do this:

Once you have the scale, calculate the shadow lengths in km.

7. Next we need to determine the tilt correction. Unless your crater is right in the middle of the moon's face, the crater floor sits on a plane which is tilted from our view a little. This means that we have to correct the shadow length for this tilt. This will make the shadow length a little longer than what we have measured.

Tilt correction =  $1 / \{\cos(\text{latitude}) * \cos(\text{longitude})\}$       Remember 1 radian = 57.29 degrees.

Corrected shadow length = (shadow length) \* (Tilt correction)

8. Next we need to calculate the sun angle since the lower the sun is in the sky, the longer the shadows will be. This angle is the difference in longitude between the feature and the terminator, slightly corrected for latitude.

$$\text{Sun angle} = (\text{feature longitude} - \text{terminator longitude}) * .01 * (100 - |\text{feature latitude}|)$$

9. Calculate the height of your lunar features by

$$\text{Height of feature} = (\text{corrected shadow length}) * (\tan (\text{sun angle}))$$

10. Look up the accepted value of the feature's height and calculate your percent error.

**Discussion:**

11. Discuss your results' reasonableness.