Concrete Technology Assignment

Instructor: Engr. Usama Ali **Total Marks:** 30

Note: 1. Attempt all questions. Write short and to the point answers. Unnecessary gibberish will cause deduction in marks.

1). Which step is taken to prevent flash setting of cement? Also, write steps to prevent false setting of concrete.

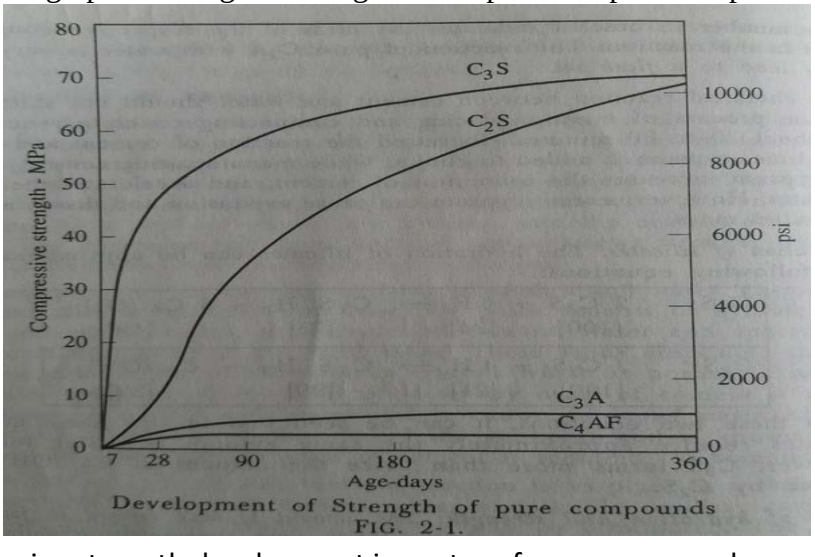
Ans#1: Calcium sulfate sources, such as gypsum are intentionally added to Portland cement to regulate early hydration reactions to prevent flash setting

Steps to prevent false setting: It is an abnormal premature stiffening of cement within a few minutes of mixing with water. It differs from flash setting in that.

- No appreciable heat is evolved.
- Remixing the cement paste without addition of water restores plasticity of the paste until it sets in the normal and without a loss of strength.
  Cause of false setting:
  1. Dehydration of gypsum when inter ground with too hot a clinker. Hemi hydrate ($CaSo4\ ^1/_2\ H_2O$) or an hydrate ($CaSO4$) are formed and when cement is mixed with water these hydrate to form needle-shaped crystals of gypsum.
  2. Bad storage: During storage the alkali is in the cement may carbonates and alkali carbonate react with $Ca(OH)_2$ librated by the hydrolysis of C_3S to form $CaCO_3$.This precipitates and induces a rigidity of the paste.
  3. Activation of C_3S by aeration at moderately high humidities.Water is absorbed on the grains of cement and these freshly activated surfaces can combined very rapidly with more water during mixing.This rapid hydration would produce false set.

2). Draw a graph showing the strength development of pure compounds of cement.

Ans#2:



Development of Strength of pure compounds
FIG. 2-1.

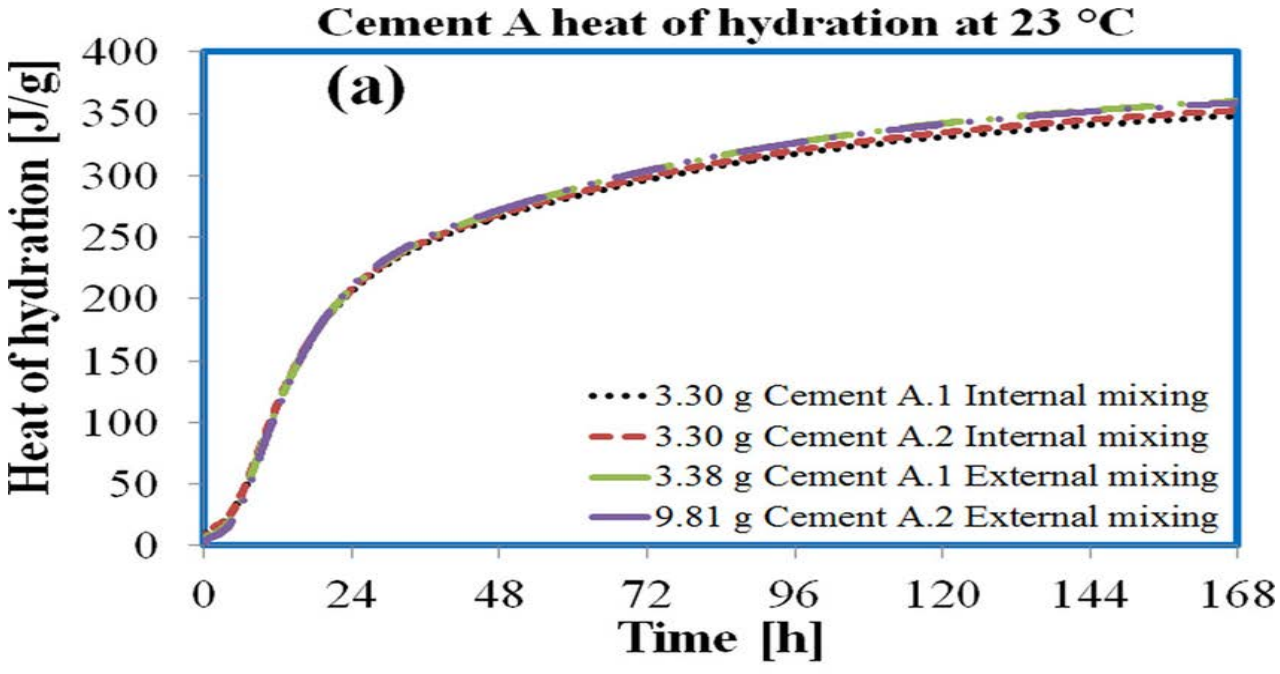
Compressive strength development in pastes of pure compounds.

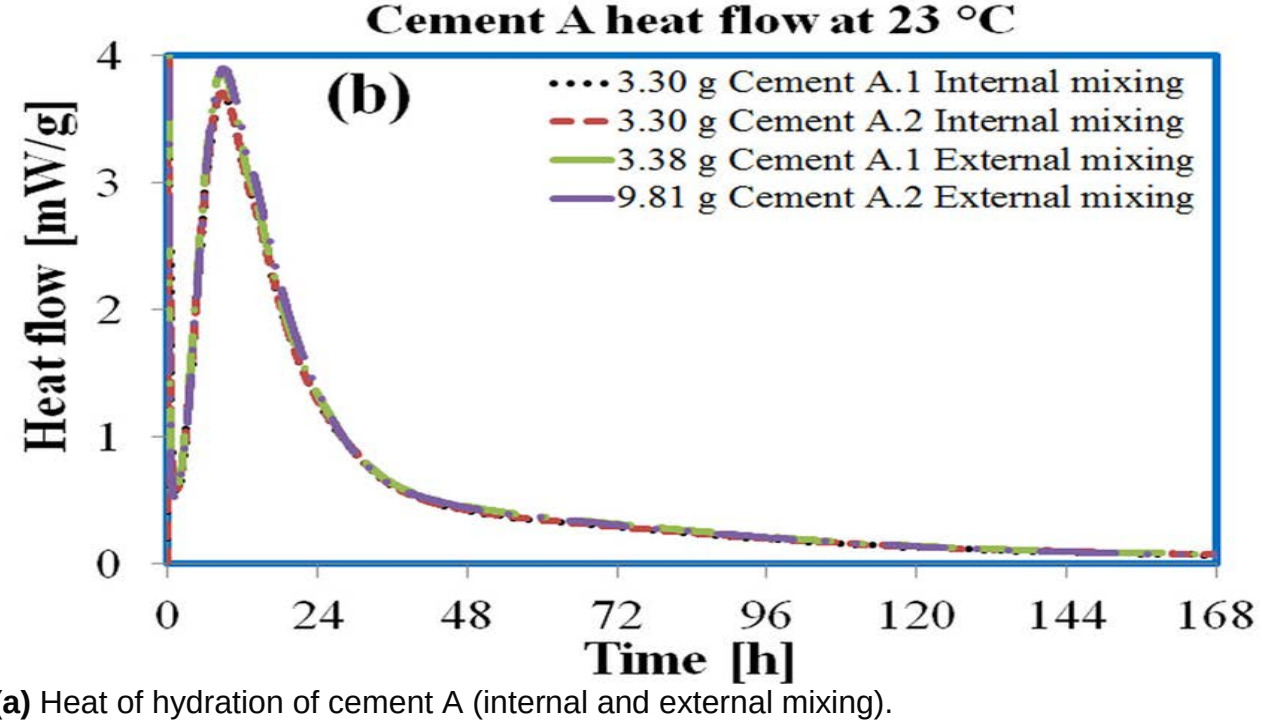
3). Why Type III cement is Rapid Hardening and Type IV Low Heat producing? Draw a graph showing the development of heat of hydration of different cement types.

Ans#3: The rate of strength gain occur due to increase of C3S compound and due to finer grinding of the cement clinker (the minimum) value of fineness is 320 m2/kg (according to IQS 5). Also rate of heat evolution is higher than in ordinary Portland cement due to the increase in C3S and C3A and due to its higher fineness.

Type IV Low heat producing: It contains less C3S and C3A percentage and higher percentage of C2S in comparison with ordinary Portland cement.

Graph showing development of heat of hydration of different cement types.





(a) Heat of hydration of cement A (internal and external mixing).
(b) Heat flow of cement A (internal and external mixing). FIG. —Heat of hydration for cement A, external versus internal mixing.

4). What is the effect of compaction on entrapped air of concrete? What will be the effect on strength if concrete is not compacted sufficiently? Explain with graph.

Ans#4: (i) Effect of compaction on entrapped air of concrete:The effects of compaction on entrapped air of concrete are two reasons.

1.To remove entrapped air and air voids from the concrete.

2.To acquire or achieve homogenous mixture of concrete for the reliable strength.

(ii) The effect on strength if concrete is not compacted sufficiently.Its strength will be compromised because there will be air voids which later on filled with water will cause creep.With little compaction there will be segregation of aggregated which in turn will reduce the strength.

Graph effecting compaction on entrapped air of concrete

Loss of strength through incomplete compaction.

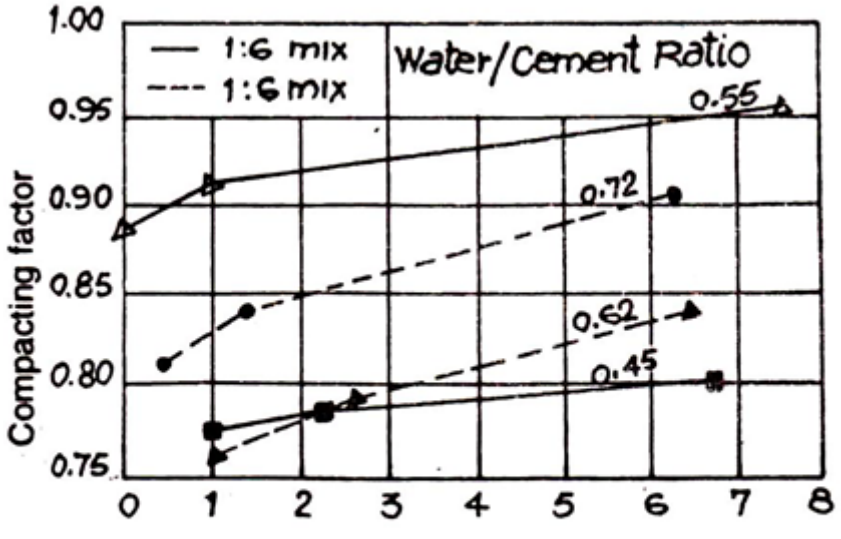


Fig. 6.5. Effect of Entrained air on the compacting factor of concrete

5). Why is the percentage of gypsum added to cement limited to 5%?

Ans#5: Excess of gypsum leads to expansion and consequent disruption of the setting time of cement paste and can lead to cracking.

6). What is the effect of following on the bond strength of concrete?

i). Shape of Aggregate:
Aggregates with a rough texture and angular or elongated shape require more water to produce a workable concrete. On other word, using this type of aggregate reduces concrete workability. While the smooth texture and rounded aggregate require less water to create a workable concrete.
ii). Size of aggregate:
When the surface area increases, the requirement of cement quantity also increase to cover up the entire surface of aggregates with paste. This will make more use of water to lubricate each aggregates. Hence, lower sizes of aggregates with same water content are less workable than the large size aggregates.
iii). Texture of aggregate:
With rough texture of aggregates, the surface area is more than the aggregates of same volume with smooth texture. Thus concrete with smooth surfaces are more workable than with rough textured aggregates.
iii). Bleeding:
If the bleeding rate is very high, then it is not good for the workability of concrete as well as on later strength related properties of concrete. When bleeding happens in excess, then it carries most of the water and fine particles of cement from freshly laid concrete. Due to this a resulting concrete will be weaker in strength, strength will not be uniform throughout the cross section, carry a large number of air voids and diminish durability of concrete.

7). What is the effect of following on workability of aggregate?
i). Porosity & absorption:
Porous and non-saturated aggregate will require more water than non-absorbent aggregates. For the same degree of workability, latter will require less water. Overall, this factor is only of secondary importance.
ii). Air Entraining agent:
The air entraining agent contribute to workability by acting as a sort of lubricant for all the aggregate and large particles in a concrete mix.

iii). Coarse aggregate to fine aggregate ratio:
There is an optimum coarse/fine aggregate ratio that minimizes the amount of voids in the aggregate skeleton thus minimizing the amount of paste required to fill the voids.
iv). Grading of aggregate:
Grading of aggregates has the greatest influence on workability. The better the grading of aggregates, the less is the amount of void in concrete so well-graded aggregates should be used. When total voids are less in concrete, the excess paste is available to give better lubricating effect.

8). What is the effect of fineness of cement on the following?
i). Strength of concrete:
Fineness of cement affects hydration rate hence the rate of gain of strength. More the fineness of the cement is, more rapid is the development of strength of concrete.
ii). Rate of heat evolution during hydration:
Since hydration starts at the surface of the cement particles, it is the total surface area of cement that represents the material available for hydration. Thus, the evolution of hydration depends on the fineness of cement particles, and for a rapid development of strength a high fineness is necessary
iii). Total heat of hydration:
The fineness of cement affects hydration rate, and in turn, the strength. Increasing fineness causes an increased rate of hydration, high strength, and high heat generation.
iv). Workability of concrete:
The workability of concrete is increased by increasing the cement fineness.

9). What steps can be taken during transportation and placement of concrete to prevent segregation of concrete?
Ans#9:
• If the concrete does not have far to travel and is transferred directly from the skip or the wheelbarrow to the final position in the formwork, the danger of segregation is small.
• During placement the concrete should not be thrown from a height of more than 1 m to prevent segregation.
• The danger of segregation is increased with improper use of a vibrator. This is particularly so when vibration is allowed to continue too long.