BUILDING MATERIALS

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BUILDING MATERIALS

TSPSC AEE SYLLABUS

Bricks– Types of Bricks, Indian standard classification, properties; Stones – Types of stones, classification, properties, dressing and polishing of stones; Methods of Quarrying; Cement – Different grades and types of cement, properties and IS specifications; Aggregates – coarse and fine aggregate, properties and IS specifications; Cement Mortar – Proportions of cement mortar for various applications; Concrete – Constituents of Concrete, Different grades of Concrete, mix proportioning using IS Code, Properties of fresh and hardened Concrete; Admixtures – Types of Admixtures

APPSC AEE SYLLABUS

BUILDING MATERIALS: Timber: Different types and species of structural timber, density – moisture relationship, strength in different directions, defects, preservations, plywood. Bricks: Types, Indian standard classification, absorption, saturation factor, strength in masonry, influence of mortar strength on masonry strength. Cement: Compounds of different types, setting times, strength. Cement mortar: Ingredients, proportions, water demand, mortars for plastering and masonry.

Concrete: Importance of w/c ratio, strength, ingredients including admixtures, workability, testing for strength, mix design methods, non-destructive testing.

SSC-JE SYLLABUS

Building Materials : Physical and Chemical properties, classification, standard tests, uses and manufacture/quarrying of materials e.g. building stones, silicate based materials, cement (Portland), asbestos products, timber and wood based products, laminates, bituminous materials, paints, varnishes.

1 CEMENT

Introduction :

Cement is invented by Joseph Aspdin (1824).

- It is a binding material, well mixture of Calcareous material (Ex: limestone (or) chalk) and Argillaceous material (Ex: clay (or) shale).
- General type of cement is Ordinary Portland Cement (OPC).
- To prevent the flash setting of cement.
- The process of manufacture of cement consists of
  - Grinding the raw materials.
  - Mixing them intimately on certain proportions, depending upon their purity and composition.
  - Burning them in a *Rotary kiln* at a temperature of 1300°C to 1500°C
  - Grinding the clinkers.
- In production of cement when grinding the cement clinkers, 3-5% of gypsum is added to increase the initial setting time of the cement.
- There are two methods available to manufacture cement.

Wet Method:

- It is an old method.
- Requires more fuel.

Dry Method:

- It is a modern method
- Requires less fuel.

Note :

Presently we are using Dry method.

Composition of Cement & Functions of the Ingredients of Cement:

Ingredients	Proportions	Functions
Lime (CaO)	60-67%	Controls Strength & Soundness. Deficiency : Strength↑ I.S.T↓ Excess : Makes the Cement Unsound
Silica (SiO_2)	18-25%	Gives Strength Excess : Strength↑ I.S.T↓
Alumina (Al_2O_3)	3-8%	Makes the Cement to set quickly.
Iron Oxide (Fe_2O_3)	0.5-6%	Gives Colour & helps in fusion of different ingredients.
Magnesia (MgO)	0.1-4%	Imparts colour & hardness, controls soundness Excess of it leads to unsound
Sulphur Trioxide	1-3%	If it is in excess, cracks occurs in mortar (or) in concrete because of unsoundness (Controls the Soundness)
Alkalis	0.2-1%	Makes the Cement to set quickly.

Bogue's Compounds:

The oxides present in raw materials when subjected to high clinkering temperature combined with each other to form complex compounds known as "Bogue's Compounds".

Traditional Names:

- C_3S - Tri Calcium Silicate - Alite
- C_2S - Di Calcium Silicate - Blite
- C_3A - Tri Calcium Aluminate - Clite
- C_4AF Tetra Calcium Alumino Ferrite - Flite

Functions of Bogue's Compounds:

- **Tricalcium Silicate C_3S-(25-50%) - normally 40%**
  - It is considered as best cementing material and is well burnt cement.
  - Increase in C_3S content beyond the specified limits increase heat of hydration and solubility of cement in water.
  - Hydrolysis of C_3S content beyond the specified limits increases heat of hydration and solubility of cement in water.
  - Hydrolysis of C_3S is mainly responsible for 7 days strength and hardness.
  - Heat of hydration is 500 J/g.
- **Dicalcium Silicate (C_2S) (25–40%) (normally 32%)**
  - It hydrates and hardens slowly and takes long time to add to the strength (after a year or more) i.e. It is responsible for ultimate strength.
  - It imparts resistance to chemical attack.
  - At early stages, less than a month, C_2S has a little influence on strength and hardness. While after one year, its contribution to the strength and hardness is proportionately almost equal to C_3S.
  - Heat of hydration is 260 J/g
- **Tricalcium Aluminate (C_3A) (5–11%) (normally 10.5%)**
  - It rapidly reacts with water and is responsible for flash set of finely grounded clinker.
  - It is most responsible for the initial setting, high heat of hydration and has greater tendency to volume change causes cracking.
  - Heat of hydration of 865 J/g.
- **Tetracalcium Alumino Ferrite (C_4AF 8-14%) (normally 9%)**
  - It is responsible for flash set but generates less heat.
  - Increase in C_4AF content reduces the strength slightly.
  - Heat of hydration 420 J/g

Hydration of Cement:

- The chemical reactions that take place when water is added to the cement is referred as *"Hydration of Cement."*

- *14 liters of water* required to hydrate one bag of *50kg cement.*
- $1m^3$ of cement = 1500 kg
- The volume of cement bag of 50kg = $0.035m^3$
- In process of hydration of cement heat liberates is called as *"Heat of hydration."*

  Heat of hydration, H = aA + bB + cC + dD.

  Here a,b,c,d are proportions of Bogue's Compounds

  A,B,C,D are individual heat of hydration values.

  Order of heat of Hydration of Bogue's Compounds in Cement:

$$\boxed{C_3A > C_3S > C_4AF > C_2S.}$$

- Normal cement produces *89-90* cal/g for 7 days, *90-100 cal/g* for 28days.
- Under normal condition, complete hydration is possible only for the cement particles of size smaller than 50μ.
- During the course of hydration, C_3S & C_2S of cement reacts with water & forms calcium silicate hydrate gel & $Ca(OH)_2$ (calcium hydroxide).

$$\mathbf{C_3S/C_2S + H_2O \rightarrow C\text{-}S\text{-}H\text{-}gel + Ca(OH)_2 + Heat\ of\ Hydration}$$

C - S - H. Gel : Tobormorite Gel (gives good properties).

$Ca(OH)_2$: Gives bad properties (presence of calcium hydroxide affects the durability of cement).

Water requirements for Hydration:

C_3S requires **24%** by weight of cement

C_2S requires **21%** by weight of cement

On an average : **23%**

- **23%** of water by weight of Cement .

  This water is also called as *Bound Water* because it directly reacts with cement.
- If this water is not sufficient to fill up Gel pores in the slurry, then add additional water by an amount of 15% by wt of Cement.
- Amount of water required for total of hydration is **38%** by wt of cement.

Note :

If we add water more than 38%, then capillary cavities will be formed and there by reduction in the strength takes place.

Tests on Cement:

Testing of Cement can be done in two categories.

- Field Testing (for Minor works).
- Laboratory testing (for Major works).

Field Testing:

- Open the cement bag and take a good look at the cement, there should not be any visible lumps.
- The color of cement should be Gray colour.
- When hand is inserted into the cement, it must give a cool feeling.
- The cement should give smooth feeling, when it feels between the fingers.
- Take a handful of cement and throw it in bucket full of water, then the particles should float for sometime before they sink.
- Take about 100g of cement and a small quantity of water and make a stiff paste. From stiff paste make a cake of square shape with sharp edges and keep it on a glass plate and slowly put it in the bucket full of water. See that the shape of the cake should not be disturbed while taking it to the bottom of the bucket. After 24 hrs the cake should retain its original shape and at the same time it should also attain some Strength.

Laboratory Testing:

- **Fineness Test:**
  - This test is done to detect proper grinding of cement.
  - Fineness of cement offers a greater surface area for hydration and hence fastens the development of strength, if cement fineness is more.
  - Increase in fineness of cement is also found to increase the drying shrinkage of Cement.
- **Fineness of Cement is tested in two ways:**
  - Sieving
  - By determination of Specific Surface Area (Total Surface area of particles in 1gm of Cement).

    Specific Surface Area can be measured by using Air permeability apparatus, Blaine's Apparatus.
- **Sieving:**
  - Sample wt:100g.
  - IS Sieve No: 9 (size-90 μ)
  - Duration of Sieving :15 min
  - Weight of Residue (retained on sieve) :10%

Note :

Now-a-days, we are not using this Method.

- **Specific Surface Area by using Air permeability test:**

  SSA can be measured using two types of apparatus:
  - Lea & Nurse Air Permeability Apparatus.
  - Blaine Type Air Permeability Apparatus.

$$\text{Specific Surface Area} = \frac{\text{Total surface area of cement particles}}{\text{weight of cement sample}}$$

Units: cm^2/g (or) m^2/kg.

Note :

OPC – 33 grade fineness (SSA): 2250 cm^2/g.

- **Principle:**

  The principle is based on the relation b/w the flow of air through the cement bed & the surface area of cement particles comprising in the cement bed.

- **Standard Consistency (or) Normal Consistency Tests:**
  - This test is used for determining the quantity of water required to form a cement paste of standard (or) normal consistency.
  - Vicat's apparatus with plunger of 10mm diameter 50mm length is used .
  - Sample wt is 500grams.
  - Add an amount of water 24%, 26%, 28%, 30%, 32%.
  - After adding water keep the cement paste in the mould of vicat's apparatus. Then allow the plunger to penetrate into the cement paste.
  - Amount of water required to form the cement paste such that it can allow the plunger to penetrate for a depth of 33 to 35mm from top of the mould (5 to 7mm from bottom) into the cement paste is noted down.

    $$\text{Normal Consistency 'P'} = \frac{\text{Amount of water required to get desired depth of penetration}}{\text{weight of cement sample}} \times 100$$

  - This Test is performed at a temperature of $27 \pm 2^0 C$
  - Generally 'P' varies from 25 to 30%.
- **Setting time Test:**
  - **Initial Setting Time:**

    Time elapsed between the moment when the water is added to the cement and the time when the cement paste starts loosing its plasticity property and sufficiant hardness is achieved.
  - **Final Setting Time:**

    The time between the moment when the water is added to the cement and the moment when the paste has completely lost its plasticity and attains sufficient strength to resist certain pressure.
  - Wt of Sample = 500 grams.

Note :

Vicat's apparatus : $\frac{\text{needle C}}{(\text{dia} - 1\text{mm})}$ for I.S.T (Square needle)

$\frac{\text{needle F}}{(\text{dia} - 1\text{mm})}$ for F.S.T (Surrounded by Annular collar)

Test	OPC	QSC
IST (⅛)	30min	5min
FST (⅛)	10hr	30min

- Weight of water added = 0.85 P.
- After adding water take the cement paste in the mould.
- In the beginning the needle will completely penetrate through test block.
- Time between water added to the cement and the instant at we get depth of 33 to 35 mm in test block in cement paste is called as "Initial Setting Time".
- Time between instant of water added to the cement and instant of at which only the needle makes an impression but the annular collar fails to do so therefore, called as "Final Setting Time".

- **Compressive Strength Test:**
  - Strength Tests are not made on neat cement paste, the Standard Sand (Ennore Sand) is used in the Combination of cement for Strength Measurement.

Cement	1	185g
Sand	3	555g

  - Weight of water = $\left(\frac{P}{4}+3\right)\%$ by combined wt of cement & sand.
  - Mould size : 7.06 cm cube
  - Surface area of mould : 50 cm^2
  - Curing at temperature of : 27 $\pm 2^0$C(curing water should be renewed for every 7 days).
  - Rate of Loading (R.O.L) is 35N/mm^2/min.
  - Minimum of three cubes should be tested at each age of testing.
  - Average of 3 cubes Strength is taken as compressive strength of Cement.

Note :

$$\frac{(\text{Strength})_{7\text{days}}}{(\text{Strength})_{28\text{days}}}=\frac{2}{3} \qquad \frac{(\text{Strength})_{3\text{days}}}{(\text{Strength})_{28\text{days}}}=\frac{1}{2}$$

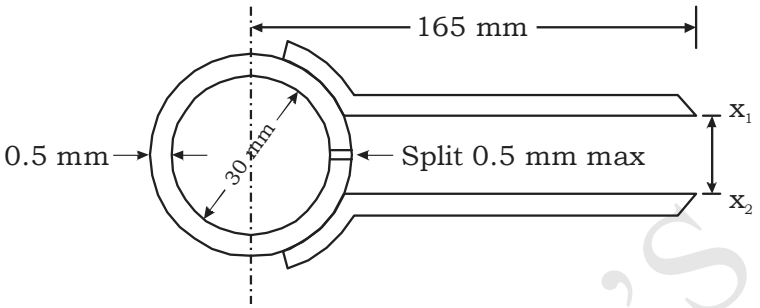
Grades of OPC:

Grade / Strength	3 Days	7 Days	28 Days
33	16	22	33
43	23	33	43
53	27	37	53

- **Soundness Test:**

Unsoundness of cement measured with

- Le Chatelier's Apparatus (because of Excess lime)
- Autoclave Apparatus (if magnesia > 3% in cement)



Le Chatlier's Test:

- Weight of Water : 0.78P.
- Split cylinder with indicator arms having dimensions

  Diameter : 30mm

  Height : 30mm

  Split : < 0.5mm.
- After adding water, take the sample in split cylinder with indicator arms and keep the whole assembly in water at 27 to 32^0 C for 24 hrs.
- After 24 hrs, take it out from the water and measure the distance between tips of indicator arms denoting it as x_1.
- Then keep the whole assembly in vessel & rise the temperature upto boiling point in 25 to 30 min and keep it in boiling water for 4.5 to 5 hrs.
- Then take the assembly out of the vessel and allow it to cool down then measure the tips of indicator arms and denote it as x_2.

$$\boxed{x_2 - x_1 \not> 10\text{mm}}$$

Note :

If we use Autoclave Test the % Expansion should not be more than 0.8%.

- **Chemical Composition Test:**

$$\frac{Al_2O_3}{Fe_2O_3} \not< 0.66$$

Lime Saturation Factor (LSF) : It is the ratio of lime to other oxides in cement

Range : $0.66 \leq LSF \leq 1.02$

TYPES OF CEMENT:

Ordinary Portland Cement (OPC):

- OPC has 3 grades (33,43,53)
- It is important for general type of construction.

Rapid Hardening Cement:

- C_3S, proportion is more, C_2S proportion is less.
- it is also called as High early strength cement.
- used in emergency repair works & where form work is required to be remove quickly to ensure completion of construction.
- $(\text{Strength of Rapid Hardening cement})_{3\text{days}} \cong (\text{Strength of OPC})_{7\text{days}}$
- $Cacl_2$ is added whose preportion is less than 2%
- The 7 days strength is 10-15% higher than rapid hardning cement
- After 90 days, the strength of OPC, RHC and ERHC remain same.

Quick Setting Cement:

- add less Gypsum content and add small quantity of Aluminium Sulphate to the cement clinker.
- used in *water logged areas* and for Under water construction.

Sulphate Resisting Cement:

- low C_3A, C_4AF.

  $C_3A \leq 5\%$
- used to *resist sulphate attack.*
- used in foundation & basement construction in soils which contains sulphates.

Super Sulphated Cement:

- Granulated Slag: 80% to 85%

  Gypsum: 10% to 15%

  OPC clinker: 5%
- *More resistance* against *Sulphate attack* than the Sulphate Resisting Cement.
- used in *Marine construction.*

Portland Pozzolonic Cement:

- OPC clinker + 10-25% of pozzolonic materials(Fly ash, Surkhi, Silica Fume etc).
- Increases Tensile strength of the cement, decreases permeability.
- Produces less heat of hydration.
- Used in hydraulic construction & large massive constructions.

Low Heat Cement:-

- Less quantity of C_3A, C_3S
- Used in large body of concrete structure to resist cracks.

High Alumina Cement:

- Grinding of mixture of Calcareous Material, Bauxite (Alumina ore).
- Used to resist *chemical attack.*
- Used in *marine construction also.*

IRST 40 Cement:

- Cement is used for the construction of the concrete *Sleepers of Indian Railways.*
- It is a special type of *"53 grade OPC."*

White Cement:

- It is used for fixing Tiles.

Masonry Cement:

- Used to improve the water retentivity.

CLASS W0RK

1. If 'p' is the standard consistency of cement, the amount of water used in conducting the initial setting time test on cement is

   a) 0.65p b) 0.85p

   c) 0.6p d) 0.8p

2. For complete hydration of cement the water-cement ratio needed is

   a) Less than 0.25

   b) More than 0.25 but less than 0.35

   c) More than 0.35 but less than 0.45

   d) More than 0.45 but less than 0.60

3. Gypsum is used as an admixture in cement grouts for

   a) Accelerating the setting time

   b) Retarding the setting time

   c) Increasing the plasticity

   d) Reducing the grout shrinkage

4. Before testing setting time of cement one should test for

   a) Soundness

   b) Strength

   c) Fineness

   d) Consistency

5. The role of superplasticizer in a cement paste is to

   a) Disperse the particles

   b) Disperse the particles and to remove air bubbles

   c) Disperse the particles, remove air bubbles and to retard setting

   d) Retard setting

6. The finesses of cement is tested by

   a) Air-content method

   b) Air-permeability method

   c) Le-Chatelier apparatus

   d) Vicat's apparatus

7. The test on cement designed to accelerate the slaking process of the ingredient of cement and to determine the resulting expansion in a short time is

   a) Setting time test

   b) Soundness test

   c) Normal consistency test

   d) Accelerated test

8. The proper size of mould for testing compressive strength of cement is.

   a) 7.06 cm cube

   b) 10.05 cm cube

   c) 15 cm cube

   d) 12.05 cm cube

9. The specific gravity of commonly available ordinary portland cement is

   a) 4.92 b) 3.15

   c) 1.5 d) 1.83

10. A quick-setting cement has an initial setting time of about

    a) 50 minutes

    b) 40 minutes

    c) 15 minutes

    d) 5 minutes

11. As per specifications, the initial setting time of ordinary portland cement should not be less than

    a) 10 minutes b) 20 minutes

    c) 30 minutes d) 60 minutes

12. In cements, generally the increase in strength during a period of 14 days to 28 days is primarily due to

    a) C_3A b) C_2S

    c) C_3S d) C_4AF

13. Ultimate strength of cement is influenced by which one of the following?
    a) Tricalcium silicate
    b) Dicalcium silicate
    c) Tricalcium aluminate
    d) Tetracalcium alumino-ferrite

14. What is the requirement of water (expressed as % of cement w/w) for the completion of chemical reactions in the process of hydration of OPC?
    a) 10 to 15% b) 15 to 20%
    c) 20 to 25 % d) 25 to 30%

15. If P is the percentage of water required for determination of normal consistency of cement, then percentage of water to be added for determination of initial setting time is.
    a) 0.70 P b) 0.75 P
    c) 0.80 P d) 0.85 P

16. A cement bag contains 0.035 cubic meter of cement by volume. How many bags will one tonne of cement comprise?
    a) 16 b) 17
    c) 18 d) 20

KEY

01. b	02. c	03. b	04. d	05. c	06. b	07. b	08. a	09. b	10. d
11. c	12. b	13. b	14. c	15. d	16. d				

AEE Previous Year Questions

1. Cement can be used for one of the following items in Building construction **[PH & Municipality 2001]**
   a) P.C.C b) RCC
   c) Masonry d) All
2. The quantity of water required for one bag of cement with w/c ratio of 0.5 is **[PH & Municipality 2001]**
   a) 20kgs b) 25kgs
   c) 30kgs d) 40kgs
3. Cement comprises of the following composition **[PH & Municipality 2001]**
   a) C_3S, C_2S,C_3A b) CS, C_1S
   c) CA, CS, C_1S d) C_2S, C_3S,C_1A
4. Initial setting time of cement is governed by the content of its **[APPSC AEE 2003]**
   a) tricalcium silicate
   b) dicalcium silicates
   c) tricalcium aluminate
   d) tetracalcium alumino ferrite
5. The percentage of water for normal consistency is **[APPSC AEE 2003]**
   a) 5-15 b) 10-25
   c) 15-25 d) 25-35
6. Standard size of cubes for testing the strength of cement is **[APPSC AEE 2003]**
   a) 150.0mm b) 200.0mm
   c) 70.6mm d) 110.5mm
7. Le Chatelier's appartus determines, in cements, the **[APPSC AEE 2004]**
   a) setting time b) soundness
   c) tensile strength d) creep
8. Long term development of strength by cement is due to **[APPSC AEE 2003]**
   a) tri calcium silicate
   b) di calcium silicate
   c) tetra calcium aluminate
   d) tri calcium alumino ferrite
9. **Assertion(A):** Pozzolana is added to cement to increase early strength.
   Reason(R): It reduces the heat of hydration **[AEE 2006]**
   a) Both A and R are true and R is the correct explanation of A
   b) Both A and R are true but R is not correct explanation of A
   c) A is true but R is false
   d) A is flase but R is true
10. Cement with lesser tricalcium aluminate has **[AEE 2006]**
    a) Lesser initial strength but higher ultimate strength
    b) Lesser initial and ultimate strengths
    c) No effect on initial and ultimate strengths
    d) Higher initial and final strength
11. Ultimate strength of cement is provided by **[AEE 2006]**
    i. Tricalcium aluminate
    ii. Tricalcium silicate
    iii. Dicalcium silicate
    The correct answer is
    a) only (iii) b) only (i)
    c) (i), (ii) and (iii) d) only (ii)
12. The water cement ratio is expressed by **[AEE 2006]**
    a) volume b) weight
    c) density d) volume and density
13. Sieve anaylsis of Ordinary Portland Cement is performed on IS sieve **[AEE 2006]**
    a) No. 7 b) No. 9
    c) No. 3 d) No. 5
14. Which of the following cements has maximum percentages of C_3S? **[AEE 2006]**

a) Ordinary Portland cement
b) Rapid hardening cement
c) Sulphate resisting cement
d) Low heat cement

15. For complete hydration of cement, the water-cement ratio needed is of the order of **[IES-96, AEE-2006, 08]**
a) less than 0.25
b) more than 0.25 but less than 0.35
c) more than 0.35 but less than 0.45
d) more than 0.45 but less than 0.60

16. Good quality of cement contains higher percentage of **[AEE 2006]**
a) Tricalcium silicate
b) Dicalcium silicate
c) Tricalcium Aluminate
d) Tetracalcium alumino ferrite

17. Rapid hardening cement attains early strength due to **[AEE 2006]**
a) Larger proportion of clinker grounded finer than normal cement
b) Lesser proportion of clinker grounded coarser than normal cement
c) Lesser proportion of clinker grounded finer than normal cement
d) Larger proportion of clinker grounded coarser than normal cement

18. Rapid hardening cement is actually early_____cement. **[Poly technic Lecturers 2007]**
a) Setting b) Strength
c) Hardening d) Curing

19. The rapid hardening Portland cement has a **[AEE 2008]**
a) lower heat of hydration and higher shrinkage coefficient
b) lower heat of hydration and lower shrinkage coefficient
c) higher heat of hydration and higher shrinkage coefficient
d) higher heat of hydration and lower shrinkage coefficient

20. The compressive strength of ordinary Portland cement of 33Grade (1:3 cement mortar cube) after 7days test should not be less than: **[AEE 2008]**
a) 110kgf/cm^2 b) 175kgf/cm^2
c) 220kgf/cm^2 d) 275kgf/cm^2

21. The rate of hydration of cement is affected by: **[AEE 2008]**
a) Soundness of cement
b) Fineness of cement
c) Setting time of cement
d) Specific gravity

22. High Alumina cement is produced by fusing together a mixture os: **[IES 97 AEE 2008]**
a) Limestone and Bauxite
b) Limestone, Bauxite and Gypsum
c) Limestone, Gypsum and Clay
d) Limestone, Gypsum, Bauxite, clay and Chalk

23. Le Chatelier's device is used for determining the: **[AEE 2008]**
a) Setting time of cement
b) Soundness of cement
c) Tensile strength of cement
d) Compressive strength of cement

24. If P is the standard consistency of cement the amount of water used in conducting the initial setting time test on cement is **[AEE 2008]**
a) 0.65P b) 0.85P
c) 0.60P d) 0.80P

25. 53 grade cement means **[Managers 2008]**
a) its fineness in 53mm^2/gram
b) its fineness is 53mm^2/kg
c) its 7day strength is 53N/mm^2
d) its 28 day strength is 53N/mm^2

26. The strength of cement at early age is due to **[Managers 2008]**
a) Tricalcium silicate
b) Dicalcium silicate

c) Tricalcium aluminate
d) Tetracalcium alumino ferrite

27. The initial setting time of OPC **[Managers 2008]**
a) not less than 600minutes
b) not less than 30 minutes
c) not more than 30minutes
d) equal to 30 minutes

28. For a water cement ratio of 0.6, the water requirement for one bag of cement is **[Managers 2008]**
a) 30ml b) 50litres
c) 60ml d) 30litres

29. Gypsum is added to cement to **[Managers 2008]**
a) give strength b) reduce setting time
c) give fineness d) avoid flash set

30. The volume of cement contained in a standard cement bag is: **[AEE 2009]**
a) $0.35m^3$ b) $0.035m^3$
c) $3.5m^3$ d) $35m^3$

31. The time taken by di-calcium silicate constituent of cement to add to the strength is **[AEE 2009]**
a) 3-4 hours b) 3-4days
c) 5-4 days d) 14-28 days

32. 43 grade ordinary Portland cement confirming to the following code: **[AEE 2009]**
a) IS-269 b) IS-8112
c) IS-12269 d) IS-8041

33. Soundness of cement is tested by: **[AEE 2009]**
a) Standand briquette test
b) Vicats apparatus
c) Le chatelier apparatus
d) Compression testing machine

34. Initial setting time of ordinary portland cement should not be less than **[APPSC AEE 2003]**
a) 15min b) 30min
c) 45min d) 1hr

35. Cement used in concrete construction is basically used as an agent of **[PSC 2011 PH and Municipality]**
a) binding b) strength
c) bending d) all

36. Sulphate resistant cement consists of 6% **[PSC 2011 PH and Municipality]**
a) C_3S b) C_2S
c) C_3A d) C_4AF

37. Which one of the following tests on cement is not useful in construction **[PSC 2011 PH and Municipality]**
a) initial setting time
b) final setting time
c) specific gravity
d) organic tests

38. Which one of the following is not a cement **[PSC 2011 PH and Municipality]**
a) 23Grade b) 33Grade
c) 43Grade d) 53Grade

39. Which one of the following is not a cement **[PSC 2011 PH and Municipality]**
a) quick setting b) high alumina
c) white cement d) black cement

40. To prepare cement mortar one of the following is essential **[PSC 2011 PH and Municipality]**
a) fine aggregate b) coarse aggregate
c) reinforcement d) masonry

41. Cement can be used in one of the following construction **[PSC 2011 PH and Municipality]**
a) RCC b) PSC
c) masonry d) all

42. The approximate temperature in kiln in which granules of cement material are exposed to is **[AEE 2011]**
a) 800 to 1000°C b) 1000 to 1200°C
c) 1300 to 1500°C d) 1500 to 1700°C

43. The approximate percentage of tricalcium aluminate in Portland cement is **[AEE 2011]**
a) 40 b) 30 c) 20 d) 10

44. The development of strength of cement and its fineness are related as **[AEE 2011]**
a) Inversely proportional
b) Directly proportional
c) Linearly proportional
d) Randomly connected

45. The following material contains pozzolanic properties **[AEE 2011]**
a) Diatomaceous clay
b) Black cotton clay
c) Not related
d) Randomly connected

46. The setting time of cement can be increased by the addition of **[AEE 2011]**
a) Calcium chloride
b) Hydrogen peroxide
c) Gypsum
d) Sodium

47. Bogue's compounds are **[AEE 2011]**
a) C_3S b) C_2S c) C_4AF d) All the above

48. Compressive strength of cement essentially depends up on **[AEE 2011]**
a) W/C ratio b) Fineness of cement
c) A/C ratio d) All the above

59. The initial setting time of the ordinary portland cement should not be less than **[AEE 2011]**
a) 15 minutes b) 30minutes
c) 45minutes d) one hour

50. PPC is a type of cement where in **[AEE 2011]**
a) Fly ash is added
b) Silica fume is added
c) GGBS is added
d) Fly ash & Silica fume are added

51. The relationship between compressive strength and water cement ratio is called **[AEE 2011]**
a) Abram's law b) Coloumb's law
c) James law d) Bernouli's law

52. Which of the following cement is suitable for use in massive concrete structure such as large dams
a) Sulphate resisting cement
b) Low heat cement
c) Rapid hardening cement
d) Ordinary portland cement

53. If P is the percentage of water required for normal consistency, water to the added for determination of initial setting time is
a) 0.75P b) 0.85P
c) 0.085P d) 0.075P

54. For a 50kg bag of cement water required is
a) 22.5liters b) 20.5liters
c) 18.5liters d) 23.5liters

55. Initial setting cement is caused due to
a) $3CaO.\ SiO_2$ b) $2CaO.\ SiO_2$
c) $3CaO.\ Al_2O_3$ d) $4CaO.\ Al_2O_3.Fe_2O_3$

56. Cement is said to be of good quality if
a) It is smooth when rubbed in between fingers
b) It's colour is greenish gray
c) A handful of cement thrown into a bucket of water does not float
d) None of the above

57. For construction of structures under water the type of lime used is
a) Pure lime b) Fat lime
c) Quick lime d) Hydraulic lime

58. Soundness test of cement determines
a) Durability
b) Tensile strength
c) Quality of free lime
d) Initial setting

59. Portland Pozzalana cement possesses
a) Lower heat of hydration
b) Water tightness
c) Lower shrinkage on drying
d) All the above

60. Le Chatelier apparatus is used to determine which of the following properties of cement? **[TSPSC AE 2015]**
a) Soundness
b) Initial setting time
c) Fineness
d) Compressive strength

61. Low heat cement consists lower percentage of which of the following?
[TSPSC AE 2015]
a) C_3A b) C_3S c) C_2S d) C_4S

62. Gypsum is added to Portland cement during its manufacturing so that it may
[TSPSC AE 2015]
a) Acceleration the setting time
b) Retard the setting time
c) Decrease the burning time
d) Facilitate grinding

63. Gypsum is added in the manufacture of Portland cement in order to
[TS GENCO 2015]
a) Shorten the setting time of cement
b) Lengthen the setting time of cement
c) Decrease the burning temperature
d) Decrease the grinding time

64. Increased fineness of cement
[TS GENCO 2015]
a) Affects only early development of strength
b) Affects only ultimate strength
c) Both (a) and (b)
d) Does not affect the strength

65. Gypsum is added in cement to
[TS TRANSCO 2015]
a) Increase its initial setting time
b) decrease its initial setting time
c) increase its compressive strength
d) increases its bond strength

66. Soundness of cement is tested by
[TSPSC AEE 2015]
a) Le Chatelier method
b) Autoclave method
c) Blaine's method
d) Autoclave method and Le Chatelier methods

67. The main constituent of cement which is responsible for initial setting of cement is **[TSPSC AEE 2015]**
a) tri-calcium silicate
b) tri-calcium alumino ferrite
c) tri calcium aluminate
d) di-calcium Silicate

68. The apparatus used for determining the consistency is **[TS TRANSCO 2015]**
a) Le Chatelier b) Abram's cone
c) Vicat d) Blaine

KEY

01. d	02. b	03. a	04. c	05. d	06. c	07. b	08. b	09.d	10. c
11. c	12. b	13. b	14. b	15. c	16. b	17. a	18. c	19. d	20. c
21. b	22. a	23. b	24. b	25. d	26. a	27. b	28. d	29. d	30. b
31. d	32. b	33. c	34. b	35. a	36. c	37. d	38. a	39. d	40. a
41. d	42. c	43. d	44. b	45. a	46. c	47. d	48. d	49. b	50. d
51. a	52. b	53. b	54. a	55. c	56. c	57. d	58. c	59. d	60. a
61. a	62. b	63. b	64. a	65. a	66. d	67. c	68. c		