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MADE EASY CIVIL ENGINEERING BUILDING MATERIAL BY-AKHILESH MATHUR

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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BUILDING MATERIAL

Chapter-01 Cement

• Cement is artificial building material having binding properties { Cohesion & Adhesion Both }

Joseph Aspain

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Calcareous [Co. Mg]

Lime

Chalk, marine shell, ash, Alkali waste

Cement Rock

Argillabus [Si.AI]
Compound

Clay

Shale, Slate

+ Water - paste looking like a stone present at postland

Postland Cement

* Constituent of Cement Lime (Cab) - + 62-67%.

Silica (Sioz) - + 17-25%.

Alumina (A1203) - 3-8%.

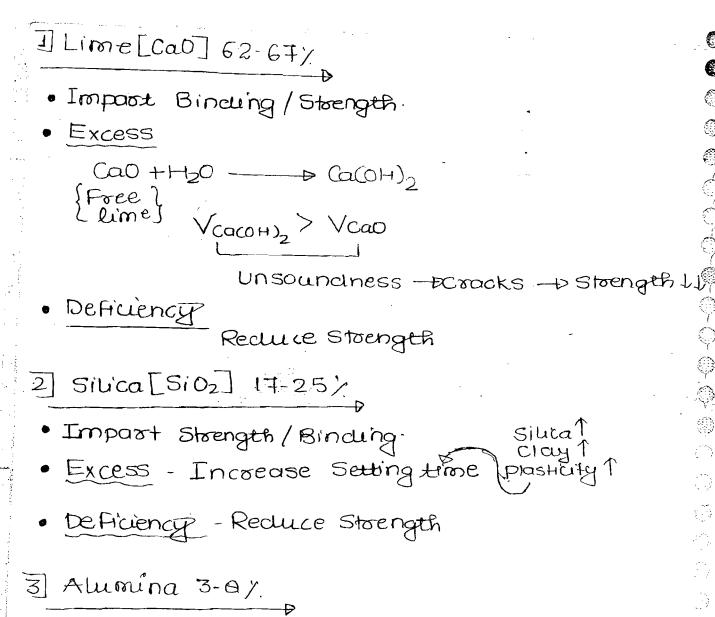
Gypsum (Caso4) - 3-4%. - (Adautive)

Iron oxide (Fe203) + 3-4%.

Mg0 - + 5%.

Sulphur Al Kali

Al Kali



· Impart Flash Set/Quick Set/ Initial set

· Rate of Hydration ?

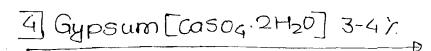
Heat of hydration?

Water Evaporate

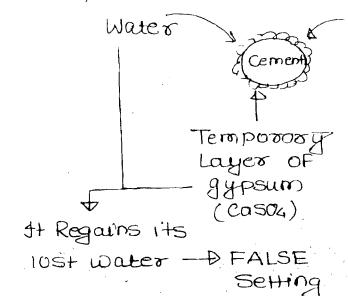
Plastic Shankage Cracks

Strength Gaining Reduces

* It wooks like "FLUX" Le it reduces demand of temp to achieve particular degree. Of Fusion hence makes manufacturing economical



• It increase l'nitial Setting time / Retard intial. Set process.



Gypsum [CaSO4:2H20] added

Coystallization Water of gypsum evaposate due to very hot Clinker

3 Ivon Oxide 3-4%

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patrica,

· Impart Strength, Hardness & Recuish Brown Colour

6 Magnesium Oxide [MgO] >5%

· Impart Strength, Hardness Lyellow Linge Colour

· Excess OF Mgo Impart unsoundness

Mote Mgo & Fe₂O₃ helps lime & Silica to Fuse.

With each other property during other

burning hence impart Strength but incirculty.

J Sulphyr (>2.5%)

· Impast Unsoundness

· Ca.A1.+5 - Calaium Alumeno Sulphatic (227/2 more Volume)

Mg0+5 - + Mg504

(\$) Alkali (\$1%) Na20+K20

- Its imparts "EFFlorosence" (White patches /spots)
- · Excess of Alkali may impart Flash Set.
- · Alkali enters into pores of Aggregate due to osmosi's pressure & result in Volume increment of Aggregate

Unsoundiness -> Cracks & Alkali aggregate Reaction "Cancer of Concrete"

* Unsoundness of Cement - Lime Sulphur

component of cement fuse with All the above each other during the burning and results in formation of "Bouge's compound

1 C3A { 30a0 A1203. 4-14/., Tricalcium aluminate}

· Impost Flash Set/ Quick Set/ initial Set

Rate of hydration of With in 24-hours

Heat of hydration { 865 J/g 310 Cal/g (90days)}

Water Evaporate

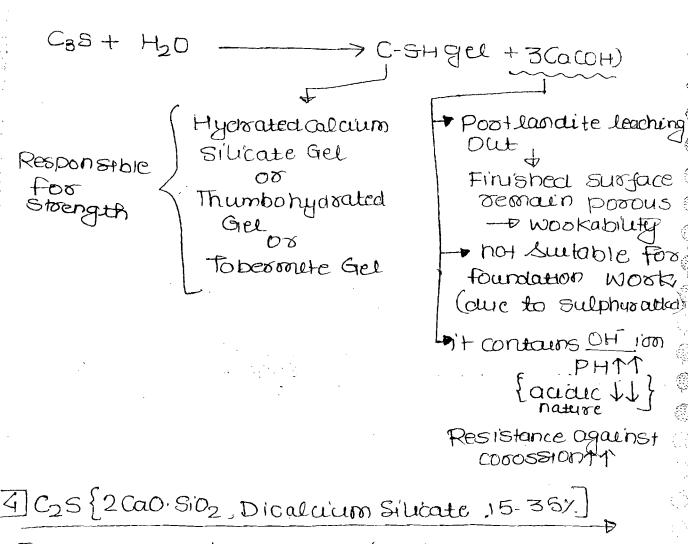
Plastic Shrinkage Crack Strength

· Resistance against Sulphur altack 111

· Harmful Compound

2 CLAF L4CaO.A12O3. Fe2O3 Calcium alumino ferriate 3/10-· Import Flash Set/ Quick Set/ initial Set. **(3)** Rate of hydration {approx 90% hydrates } (1) • A11 the ausadvantage are same as GA but (3) With lesser Impact like Resistance against Sulphur attack is less but better than C3A. · WORST compound because it is not safe able , **(**,) to provide comentaneous property further 3 C35 [3CaOSiO2 Toicalcum Silicate, 45-65%] 1 · Impact Early Strength $\langle j_{ij} \rangle$ Rate of hydration { 60-70% hydrates } with in Fdays] 44.3 Heat of hydration (502 J/g: [105 Cal/g (90 days)] (3) - impact drying Shrinkage -> pavement construction/Repair -> Precast construction -> Whenever formwork is limited - (5) e^ta -> Cold weather construction - Resistance against FROST ACTIONA Sdiameter OF C35 13 vorg less . . . KV)

 $\mathcal{F}(\mathcal{S}_{i}^{k})$



· Import Later/Progressive/Ultimate Strength. Rate of hydration { Slow, Yeardy} Heat of Hydration [265 Jg (ardays)]

Doyeng shookage 111

· Resistance against chemical attack | Rate of 1

* Used for mass concreting like dam, bridge etc

corosion &

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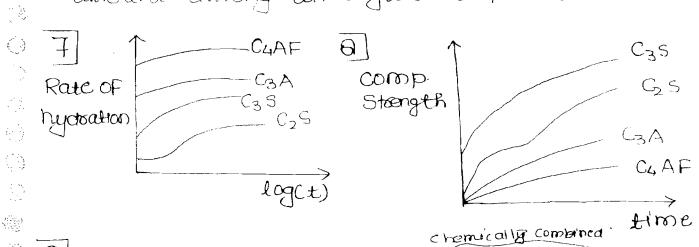
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- 1 Rate of hydration C4AF>C3A>C3S>C2S
- @ 2] Binding Property C35 > C25 > GA > C4AF

 Aelite Belite Celite Felite
 - 3 Water Requirement C35 > C25 > C3A ~ C4AF
- 4 Amount of bouge's Compound C35>C25>CLAF>GA
 - 5 Amount of Heat of hydration C3A>C3S>CAF>C2S
 - 6 In absolute term, C35 1's responsible for highest heat of hyperthon b.c1 1 1's present in highest amount among all bogues compound.



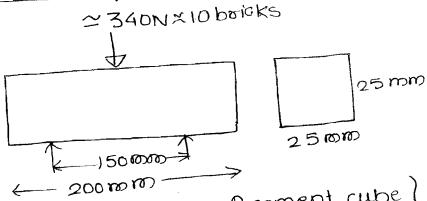
9 for complete hydration (23% of water) by weight of coment is Required but out of that 15% remain in capillary voids hence 38% of water by weight of coment is Added for complete hydration

WC = 0.39 × 0.4 (For complete hydration)

*Testing For Cement

- 1 Field Test For Cement
- il Cement Should be Smooth of have Uniform Grey (Finness) (Blending) coloux.
- 11 Cement Particles should have sink in water (Sp. grovity)
- III Thin paste of cement showd feel sticky (Binding)
 - IN Thick paste of (faster) cement should not impact any sign of crack after immerging 24 hr in water [unsound ness]
 - V There must not be any air lumps and it should feel cool in cement bag { Prenydration or air induced settings

Vij Skength test



(in given loading cond cement cube) should not fail

2 Lab Test For Cement