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Exam Final Term

Q no 3A = Define & Explain Briefly?

Batching = batching is the process of measuring concrete mix ingredients by either mass or volume and introducing them into the mixer.

To produce concrete of uniform quality, the ingredients must be measured accurately for each batch.

2 Mixing = the mixing should be ensured that the mass becomes homogeneous, uniform in colour and consistency.

Methods of Mixing:

1. Hands (using hand shovels)

2. Stationary Mixers

3. Ready mix concrete

Hand Mixing:-

Mixing by hands using ordinary tools like, hand shovels etc. This type of mixing is done for

less output of concrete.
Transporting

Mortar Pan :

Concrete is carried in small Quantities

Wheelbarrows and Buggies: The capacity of wheelbarrows varies from 70 to 80 liters.

Suitable for concrete road construction where concrete is deposited at or below mixer level.

Q no 3B Ans =

Ans = Segregation of concrete is the separation of cement paste and aggregates of concrete from each other during handling and placement. Segregation also occurs due to over-vibration or compaction of concrete, in which cement paste comes to the top and aggregates settles at the bottom. Segregation of concrete affects strength and durability in structures. In a good concrete, all concrete aggregates are evenly coated with sand and cement paste and forms a homogeneous mass. During handling, transporting and placing, due to jerks and vibrations the paste of cement and sands gets separated from coarse aggregate. If concrete segregates during transit it should be remixed properly before depositing. However a concrete where initial setting time is over, should not be used.

Causes of Segregation of Concrete

Use of high water-cement ratio in concrete. This general happens in case of concrete mixed at site by unskilled workers.

Excessive vibration of concrete with mechanical needle vibrators makes heavier particles settle at bottom and lighter cement sand paste comes on top.

When concreting is done from height in case of underground foundations and rafts, which causes concrete to segregate

Effect of Cement Characteristics on Strength and Heat of Hydration

Q no 2A= Define Admixture. When concrete admixture in used? And explain briefly its types?

Ans No 2B = Admixtures are those ingredients in concrete other than cement, water, and aggregates that are added to the mixture immediately before or during mixing as to obtain the required properties.

Concrete admixtures (additives) enhances the properties of concrete for applications in construction with special requirements.

Concrete additives are used to achieve desired workability in case of low water cement ratio, and to enhance setting time of concrete for long distance transportation of concrete.

It is of much importance for a civil site engineer to know about the types of admixtures (additives) and their properties for better selection and application in concrete works.

As per BIS (IS – 9103: 1999), Concrete Admixture is defined as a material other than water, aggregates and hydraulic cement and additives like Pozzolana or slag and fiber reinforcement, used as on ingredient of concrete or mortar and added to the batch immediately before or during its mixing to modify one or more of the properties of concrete in the plastic or hardened state.

When Concrete Admixtures Used?

When properties cannot be made by varying the composition of basic material.

To produce desired effects more economically.

Unlikely to make a poor concrete better.

Type of Admixture.

1 Air-entraining admixtures are used to introduce and stabilize microscopic air bubbles in concrete.
These are generally used to improve workability, ease of placing, increased durability, better resistance to frost action and reduction in bleeding.
The common Air-Entraining agents are natural wood resins, neutralized vinsol resins, polyethylene oxide polymers and sulfonated compounds.
The primary ingredients used in air- entraining admixtures are salts of Vinsol resin, synthetic detergents and salts of petroleum acids. In cold weather, water in

concrete converts into ice. As ice occupies more volume than liquid water so it exerts stress on surrounding concrete as a result concrete might crack. But air bubbles inside the concrete provide space for the enhanced volume of ice and prevents cracks in the concrete.

2 Retarding admixtures are used to slow down the speed of the reaction between cement and water by affecting the growth of the hydration products or reducing the rate of water penetration to the cement particles. The use of a retarder will increase the setting time and may delay strength development of the concrete.

Use of Retarding Admixtures =

To allow the placing of a large pour of concrete over several hours.

To extend the time between mixing and placing.

To prevent setting of the concrete in the truck in case of delay.

3 Mineral admixtures are "inorganic" materials that also have pozzolanic properties. These very fine- grained materials are added to the concrete mix to improve the properties of concrete, or even as a replacement for Portland cement and aggregates.

Type of Mineral Admixture BLAST-FURNANCE SLAG

SILICA FUMES

RICE HUSK

4 Grouting Admixture = it is a powder admixture which can be used for making neat cementitious grouts. It comprises a water reducing / plasticizing agent

ADVANTAGES

Higher Strength
Higher fluidity
Lower permeability

Reduced bleeding

Q no 2B = Explain Following

1 Slump Test

2 Compacting Factor Test

3 Flow Test

4 Kelly Ball Test

5 Vee Bre Test

Slump Test Definition A slump test is a method used to determine the consistency of concrete. The consistency, or stiffness, indicates how much water has been used in the mix. The stiffness of the concrete mix should be matched to the requirements for the finished product quality Slump is a measurement of concrete's workability, or fluidity. It's an indirect measurement of concrete consistency or stiffness.

Principle The slump test result is a measure of the behavior of a compacted inverted cone of concrete under the action of gravity. It measures the consistency or the wetness of concrete.

Apparatus Slump cone: inverted cone, 300 mm (12 in) of height. The base is 200 mm (8in) in diameter and it has a smaller opening at the top of 100 mm

Scale for measurement,

Temping rod (steel) 16mm diameter, 60cm length.

Procedure The base is placed on a smooth surface and the container is filled with concrete in three layers, whose workability is to be tested.
Each layer is temped 25 times with a standard 16 mm (5/8 in) diameter steel rod, rounded at the end.

After the top layer has been tamped, the concrete is struck off level with trowel land

tamping

Rod.

Then, the mould is removed by lifting it slowly and carefully in a vertical direction. This allows the concrete to subside. This subsidence is referred as slump concrete.

Compaction Factor Test compacting factor test, developed at the road research laboratory UK is more precise and sensitive than the slump test.

It is primarily designed for laboratory work but can also be used in the field.

It is particularly useful for concrete mixes of very low workability

Normally used when concrete is to be compacted by vibration such concrete may constantly fail to slump.

For the normal range of concrete the compacting factor lies between 0.8 - 0.92

Calculation of Compaction Factor Value The compaction factor is defined as the ratio of the weight of partially compacted concrete to the weight of fully compacted concrete. It shall normally to be stated to the nearest second decimal place.

Compaction Factor Value= (W1-W) / (W2-W)

Flow table test

The **flow table test** or **flow test** is a method to determine the consistence of fresh concrete.

When fresh concrete is delivered to a site by a truck mixer it is

Sometimes necessary to check its consistence before pouring it into formwork.

If the consistence is not correct, the concrete will not have the desired qualities once it

Has set, particularly the desired strength.

If the concrete is too pasty, it may result in cavities within the concrete which leads to corrosion of the rebar, eventually leading to the formation of cracks (as the rebar expands as it corrodes).

Cavities will also lower the strength of concrete.

Kelly ball test another method used in the field and laboratory to measure the consistency of concrete is the ball penetration test which is also known as the Kelly ball test.

Procedure It is performed by measuring the penetration, in inches, of a 6-in. diameter steel cylinder with a hemi spherically shaped bottom, weighing 30 lbs.

Vee bra Test It is based on measuring the time (Called VEBE time) needed to transfer the shape of a concrete mix from a cone to a cylinder (these shapes are standardized by the apparatus of this test), by vibrating and compacting the mix. The more V E B E time needed the less workable the mix is. This method is very useful for stiff mixes.

Q no 1a = briefly explain classification of Causes of Concrete deterioration.

1 Frost
2 Effect of Fire
3 Sulphate Attack

4 Alkali Aggregate

Ans Q no 1a = Frost Action Frost Action is a major cause of deterioration of concrete in Cold Climates. It takes place due to freezing or water within the concrete pores and cavities during extremely cold weather. Water on freezing expands and exerts pressure on the walls of the pores. This cyclic freezing of water in the pores are responsible for the development of cracks of various nature in the concrete.

To minimize frost actions following measures should be taken:

In cold weather, the water-cement ratio should be kept also was possible.Thiswillnotallowanyextrawatertoremainwithintheconcretepores.Hencefrostformationwillnottakeplace.Use good drainage and covering methods for removing any surface water from staying on the concrete during the curing process.

Aggregate Expansion Some aggregates may absorb so much water (to critical saturation) that they cannot accommodate the expansion and hydraulic pressure that occurs during the freezing of water. The result is expansion of the aggregate and possible disintegration of the concrete. If a problem particle is near the surface of the concrete, it can cause a pop out.

2. Effect of fire the concrete as a building material has a very good behavior when it exposed to fire, especially when it is compared to any others building material slice wood and steel.

But this is not mean that the concrete has infinite fire resistance, in some levels of fires when the concrete exposed to high temperature up to 900° C,significant changes in the mechanical properties of the structural elements like stiffness and strength will be occur.

Physical and chemical response to fire

100to140°C-Evaporation of the free water inside the concrete mix.

300°C-The cement paste will start to shrink due to water evaporation and the aggregate will expand. This will cause damage which his called the spalling of concrete.400to600°C-the calcium hydroxide in the cement paste breaks to calcium oxide and water. There sultans water from the chemical reaction, start to evaporate. This will cause a significant reduction in the concrete strength.

3 Sulphate attack

Sulphate attack on concrete is a chemical break down mechanism where sulphate ions attack components of the cement paste. The compounds responsible for sulphate attack on concrete are water-soluble sulphate-containing salts, such as alkali-earth (calcium, magnesium) and alkali (sodium, potassium) sulphates that are capable of chemically reacting with components of concrete.

Forms of Sulphate Attack on Concrete

Sulphate attack on concrete might show itself in different forms depending on:

The chemical form of the sulphate

What happens when sulphatesget into concrete?

When sulphates enters into concrete:

It combines with the concrete paste, and begins destroying the paste that holds the concrete together. As sulphated rise, new compounds are formed, often called **ettringite**. These new crystals occupy space, and as they continue to form, they cause the paste to crack, further damaging the concrete.

4. Alkali-Aggregate Reaction.

Sodium and potassium hydroxides of cement are capable of reaction with silica.

Since amorphous silica is a common component of many coarse aggregates, such an alkali-aggregate reaction may create harmful effects on cement concrete.

This is because the get-like silicate structures produced by the above reaction are quite weak and unstable and result in greater expansion.

These may be the cause of frequent cracking in some concrete.

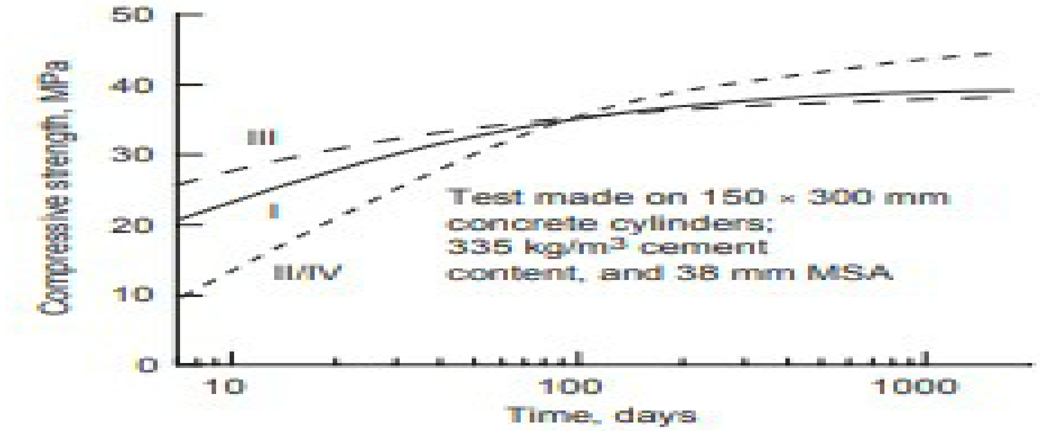
For avoiding this reaction, either the percentage of alkalis (K2OandNa20) has to be kept very low in the Portland cement.

Or a great care has to be taken for selecting aggregates free of silica

Q no 1B = what are the Effect of Cement Characteristics on Strength and Heat of Hydration Explain briefly?
Ans No 1B = since the rates of reactivity of individual Portland cement compounds with water vary considerably, it is possible to change the strength development characteristics of cements simply by changing the compound composition.

For example, the early strengths at 3, 7 and 14 days would be high if the cement contains relatively large amounts of C3S and C3A; and the early strength would be low if the cement contains a larger proportion of C2S.

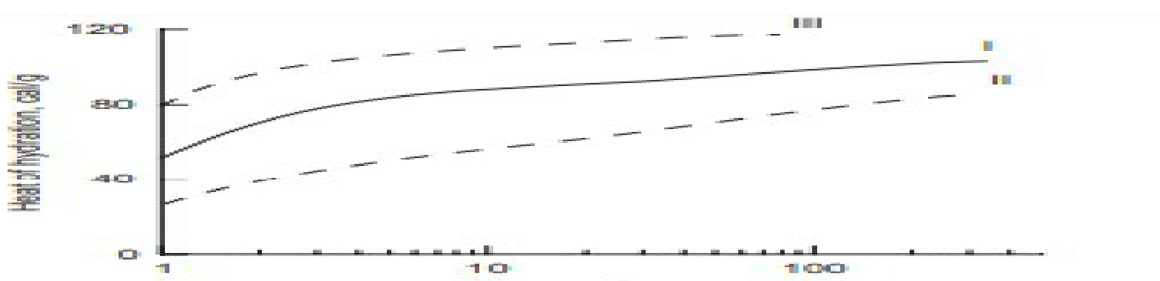
Also, from theoretical considerations, the ultimate strength of a high-C2S cement should be greater than that of a low-C2S cement. Laboratory studies confirm this (Figure)



(a)

Influence of cement composition on strength

<u>Effect of Cement Characteristics on Strength and Heat of Hydration</u> = Also, as the compound composition of the cement affects the heat of hydration, it is to be expected that cements containing high C2S will not only exhibit slow hardening but also less heat production (Figure).



Cement No.	Compound composition			
	C_3S	C_2S	C_3A	C_4AF
I	49	25	12	8
II*	30	46	5	13
III	56	15	12	8

* Cement II corresponds to the ASTM type IV portland cement.

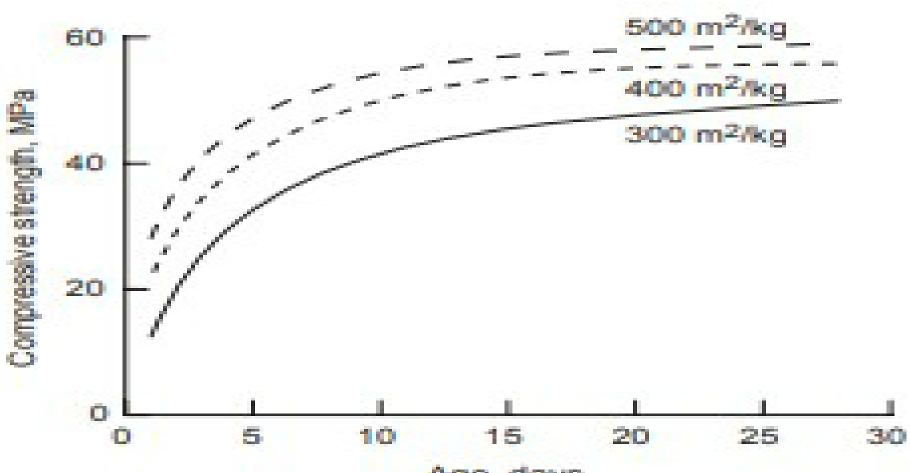
(b)

Influence of cement composition on heat of hydration

The rates of strength development and heat evolution can also be controlled by controlling the fineness of cement

For example, with a given compound composition, by making a change in the surface area of the cement from 300 to 500 m2 /kg Blaine, it was possible to increase the 1, 3, and 7 day compressive strengths of the cement mortar by about 50 to 100 percent, 30 to 60 percent, and 15 to 40 percent, respectively.

Typical data on the influence of fineness on strength are shown in Figure.



Influence of cement fineness on strength