

THE SIZES OF PEBBLES

Purpose

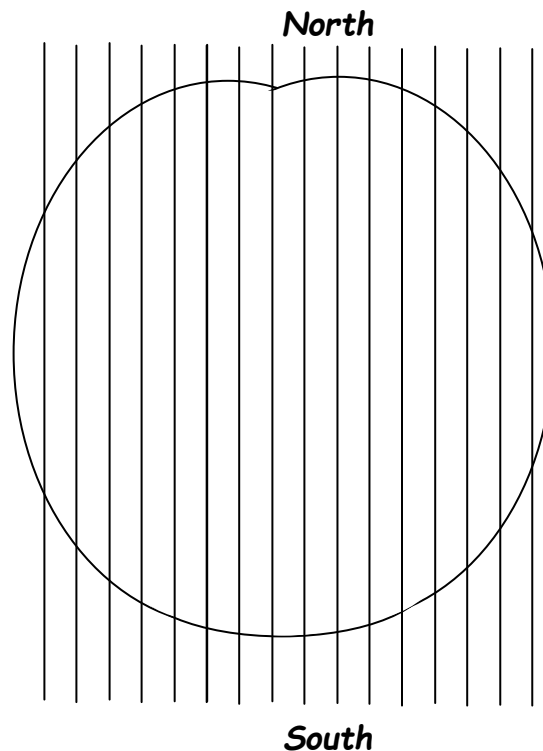
To determine how the sizes of pebbles seen on a flat surface relate to the sizes of the actual pebbles. To devise a method which will give an accurate idea of the real maximum pebble size when looking at a flat surface of a conglomerate or breccia.

- 1. Imagine a rock containing spherical pebbles all 5cm in diameter. If the rock is now sliced what will the sizes of the pebbles shown on the surface be? What will be the maximum size and minimum size?*

Because the pebbles are randomly distributed some pebbles will be sliced through their maximum diameters whereas others will just have a slice taken off the edge. We can get an idea of the range of sizes on the face by slicing a sphere and measuring the apparent diameters.

Activity I Apple

- 1. Measure the "equatorial" diameter of your apple.*



- 2. Slice your apple into 1cm thick slices. Your slices should go north-south. Measure the maximum diameter of each slice in the plane of the "equator". Slice your apple on the wooden board or tray.*

3. Calculate the diameter of each slice as a percentage of the diameter of the apple.
4. Work out a) the average length as a percentage.
 b) the fraction of lengths greater than 90% of the maximum
5. Eat your apple.

Activity II Paper

1. Draw a circle 20cm in diameter on lined paper. This represents a pebble.
2. Each line represents where the pebble might be sliced. Measure the diameters of the pebble along each line.
3. Collect data from the other students and plot a frequency graph of percentages using a 5% interval.
4. Calculate the average size and what fraction that is of the maximum

Activity III Slice of conglomerate

1. Measure the sizes of the pebbles on the surface of the slice.
2. Calculate the average size.
3. Use the information you found in Activity II to calculate the actual average size of the pebbles (if you could measure them in 3 dimensions).
4. If the conglomerate is well sorted how close is the maximum size you have measured on the surface to the real maximum size? Within 5%, 10% or 20%.

Teacher's Section

Requirements

Activity I

Round apples, sharp knives, wood blocks (or upside down trays) to save the bench being cut.

Rulers and Callipers

Activity II

Lined A4 paper, compasses for drawing circles

Activity III

Slices of real conglomerates or photos

Notes

Activity I is more fun but activity II gives better results. You will need to explain what a frequency graph is. Students taking maths could compare the experimental result with the theoretical result using integration.

Results

Average size is 78.5% of maximum diameter and about 40% of measurements will be more than 90% of the original diameter. To get the real average size multiply by the reciprocal of 78.5%. The maximum size will be within 5% of real size.

Time

Activity I 15 minutes, activity II 30 minutes, activity III 30 minutes



Enlarge and use for activity III