

DETERMINATION OF SPECIFIC GRAVITY OF SOIL

1. Objective: The value of specific gravity is needed in calculation of soil properties like void ratio, degree of saturation, particle size analysis by hydrometer test etc. The value of specific gravity is sometimes used to determine the suitability of the soil as fill material.

2. Apparatus Required:

2.1 Density Bottle



Two density bottles (pycnometers) of 50 ml with stopper, having capillary hole.

2.2 Water Bath



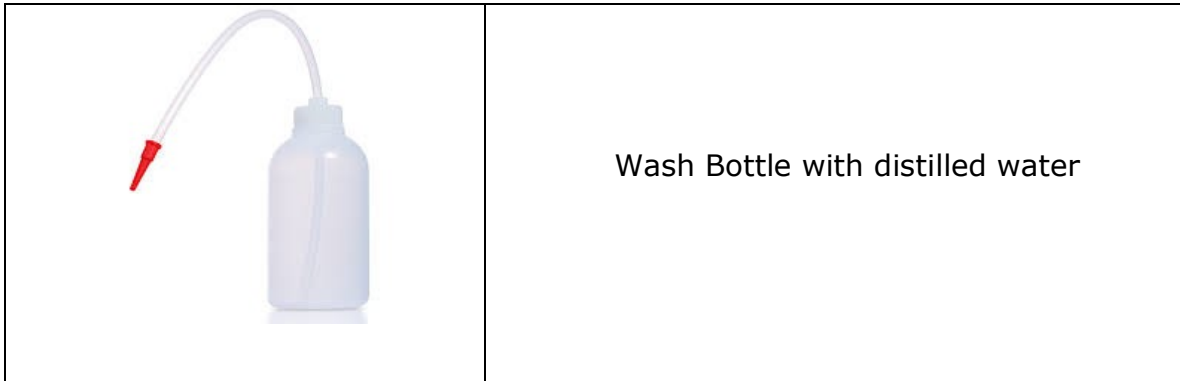
A water-bath maintained at a constant temperature of $27 \pm 0.2^\circ \text{C}$.

2.3 Weigh Balance



Balance to weigh the materials (accuracy 0.001g)

2.4 Wash Bottle



2.5 Vacuum desiccators

2.6 Hot Air Oven, thermostatically controlled, capable of maintaining temperature of 105° to 110° C.

3. Reference- IS 2720 (Part-3/Sec-2): 1980 (Reaffirmed 2021) **“Method of test for soil: Determination of Specific Gravity, Section-1, Fine Grained Soils.”**

4. Procedure:

4.1. Clean and dry the density bottle. Wash the bottle with water and allow it to drain. Wash it with alcohol and drain it to remove water. Wash it with ether to remove alcohol and drain ether. Weigh the empty bottle with stopper (W_1).

4.2 Take about 5 to 10 gm of oven dried soil sample which is cooled in desiccator. Transfer it to the bottle. Find the weight of the bottle and soil (W_2).

4.3 Put 10 ml of distilled water in the bottle to allow the soil to soak completely. Leave it for about 2 hours.

4.4 Again fill the bottle completely with distilled water put the stopper and keep the bottle under constant temperature water bath ($T_x^{\circ}\text{C}$). Take the bottle outside and wipe it clean and dry note. Now determine the weight of the bottle and the contents (W_3).

4.5 Now empty the bottle and thoroughly clean it. Fill the bottle with only distilled water and weigh it. Let it be (W_4) at temperature ($T_x^{\circ}\text{C}$)

4.6 Repeat the same process for 2 to 3 times.

5. Observations:

S.No.	Weight	1	2	3
1	Weight of density bottle (W_1 , g)			
2	Weight of density bottle + dry soil (W_2 , g)			
3	Weight of density bottle + dry soil + water at temperature T_x °C (W_3 , g).			
4	Weight of density bottle + water (W_4 , g) at temperature T_x °C			
5	Specific Gravity G at			
	Average Specific Gravity at T_x °C			

6. Calculation:

$$\begin{aligned}\text{Specific gravity of soil} &= \frac{\text{Weight of soil}}{\text{Weight of water of equal volume at } 27^\circ\text{C}} \\ &= \frac{W_2 - W_1}{[(W_4 - W_1) - (W_3 - W_2)]} \\ &= \frac{W_2 - W_1}{[(W_2 - W_1) - (W_3 - W_4)]}\end{aligned}$$

7. Reporting: Unless or otherwise specified, specific gravity value reported shall be based on water at 27°C. The average of the values obtained shall be as the specific gravity to the nearest of 0.01. If the two results differ by more than 0.03 the test shall be repeated.

$$\text{Specific Gravity at } 27^\circ\text{C} = K \times \text{Specific Gravity at } T_x^\circ\text{C}$$

Where, $K = (\text{Density of water at } T_x^\circ\text{C} / \text{Density of water at } 27^\circ\text{C})$

Table: Values of "K"

Temperature T_x °C	K_{27}	Temperature T_x °C	K_{27}
15	1.0026	28	0.9997
16	1.0024	29	0.9994
17	1.0023	30	0.9991
18	1.0021	31	0.9988
19	1.0019	32	0.9985
20	1.0017	33	0.9982
21	1.0015	34	0.9979
22	1.0013	35	0.9975
23	1.0010	36	0.9972
24	1.0008	37	0.9968
25	1.0005	38	0.9964
26	1.0003	39	0.9961
27	1.0000	40	0.9957

8. Video:

9. Download: