to black. The main purpose of bitumen in flexible pavements is to strongly bind and hold the other pavement components together and provide a smooth and leveled surface for the moving vehicles. Bitumen is a naturally occurring material and is found in large quantities in the solid or semi solid forms of petroleum. It is also manufactured artificially in vast amounts globally.

Bitumen mixed with some other materials has always been used as a sealant and adhesive material over the ages. It was also widely used in the water proofing of boats and ships as it is insoluble in water. Highest applications of bitumen are found in the construction filed for the construction of roads, airports etc, in the hydraulic field for the construction of water tanks, dams, bridges etc, is also used in battery making, tyre making and for the thermal and acoustic insulation purposes.

Properties of Bituminous Materials:

The high demand of bituminous materials is owing to the number of their first-rate advantageous properties listed below:

1. **Adhesive:** Binds together all the components without bringing about any positive or negative changes in their properties.
2. **Water proof:** Bitumen is insoluble in water and can serve as an effective sealant
3. **Strong:** Though the coarse aggregates are the main load bearing component in a pavement, bitumen or asphalt also play a vital role in distributing the traffic loads to the layers beneath.
4. **Durable:** Bitumen lives upto twenty years if maintained properly throughout the pavement life.
5. **Versatile:** Bitumen is a relatively easy to use material because of its thermoplastic property. It can be spread easily along the underlying pavement layers as it liquefies when heated making the job easier and hardens in a solid mass when cooled.
6. **Economical:** It is available in cheaper rates almost all over the world

Types of Bituminous Materials:

Depending upon the temperature and other factors various types of bitumen are found and used throughout the world.

Cutback Bitumen:

Cut-back bitumens are those which are prepared with the addition of a volatile to reduce the thickness of the binder.

Fluxed Bitumen:

Fluxed bitumens are those bitumen which are prepared by the addition of relatively non volatile oils to reduce the viscosity of the binder.

Modified Bitumen:

Modified bituminous binder are those whose properties such as cohesive strength, adhesive property, elasticity or viscosity have been modified by the use of one or combined chemical agents.

Asphalt:

Asphalt is a mixture of aggregates both fine (sand and filler) and coarse (stone) and a bituminous binder. It typically contains approximately 4-7% of bitumen. Asphalt is primarily used in road construction and its properties depend upon the type, size and amount of aggregate used in the mixture, all of which can be adjusted to provide the required properties for the desired application.

PAINTS, VARNISHES AND DISTEMPERS

The paints are coatings of fluid materials and they are applied over the surfaces of timber and metals. The varnishes are transparent or nearly transparent solutions of resinous materials and they are applied over the painted surfaces. The distempers are applied over the plastered surfaces.

The protective power granted by the application of paints, varnishes and distempers decreases with the passage of time and hence, they are to be periodically applied at the intervals of about 2 to 5 years.

Painting:

Ingredients of an Oil Borne Paint:

1. Base,
2. Vehicle or carrier
3. Drier
4. Colouring pigment, and
5. Solvent

1. **Bases :** A base is a solid substance in a fine state of division and it forms the bulk of a paint. It determines the character of the paint and imparts durability to the surface which is painted. It reduces shrinkage cracks formed on drying.

   Bases of Paints are given as follows :

   (*i*) **White lead :** It is most suitable for wood surfaces and not used for iron surfaces as it does not afford protection against rusting.

   (*ii*) It is quite suitable for painting iron surfaces and for providing a priming coat to the wood surfaces. It solidifies in a short time with linseed oil and hence it is used as a drier also.

   (*iii*) Oxide of zinc or zinc white

2. **Vehicle or Carrier**
   (*i*) **Double boiled linseed oil :** This oil dries very quickly and is suitable for external work. It however requires a thinning agent like turpentine.
   (*ii*) **Tung Oil :** This oil is far superior to linseed oil and is used for preparing paints of superior quality.
3. **Driers :** These substances accelerate the process of drying. A drier absorbs oxygen from the air and transfers it to the linseed oil, which is turn, gets hardened.
   The litharge, red lead and sulphate, of manganese can also be used as driers. The litharge is the most commonly used drier.
4. **Colouring Pigments :** When it is desired to have a different colour than the base of a paint, a colouring pigment is to be added. The pigments are available in the form of fine providers in various colours and qualities.
5. **Solvents or Thinner :** The function of a solvent is to make the paint thin so that it can be easly applied on the surface. It also helps the paint in penetrating through the porous surfaces. The most commonly used solvent is the spirit of turpentine. The benzine and naphtha are used as substitutes.

Types of Paints:

1. Aluminium paint
2. Anticorrosive paint
3. Asbestos paint
4. Bituminous paint
5. Cellulose paint
6. Cement paint
7. Colloidal paint
8. Emulsion paint
9. Enamel paint
10. Graphite paint
11. Inodorous paint
12. Cuminous paint
13. Oil paint
14. Plastic paint
15. Silicate paint
16. Synthetic rubber paint

VARNISHING:

The term varnish is used to indicate the solution of resins or resinous substances prepared either in alcohol, oil or turpentine.

Ingredients of a Varnish :

1. Resin or resinous substances
2. Driers
3. Solvents

The commonly used resins are copal, lac or shellac and rosin. The rosin is obtained from pine trees. Other resins are amber, mastic, gum dammar etc.

The function of a drier in varnish is to accelerate the process of drying. The common driers used in varnishes are litharge, white copper and lead sulphate :

Solvents for Resins

Solvent	*Resins*
1. Boiled linseed oil	Amber, Copal
2. Methylated spirits of wine	Lac or shellac
3. Turpentine	Mostic, Gum dammar, Rosin
4. Wood naphtha	Cheap varieties of resins

Types of Varnishes:

Depending upon the solvent, the varnishes are classified into the following four categories :

1. **Oil Varnishes :** The linseed oil is used as solvent in this type of varnish. The hard resins such as amber and copal are dissolved in linseed oil and if the varnish is not workable, a small quantity of turpentine is added. The oil varnishes dry slowly, but they form hard and durable surface. In fact, these are the hardest and the most suitable varnishes.
2. Spirit Varnishes
3. Turpentine Varnishes
4. Water Varnishes

Distempering: The main object of applying distemper to the plastered surfaces is to create a smooth surface.

Ingredients of Distemper :

1. Base : For base, the whiting or chalk is used
2. Carrier : For carrier, the water is used.
3. Colouring pigments and
4. Size

The distempers are available in powder form or paste form. They are to be mixed with hot water before use.

White or ashing: The fresh lime is slaked at site of work and mixed throughly with sufficient quantity of water in a tub. It is then screened through a clean cloth.

SOLVED EXAMPLES

1. List out the characteristics of good timber.

Ans. Characteristics of Good Timber

1. **Appearance :** A freshly felled out surface of timber should exhibit hard and shining appearance.
2. **Colour :** The colour of timber should be dark.
3. **Defect:** The timber should be free from serious defects such as deed knots, flaws.
4. **Durability:** The timber should be durable.
5. **Elasticity :** This is the essential property of the timber when it is to be used for bows, carriage shafts, sports goods etc.
6. **Fibres :** The timber should have straight fibres.
7. **Fire Resistance :** For timber to be fire resistant, it should be dense.
8. **Hardness:** The timber should be hard.
9. **Mechanical Wear :** The timber should not deteriorate easily due to mechanical wear or abrasion.
10. **Shape :** The timber should be capable of retaining its shape during conversion or seasoning.
11. **Smell:** The timber should have sweet smell.
12. **Sound:** The timber should give out a clear ringing sound when struck.
13. **Strength :** The timber should be sufficiently strong for working as structural member.
14. **Structure:** The structure of the timber should be uniform. Fibres should be firmly held.
15. **Toughness:** The timber should be tough.
16. **Weathering effects:** The timber should be able to stand reasonably the weathering effect.

2. What is meant by '*seasoning of timber*' ? Why is it necessary ? Mention the different methods of seasoning of timber.

Ans. Seasoning of Timber

When a tree is newly felled, it contain about 50% or more of its oven dry weight as water. This water is in the form of sap and moisture and should be removed before the timber can be used for any engineering purpose. The process of drying of timber is known as **seasoning to timber**.

Necessity of Seasoning

The seasoning of timber of is necessary to decrease the weight of timber, to impart hardness, stiffness, and strength to timber to maintain the shape and size of the timber and to make timber easily workable.

Methods of Seasoning

1. Natural Seasoning
2. Artificial Seasoning: Various methods of artificial seasoning are :
   (*i*) Boiling
   (*ii*) Chemical Seasoning
   (*iii*) Electrical Seasoning
   (*iv*) Kiln Seasoning
   (*v*) Water Seasoning

3. What is decay in timber ? How is it detected ? How can the timber be guarded against decay ? Name any two diseases of timber.

Ans. Decay in Timber

Timber is said to be decayed when it is so deteriorated that it loses its value as an engineering material. There are various defects in the timber and when these are in excess, timber decays and is not used for purposes enginnering.

Decay of timber is caused due to

(*i*) Alternate dry and wet conditions
(*ii*) Bad storage or stacking of timber
(*iii*) Improper seasoning
(*iv*) Insects such as beetles, marine borers, termites etc.
(*v*) Fungi which are responsible for developing diseases in timber
(*vi*) Using unseasoned wood with the application of protective coat of paint or tar.

Safe-guard of timber against decay

The timber can be safe-guarded against decaying by using preservatives. The objects for preservation of timber are,

(*i*) To increase the life of timber structure
(*ii*) To make the timber structures durable.
(*iii*) To protect the timber structures from the attack of destroying agencies such as fungi, insects, etc.

Commonly used preservatives are:

(*i*) Ascue treatment
(*ii*) Chemical salts
(*iii*) Coal tar
(*iv*) Creosote oil
(*v*) Oil paints
(*vi*) Solignum paints.

Common diseases of timber :

(*i*) Dry rot

(*ii*) Brown rot

(*iii*) Knots

(*iv*) Blue stoin etc

4. What are initial and final setting times of cement ?

How are they experimentally determined ? Briefly explain the roles of gypsum and calcium chloride in cement.

Ans. Initial setting time

It is the time at which the cement starts setting. As per IS Code, the initial setting time should not be less than 30 minutes so that within that time we can mix, transport and place the concrete at required place.

Final setting time

It is time at which the cement start gaining strength. After this time we can remove the form work. As per IS code, final setting time should not be more than 10 hours.

Determination of initial and final setting time of cement

The initial and final setting time of cement can be determined experimentally by using Vicat's Apparatus.

Experimental Determination of Initial setting time

Weigh 400 gms of cement and add 0.85 times the water required for the standard consistency. Make the cement paste. Fill up the Vicat's mould with the cement paste. Square needle of cross-section 1 mm is attached to the moving rod of Vicat apparatus.The needle is quickly released and it is allowed to fall freely under gravity to penetrate the cement paste. The time will be noted when the penetration of the needle is 5 to 7 mm from the bottom.

The difference between the time when water is added and the final time noted gives the initial setting time of cement.

Experimental Determination of Final Setting Time

To find the final setting time in the same Vicat's mould, replace the initial setting time needed by the final setting time needle. This needle is gently released. The time at which needle makes an impression on test block and the collar fails to do so is noted. The final setting time is the difference between the time noted above and the time at which the water was added to cement.

- **Role of GYPSUM and Calcium Chloride in Cement**

  The gypsum and calcium chloride is added in cement in small quantity. Gypsum controls the initial setting time of the cement, if the gypsum is not added, cement would set as soon as water is added in cement.

5. What do you understand by workability of concrete ? Describe briefly a test for its in-situ determination. What should be the values of observation from this test for concrete used for different purposes ?

Ans. Workability describes the ease or difficulty with which the concrete is handled, transported and placed between the forms with minimum loss of homogeneity.

Workability is important because if

(*i*) the concrete mixture is too wet, coarse aggregates settle at the bottom of concrete mass and as a result concrete becomes non-uniform composition,

(*ii*) the concrete mixture is too dry, it will be difficult to handle and place it in position.

Workability of concrete mixture is measured by

(*i*) Vee-bee consistometer test

(*ii*) Compaction Factor Test

(*iii*) Slump Test

The first two tests are laboratory tests while the third test is the field test.

Slump Test

This test is carried out with a mould called slump cone whose top diameter is 10 cm, bottom diameter is 20 cm and height is 30 cm. The test may be performed in the following steps:

1. Place the slump mould on a smooth flat and non-absorbent surface.
2. Mix the dry ingredients of the concrete thoroughly till a uniform colour is obtained and then add the required quantity of water.
3. Place the mixed concrete in the mould to about one-fourth of its height.
4. Compact the concrete 25 times with the help of a tamping rod uniformly all over the area.
5. Place the mixed concrete in the mould to about half of its height and compact it again.
6. Place the concrete upto its three-fourth height and then up to its top. Compact each layer 25 times with the help of tamping rod uniformly. For the second and subsequent layers, the tamping rod should penetrate into underlying layers.

7. Strike off the top surface of mould with a towerl or tamping rod so that the mould is filled to its top.
8. Remove the mould immediately, ensuring its movement in vertical direction.
9. When the settlement of concrete stops, measure the subsidence of the concrete in millimeters which is required slump of the concrete.

Suitability. This method is suitable only for the concrete of high or medium workability.

Recommended Values of Slump

Type of Concrete	Slump
1. Concrete for road construction	— 20 to 40 mm
2. Concrete for tops of curbs, parapets piers, slabs and wall	— 40 to 50 mm
3. Concrete for canal lining	— 70 to 80 mm
4. Normal R.C.C. work	— 80 to 150 mm
5. Mass concrete	— 20 to 50 mm
6. Concrete to be vibrated	— 10 to 25 mm

6. What is meant by the terms: seasoning of timber and preservation of timber ? Name the various methods of applying preservatives to timber. Give a brief account of one method.

Ans. Seasoning of Timber.

Newly felled tree contains about 50 per cent or more of its oven dry weight, as water. This water is in the form of sap and moisture. This water is to be removed before the timber can be used for any engineering purpose. In other words, timber is to be dried. The process of drying of timber is known as seasoning of timber.

Preservation of Timber

It is carried out

1. to increase the life of timber structures.
2. to make the timber structure durable.
3. to protect the timber structures from the attack of destroying agencies such as fungi, insects etc.

Methods of applying preservatives to the timber

1. Brushing
2. Charring
3. Dipping and steeping
4. Hot and cold open tank treatment
5. Injecting under pressure
6. Spraying

Injecting Under Pressure

This method is usually adopted in creosoting, in which the preservatives is injected under pressure into the timber. This is the most effective method of treating timber with preservative. But is requires special treatment plant. This method proves to be essential for treating non-durable timbers which are to be used at places where there is danger of attack by fungi and insects.

7. Explain the preservative treatment of timber indicating the types, characteristics and methods of application of preservatives.

Ans. Preservative treatment of timber

Perfect seasoning is the most effective means of preservation. Proper damp proofing of the building and providing free circulation of air around the builtin portion of timber are essential for the preservation of the timber used. However, when these conditions cannot be obtained then preservatives have to be applied for preservation. Timber should be well seasoned before the application for preservation. Following are some of the more common methods of preservation adopted.

(1) **Charring :** Lower ends of the posts that are to be embedded in ground are generally charred with a view of prevent dry rot and attack of worms. It is done by quenching the ends of ports in water after they are charred on wood fine to a depth of 1.5 cm.

(2) **Tarring :** It consists in coating with tar or mixed with pitch.

(3) **Painting :** A paint when applied to timber acts not only as a good preservative but also it enhances the appearance of the surface so treated.

(4) **Creosoting :** Creosote oil is a dark brown thick oil liquid. It is used in case of railway sleepers piles and transmission poles.

(5) **Wolman salt :** This salt consists of creosote and sodium fluoride and is soluble in water.

(6) **ASCU treatment:** FRI, Dehradun has developed a new preservative known as ASCU. It is available in the form of powder and is made up of three chemical mixed in the ratio given below :

— 1 part by weight of hydrated arsenic pentaoxide ($As_2O_6.2H_2O$)

— 3 part by weight of blue vitriol ($CuSO_4.5H_2O$)

— 4 parts by weight of potassium dichromate ($K_2Cr_2O_7.2H_2O$)

Six part of this powder are mixed with 100 parts by weight of water. ASCU solution can be applied or sprayed in two coats.

8. Name the four important constituents of cement and state the role of each in achieving its properties.

Ans. Constituents of Cement: Following are four important constituents.

(1) Lime(CaO) — 60 to 57%
(2) Silica (SiO_2) — 17 to 25%
(3) Alumina (Al_2O_3) — 3 to 8%
(4) Sulphur trioxide (SO_3) — 1 to 2.75%

Cement is manufactured by burning to white heat an intimate mixture of the above ingredients and then grinding. If well burnt portland cement clinker is ground to a fine powder and examined, it will be found to be composed of four important mineral compounds given below:

(1) Tricalcium silicate ($3CaO.SiO_2$) — C_3S
(2) Dicalcium silicate ($2CaO.SiO_2$) — C_2S
(3) Tri-calcium Aluminate ($3CaO.Al_2O_3$) — C_3A
(4) Tetra-calcium Aluminoferrite ($4CaO.Al_2O_3.Fe_3O_3$) — C_4AF

Out of four C_2S acts as the best cementing material and greater its percentage in the cement, the better cement it will make. The aluminates are the first to set and harden are responsible for the initial setting of cement. Tri-calcium silicate is the next to set and harden and it impart marked strength in 7 to 8 days. Di-calcium silicates react with water at very slow rate. It influence on strength and hardness is small during the first 28 days but after about one year, it contributes nearly as much strength as tri-calcium silicates does.

9. How are bricks classified as per I.S code? What are the properties associated with this classification?

Ans. Bricks classification : As per IS : 1077 - 1976 common burnt clay bricks are classified on the basis of their average compresive strength.

Each class of bricks is further subdivided into two sub-classes A and B based on tolerances and shapes *e.g.* brick classification 100 A and 100 B and so on. Brick of sub class A shall have smooth faces, sharp edges and corners and uniformity in colour whereas bricks of sub class B may be slightly distorted or may have slightly rounded edges subject to the condition that there distortions do not cause any difficulty in laying of uniform courses.

AVERAGE COMPRESSIVE STRENGTH

Class	Not less than	Less than
350	350	400
300	300	350
250	250	300
200	200	250
175	175	200
150	150	175
125	125	150
100	100	125
75	75	100
50	50	75

10. Explain how do the Portland-pozzolana cement and super-sulphate cement differ from ordinary portland cement. Under what specific circumstances these cements would be used?

Ans. *Properties of the two cements compared to portland cement are*

S.No.	Type	Ingredients	Properties	Uses
1.	Portland pozzolana cement	Portland cement clinker + pozzolana (burnt clay or fly ash).	1. Resistance to chemical attack is more. 2 Lower rate of development of strength. 3. Ultimate strength comparable to portland cement. 4. Heat evolved is lower.	Marine works and dams
2.	Super sulphate cement	Small quantity of portland cement + finely ground mixture of granulated blast furnance slag + calcium sulphate.	1. Lower heat of hydration. 2. Resistant to sulphate attacks. 3. 3 days compressive strength is same as structures in that of portland cement.	1. At places with temperature below 40°C. 2. RCC pipes in ground water. 3. Concrete sulphate bearing soils. 4. Sewers carrying industrial effluents.

EXERCISE - I

1. Sand stone is a
(*a*) sedimentary rock (*b*) igneous rock
(*c*) silicious rock (*d*) both (*a*) and (*b*) above

2. Lime stone is a
(*a*) igneous rock (*b*) sedimentary rock
(*c*) metamorphic rock (*d*) granite rock.

3. Marble contains mostly
(*a*) lime (*b*) silica
(*c*) lime and Silica (*d*) none of the above

4. Granites are the type of
(*a*) silicious rock (*b*) argillaceous rock
(*c*) calcareous rock (*d*) none of the above

5. Slate is formed from the metamorphic action on
(*a*) shale (*b*) lime stone
(*c*) sand stone (*d*) granite

6. Gravel is a type of
(*a*) igneous rock (*b*) sedimentary rock
(*c*) metamorphic rock (*d*) none of the above

7. Basalt is a
(*a*) extrusive igneous rock
(*b*) intrusive igneous rock
(*c*) sedimentary rock
(*d*) metamorphic rock.

8. Which of the following is a rock ?
(*a*) Gypsum (*b*) Augite
(*c*) Calcite (*d*) Mica

9. The rock having calcium carbonate as main mineral constituent, is known as
(*a*) calcareous rock (*b*) argillaceous rock
(*c*) silicious rock (*d*) sandy rock.

10. Kaoline is a
(*a*) calcareous rock (*b*) argillaceous rock
(*c*) silicious rock (*d*) sandy rock

11. The tendency of minerals to split along a certain plane, is known as
(*a*) fracture (*b*) cleavage
(*c*) breaking (*d*) fault

12. A good quality stone must absorb water less than
(*a*) 2.5% (*b*) 5%
(*c*) 10% (*d*) 20%

13. The building stone can be dressed very easily
(*a*) just after quarrying
(*b*) after seasoning
(*c*) after some months of quarrying
(*d*) any time.

14. In stone masonary, the direction of pressure line is
(*a*) parallel to natural bed
(*b*) perpendicular to natural bed
(*c*) inclined to natural bed at 30°
(*d*) inclined to natural bed at 45°

15. For stones Mohs scale is used to determine
(*a*) toughness (*b*) hardness
(*c*) flakiness index (*d*) durability

16. Match List -I with List - II and select the correct answer using the codes given below:

List - 1 *(Type of rock)*	**List - II** *(Transformed rock)*
A. Argillaceous	1. Slate
B. Silicious	2. Dolomite
C. Calcarious	3. Quartzite

Codes:

	A	**B**	**C**
(*a*)	3	3	2
(*b*)	1	2	3
(*c*)	3	1	2
(*d*)	2	1	3

17. Match List -I with List - II with regards to stones and select the correct answer using the codes given below the lists:

List - I	**List - II**
A. Smith test	1. Forest
B. Brard test	2. Durability
C. Hardness test	3. Devil's
D. Attrition tes	4. Mohs scale

Codes:

	A	**B**	**C**	**D**
(*a*)	3	1	4	3
(*b*)	2	4	1	3
(*c*)	1	2	3	4
(*d*)	2	1	4	3

18. In rock masses reduction in strength occurs due to the presence of relatively large quantities of
(*a*) silica (*b*) iron oxides
(*c*) orthoclase (*d*) hornblnde

19. Smith's test is performed on stones for determining
(*a*) Specific gravity
(*b*) Hardness
(*c*) Water absorption
(*d*) Soluble and clayey matter.

20. Crushing strength for most of the building stone should be more than
(*a*) 500 kg/cm^2 (*b*) 1000 kg/cm^2
(*c*) 1500 kg/cm^2 (*d*) 2000 kg/cm^2

21. Specific gravity for most of the building stone lies between
(*a*) 1.5 to 2.0 (*b*) 2.0 to 2.5
(*c*) 2.5 to 3.0 (*d*) 3.0 to 3.5

22. Attritioin test on stone is done to find out
(*a*) compressive strength
(*b*) hardness
(*c*) rate of wear
(*d*) toughness

23. The stone that exhibit highest compressive strength is
(*a*) Slate (*b*) Gneiss
(*c*) Lime stone (*d*) Granite

24. Most weather resisting metamorphic rock is
(*a*) Lime stone (*b*) Slate
(*c*) Marble (*d*) Quartzite

25. Spoiling hammer is used for
(*a*) rough dressing of stones
(*b*) quarrying of stones
(*c*) carrying of stones
(*d*) all of the above

26. The tool used for quarrying of stones is
(*a*) Dipper (*b*) Spalling hammer
(*c*) Jumper (*d*) Priming needle

27. The compressive strength of stone is find out by
(*a*) Attrition test (*b*) Crushing test
(*c*) Hardness test (*d*) Impact test

28. Impurity not desirable in the soil used for brick formation is
(*a*) Alkali (*b*) Kankar
(*c*) Both (*a*) and (*b*) (*d*) None of the above

29. Ingredient of the brick earth which enables the brick to retain shape is
(*a*) alumina (*b*) silica
(*c*) iron oxide (*d*) magnesia.

30. Percentage of silica in a good brick earth lies between
(*a*) 10-20% (*b*) 20-40%
(*c*) 50-60% (*d*) None of the above

31. The nominal size of a modular brick is
(*a*) 20 × 10 × 10 cm (*b*) 19 × 9 × 9 cm
(*c*) 18 × 9 × 9 cm (*d*) 18 × 8 × 8 cm

32. Excess of silica in brick earth causes
(*a*) loss of cohesion
(*b*) impermeable
(*c*) cracking and warping on drying
(*d*) brittleness

33. Excess of alumina in a brick earth causes
(*a*) loss of cohesion
(*b*) impermeable
(*c*) cracking and warping on drying
(*d*) brittleness

34. The process of mixing clay, water and other ingredients to make brick is called
(*a*) moulding (*b*) tempering
(*c*) pugging (*d*) blending

35. Excess of iron oxide in brick earth causes
(*a*) loss of cohesion
(*b*) decay of bricks
(*c*) the colour change i.e. from red to dark blue
(*d*) none of the above

36. Lime is mixed with brick earth
(*a*) to impart plasticity
(*b*) to increase durability
(*c*) to prevent shrinkage
(*d*) to increase impermeability

37. Maximum percentage of water absorption of II class bricks in 24 hrs should be limited to
(*a*) 10% (*b*) 15%
(*c*) 20% (*d*) 24%

38. Minimum compressive strength of a II class bricks should be
(*a*) 35 kg/cm^2 (*b*) 70 kg/cm^2
(*c*) 105 kg/cm^2 (*d*) 140 kg/cm^2

39. The internal size of mould used in brick preparatioin is
(*a*) smaller than the size of fully burnt brick
(*b*) larger than the size of fully burnt brick
(*c*) equal to the size of fully burnt brick
(*d*) none of the above

40. The overground continuous kiln is
(*a*) Bull's hench kiln (*b*) Hoffman's kiln
(*c*) Tunnel kiln (*d*) All of the above

41. In brick masonry, frog of the brick is generally kept on
(*a*) top face (*b*) bottom face
(*c*) exposed face (*d*) interior face

42. Fire bricks are used
(*a*) to reflect heat
(*b*) to increase heat flow
(*c*) to decrease heat flow
(*d*) all of the above

43. Terracota is used in buildings for
(*a*) ornamental work (*b*) insulation
(*c*) storage (*d*) none of the above

44. Swelling of bricks is known as
(*a*) Bloating (*b*) Lamination
(*c*) Chuffs (*d*) Efflorescence

45. If rain water falls on hot bricks, then shape of the brick gets deformed, this defect is known as
(*a*) Efflorescence (*b*) Bloating
(*c*) Chuffs (*d*) Nodules

46. Portion of the brick cut across its width and having its length equal to that of a full brick, is known as
(*a*) Closer (*b*) King closer
(*c*) Queen closer (*d*) Squint brick.

47. The desirable silt content in an alluvial soil suitable for the production of structural bricks is
(*a*) 20 – 30% (*b*) 40 – 65%
(*c*) 65 – 75% (*d*) less than 10%

48. The moulded bricks are dried before burning to an approximate moisture content of
(*a*) 3% (*b*) 6%
(*c*) 10% (*d*) 20%

49. Hollow brick is
(*a*) sound proof
(*b*) hear proof
(*c*) about 1/3 in weight of standard brick
(*d*) all of the above

50. The compressive strength of burnt clay bricks as per IS 1077-1976 is
(*a*) 105 kg/cm^2 (*b*) 150 kg/cm^2
(*c*) 105 – 150 kg/cm^2 (*d*) 35 – 350 kg/cm^2

51. Consider the following statements :
A good soil for making bricks should contain
1. about 30% alumina.
2. about 10% lime nodules.
3. a small quantity of iron oxides, say 0.1%
4. about 5% magnesia.

Of these statements
(*a*) 1 and 2 are correct (*b*) 1 and 3 are correct
(*c*) 1, 3 and 4 are correct (*d*) 1 and 4 are correct

52. Which of the following constituent in earth gives plasticity to mould bricks in suitable shape ?
(*a*) Silica (*b*) Lime
(*c*) Alumina (*d*) Magnesia

53. The raw bricks shrink during drying and warp during burning because of
(*a*) less lime in brick earth
(*b*) less silica and excess magnesia in brick earth
(*c*) excess of alumina and silica in brick earth
(*d*) alkalis in bricks earth

54. Glazing is used to make earthenware
(*a*) hard (*b*) soft
(*c*) porous (*d*) impervious.

55. Limes used for making mortar is
(*a*) semi hydraulic lime
(*b*) fat lime
(*c*) eminently hydraulic lime
(*d*) all of the above

56. Putty is made up of
(*a*) white lead and turpentine
(*b*) powdered chalk and raw linseed oil
(*c*) red lead and linseed oil
(*d*) zinc oxide and boiled linseed oil

57. The lime putty
(*a*) is a paste of fat lime
(*b*) should be consumed within 1-2 weeks
(*c*) is prepared by adding water to lime
(*d*) is a naturally available material

58. Quick lime is
(*a*) slow in setting
(*b*) rapid in slacking
(*c*) both (*a*) and (*b*) above
(*d*) none of the above

59. Hydraulic lime is obtained by
(*a*) burning of kankar
(*b*) burning of lime stone
(*c*) adding water to quick lime
(*d*) all of the above

60. The lime which is obtaind by calcination of pure lime is
(*a*) Hydrated lime (*b*) Fat lime
(*c*) Quick lime (*d*) All of the above

61. The lime suitable for making mortar is
(*a*) quick lime (*b*) fat lime
(*c*) hydraulic lime (*d*) pure lime

62. The advantage of adding pozzolana to lime is
(*a*) increased resistance to cracking
(*b*) increased resistance to chemical attack
(*c*) reduced shrinkage
(*d*) impart greater strength.

63. Very strong lime mortar is obtained from
(*a*) quick lime (*b*) semi-hydraulic lime
(*c*) hydrated lime (*d*) hydraulic lime

64. Fat lime can be used in
(*a*) Distempers (*b*) Lime mortars
(*c*) Lime terracing (*d*) None of the above

65. Quick lime is obtained from the burning of
(*a*) kankar (*b*) lime stone
(*c*) slaked line (*d*) all of the above

66. As per IS specification, the minimum time for initial setting of ordinary portland cement is
(*a*) 20 minutes (*b*) 30 minutes
(*c*) 60 minutes (*d*) 10 hours.

67. Match List-I with List-II and select the correct answer using the codes given below the Lists:

List-I *(Cement Test)*	**List -II** *(Apparatus used)*
A. Soundness test	1. Permeability apparatus
B. Initial setting time test	2. Le-chatlier's apparatus
C. Strength of cement at later age	3. Vicat's apparatus
D. Fineness test	4. Universal testing mechine

Codes:

	A	**B**	**C**	**D**
(*a*)	2	3	4	1
(*b*)	1	3	4	2
(c)	2	3	1	4
(*d*)	1	4	3	2

68. For rapid hardening cement
(*a*) gypsum is not added
(*b*) has 1 day strength same as that of 3 days ordinary portland cement
(*c*) is subjected to large shrinkage cracks
(*d*) all of the above

69. Finer the cement, more is the
(*a*) early strength
(*b*) workability
(*c*) shrinkage cracking
(*d*) all of the above

70. Rate of hydration of the following cement compounds in descending order is
(*i*) C_3A (*ii*) C_3S
(*iii*) C_4AF (*iv*) C_2S
(*a*) (*i*) (*ii*) (*iv*) (*iii*) (*b*) (*i*) (*ii*) (*iii*) (*iv*)
(*c*) (*iii*) (i) (ii) (iv) (*d*) (*iv*) (*iii*) (*ii*) (*i*)

71. Rapid hardening cement is obtained by combining
(*a*) high tricalcium silicate with fine grinding of clinker
(*b*) high tricalcium silicate with addition of gypsum
(*c*) high dicalcium silicate with addition of calcium sulphate
(*d*) high lime content with addition of calcium sulphate

72. Gypsum is added to Portland cement during its manufacture so that it may
(*a*) accelerate the setting time
(*b*) retard the setting time
(*c*) decrease the burning temperature
(*d*) facilitate grinding

73. The constituents of cement, which act as binder are
(*a*) dicalcium silicate, tricalcium silicate and carbon
(*b*) tricalcium aluminate and tricalcium silicate
(*c*) silica and carbon
(*d*) none of the above

74. A slow setting cement has higher percentage of
(*a*) tricalcium aluminate
(*b*) tricalcium silicate
(*c*) dicalcium silicate
(*d*) gypsum

75. In low heat cement, the constituent kept to the minimum is
(*a*) dicalcium silicate
(*b*) tricalcium silicate
(*c*) tricalcium aluminate
(*d*) tetracalcium aluminate

76. In ordinary Portland cement approximate content of tricalcium silicate is
(*a*) 55% (*b*) 40%
(*c*) 30% (*d*) 15%

77. Sulphate resisting cement contains
(*a*) High percentage of gypsum
(*b*) High C_3A and C_4AF content
(*c*) High silicate content
(*d*) High minor oxides

78. The compressive strength of cement paste depends upon
(*a*) Gel-space ratio
(*b*) w/c ratio by weight
(*c*) age of the hydrating cement paste
(*d*) temperature of the hydrating paste

79. Equilibrium moisture content for most of the tropical timbers varies between
(*a*) 1 – 5% (*b*) 5 – 10%
(*c*) 10 – 20% (*d*) 20 – 30%

80. Upsets are defects in timber caused because of
(*a*) wind turning young tree continuously in one direction
(*b*) breakage of continuity of fibers
(*c*) greater evaporation of sap from the exposed and grains
(*d*) any of the above

81. Seasoning of timber is necessary to
(*a*) increase the fire resistance
(*b*) increase the vermin resistance
(*c*) reduce the microbial substances
(*d*) expel the moisture present in the timber

82. Ratio of the modulus of elasticity of wood in a direction perpendicular to the grain to the value in a direction parallel to the grain falls in the range
(*a*) 1/20 and 1/12 (*b*) 1/3 and 1/2
(*c*) 2 to 3 (*d*) 5 to 10

83. Plywood is specified by
(*a*) weight
(*b*) volume
(*c*) thickness
(*d*) numbers of layers

84. Match List-I with List-II and select the correct answer using the codes given below the lists:

List - I	**List - II**
A. Agricultural implements	1. Jack
B. Boat construction	2. Deodar
C. Railway sleepers	3. Babul
D. Musical instruments	4. Benteak

Codes:

	A	**B**	**C**	**D**
(*a*)	1	2	3	4
(*b*)	3	4	2	1
(*c*)	4	3	2	1
(*d*)	2	1	4	3

85. Consider the following statements: Seasoning of timber results in
1. increased strength
2. increased durability
3. reduced resilience

Of these statements:
(*a*) 1, 2 and 3 are correct
(*b*) 1 and 3 are correct
(*c*) 1 and 2 are correct
(*d*) 2 and 3 are correct

86. Timber can be made more fire resistant by
(*a*) dipping and stepping process
(*b*) Sir Abel's process
(*c*) charring
(*d*) hot and cold open tank treatment

87. The wood preservative "Creosote" is derive from
(*a*) wood or coal
(*b*) acidic cupric chromate
(*c*) chromated zinc chloride
(*d*) pentachlorophenol

88. Seasoning of timber can be done in kilns within
(*a*) 1-5 days (*b*) 5-10 days
(*c*) 15-20 days (*d*) about 30 days

89. The average life of timber used in exposed environment is
(*a*) 2.5 years (*b*) 5 years
(*c*) 10 years (*d*) 25 years

90. The age of the tree can be determined by
(*a*) cambium layer (*b*) annular rings
(*c*) medullary (*d*) heart wood.

91. The moisture content achieved after oven drying of timber is
(*a*) 5% (*b*) 10%
(*c*) 15% (*d*) 25%

92. Disease of dry rot in timber is caused by
(*a*) alternate wetting and drying
(*b*) complete submergence in water
(*c*) lack of ventilation
(*d*) none of the above.

93. Defect in the growth of timber is/are called
(*a*) Shakes
(*b*) Checks
(*c*) Both (*a*) and (*b*) above
(*d*) None of the above