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SECTION: B
DEPARTMENT: Civil Engineering
PAPER: Concrete Technology
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QUESTION: 1

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

ANSWER:

FLASH SETTING:

It is the immediate stiffening of cement paste in a few minutes after mixing with water. It is accompanied by large amount of heat generation upon reaction of C_3A with water Gypsum is added in cement to prevent flash set. Calcium sulfate sources, such as gypsum are intentionally added to portland cement to regulate early hydration reactions to prevent flash setting, improve strength development,

and reduce drying shrinkage. Sulfate and aluminate are also present in supplementary cementitous materials and admixtures.

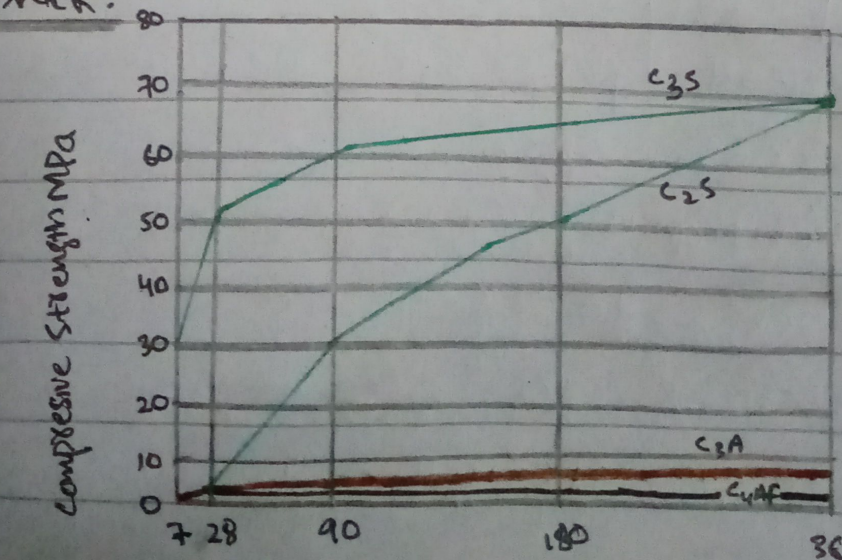
FLASE SETTING:

It is a rapid development of rigidity of concrete paste without generation of much heat. This rigidity can be overcome and plasticity can be regained by further mixing without addition of water. In this way concrete paste restores its plasticity and sets in a normal manner without any loss of strength. It may be due to dehydration of gypsum as a result of contacting hot clinker or due to activation of C_3S.

QUESTION: 2

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

ANSWER:



QUESTION: 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.

ANSWER:

RAPID HARDENING CEMENT:

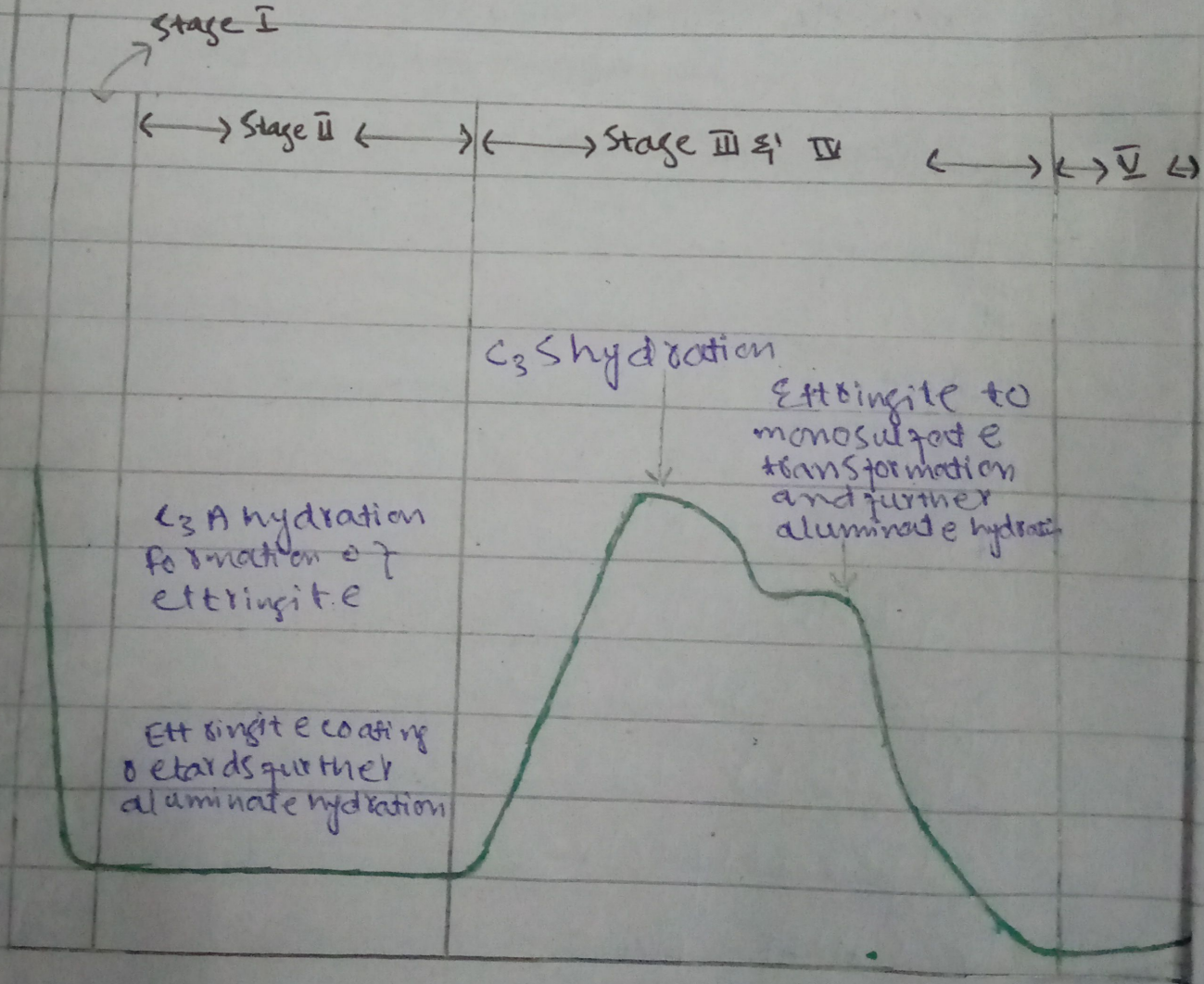
Rapid hardening cement attains high strength in early days it is used in concrete where formworks are removed at an early stage and is similar to ordinary portland cement (OPC). This cement has increased lime content and contains higher C_3S content and finer grinding which gives greater strength development than OPC at an early stage.

LOW HEAT CEMENT:

Low heat cement is prepared by maintaining the percentage of tricalcium aluminate below 6% by increasing the proportion of C_2S. This makes the

concrete to produce low heat of hydration and thus is used in mass concrete construction like gravity dams, as the low heat of hydration prevents the cracking of concrete due to heat.

GRAPH:



QUESTION: 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.

ANSWER:

COMPACTION:

Compaction is the process that expels entrapped air from freshly placed concrete and packs the aggregate particles together so as to increase the density of the concrete.

→ Effect On Strength:

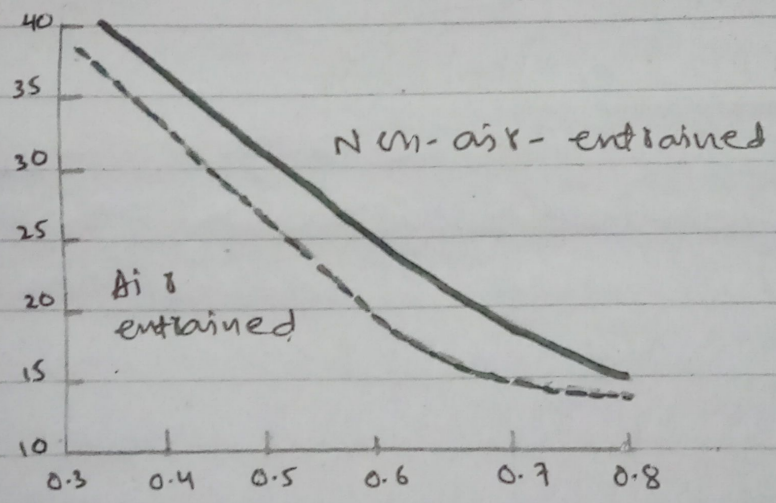
If compaction is not carried out as required, a series of defects may become apparent and the concrete slab will suffer from significant loss of strength.

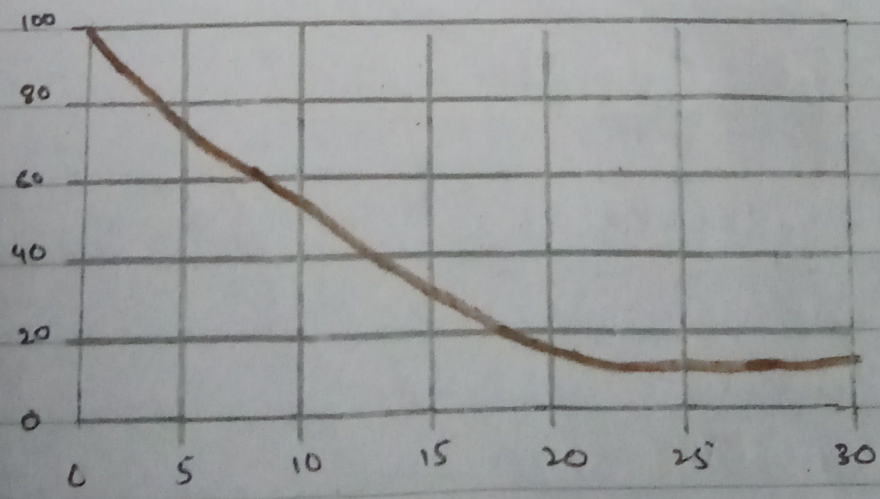
→ ENTRAPPED AIR:

Entrapped air is air that is naturally entrapped in all concrete occuring without the use

of an air entraining agent. These voids are large than entrained air and contribute nothing to durability. Entrapped air has no consequential positive or negative effect on the performance of the concrete.

GRAPH:





QUESTION: 5

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

Ans:

GYPSUM:

Gypsum is a naturally occuring mineral mined from deposits formed by ancient seabeds as a raw material.

ROLE OF GYPSUM IN CEMENT:

The main purpose of adding gysum in the cement is to slow down the hydration process of cement once it is mixed with water.

PERCENTAGE:

Gypsum is added to cement while manufacturing, because it controls the setting time of cement It is more or less essential that gypsum is added to clinker at the rate of around 3% to 5% to act as a set retarder, so that portland cement acts like portland

cement, and does not flash set.

QUESTION: 6

What is the effect of following on the bond strength of Concrete?

(i) Shape of aggregate
(ii) Size of aggregate
(iii) Texture of aggregate
(iv) Bleeding.

ANSWER:

SHAPE OF AGGREGATE:

The shape of aggregate affects the properties of fresh concrete more than hardened concrete. A smoth surface can improve workability, yet a rougher surface generates a strong bond between the paste and the aggregate creating a higher strength.

SIZE OF AGGREGATE:

With increase in maximum aggregate size used in concrete, the compressive strength and splitting tensile strength decrease. when higher maximum aggregate size of

coarse aggregates values are used in concrete, there is no vibration in bond strength but it reduces when maximum aggregate size of less than 10mm is used.

TEXTURE OF AGGREGATE:

Texture of aggregate affects the properties of fresh concrete. Texture improve workability, strong bond and higher strength.

BLEEDING:

Bleeding in concrete may be considered as the physical migration of water towards the top surface. It is not always favorable as it increase finishing time, produces laitance at the surface, decreases strength, wear resistance and bond strength and causes poor bonds between successive lifts.

QUESTION: 7

What is the effect of following on workability of aggregate?

(i) porosity and absorption

(ii) Air entraining agent

(iii) coarse aggregate to fine aggregate ratio

(iv) grading of aggregate

ANSWER:

POROSITY AND ABSORPTION:

The porosity of an aggregate may also effect workability of aggregate. If the aggregate can absorb a great deal of water, less will be available to provide workability.

If the absorption is not in proper ratio the workability reduces, may be becoming unworkable, depending on the dryness of the aggregates.

AIR ENTRAINING AGENT:

Air entraining effects compressive strength of aggregate and its workability. It increases the

workability of aggregate.

COARSE AGGREGATE TO FINE AGGREGATE RATIO:

The workability of laterized concrete at constant mix ratio of 1:2:4 and water-cement ratio of 0.6 increases as coarse aggregate particle size increases. How it decreases with the increase in percentage of laterite content. Fine aggregates, because of its cohesiveness and high surface area, along with its gradation characteristics plays a crucial role in concrete's workability. Particles smaller than 300 μ tend to increase concretes workability.

GRADING OF AGGREGATE:

Grading of aggregate have the maximum effects on the workability of aggregate. This helps in reducing the voids in a given volume of aggregates. The less volume of voids makes the cement paste available for

aggregate surfaces to provide better lubrication to the aggregate.

QUESTION: 8

What is the effect of fineness of cement on the following?

(i) Strength of concrete

(ii) Rate of heat evolution during hydration.

(iii) workability of concrete.

ANSWER:

STRENGTH OF CONCRETE:

The 28-day compressive strength of concrete, with or without entrained air, increase with an increase in cement fineness. The fineness of cement influences the drying shrinkage of concrete. When the water content is increased because of fineness, the drying shrinkage is increased.

RATE OF HEAT EVOLUTION DURING HYDRATION:

The hydration heat generated from cement with higher fineness

was larger and faster compared to coarser cements in early ages the set times increased with the increasing of the w/c and decreasing of the cement fineness.

WORKABILITY OF CONCRETE:

Workability of concrete is increase by increasing the cement fineness. In concrete the effect of finess of cement on workability is very much less pronounced.

TOTAL HEAT OF HYDRATION:

The size of cement particles directly affects the hydration, setting and hardening strength and heat of hydration. The fine the cement particle are, the larger the total surface area is and the bigger area contacting with water is.

QUESTION: 9

What steps can be taken during transportation and placement of concrete to prevent segregation of concrete?

Ans:

Regularly check the performance of mixer with respect to adequate uniformity of distribution of constituents in each batch. Transport the concrete mix correctly. choose the shortest route for transportation of concrete mix. place the concrete in its final position as soon as possible.

(FINISH)