

Concrete Technology Assignment

Instructor: Engr. Usama Ali

Total Marks: 30

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Section: A

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. (4 marks, CLO1)

Answer: The reaction of pure C3A with water is very violent and leads to immediate stiffening of the paste, known as “flash set”. To prevent **flash set** 2 to 3% of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is added at the time of grinding the **cement** clinkers.

Formula:

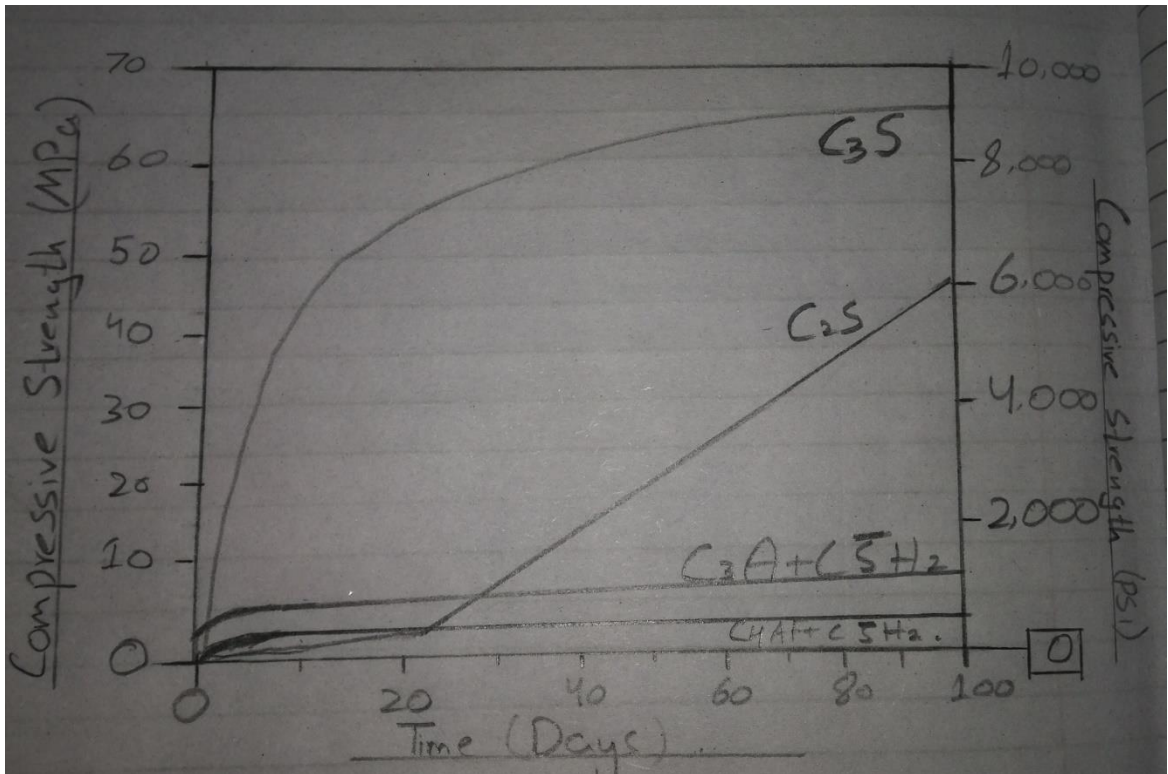
$\text{C}_3\text{A} + \text{CaSO}_4 + \text{H}_2\text{O}$.

Steps to prevent false setting of concrete: A chemical reaction starts which throws off heat and mix to cure or harden. The concrete must be placed as quickly as possible. It will start to cure while it is being mixed while transported in the ready mix truck. Depending on the formula and additives, the truck usually has 1 to 2 hours to discharge its contents or the load will be rejected. Adding more water may keep the concrete from solidifying in the truck, but its strength will be so denigrated that the concrete will be unusable. A slab can be walked in 1 or 2 hours. If a wall or column, it will continue to cure. In 28 days it is expected to be over 90% of its strength. It will then continue to cure and strengthen for years, depending on the size of the concrete mass.

2. Draw a graph showing the strength development of pure compounds of cement. (3 marks, CLO1)

Answer: The figure shows the strength development of pure compounds of cement.

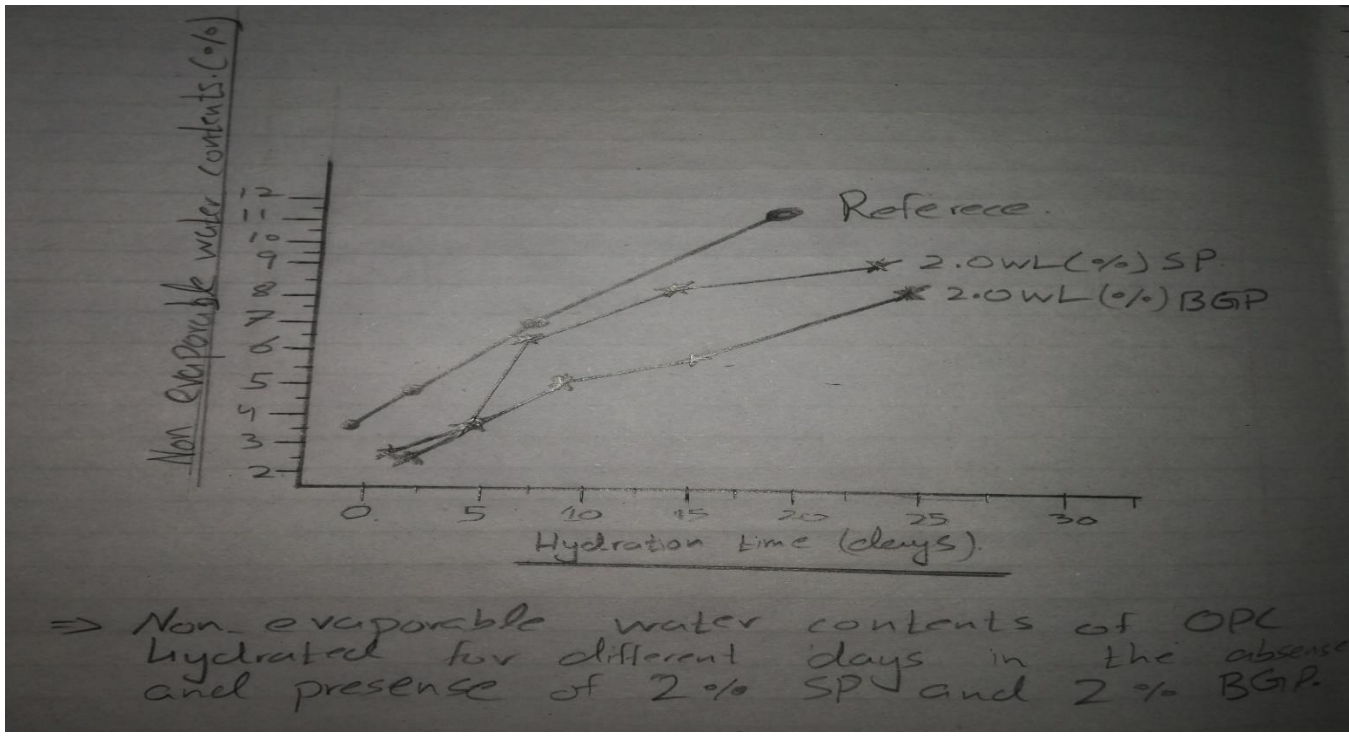
GRAPH:



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. (3 Marks, CLO1)

Answer: 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. The strength of rapid hardening cement at the 3 days is similar to 7 days strength of OPC with the same water-cement ratio. While in low heat producing cement is a special tailored cement which generates low heat of hydration during setting. It is manufactured by modifying the chemical composition of normal Portland cement.

GRAPH:

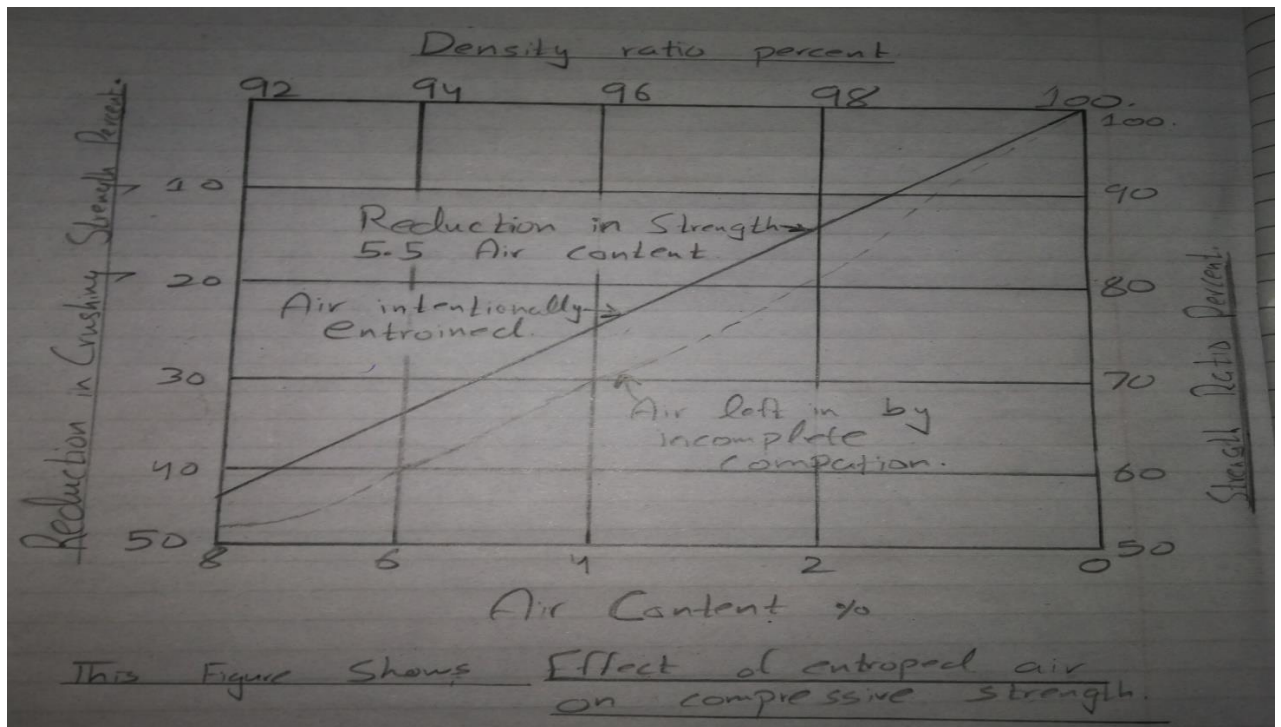


4. What is the effect of compaction on entrapped air of concrete? What will be the effect on strength if concrete is not compacted sufficiently? Explain with graph. (3 marks, CLO1)

Answer: The effect of compaction on entrapped air from freshly placed concrete and packs the aggregate particles together so, as to increase the density of concrete. It increases significantly the ultimate strength of concrete and enhances the bond with reinforcement.

While the effect on Compaction of concrete is an important component in the process of laying a concrete slab. 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.

GRAPH:



5. Why is the percentage of gypsum added to cement limited only to 5%? (2 marks, CLO1)

Answer: Gypsum plays a very important role in controlling the rate of hardening of the cement. During the cement manufacturing process, upon the cooling of clinker, a small amount of gypsum is introduced during the final grinding process. Gypsum is added to control the “setting of cement”. If gypsum is increased the setting duration will be disturbed.

6. What is the effect of following on the bond strength of concrete? (Use not more than 2 sentences to answer each part) (4 marks, CLO1)

i. Shape of aggregate

Answer: The effect of shape on bond strength affects the w/cm by its effect on water demand and amount of paste required for workability of a given mixture.

ii. Size of aggregate

Answer: The effect of size on bond strength plays an important role in properties of the concrete like workability and compressive strength. The smaller the size of aggregates the higher is the strength of the concrete and less will be its workability.

iii. Texture of aggregate

Answer: The effect of texture of aggregate on bond strength can be either smooth or rough. A smooth surface can improve workability, while rough surface generates a stronger bond between the paste and the aggregate creating a higher strength.

iv. Bleeding

Answer: The physical migration of water towards the top surface which is not always favorable as it increases finishing time, produce laitance at the surface and decreases strength, wear resistance and bond strength and causes poor bonds between successive lifts.

7. What is the effect of following on workability of aggregate? (4 Marks, CLO1)

i. Porosity and absorption

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

Absorption: The aggregates absorb water and equivalent water for this absorption which is not added above the required water/cement ratio. The workability reduce working depend on the dryness of the aggregates.

ii. Air entraining agent

Answer: The effect of air entraining agent increases the workability of concrete without much increase in water-cement ratio. And it also effect the compressive strength of concrete.

iii. Coarse aggregate to fine aggregate ratio

Answer: Coarse aggregate is usually greater than 4.75 mm and shape and texture of aggregate affects the properties of fresh concrete more than hardened concrete.

iv. Grading of aggregate

Answer: Grading of aggregates tend to fill up voids and get workability. where Less amount of water can make it workable. If grading is better, there will be fewer voids and excess paste will be available to give better lubricating effect.

8. What is the effect of fineness of cement on the following? (Use not more than 2 sentences to answer each part) (4 marks, CLO1)

i. Strength of concrete

Answer: The effect of fineness of cement on Strength of concrete depends on the rate of hydration. More the fineness of the cement more will be strength.

ii. Rate of heat evolution during hydration

Answer: The fineness of cement affects hydration rate and strength. Increasing fineness cause increase in rate of hydration, high strength, and high heat generation. increased fineness can also lead to the requirement of more water for workability, resulting in a higher possibility of dry shrinkage.

iii. Total heat of hydration

Answer: The size of cement particles directly affects the heat of hydration and getting more hard and strengthen.

iv. Workability of concrete

Answer: The particles of cement itself starts acting as lubricants in the concrete. so, the particles flow and less effort work is required for compaction of concrete.

9. What steps can be taken during transportation and placement of concrete to prevent segregation of concrete? (3 marks, CLO1)

Answer:

Step1: Correctly proportioning the mix and using the recommended water-cement ratio.

Step2: Must do care in handling and transporting .and prevent excess use of water.

Step3: Compacting and finishing like placing .