**MATERIALS OF CONSTRUCTION LABORATORY   
 DEPARTMENT OF CIVIL ENGINEERING, M.E.T.U.**



**CE344 MATERIALS OF Construction, GROUP 5**

**TESTS ON PORTLAND CEMENTS**

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## Question 1:

Cement density = mass of cement (g) / displaced volume (cm^3)

Specific gravity = cement density / water density at 4 C

For Sample A:

Cement density = 64 (g) / (21-1.20) (cm^3) = 3.23

Specific gravity = 44.2 / 1 = 44.2

According to ASTM C204 standards, different equations are utilized to determine specific surface areas.

(4)

(5)

*S* = specific surface of the test sample, m2/kg,

*S*s = specific surface of the standard sample used in calibration of the apparatus, m2/kg

*T* = measured time interval, s, of manometer drop for test sample

*T*s = measured time interval, s, of manometer drop for standard sample used in calibration of the apparatus

n = viscosity of air, micro pascal seconds (μPa·s), at the temperature of test of the test sample

ns = viscosity of air, micro pascal seconds (μPa·s), at the temperature of test of the standard sample used in calibration of the apparatus

Equation 4 is used when the temperature of test of the test sample is within +-3 C of the temperature of calibration test, and Equation % shall be used if the temperature of the test sample is outside this range.

Therefore, while calculating the specific surface areas of sample A, B, C and D, equation 4 is utilized for samples B, C and D, whereas equation 5 is used for sample A considering the statement above.

*Note that the required values are obtained from ASTM C204 file.*

For Sample A:

S = (360\*4.28\*9.8) / (10.15\*4.25) = 350.04 m^2/kg

For Sample B:

S = 360\*5.1/10.15 = 180.89 m^2/kg

|  |  |  |
| --- | --- | --- |
|  | Specifc Gravity | Spes. Surf. Area |
| A | 3,23 | 350,04 |
| B | 2,55 | 180,89 |
| C | 2,32 | 404,08 |
| D | 3,01 | 665,65 |

To meet ASTM C150 standards, minimum value of fineness of the cement has to be 260 m^2/kg.

When the results obtained are considered, it is seen that sample B does not meet the requirements of ASTM C150. Sample B is coarser than the specified values.

## Question 3:

Naphta or kerosene should have been used while determining the specific gravity, but instead water was used. There are some consequenses of this action.

* First of all water has the ability to make chemical reaction with cement so that will affect the result of the test.
* Secondly water particles tend to stick to glass more than kerosene & naphtha so the result may vary a little bit more than expected.
* And lastly

## Question 4:

It is not possible to determine the specific gravity less than 2.66 with this type of testing. A constant value of 64 grams of cement must be used in the test and that is one of the important restrictions. The other one is that the Le Chatelier flask has a capacity of 24ml and with both of these restrictions the minimum specific gravity can be determined as 2.66. The flask could be changed and instead of 64 grams less cement could be used but that would change the whole standard and it would not be professional. If a specific gravity less than 2.66 is needed or wanted there are other test methods which would give more precise results.

## Question 7:

## Soundness can be basically defined as the volume stability of the cement paste. The cement paste is expected not to change largely in volume after setting.

After setting, free CaO and MgO in the cement tend to react with water. As a result of this, expansion occurs in the hardened cement paste, which leads to cracks in the concrete. This makes cement unsound.