**Grain Size Analysis of Soils**

**(Revised 11 September 2019)**

**Weight of Sand**

1. Weigh out a 40.00 g sample of -10 sieve dried soil. (The #10 sieve was used to remove the gravel fraction during sample preparation).
2. Place soil in a container with 350 ml of deionized water and 10 ml of defloculant (5% solution hexametaphosphate).
3. Agitate mixture with blender for 4 minutes.
4. Pour and rinse mixture into nest of sieves and bottom pan. Rinse the soil residue from the sides of the container with the deionized (DI) water squeeze bottle.
5. Using fingers and a squeeze bottle of DI water, gently work the mixture through the following sieves and into the bottom pan. **Use only as much DI water as necessary**
   1. #60 sieve (0.25 mm openings): Retains coarse-to-medium sand
   2. #230 sieve (0.063 mm openings): Holds fine and very fine sand
   3. Pan: Holds water and suspended silt and clay.
6. Transfer sediment from both sieves into a single pre-weighed beaker (100 ml). Dry in the oven for a minimum of 24 hours.
7. Remove and weigh to 0.001 of a gram. Subtract off weight of the beaker to determine the total weight of the sand in sample. NOTE: Remove hot beakers with gloves or metal tongs—do not touch the beaker with your hands, nose, or tongue!!

**Analysis of Silt and Clay**

1. Pour and rinse the contents of the pan from the previous procedure into a 1000 ml graduated cylinder.
2. Top off the cylinder to the 1000 ml mark with DI water.
3. Mix thoroughly the contents of the cylinder with a stirring rod using gentle, vertical motions; and ensuring not to knock over the cylinder.
4. **(Hydrometer Analysis):** After 40 seconds, carefully insert the hydrometer into the cylinder, and record the value of the hydrometer where the meniscus comes into contact with the device. This value will be used to calculate total silt and clay in the cylinder.
5. **(Hydrometer Analysis):** After 2 hours, repeat the procedure as outlined in previous step. This value will be used to calculate total clay, as the silt has hypothetically fallen beyond the reach of the hydrometer.

1. **(The remaining steps listed below are for the pipette)** Restir, and immediately insert a 20 ml pipette half way down into the cylinder and withdraw 20 ml of sample. Place this liquid into a pre-weighed 50 ml beaker. Rinse the interior of the pipette with DI water and let the water drain into the beaker to ensure total sample capture. This sample will represent your ‘total silt and clay’ fraction. Place beaker in oven for a minimum of 24 hours.
2. Top off graduated cylinder to the 1000 ml mark and rinse rod of lingering sample, all using DI water. Be sure the cylinder is in a safe place away from disturbances.
3. Later at a convenient time, completely stir mixture in the graduated cylinder as described earlier.
4. Let the mixture settle for exactly 3 hours, 48 minutes as prescribed by Stokes Law. This time block ensures (in theory) that all of the silt has fallen below a certain depth, leaving behind only clay in suspension at that level.
5. Insert the pipette to 5 cm (from the 1000 ml mark). Remove exactly 20 ml of fluid.
6. Place fluid in a preweighed 50 ml beaker.
7. Rinse pipette with DI water
8. Place sample in drying oven for at least 24 hours at 100-130 C.
   1. Remove dried samples from the oven and let cool to room temperature.
   2. Weigh to the nearest 0.001 g on the balance.

**For the Hydrometer Calculations:**

1. To determine the weight of clay: record the Hydrometer Reading – this is your value in grams
2. To determine the weight of silt and clay: record the Hydrometer Reading – this is your value in grams
3. To determine the weight of silt, subtract the value found in step 1 from that found in step 2.
4. To determine the % weight of clay: (Hydrometer Reading / original wt. of oven dried sample) \*100
5. To determine the % weight of silt and clay: (Hydrometer Reading / original wt. of oven dried sample) \*100
6. To determine the % weight of silt, subtract the value found in step 1 from that found in step 2.

**For the Pipette Calculations:**

1. To determine the weight of clay, multiply the weight of the dry sample by 50.
2. To determine the weight of silt and clay, multiply the weight of your first sample by 50.
3. To determine the weight of silt, subtract the value found in step 1 from that found in step 2.

In the next several days, you will be given further instructions on reporting your values and the final laboratory submittal.