INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR
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SPECIFIC GRAVITY TEST

(IS-2720-PART-3/section-1-1980) (Reaffirmed-2002)

THEORY:

The specific gravity of a soil is the ratio of the mass of a given volume of the soil solids at a stated temperature to the mass of an equal volume of de-aired water at the same temperature.

NEED AND SCOPE:

The specific gravity is used in the computations of the laboratory tests such as hydrometer test and oedometer test (1-D consolidation test). It can be used in relating the weight of soil to its volume and in calculation of phase relationship, i.e., the relative volume of solids to water and air in a given volume of soil. The value of specific gravity can give rough idea of presence of organic matters or any metal present in soil. Lower specific gravity values around 2 or below indicates the presence of high organic content in soil. Higher specific gravity values in range of 2.75-2.85 indicates the presence of iron or any other metal in the soil.

APPARATUS REQUIRED:

1. Specific gravity bottles of glass with 50 ml/100 ml capacity with a fitted glass stopper
2. Glass-stopper with small hole through center to permit emission of air and water
3. Balance - 0.001 g sensitivity
4. Oven - capable of $105^0C \pm 1^0C$
5. Thermometer
6. Funnel
7. Sand bath for heating

PROCEDURE:

1. Take the weight of the empty specific gravity bottle, 'W_1'.
2. Transfer the oven dried soil sample to the specific gravity bottle (about *10 gm when 50 cc stoppered bottle is used and about 20gm when 100cc stoppered bottle* is used).
3. Take the weight of bottle filled with soil, 'W_2'.
4. Add water to fill the bottle about three fourth of its volume.
5. Remove the entrapped air either by subjecting the contents to a partial vacuum or by boiling gently in a sand-bath till the air bubbles cease to appear while occasionally rolling the bottle to assist in removal of air
6. Then cool to room temperature and fill the bottle with water up to the mark and clean and dry the outside surface with a clean, dry cloth and note down the temperature.
7. Determine the weight of the bottle with water and soil, 'W_3'.
8. Then remove the soil and water from the bottle and clean it.
9. Fill the bottle completely with water up to the mark and take the weight of bottle filled with water, 'W_4'.
10. From data obtained determine specific gravity of the soil.

TABULATION AND RESULTS:

Test no.	1	2	3
Temperature ^{o}c			
Bottle no.			
Weight of specific gravity bottle (W_1) (g)			
Weight of specific gravity bottle + soil (W_2) (g)			
Weight of specific gravity bottle + soil + water (W_3) (g)			
Weight of specific gravity bottle + water (W_4) (g)			
Specific gravity of soil at temperature ^{o}c $G'_s = \frac{(W_2 - W_1)}{(W_4 - W_1) - (W_3 - W_2)}$.			
Temperature correction, k_{27}			
Specific gravity of soil at temperature, 27 ^{o}c $G_s = K_{27} \times G'_s$ (see K_{27} from Table I)			
Average			

The specific gravity of the given sol is = (No unit)
Determine the type of soil according to your interpretations from specific gravity of the soil

For any temperature T, correction factor can be given as,

$$K_{27} = \frac{Specific\ gravity\ of\ water\ at\ T^{\circ}\ C\ temperature}{Specific\ gravity\ of\ water\ at\ 27^{\circ}\ C\ temperature}$$

Correction factors for different temperatures are given in Table I.

Table-I: Correction Factor for Variation in Specific Gravity of water due to Temperature

Temperature °C	K_{27}
15	1.0026
16	1.0024
17	1.0023
18	1.0021
19	1.0019
20	1.0017
21	1.0015
22	1.0013
23	1.0010
24	1.0008
25	1.0005
26	1.0003
27	1
28	0.9997
29	0.9994
30	0.9991
31	0.9988
32	0.9985
33	0.9982
34	0.9979
35	0.9975
36	0.9972
37	0.9968
38	0.9964
39	0.9961
40	0.9957