

1. Rocks formed due to alteration of original structure due to heat and excessive pressure is called_____.

- A. Sedimentary rock
- B. Igneous rocks
- C. Metamorphic rocks
- D. None of these

Ans. C.

A metamorphic rock is a result of a transformation of a pre-existing rock. The original rock is subjected to very high heat and pressure, which cause obvious physical and/or chemical changes.

Examples of these rock types include marble, slate, gneiss, schist.

Metamorphic rocks are made by either heating up or squashing the earth's crust. They are often found in mountainous regions. One example is slate. Slate was originally a black mud laid down on the bottom of the sea or lake. Fossils Andreas can sometimes be found in it but they are often squashed. Other common metamorphic rocks are called marble, gneiss, schist.

2. Granite mainly composed of quartz and felsper particles is obtained from _____.

- A. Sedimentary rocks
- B. Metamorphic rocks
- C. Igneous rocks
- D. All options are correct

Ans. C.

Igneous rock is formed through the cooling and solidification of magma or lava. The magma can be derived from partial melts of existing rocks in either a planet's mantle or crust. Typically, the melting is caused by one or more of three processes: an increase in temperature, a decrease in pressure, or a change in composition. Solidification into rock occurs either below the surface as intrusive rocks or on the surface as extrusive rocks.

Igneous rock may form with crystallization to form granular, crystalline rocks, or without crystallization to form natural glasses.

The classification of the many types of different igneous rocks can provide us with important information about the

conditions under which they formed. Two important variables used for the classification of igneous rocks are particle size, which largely depends on the cooling history, and the mineral composition of the rock. Feldspars, quartz or feldspathoids, olivines, pyroxenes, amphiboles, and micas are all important minerals in the formation of almost all igneous rocks, and they are basic to the classification of these rocks. All other minerals present are regarded as nonessential in almost all igneous rocks and are called accessory minerals. Types of igneous rocks with other essential minerals are very rare, and these rare rocks include those with essential carbonates.

3. In stone masonry, stones (stratified rocks) are so placed that the direction of pressure to the plane of bending is_____.

- A. right angles
- B. 45°
- C. 60°
- D. parallel

Ans. A.

The craft of stonemasonry (or stonecraft) involves creating buildings, structures, and sculpture using stone from the earth, and is one of the oldest trades in human history. These materials have been used to construct many of the long-lasting, ancient monuments, artifacts, cathedrals, and cities in a wide variety of cultures.

The construction of stones bonded together with mortar is termed as stone masonry where the stones are available in abundance in nature, on cutting and dressing to the proper shape, they provide an economical material for the construction of various building components such as walls, columns, footings, arches, lintels, beams etc.

The stones to be used for stone masonry should be hard, tough and durable. The pressure acting on stones should be vertical. The stones should be perfectly dressed as per the requirements. The heads and bond stones should not be of a dumb bell shape. In order to obtain uniform distribution of load, under the ends of girders, roof trusses etc large flat stones should be used.

4. The term frog means _____.

- A. an apparatus to lift the stone
- B. a depression on a face of brick
- C. vertical joint in a brick work
- D. soaking brick in water

Ans. B.

Frog of Bricks: The depression provided in the face of brick during its manufacturing is known as frog of bricks.

Depth of a frog in a brick is 10mm to 20 mm.

If the bricks are laid according to British standards, the frog should be laid upward and filled with mortar.

5. The minimum compressive strength of 2nd class bricks should be _____.

- A. 70 kg/cm²
- B. 90 kg/cm²
- C. 100 kg/cm²
- D. 120 kg/cm²

Ans. A.

The second class bricks are ground moulded and they are burnt in kilns. The surface of the second class bricks is slightly rough and shape is also slightly regular. These bricks may have hair cracks and their edges may not be sharp and uniform. These bricks are commonly used at places where brickwork is to be provided with a coat of plaster.

The minimum crushing / compressive strengths of burnt bricks tested flat-wise prescribed are:

- 1. Common building bricks—35 kg/sq. cm.
- 2. Second class bricks—70 kg/sq. cm.
- 3. First class bricks— 105 kg/sq. cm.
- 4. Crushing strength of bricks not less than 140 kg/sq. cm are graded as AA class.

6. A pug mill is used for _____.

- A. Softening brick earth
- B. moulding brick earth
- C. tempering brick earth
- D. providing brick earth

Ans. C.

A pugmill or pug mill is a machine in which clay or other materials are mixed into a plastic state or a similar machine for the trituration of ore.[1] Industrial applications are found in pottery, bricks, cement and some parts of the concrete and asphalt mixing processes.

After completion of weathering process the soil is blended with other material to

prepare good brick earth. Then the mixed soil is tempered by being thoroughly broken up, watered and kneaded. The tempering is usually done in pug mill.

7. The lime which contains high percentage of calcium oxide is generally called _____.

- A. fat lime
- B. rich lime
- C. white lime
- D. None of these

Ans. A.

Fat lime: It is composed of 95 percentage of calcium oxide. When water is added, it slakes vigorously and its volume increases to 2 to 2x(1/2) times. It is white in colour.

Its properties are:

- 1. Hardens slowly
- 2. High degree of plasticity
- 3. Sets slowly in the presence of air
- 4. White in colour
- 5. Slakes vigorously.

This lime is used for various purposes as white washing, plastering of walls, as lime mortar with sand for pointing in masonry work, as a lime mortar with surkhi for thick masonry walls, foundations, etc.

8. Lime putty _____.

- A. is made from hydraulic lime
- B. is made by adding lime to water
- C. can be used only upto three days
- D. All options are correct

Ans. D.

For conservation work, non-hydraulic lime is usually used in the saturated form known as 'lime putty'. This is supplied to site covered by a thin film of water in air tight tubs, to minimize the risk of carbonation. It is made by slaking the lime with a slight excess of water. When matured (lime putty continues to mature for months), the result is the purest form of non-hydraulic lime, ideal for making fine plasterwork and limewash, but also widely used for pointing masonry and making render, daub and other lime-based mortars.

9. For lime concrete, _____

- A. slump is 0 to 70 mm
- B. flexural strength at 90 days is 0.2 N/mm²
- C. compressive strength at 90 days is 1.5 N/mm²
- D. All options are correct

Ans. D.

It is a concrete made from a mixture of lime, sand, and gravel is said to be as lime concrete. It was widely used before the lime was replaced by Portland cement. Hence all the above options is correct.

10. The minimum width of a septic tank is taken _____.

- A. 70 cm
- B. 75 cm
- C. 80 cm
- D. 90 cm

Ans. B.

A septic tank is a watertight chamber made of concrete, fiberglass, PVC or plastic, through which domestic wastewater (sewage) flows for primary treatment. Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate.

Septic tank shall have minimum width of 750 mm, minimum depth of one metre below water level and a minimum liquid capacity of 1 000 litres.

11. The trap which is provided to disconnect the house drain from the street sewer is called _____.

- A. Master trap
- B. Intercepting trap
- C. Interception manhole
- D. All options are correct

Ans. D.

In plumbing, a trap is a device which has a shape that uses a bending path to capture water to prevent sewer gases from entering buildings, while allowing waste to pass through.

Intercepting trap is provided in to the Interceptor Manhole (Interceptor Chamber). An Interceptor manhole is provided at the intercept of building sewer and Public sewer.

Intercepting trap is provided to prevent the foul gases entering in to the building sewer by providing water seal. It has deep water seal of 100 mm depth and it also prevents entry of bugs and insects from sewer line to building sewer.

12. Anti-siphonage pipe is connected to _____.

- A. Main soil pipe
- B. Bottom of P trap W.C
- C. Top of P trap W.C
- D. Side of water closet

Ans. C.

The pipe installed for the purpose of ventilation is known as a vent pipe while a pipe which is installed in a house drainage to preserve the water seal of trap is an anti-siphonage pipe.

The main anti-siphonage pipe is generally connected to the upper continuation of the waste-pipe above the highest fitting; this economises piping, and is quite as effective as carrying it up independently to the same height as the waste-pipe vent.

13. The cross-sections for a highway is taken at _____.

- A. right angle to the triangle
- B. 30 meters apart
- C. intermediate points having abrupt change is gradient
- D. All options are correct

Ans. D.

The cross sections are taken at right angles to some convenient line which runs longitudinally through the earthworks and although it is capable of general application, it is probably most used on long narrow works such as roads, railways, canals, embankments, pipe excavations, etc.

The volume of earthwork between successive cross sections are calculated from a consideration of the cross-sectional areas, which in turn are measured or calculated by the general methods such as, by planimeter, division into triangles, coordinates, etc.

A cross section is a section taken normal to the direction of the proposed centre line of an engineering project, such as a highways, railroad, trench, earth dam or canal.

The cross section for these would have similar characteristics. It is bounded by a base (formation), side slopes and the natural terrain. The inclination of a side slope is defined by the horizontal distance m on the slope corresponding to a unit vertical distance. The slope may be a rise (in excavation) or a fall (in emabankment). A slide slope of 3 to 1, e.g., means that for each 3 ft of horizontal distance, the rise or fall of slide slope is 1 ft.

14. The assumption on which the trapezoidal formula for volume is based, is _____.

- A. The end sections are parallel planes
- B. The mid-area of a pyramid is half the average area of the ends
- C. The volume of the prismoidal is over-estimated and hence a prismoidal correction is applied
- D. All options are correct

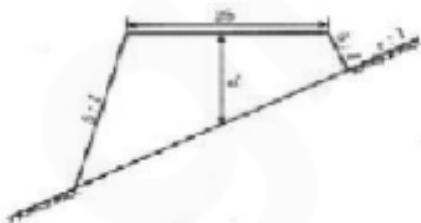
Ans. B.

This method is based on the assumption that the mid-area is the mean of the end areas. In that case, the volume of the prismoid is given by:

$$V = \frac{d}{2} (A_1 + A_2)$$

This is true only if the prismoid is composed of prisms and wedges only and not of pyramids. The mid area of a pyramid is half the average of the ends: hence the volume of the prismoid (having pyramids also) is over estimated. However, the method of end area may be accepted with sufficient accuracy since actual earth solid may not be exactly a prismoid. In some cases, the volume is calculated and then a correction is applied, the correction being equal to the difference between the volume as calculated and that which could be obtained by the use of prismoidal formula. The correction is known as the prismoidal correction.

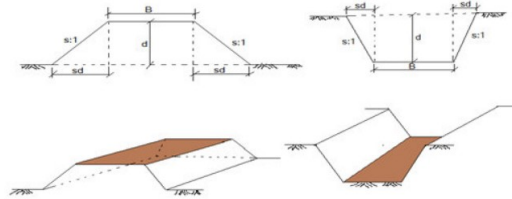
15. The area of the cross-section of a road fully in banking shown in the figure below is _____.



- A. $\frac{(sb^2+r^2(2bd+sd)^2)}{r^2-s^2}$
- B. $\frac{(sb^2+r^2(2bd-sd)^2)}{r^2-s^5}$
- C. $\frac{(sb^2+r^2(2bd+sd)^2)}{r-s}$
- D. $\frac{(sb^2+r^2(2bd-sd)^2)}{r-s}$

Ans. A.

Calculation of cross-sectional area having no transverse area:



If there is no transverse slope then C/S area for banking and cutting = $B*d + 2*(s*d*d)$
 $= Bd + sd^2$

Where B = crest width of the road
 d = depth of cutting or banking
 s:1 = ratio of side slopes as horizontal: vertical

Hence the correct answer is option (A)

16. A portion of an embankment having a uniform up-gradient 1 in 500 is circular with radius 1000 m of the center line. It subtends 180° at the center. If the height of the bank is 1 m at lower end, and side slopes 2:1, the earth work involved _____

- A. 26,000 m³
- B. 26,500 m³
- C. 27,000 m³
- D. 27,500 m³

Ans. D.

For truncated cone, with slope 2:1 top radius will be 500m as the bottom radius is given as 1000m

Therefore volume of truncated cone is

$$= \frac{\pi \times h \times (R^2 + r^2 + (r \times R))}{3}$$

$$= \frac{3.14 \times 1 \times (1000^2 + 500^2 + (1000 \times 500))}{3}$$

$$= 27500$$

17. The concrete work for the following part of the building of specified thickness is measured in square meters _____.

- A. Root slabs
- B. Floors
- C. D.P.C
- D. All options are correct

Ans. D.

Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., and are expressed in square meters (m²).

Works consists cubical contents which involve volume like earth work, cement concrete, Masonry etc. are expressed in Cubic meters. Damp proof course (DPC) – thickness mentioned are measured in square meters (m²).

Hence, all the option are correct.

18. The item of steel work is measured sq. m is _____

- A. Collapsible gates
- B. Rolling shutters
- C. Steel doors
- D. All options are correct

Ans. C.

Collapsible gates shall be described and measured in square metres as fixed stating size of gate opening, pickets, pivoted flat bars and size of meshes formed by them when fully extended. Steel rolling shutter/grills shall be described and measured in square metres. The width shall be measured as the outer distance between the backs of the two guide channels of the rolling shutters and the height shall be the distance between the still and the centre of the hood cover. Unless otherwise stated, steel doors, windows, ventilators and glazing frames shall be measured in square metres as fixed stating type given in relevant Indian Standard.

Hence all options are correct.

19. For 12 mm thick cement plastering 1:6 on 100 sq. m, new brick work, the quantity of cement required is _____.

- A. 0.200 m³
- B. 0.217 m³
- C. 0.340 m³
- D. None of these

Ans. B.

Given thickness = 12 mm = 0.012 m

Area = 100 m²

Hence, volume = 100 × 0.012 = 1.2 m³

mortar will be 30% more than the given volume

= 1.2 + 30% of 1.2 = 1.56 m³

dry mortar will be 25% more than the mortar volume

= 1.56 + 25% of 1.56 = 1.95 m³

Now proportion is given as 1:6, so total volume will be

$$1x + 6x = 7x$$

$$7x = 1.95$$

$$\text{or } x = \frac{1.95}{7} = 0.27850$$

Hence, none of these is correct.

20. The distance between steps for measuring downhill to obtain better accuracy _____.

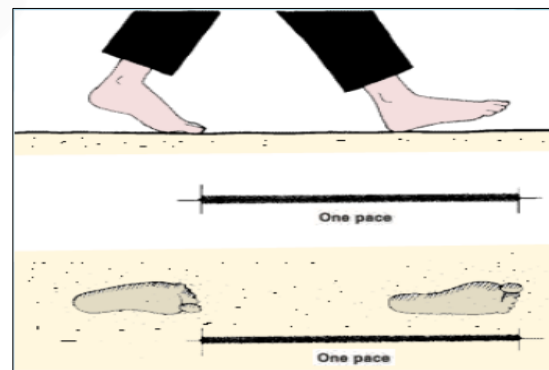
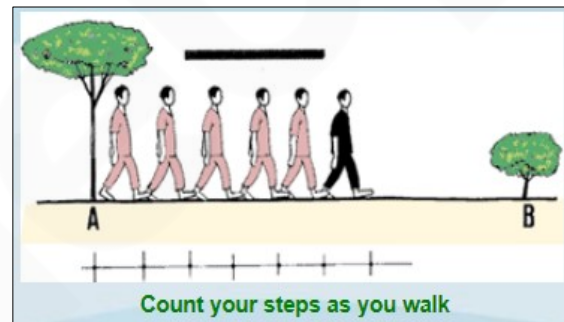
- A. decreases with decrease of slope
- B. increases with increase of slope
- C. decreases with increase of slope

D. decreases with decrease of weight of the chain

Ans. C.

You may measure distances roughly by pacing. This means you count the number of normal steps which will cover the distance between two points along a straight line. Pacing is particularly useful in reconnaissance surveys, for contouring using the grid method and for quickly checking chaining measurements

To be accurate, you should know the average length of your step when you walk normally. This length is called your normal pace. Always measure your pace from the toes of the foot behind to the toes of the foot in front.



21. The correction to be applied to each 30 meter chain length along 0° slope is _

- A. 30 (sec θ - 1) m
- B. 30 (sin θ - 1) m
- C. 30 (cos θ - 1) m
- D. 30 (tan θ - 1) m

Ans. A.

In surveying, tape correction(s) refer(s) to correcting measurements for the effect of slope angle, expansion or contraction due to temperature, and the tape's sag, which varies with the applied tension. Not correcting for these effects gives rise to

systematic errors, i.e. effects which act in a predictable manner and therefore can be corrected by mathematical methods.

For very steep slopes, $m > 30$

$$C_h = s(1 - \cos \theta)$$

$$C_h = 30(1 - \cos \theta)$$

$$\text{or, } = 30(\sec \theta - 1)$$

22. Correction per chain length of 100 links along a slope of α° is _____.

- A. $1.5 \alpha^2/100$
- B. $1.5 \alpha/100$
- C. $1.5 \alpha^3/100$
- D. $1.5 \alpha^2$

Ans. A.

We know that the correction can be calculated by:

$$100(\sec \theta - 1) \text{ links where } \theta \text{ is in radians}$$

$$\text{if } \theta \text{ is in degrees then hypotensual allowance}$$

$$= 0.015 \theta^2 \text{ links}$$

Therefore, $15 \alpha^2/100$

23. An angle of 45° with a chain line may be set out with _____.

- A. optical square
- B. open cross staff
- C. French cross staff
- D. prismatic square

Ans. C.

The octagonal form cross staff is the French cross staff. It consists of an octagonal brass tube with slits on all eight sides. If has an alternate vertical slit and an opposite vertical window with a vertical horse hair or affine wire on each of the four sides. These are used for setting our right angles. On the other side are vertical slits, which are at 45 degree to those previously mentioned, for setting out angles of 45 degree.

The base carries a socket so that it may be fitted on the pointed staff when the instrument is to be used. The sight being too close (only 8 cm apart) it is inferior to the open type.


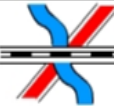






24. The conventional sign shown in the figure below represents a



- A. Bridge carrying railway below the road.
- B. Bridge carrying road below railway.
- C. Bridge carrying road railway at the same level.
- D. A level crossing.

Ans. A.

Standard (Survey of India) Conventional Signs of Salient objects for Topographic Map are:

Symbol	Description
	Railway, Broad Gauge Double Line
	Bridge carrying Railway over Road
	Metalled Road
	National Highway
	UN-Metalled Road
	Level Crossing
	Foot Path with Bridge, Culvert
	(Road or Railway) Embankment

25. The surface of zero elevation around the earth, which is slightly irregular and curved is known as _____.

- A. mean sea level
- B. geoid surface
- C. level surface
- D. horizontal surface

Ans. B.

The geoid is the shape that the surface of the oceans would take under the influence of Earth's gravity and rotation alone, in the absence of other influences such as winds and tides. This surface is extended through the continents (such as with very narrow hypothetical canals). All points on a geoid surface have the same effective potential (the sum of gravitational potential energy and centrifugal potential energy). The geoid can be defined at any value of gravitational potential such as within the Earth's crust or far out in space, not just at sea level.

26. The imaginary line passing through the intersection of cross hairs and the optical center of the objective is known as _____.

- A. line of sight
- B. line of collimation geoid
- C. axis of the telescope
- D. None of these

Ans. B.

Line joining the intersection of the cross-hairs to the optical center of the objective and its continuation. It is also known as Line of sight.

The line of sight of the telescope of a surveying instrument, defined as the line through the rear nodal point of the objective lens of the telescope and the center of the reticle when they are in perfect alignment.

27. The sensitiveness of a level tube decreases if _____.

- A. radius of curvature of its inner surface is increased
- B. diameter of the tube is increased
- C. length of the vapour bubble is increased
- D. both viscosity and surface tension are increased

Ans. D.

Sensitiveness or the sensitivity of a level tube is its capability of exhibiting small deviations of the tube from the horizontal. This quality depends mainly upon the radius of curvature of the level tube which may vary from 10 to 300 metres —the larger the radius, the greater the sensitiveness. Sensitiveness is also increased by increase in the length of bubble and by decrease of viscosity and surface tension of the liquid in the level tube.

28. The rise and fall method of reduction of levels, provides a check on _____.

- A. back sights
- B. foresights
- C. both back sights and foresights
- D. None of these

Ans. C.

Booking levels

There are two main methods of booking levels:

- Rise and fall method
- Height of collimation method

Back-sight	Inter-mediate	Fore-sight	Rise	Fall	Reduced level	Distance	Remarks
2.554					50.00	0	Datum RL+50 m
	1.783		0.771		50.771	14.990	A
	0.926		0.857		51.628	29.105	B
	1.963			1.037	50.591	48.490	C
1.305		3.587		1.624	48.967	63.540	D / change point 1
	1.432			0.127	48.840	87.665	E
3.250		0.573	0.859		49.699	102.050	F / change point 2
	1.925		1.325		51.024	113.285	G
3.015		0.496	1.429		52.453	128.345	H / change point 3
		0.780	2.235		54.688	150.460	J
10.124		5.436	7.476	2.788	54.688		Sum of B-sight & F-sight, Sum of Rise & Fall
-5.436					-50.000		Take smaller from greater
4.688			4.688		4.688		Difference should be equal

The millimeter reading may be taken by estimation to an accuracy of 0.005 metres or even less.

1. Backsight, intermediate sight and foresight readings are entered in the appropriate columns on different lines. However, as shown in the table above backsights and foresights are placed on the same line if you change the level instrument.

2. The first reduced level is the height of the datum, benchmark or R.L.

3. If an intermediate sight or foresight is smaller than the immediately preceding staff reading then the difference between the two readings is placed in the rise column.

4. If an intermediate sight or foresight is larger than the immediately preceding staff reading then the difference between the two readings is placed in the fall column.

5. A rise is added to the preceding reduced level (RL) and a fall is subtracted from the preceding RL.

29. If the plane table is not horizontal in a direction at right angles to the alidade, the line of sight is parallel to the fiducial edge only for _____.

- A. horizontal sights
- B. inclined sight upward
- C. inclined sight downward
- D. None of these

Ans. A.

Plane Table Surveying is a graphical method of survey in which the field observations and plotting are done simultaneously. It is simple and cheaper than theodolite survey. It is most suitable for small scale maps. The plan is drawn by the surveyor in the field, while the area to be surveyed is before his eyes. Therefore, there is no possibility of omitting the necessary measurements.

For leveling the table ordinary spirit level may be used. The table is leveled by placing the level on the board in two positions at right angles and getting the bubble central in both directions. An alidade or a turning board is a device that allows one to sight a distant object and use the line of sight to perform a task. This task can be, for example, to draw a line on a plane table in the direction of the object or to measure the angle to the object from some reference point. Angles measured can be horizontal, vertical or in any chosen plane. The alidade was originally a part of many types of scientific and astronomical instrument. At one time, some alidades, particularly those used on graduated circles as on astrolabes, were also called diopters. With modern technology, the name is applied to complete instruments such as the plane table alidade.

30. Pick up the correct statement from the following _____.

- A. The void space between the soil grains, is filled partly with air & partly with water
- B. In perfectly saturated soil, the voids are completely filled with water
- C. In dry soil, the voids are completely filled with air
- D. All options are correct

Ans. D.

Soil is a complex physical system. A mass of soil includes accumulated solid particles or soil grains and the void spaces that exist between the particles. The void spaces may be partially or completely filled with water or some other liquid. Void spaces not occupied by water or any other liquid are filled with air or some other gas. The volume of water in a soil can only vary between zero (i.e. a dry soil) and the volume of voids; this can be expressed as a ratio:

$$\text{Degree of saturation, } S_r = \frac{\text{volume of water}}{\text{Volume of voids}}$$

For a perfectly dry soil: $S_r = 0$

For a saturated soil: $S_r = 1$

In clay soils as the amount water increases the volume and therefore the volume of voids will also increase, and so the degree of saturation may remain at

$S_r = 1$ while the actual volume of water is increasing.

31. The ratio of the difference between the void ratio of the soil in its loosest state and its natural void ratio (e) to the difference the void ratios in the loosest and fully dense state, is generally termed as _____.

- A. Degree of density
- B. relativity
- C. density index
- D. All options are correct

Ans. A.

Relative density or density index is the ratio of the difference between the void ratios of a cohesionless soil in its loosest state and existing natural state to the difference between its void ratio in the loosest and densest states.

$$\text{Relative density} = \frac{e_{\max} - e}{e_{\max} - e_{\min}}$$

where,

e_{\max}
= void ratio of coarse grained soil in its loosest state.

e_{\min}
= void ratio of coarse grained soil in its densest state.

e = void ratio of coarse grained soil in its natural existing state in the field

32. If the void ratio is 0.67, water content is 0.188 and specific gravity is 2.68, the degree of saturation of the soil, is _____.

- A. 25%
- B. 40%
- C. 60%
- D. 75%

Ans. D.

We know that

$$e = \frac{W \times G}{S}$$

$$\text{or, } S = \frac{W \times G}{e}$$

$$= \frac{0.188 \times 2.68}{0.67}$$

$$= 0.752 \text{ or } 75.2\%$$

33. The coefficient of compressibility of soil, is the ratio of _____.

- A. stress to strain
- B. strain to stress
- C. stress to settlement
- D. rate of loading to that of settlement

Ans. D.

It can be said that the compressibility of a soil decreases as the effective stress increases. This can be represented by the slope of the void ratio – effective stress

relation, which is called the coefficient of compressibility,

$$a_v = \frac{de}{de\sigma'}$$

34. The value of mass density in $\text{kg}\cdot\text{sec}^2/\text{m}^4$ for water at 0°C is _____.

- A. 1 B. 1000
C. 100 D. 101.9

Ans. D.

Water never has an absolute density because its density varies with temperature. Water has its maximum density of $1\text{g}/\text{cm}^3$ at 4 degrees Celsius. When the temperature changes from either greater or less than 4 degrees, the density will become less than $1\text{g}/\text{cm}^3$. Water has the maximum density of $1\text{g}/\text{cm}^3$ only when it is pure water. Other factors affect water's density such as whether it is tap or fresh water or salt water. These variations of water changes its density because what's in the water has its own density. Units of measurement are not same.

$$\frac{\text{Kgs}^2}{\text{m}^4} = \frac{\text{Kg}}{\text{m}^3} \times \frac{\text{s}^2}{\text{m}} = \frac{\text{density}}{\text{acceleration}}$$

$$= \frac{1000}{9.8} = 101.9 \frac{\text{Kgs}^2}{\text{m}^4}$$

35. Viscosity of water in comparison to mercury is _____.

- A. higher
B. lower
C. same
D. higher/lower depending on temperature

Ans. A.

The kinematic viscosity is the dynamic viscosity divided by the density. Mercury is a lot denser than water, so its kinematic viscosity is lower than the kinematic viscosity of water. But that's just because mercury is very dense.

The dynamic viscosity of mercury is 1.52 and water is 0.894 but the kinematic viscosity is smaller for mercury because it has large density than water.

36. Center of gravity of thin hollow lines on the axis of symmetry at a height of _____.

- A. one-half of the total height above base
B. one-third of the total height above base
C. one-fourth of the total height above base
D. None of these

Ans. B.

The center of gravity is the point through which the weight of the body acts. Centroid is the point at which the total area may be assumed to be concentrated for the determination of the first moment of area. CG of a triangle lies at the point of intersection of its median. If the coordinates of the vertices area (x_1, y_1) , (x_2, y_2) , and (x_3, y_3) , the coordinates if the centroid are:

$$x_c = \frac{1}{3}(x_1 + x_2 + x_3) \text{ and } y_c = \frac{1}{3}(y_1 + y_2 + y_3)$$

Therefore, the centroid of the triangle lies at one-third of the height from the base.

37. Which of the following meters is not associated with viscosity _____.

- A. Red wood B. Say bolt
C. Engler D. Orsat

Ans. D.

An Orsat gas analyser is a piece of laboratory equipment used to analyse a gas sample (typically fossil fuel flue gas) for its oxygen, carbon monoxide and carbon dioxide content. Although largely replaced by instrumental techniques, the Orsat remains a reliable method of measurement and is relatively simple to use.

38. If mercury in a barometer is replaced by water, the height of 3.75 cm of mercury will be following cm of water _____.

- A. 51 cm B. 50 cm
C. 52 cm D. 52.2 cm

Ans. A.

Let the density of mercury is 13.6 times the density of water.

$$h_1\rho_1g = h_2\rho_2g$$

$$h_2 = \frac{h_1\rho_1}{\rho_2}$$

$$h_2 = 3.75 \times 13.6 = 51 \text{ cm}$$

39. If w is the specific weight of liquid and h the depth of any point from the surface, then pressure intensity at that point will be

- A. h B. wh
C. w/h D. h/w

Ans. B.

It is given that:

$w = \text{specific weight of liquid}$

$h = \text{depth of any point from the surface}$

$\text{Pressure intensity at a point}$

$$= \text{specific weight of liquid} \times h$$

$$= w \times h = wh$$

40. Which of the following is the unit of kinematic viscosity _____.

- A. pascal B. poise
C. stoke D. faraday

Ans. C.

The kinematic viscosity [m^2/s] is the ratio between the dynamic viscosity [$Pa \cdot s = 1 \text{ kg/m} \cdot s$] and the density of a fluid [kg/m^3].

The SI unit of the kinematic viscosity is m^2/s . Other units are: 1 St (Stoke) = $1 \text{ cm}^2/s = 10^{-4} \text{ m}^2/s$.

41. If 850 Kg liquid occupies volume of one cubic meter, then 0.85 represents its

- A. specific weight B. specific mass
C. specific gravity D. specific density

Ans. C.

Specific gravity is the ratio of the density of a substance to the density of a reference substance; equivalently, it is the ratio of the mass of a substance to the mass of a reference substance for the same given volume.

$$\text{Specific gravity} = \frac{\rho_{\text{sample}}}{\rho_{H_2O}} = \frac{850}{1000} = 0.85$$

42. A liquid would wet the solid, if adhesion forces as compared to cohesion forces are _____.

- A. less
B. more
C. equal
D. less at low temperature and more at high temperature

Ans. B.

Cohesive and adhesive forces. It takes great force to pull many solids apart. An example is steel. It is obvious that there must be a very strong force of attraction between the molecules of substances like steel. The force of attraction between molecules of the same kind is known as cohesion. There can also be an attraction between molecules of different substances. For example chewing gum or various types of glue may stick to many different kinds of substances. The force of attraction between unlike molecules is called adhesion. Forces between molecules, such as those of cohesion and adhesion, are effective only over extremely short distances, distances of the order of molecular diameters.

Consequently, they are called short-range forces in contradistinction to forces such as gravitational attraction which is a long-range force.

An experiment illustrating cohesive forces is the following: Take two pieces of metal, each with an accurately plane surface, and bring them together. There will be no attraction between them until they are in contact. However, once in contact, it will take a very great force to pull them apart. If the force of cohesion is greater than the force of adhesion, the liquid will cling to itself and will tend to form droplets when placed on a smooth surface instead of spreading out to wet the surface.

43. The resultant upward pressure of a fluid on a floating body is equal to the weight of the fluid displaced by the body. The definition is according to _____.

- A. Buoyancy
B. Equilibrium of a floating body
C. Archimedes principle
D. Bernoulli's theorem

Ans. C.

Archimedes' principle states that the upward buoyant force that is exerted on a body immersed in a fluid, whether fully or partially submerged, is equal to the weight of the fluid that the body displaces and acts in the upward direction at the center of mass of the displaced fluid.

44. If the irrigation efficiency is 80%, conveyance losses are 20% and the actual depth of the watering is 16 cm, the depth of water required at the canal outlet is _____.

- A. 10 cm B. 15 cm
C. 20 cm D. 25 cm

Ans. D.

Depth of water required considering conveyance losses is

$$= \frac{16}{0.8} = 20 \text{ cm}$$

Because 20% is lost in conveyance means only 80% is reached. So we have to provide more depth of water.

To make 100 % irrigation, Depth of water from canal outlet is

$$= \frac{20}{0.8} = 25 \text{ cm}$$

45. The intensity of irrigation means
- A. percentage of culturable command area to be irrigated annually
 - B. percentage of gross command area to be irrigated annually
 - C. percentage of the mean of culturable command area and the gross commanded area to be irrigated annually
 - D. total depth of water supplied by the number of waterings

Ans. A.

Intensity of irrigation is defined as the percentage of the irrigation proposed to be irrigated annually. Usually the areas irrigated during each crop season (Rabi, Kharif, etc) is expressed as a percentage of the CCA which represents the intensity of irrigation for the crop season.

46. Pick up the incorrect statement from the following. The width of the right-of-way is decided to accommodate
- A. formation width
 - B. side slopes
 - C. horizontal curve
 - D. vertical curve

Ans. D.

Common suburban and rural rights-of-way in Chester County are thirty-three feet. Right-of-Way elements include the cartway, shoulder and buffer area. The buffer provides an area for: snow storage, guide rails, sight distance, drainage, utilities, side slope, and pedestrian facilities. Right-of-way widths should vary according to the intended function of the road. Right-of-way preservation should include allowances for bus passenger facilities, including ADA accessible loading pads, bus shelters and ADA-compliant sidewalk connections, where appropriate. A right-of-way (ROW) is a right to make a way over a piece of land, usually to and from another piece of land. A right of way is a type of easement granted or reserved over the land for transportation purposes, this can be for a highway, public footpath, rail transport, canal, as well as electrical transmission lines, oil and gas pipelines. A right-of-way can be used to build a bike trail. A right-of-way is reserved for the purposes of maintenance or expansion of existing services with the right-of-way.

47. Widening of gauge is provided if degree of the curve is

- A. 3° or less
 - B. 3° to 3.5°
 - C. more than 4.5°
 - D. None of these
- Ans. C.

A vehicle normally assumes the central position on a straight track and the flanges of the wheels stay clear of the rails. The situation, however, changes on a curved track. As soon as the vehicle moves onto a curve, the flange of the outside wheel of the leading axle continues to travel in a straight line till it rubs against the rail. Due to the coning of wheels, the outside wheel travels a longer distance compared to the inner wheel. This, however, becomes impossible for the vehicle as a whole since the rigidity of the wheel base causes the trailing axle to occupy a different position. In an effort to make up for the difference in the distance travelled by the outer wheel and the inner wheel, the inside wheels slip backward and the outer wheels skid forward. A close study of the running of vehicles on curves indicates that the wear of flanges eases the passage of the vehicle round curves, as it has the effect of increasing the gauge. The widening of the gauge on a curve has, in fact, the same effect and tends to decrease the wear and tear on both the wheel and the track. The widening of the gauge on curves can be calculated using the formula

$$\text{Extra width on curves } (w) = \frac{13(B+L)^2}{R}$$

Hence the widening of gauge is provided if degree of the curve is more than 4½°

48. Pick up the correct statement from the following _____.
- A. The maximum rate of storm run-off is called peak drainage discharge
 - B. Rational method of estimating peak run off, may be used precisely for areas less than 50 hectares
 - C. The period after which the entire area starts contributing to the run off is called the time of concentration
 - D. All options are correct

Ans. D.

As per irrigation engineering theory all the above statements are correct. Hence, Option (D) is the correct answer.

49. If the length of overland flow from the critical point to the mouth of drain is 13.58 Km and difference in level between the critical point and drain mouth is 10 m, the inlet time is

- A. 2 hours
- B. 4 hours
- C. 6 hours
- D. 8 hours

Ans. D.

The inlet time can be calculated by:

$$Ti = \left(0.885 \frac{L^3}{H}\right)^{0.385}$$

Given, $L = 13.58$

$H = 10$

$$Ti = \left(0.885 \times \frac{13.58^3}{10}\right)^{0.385} = (221.6371)^{0.385} = 7.9997 = 8$$

50. If $\sum H$ and $\sum V$ are the algebraic sums of the forces resolved horizontally and vertically respectively, and $\sum M$ is the algebraic sum of the moments of forces about any point for the equilibrium of the body acted upon _____.

- A. $\sum H = 0$
- B. $\sum V = 0$
- C. $\sum M = 0$
- D. All options are correct

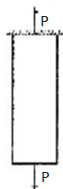
Ans. D.

When all the forces that act upon an object are balanced, then the object is said to be in a state of equilibrium. The forces are considered to be balanced if the rightward forces are balanced by the leftward forces and the upward forces are balanced by the downward forces.

Therefore, for an object to be at equilibrium, the net force acting horizontally should be zero, net forces acting vertically should be zero, and the net forces acting at any point should be zero.

$$\sum H = 0, \sum V = 0, \text{ and } \sum M = 0$$

51. The force acting normally on the cross section of a bar shown in the figure below introduce _____.



- A. Compressive stress
- B. tensile stress
- C. shear stress
- D. None of these

Ans. B.

Tensile stress (or tension) is the stress state leading to expansion; that is, the length of a material tends to increase in the tensile direction. The volume of the material stays constant. When equal and opposite forces are applied on a body, then the stress due to this force is called tensile stress.

In the given figure the force P is acting on both side of the object, therefore it will generate tensile stress in the object.

52. A material is said to be perfectly elastic if _____.

- A. It regains its original shape on removal of load
- B. It regains its original shape partially on removal of the load
- C. It does not regains its original shape at all
- D. None of these

Ans. A.

Elasticity is the ability of a body to resist a distorting influence or deforming force and to return to its original size and shape when that influence or force is removed. Solid objects will deform when adequate forces are applied on them. If the material is elastic, the object will return to its initial shape and size when these forces are removed.

53. A_b and A_c are the cross section of bronze and copper bars of equal length. $\sum b, \sum c$ are their respective stresses due to load P. If P_b and P_c are the loads shared by them _____.

- A. $\frac{\sigma_b}{\sigma_c} = \frac{E_b}{E_c}$
- B. $P = P_b + P_c$
- C. $P = A_b \sum b + A_c \sum b$
- D. All options are correct

Ans. D.

Loads shared by cross section of bronze and copper bars are P_b and P_c respectively. Hence, respective stresses due to load $P = A_b \sum b + A_c \sum b$

54. The ratio of shear stress and shear strain of an elastic metal is _____.

- A. Modulus of rigidity
- B. Both Modulus of rigidity & Shear modulus
- C. Young's modulus
- D. Modulus of Elasticity

Ans. B.

Shear modulus or modulus of rigidity, denoted by G , or sometimes S or μ , is defined as the ratio of shear stress to the shear strain:

$$G \stackrel{\text{def}}{=} \frac{\tau_{xy}}{\gamma_{xy}}$$

where, τ_{xy} is the shear stress and, γ_{xy} is the shear strain

Shear modulus' derived SI unit is the pascal (Pa), although it is usually expressed in gigapascals (GPa) or in thousands of pounds per square inch (ksi).

55. A load of 1960 N is raised at the end of a steel wire. The minimum diameter of the wire so the stress in the wire does not exceed 100 N/m^2 is _____.

- A. 4.0 mm
- B. 4.5 mm
- C. 5.0 mm
- D. 5.5 mm

Ans. C.

Given, Load = 1960 N

Stress = 100 N/m^2

We know that,

$$\text{Stress} = \frac{\text{Load}}{\text{Area}}$$

$$\text{or, Area} = \frac{\text{Load}}{\text{Stress}}$$

$$= \frac{1960}{100} = 19.6$$

$$\text{Also, Area} = \frac{\pi d^2}{4} = 19.6$$

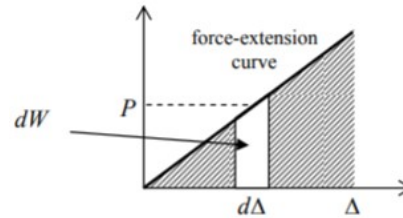
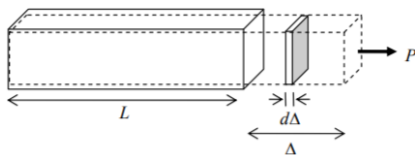
$$d^2 = 19.6 \times \frac{4}{\pi} = 24.956$$

$$d = 4.996 = 5$$

56. A bar L meter long and having its area of cross-section A , is subjected to a gradually applied tensile load W . The strain energy stored in the bar is _____.

- A. $WL/2AE$
- B. WL/AE
- C. W^2L/AE
- D. $W^2L/2AE$

Ans. D.



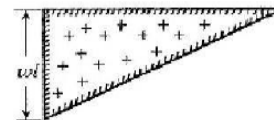
It was shown in the above figure that the force and extension Δ are linearly related through $\Delta = PL / EA$, where E is the Young's modulus and A is the cross sectional area. The work expressed is the white region under the force-extension curve (line). The total work done during the complete extension up to a final force P and final extension Δ is the total area beneath the curve.

The work done is stored as elastic strain energy U and so

$$U = \frac{1}{2} \frac{P^2 L}{EA}$$

Strain energy is the energy stored by a system undergoing deformation. The strain energy is always positive, due to the square on the force P , regardless of whether the bar is being compressed or elongated.

57. The Shear Force diagram of a loaded beam shown in the figure below is that of _____.



- A. a simply supported beam with isolated central load
- B. a simply supported beam with uniformly distributed load
- C. a cantilever beam with an isolated load at free end
- D. a cantilever with uniformly distributed load

Ans. D.

A shear force diagram can be constructed from the loading diagram of the beam. In order to draw this, first the reactions must be determined always. Then the vertical components of forces and reactions are successively summed from the left end of the beam to preserve the mathematical sign conventions adopted. The shear at a section is simply equal to the sum of all the vertical forces to the left of the section.

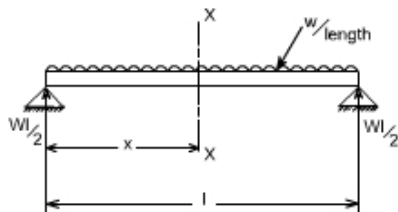
When the successive summation process is used, the shear force diagram should end up with the previously calculated shear (reaction at right end of the beam. No shear force acts through the beam just beyond the last vertical force or reaction. If the shear force diagram closes in this fashion, then it gives an important check on mathematical calculations.

In the given figure the beam is connected as a cantilever and the load is evenly distributed around the full length of the beam. Hence, it is a cantilever with uniformly distributed load.

58. The maximum bending moment for a simply supported beam with a uniformly distributed load W per unit length is

- A. $Wl/2$ B. $Wl^2/4$
 C. $Wl^2/8$ D. $Wl^2/12$

Ans. C.



The total load carried by the span would be = intensity of loading \times length = $w \times l$

By symmetry the reactions at the end supports are each $wl/2$

If x is the distance of the section considered from the left hand end of the beam.

S.F at any X-section X-X is

$$= \frac{Wl}{2} - Wx$$

$$= W \left(\frac{l}{2} - x \right)$$

Giving a straight relation, having a slope equal to the rate of loading or intensity of the loading.

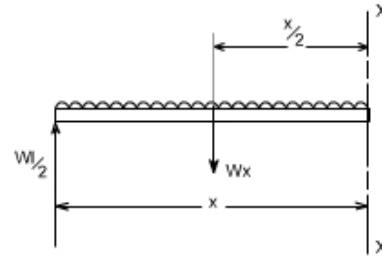
$$S.F_{at\ x=0} = \frac{Wl}{2} - wx$$

Therefore,

$S.F_{at\ x=\frac{l}{2}} = 0$ hence the S.f is zero at the center

$$S.F_{at\ x=l} = -\frac{Wl}{2}$$

The bending moment at the section x is found by treating the distributed load as acting at its centre of gravity, which at a distance of $x/2$ from the section



$$B.M_{X-x} = \frac{Wl}{2}x - Wx \times \frac{x}{2} = \frac{Wx}{2}(l - x)$$

$$B.M_{at\ x=0} = 0$$

$$B.M_{at\ x=l} = 0$$

$$B.M_{at\ x=l} = -\frac{Wl^2}{8}$$

59. A simply supported beam which carries a uniformly distributed load has two equal overhangs. To have maximum B.M. produced in the beam least possible, the ratio of the length of the overhang to the total length of the beam is _____.

- A. 0.207 B. 0.307
 C. 0.407 D. 0.508

Ans. A.

We know that the maximum tension is given by:

$$T_{max} = \sigma \times Area = \sigma \times b \times t$$

$$or, \sigma = \frac{T_{max}}{bt}$$

$$= \frac{100}{10 \times 4} = 2.5$$

60. The point of a contraflexure is the point where _____.

- A. B.M changes sign
 B. B.M is maximum
 C. B.M. is minimum
 D. S.F is zero

Ans. A.

In a bending beam, a point is known as a point of contraflexure if it is a location at which no bending occurs. In a bending moment diagram, it is the point at which the bending moment curve intersects with the zero line. In other words where the bending moment changes its sign from negative to positive or vice versa.

61. The assumption in the theory of bending of beams is _____.

- A. material is homogenous
 B. material is isotropic
 C. Young's modulus is same in tension as well as compression
 D. All options are correct

Ans. D.

Assumptions made in the theory of Pure Bending

1. The material of the beam is homogeneous and isotropic.
 2. The value of Young's Modulus of Elasticity is same in tension and compression.
 3. The transverse sections which were plane before bending, remain plane after bending also.
 4. The beam is initially straight and all longitudinal filaments bend into circular arcs with a common centre of curvature.
 5. The radius of curvature is large as compared to the dimensions of the cross-section.
 6. Each layer of the beam is free to expand or contract, independently of the layer, above or below it.
62. To hydrate 500 Kg cement fully water needed is _____.
- A. 100Kg B. 110 Kg
C. 120 Kg D. 130 Kg

Ans. D.

For complete hydration of cement 38% water of cement weight is needed. Therefore, for 500 kg cement, water needed is

$$= 38\% \text{ of } 500 = 0.38 \times 500 = 190 \text{ Kg}$$

However, in the question highest quantity given is 130 Kg, so the correct answer is 130 Kg.

63. The entrained air in concrete _____.
- A. increases workability
B. decreases workability
C. decreases resistance to weathering
D. increases strength

Ans. A.

There are two main purposes of air entrained concrete.

1. To replace water by air so as to reduce the risks of freezing of water in cold regions thus increasing the durability of concrete.
 2. To increase the workability of concrete.
64. The produce impermeable concrete _____.

- A. thorough mixing of concrete is required
B. proper concentration of concrete is required
C. proper curing of concrete is required
D. All options are correct

Ans. D.

Low permeability concrete is a material with a very low porosity, thus reducing the flow of water through it.

- It can be used in Cisterns, water storage tanks and water Canals.
- Its low permeability helps the water-proofing systems.
- Allows for the recovery of rain water.
- Reduces the flow of humidity
- Substitutes for water proofing of walls and foundations.

To produce impermeable concrete, one should do the following

- Proper compaction of concrete
- Thorough mixing of concrete
- Proper curing of concrete
- Use properly graded and non-porous aggregates

65. Pick up the correct statements from the following _____.

- A. Water cement paste hardens due to hydration
B. During hardening cement binds the aggregates together
C. Cement provides strength, durability and water tightness to the concrete
D. All options are correct

Ans. D.

Water is the key ingredient, which when mixed with cement, forms a paste that binds the aggregate together. The water causes the hardening of concrete through a process called hydration. Hydration is a chemical reaction in which the major compounds in cement form chemical bonds with water molecules and become hydrates or hydration products. Details of the hydration process are explored in the next section. The water needs to be pure in order to prevent side reactions from occurring which may weaken the concrete or otherwise interfere with the hydration process. The role of water is important because the water to cement ratio is the most critical factor in the production of "perfect" concrete. Too much water reduces concrete strength, while too little will make the concrete unworkable. Concrete needs to be workable so that it may be consolidated and shaped into different forms (i.e. walls, domes, etc.). Because concrete must be both strong and

workable, a careful balance of the cement to water ratio is required when making concrete.

Hence, all options are correct.

66. The maximum percentage of chemical ingredient of cement is that of _____.

- A. magnesium oxide
- B. iron oxide
- C. aluminum
- D. lime

Ans. D.

Composition of Cement

There are eight major ingredients of cement. The general percentage of these ingredients in cement is given below:

<i>Ingredient</i>	<i>Percentage in cement</i>
Lime	60-65
Silica	17-25
Alumina	3-8
Magnesia	1-3
Iron oxide	0.5-6
Calcium Sulfate	0.1-0.5
Sulfur Trioxide	1-3
Alkaline	0-1

67. Efflorescence in cement is caused due to an excess of _____.

- A. alumina
- B. iron oxide
- C. silica
- D. alkalis

Ans. D.

Efflorescence is the white powdery substance on the surfaces of unsealed concrete and the white blush seen with sealed floors. Efflorescence is caused by vapor migrating through the slab bringing soluble salts to the surface of the concrete.

Efflorescence is caused when soluble salts and other water dispersible materials come to the surface of concrete and mortars. It's induced by low temperatures, moist conditions, condensation, rain, dew, and water added to the surface of fresh concrete to assist troweling. It can occur very soon after exposure to moist or cool conditions or gradually, especially when it comes from within the concrete or from the subgrade. Hence, alkalis is the correct option.

68. Pick up the incorrect statement from the following:

- A. The degree of grinding of cement is called fineness
- B. The process of changing cement paste into hard mass, is known as setting of cement
- C. The phenomenon by virtue of which cement does not allow transmission of sound, is known as soundness of cement
- D. The heat generated during chemical reaction of cement with water is known as heat of hydration

Ans. C.

Soundness of cement is the property of hardened cement paste undergoing large change in volume after setting without delayed destructive expansion. This destructive expansion is caused by excessive amounts of free lime or magnesia.

69. You are asked to construct a massive dam, the type of cement you will use is _____.

- A. Ordinary Portland cement
- B. rapid hardening cement
- C. low heat cement
- D. blast furnace slag cement

Ans. C.

Hydration of cement is an exothermic process that produces large quantity of heat. In mass concrete structures such as dams, retaining walls, bridge abutment, raft etc. the rate of dissipation of heat of hydration from the surface is much lower than that generated. It causes rise in temperature inside the concrete mass and may develop thermal and shrinkage cracks. Under this circumstances, the low heat cement or low heat Portland cement can be effectively used.

70. The diameter of the Vicat plunger is 10 mm and its length varies from _____.

- A. 20 mm to 30 mm
- B. 30 mm to 40 mm
- C. 40 mm to 50 mm
- D. 50 mm to 60 mm

Ans. C.

Vicat's Apparatus is used to find out the consistency, initial setting time and final setting time of the cement. In the normal consistency test we have to find out the amount of water to be added to the cement to form a cement paste of normal consistency.

Vicat's apparatus consists of an arrangement to hold the plunger of 10 mm diameter and two other needles which are made to freely fall into a mould filled with the cement paste and the amount of penetration of the needles of plunger can be noted using the vertical graduations from 0 mm to 50 mm.

Since the maximum length is 50 mm, therefore option (C) is correct.

71. If 1500 g of water is required to have a cement paste 1875 g of normal consistency the percentage of water is _____.

- A. 20% B. 25%
C. 30% D. 35%

Ans. B.

Given,

Weight of water = 1500 g

Weight of paste = 1875 g

Therefore weight of cement = 1875 - 1500 = 375 g

Percentage of water

$$= \frac{\text{weight of cement}}{\text{weight of water}} \times 100$$

$$= \frac{375}{1500} \times 100 = 25\%$$

72. Pick up the incorrect statement from the following.

- A. cement and standard sand mortar are used in the ratio of 1:3
B. water is added to the ratio of $P/4 + 3$ percentage of water where P is the percentage of water for standard consistency
C. A cube mould of 10 cm × 10 cm × 10 cm is used
D. The prepared moulds are kept in an atmosphere of 50% relative humidity

Ans. D.

COMPRESSIVE STRENGTH OF HYDRAULIC CEMENT (IS:4031-PART 6-1988)

- Take 200 g of cement and 600 g of standard sand and mix them dry thoroughly.
- Add $\frac{P}{4} + 3\%$ of water (where P is % of water required for preparing paste of standard consistency) to the dry mix of cement and sand and mix thoroughly for a minimum of 3 minutes and maximum of 4 minutes to obtain a mix of uniform colour.

If even in 4 minutes uniform colour of the mix is not obtained reject the mix and mix fresh quantities of cement, sand and water to obtain a mix of uniform colour.

- Place the thoroughly cleaned and oiled (on interior face) mould on the vibrating machine and hold it in position by clamps provided on the machine for the purpose.
- Fill the mould with entire quantity of mortar using a suitable hopper attached to the top of the mould for facility of filling and vibrate it for 2 minutes at a specified speed of 12000 ± 400 per minute to achieve full compaction.
- Remove the mould from the machine and keep it in a place with temp of $27 \pm 20^\circ\text{C}$ and relative humidity of 90% for 24 hours.
- At the end of 24 hrs remove the cube from the mould and immediately submerge in fresh clean water. The cube be taken out of the water only at the time of testing.
- Prepare at least 6 cubes in the manner explained above.
- Place the test cube on the platform of a compressive testing machine without any packing between the cube and the plates of the testing machine.
- An aggregate is said to be flaky if its dimension is less than _____.

- A. $2/3$ mean diameter
B. $3/4$ mean diameter
C. $3/5$ mean diameter
D. $5/8$ mean diameter

Ans. C.

According to shape the aggregate is classified as

- Rounded aggregate
- Irregular or partly rounded aggregate
- Angular aggregate
- Flaky aggregate
- Elongated aggregate
- Flaky and elongated aggregate

The aggregate is said to be flaky when its least dimension is less than $3/5$ th (or 60%) of its mean dimension. Mean dimension is the average size through which th particles pass and the sieve size on which these are retained.

74. Log Angles machines is used to test the aggregate for _____.

- A. crushing strength
- B. impact value
- C. abrasion resistance
- D. water absorption

Ans. C.

The Los Angeles Abrasion test, also known as LA Abrasion test for short, is widely used as an indicator of aggregate quality. The test measures degradation of standard gradings of aggregates subjected to abrasion and impact in a rotating steel drum containing an abrasive charge of steel balls. Up to twelve balls are used, depending on gradation of test samples.

75. The impurity of mixing water which affects the setting time and strength of concrete is _____.

- A. sodium sulphates
- B. sodium chlorides
- C. sodium carbonates and bicarbonates
- D. calcium chlorides

Ans. C.

Presence of impurities in water for concrete mix leads to decrease in structural properties of concrete such as strength and durability to a large extent. The sodium and potassium carbonates cause extremely large rapid setting in large concentrations. This results in the reduction of concrete strength.

The presence of calcium chlorides accelerates the setting and hardening of the concrete. But the presence of calcium chloride is restricted to 1.5 percent of the total weight of the cement used in the mix.

76. Pozzolana cement is used with confidence for construction of _____.

- A. dams
- B. massive foundations
- C. abutments
- D. All options are correct

Ans. D.

The Portland Pozzolana Cement (PPC) produced by National Cement is a quality cement with 32.5 R Strength Class.

The Portland Pozzolana Cement is a kind of Blended Cement which is produced by either intergrinding of OPC clinker along with gypsum and pozzolanic materials in

certain proportions or grinding the OPC clinker, gypsum and Pozzolanic materials separately and thoroughly blending them in certain proportions.

The Portland Pozzolana Cement is ideal for general construction which does not required high early strength. Commonly, it is ideally suited for constructions such as hydraulic structures, mass concreting works, marine structures, masonry mortars and plastering, under aggressive conditions, and all other applications where Ordinary Portland Cement (OPC) is used.

77. Water cement ratio is generally expressed in volume of water required per _____.

- A. 10 Kg
- B. 20 Kg
- C. 30 Kg
- D. 50 Kg

Ans. D.

It is found theoretically that water required for these two functions is about 0.50 to 0.60 times the weight of cement. This ratio of the amount of water to the amount of cement by weight is termed as the water-cement ratio and the strength and quality of concrete primarily depend upon this ratio.

The quantity of water is usually expressed in litres per bag of cement and hence the water-cement ratio reduces to the quantity of water required in litres per kg of cement as 1 litre of water weighs 1 kg. For instance, if water required for, 1 bag of cement is 30 litres, the water-cement ratio is equal to $30/50 = 0.60$

78. The condition not applicable to water cement ratio law is _____.

- A. internal moisture conditions on hydration continue till strength is gained
- B. concrete specimens may be tested at any temperature
- C. concrete specimens are needed to be of same age
- D. concrete specimens are needed to be of same size

Ans. B.

The most important factor determining the strength of concrete is the water to cement ratio. It is the ratio of weight of mixing water (free water available for the reaction with cement) to that of cement in the mixture. Cement needs water of about

38% by weight for complete hydration. But since the complete hydration is a long term process, and under practical conditions, the period of concrete mixing and casting being short, the cement combines with only 23% of water. If only 23% of water is added while mixing, the concrete won't be workable because the water-cement ratio of 0.23 will be too less. So additional water will be required for workability. This water in excess of 23% by weight will evaporate on drying of concrete, creating voids in it due to trapping of air bubbles insides, thereby reducing the strength of concrete.

Assuming full compaction, and at a given age and normal temperature, strength of concrete can be taken to be inversely proportional to the water-cement ratio. This is so called the Abrams' law.

79. According to Water - Cement Ratio Law, the strength of workable plastic concrete _____.

- A. depends on amount of water used in the mix
- B. does not depend upon the quality of cement mixed with aggregates
- C. does not depend on the quantity of cement mixed with aggregates
- D. All options are correct

Ans. D.

This law states that for any given conditions of test the strength of workable concrete mix is dependent only on the water cement ratio. It means that if the concrete is fully compacted, the strength is not affected by aggregate shape, type or surface texture or the aggregate grading. According to this law, the strength of mix increases with decrease in water content.

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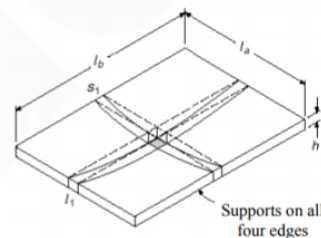
Assuming full compaction, and at a given age and normal temperature, strength of concrete can be taken to be inversely proportional to the water-cement ratio.

This is so called the Abrams' law.

80. If l_1 and l_2 are the lengths of long and short spans of a two way slab simply supported on four edges and carrying a load w per unit area, the ratio of the loads split into w_1 and w_2 acting on strips parallel to l_1 and l_2 is

- A. $\frac{w_1}{w_2} = \frac{l_2}{l_1}$
- B. $\frac{w_1}{w_2} = \left(\frac{l_2}{l_1}\right)^2$
- C. $\frac{w_1}{w_2} = \left(\frac{l_2}{l_1}\right)^3$
- D. $\frac{w_1}{w_2} = \left(\frac{l_2}{l_1}\right)^4$

Ans. D.



Above figure shows two center strips of a rectangular plate with spans l_a and l_b . For uniformly distributed loads of w per square foot of the slab, each strip acts approximately like a simple beam uniformly loaded by its share of w ; i.e., w_a and w_b . Since they are part of the same slab, their midspan deflections must be the same. Equating the center deflections of the short and long strips. A thrust bearing is a particular type of rotary bearing. Like other bearings they permit rotation between parts, but they are designed to support a predominately axial load.

$$\frac{5w_a l_a^4}{384EI} = \frac{5w_b l_b^4}{384EI}$$

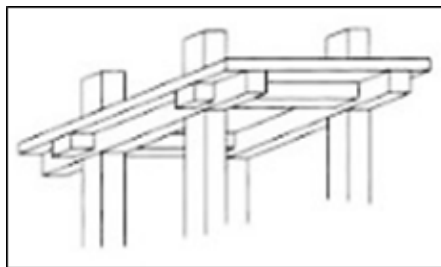
$$\text{or, } \frac{w_a}{w_b} = \left(\frac{l_b}{l_a}\right)^4$$

81. If the ratio of long and short spans of a two way slab with corners held down is r , the actual of B.M. is given by

- A. $\frac{5}{6} \frac{r}{1+r^2} M$ B. $\frac{5}{6} \frac{r^2}{1+r^2} M$
 C. $\frac{5}{6} \frac{r^2}{1+r^3} M$ D. $\frac{5}{6} \frac{r^2}{1+r^4} M$

Ans. D.

Two way slabs are the slabs that are supported on four sides and the ratio of longer span (l) to shorter span (b) is less than 2. In two way slabs, load will be carried in both the directions. So, main reinforcement is provided in both directions for two way slabs.



Hence, the actual of B.M is given by

$$\frac{5}{6} \frac{r^2}{1+r^4} M$$

82. According to IS:456, slabs which span in two directions with corners held down are assumed to be divided in each direction into middle strips and edge strips such that the width of the middle strip is _____.

- A. half of the width of the slab
 B. two-third of the width of the slab
 C. three-fourth of the width of the slab
 D. four-fifth of the width of the slab

Ans. C.

IS 456-2000 Plain and Reinforced Concrete - Code of Practice is an Indian Standard code of practice for general structural use of plain and reinforced concrete. The latest revision of this standard was done in year 2000, reaffirmed 2005. This code uses the limit state design approach as well working stress design approach. It is written for use in India. It gives extensive information on the various aspects of concrete.

Annex D of IS 456 can be employed to determine the bending moments in the two directions for two types of slabs: (i) restrained slabs, and (ii) simply supported slabs. Restrained slabs are considered as divided into two types of strips in each direction: (i) one middle strip of width equal to three-quarters of the respective length of span in either directions, and (ii) two edge strips, each of width equal to one-eighth of the respective length of span in either directions.

83. A bull nose brick is not used for _____.

- A. rounding off sharp corners
 B. pillars
 C. decoration purpose
 D. arches

Ans. D.

Bullnose brick is a style of brick that has one, some or all of its corners rounded off. These brick can be used to create soft and attractive curved edges to steps, sills, or in capping walls.

Arch: A form of construction in which masonry units span an opening by transferring vertical loads laterally to adjacent voussoirs and, thus, to the abutments. That's why bull nose bricks are not used for arches.

84. If the sides of a slab simply supported on edges and spanning in two directions are equal, the maximum bending moment is multiplied by _____.

- A. 0.2 B. 0.3
 C. 0.4 D. 0.5

Ans. D.

Centrifugal compressors, sometimes termed radial compressors, are a subclass of dynamic axisymmetric work-absorbing turbomachinery. The idealized compressive dynamic turbo-machine achieves a pressure rise by adding kinetic energy/velocity to a continuous flow of fluid through the rotor or impeller.

85. Design of a two-way slab simply supported on edges and having no provision to prevent the corners from lifting, is made by _____.

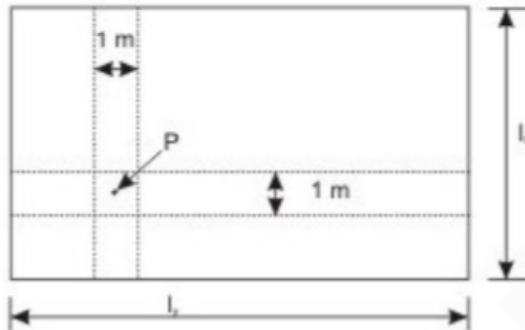
- A. Rankine formula
 B. Marcus formula
 C. Rankine Grashoff formula
 D. Grashoff formula

Ans. C.

The maximum moments per unit width of simply supported slabs, not having adequate provision to resist torsion at corners and to prevent the corners from lifting, are determined from below equations, where a_x and a_y are the respective coefficients of moments. The notations M_x, M_y, w, l_x and l_y are the same as mentioned below equations.

$$M_x = a_x w l_x^2$$

$$M_y = a_y w l_y^2$$



The coefficients a_x and a_y of simply supported two-way slabs are derived from the Grashoff-Rankine formula which is based on the consideration of the same deflection at any point P (above figure) of two perpendicular interconnected strips containing the common point P of the two-way slab subjected to uniformly distributed loads.

86. A flat slab is supported _____.
- on beams
 - on columns
 - on both beams and columns
 - on columns monolithically built with slab

Ans. D.

Flat slab is a reinforced concrete slab supported directly by concrete columns without the use of beams. Flat slab is defined as one sided or two-sided support system with shear load of the slab being concentrated on the supporting columns and a square slab called 'drop panels'. Flat Slabs are considered suitable for most of the construction and for asymmetrical column layouts like floors with curved shapes and ramps etc. The advantages of applying flat slabs are many like depth solution, flat soffit and flexibility in design layout.

The term monolithic means cast at the same time like when slabs are cast or poured the reinforcement of slab and beam are arranged such that there will be fixity at the joint of slab and beam and the entire unit act as single entity.

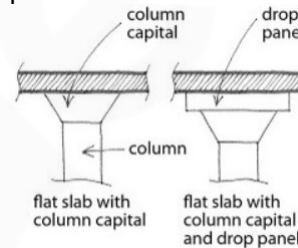
87. Enlarged head of a supporting column of a flat slab is technically known as _____.

- supporting end of the column
- top of the column
- capital
- drop panel

Ans. C.

The column tends to punch through the slab in Flat Slabs, which can be treated by three methods:

- Using a drop panel and a column capital in flat slab
- Using a drop panel without a column capital in flat slab
- Using a column capital without drop panel in flat slab



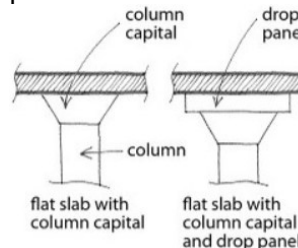
88. Thickened part of a flat slab over its supporting column, is technically known as _____.

- drop panel
- capital
- column head
- None of these

Ans. A.

The column tends to punch through the slab in Flat Slabs, which can be treated by three methods:

- Using a drop panel and a column capital in flat slab
- Using a drop panel without a column capital in flat slab
- Using a column capital without drop panel in flat slab



89. This section of a reinforced beam where most distant concrete fiber in compression and tension in steel attains permissible stresses simultaneously, is called _____.

- A. balanced section
- B. economic section
- C. critical section
- D. All options are correct

Ans. D.

A section is known as balanced section in which the compressive stress in concrete (in compressive zones) and tensile stress in steel will both reach the maximum permissible values simultaneously.

The neutral axis of balanced (or critical) section is known as critical neutral axis (nc). The area of steel provided as economical area of steel. Reinforced concrete sections are designed as balanced sections.

90. The diameter of the column head support a flat slab, is generally kept _____.

- A. 0.25 times of the span length
- B. 0.25 times the diameter of the column
- C. 5.0 cm larger than the diameter of the column
- D. 5.0 cm larger than the diameter of the column

Ans. A.

The effective diameter of a column or a column head is defined as follows:

For a column, the diameter of a circle whose area equals the area of the column

For a column head, the diameter of the column head based on the effective dimensions. The effective diameter of the column head shall be not more than $\frac{1}{4}$ of the shorter span framing into the column.

91. The main advantage of a steel member is _____.

- A. its high strength
- B. its gas and water tightness
- C. its long service life
- D. All options are correct

Ans. D.

Structural steel isn't just for skyscrapers, large agriculture buildings and garages.

There are multiple reasons why steel makes an attractive building option from start to finish, not the least of which are:

- Sustainability
- Affordability
- Durability

Steel is a versatile building material, which has led to its inclusion in nearly every stage of the construction process from framing and floor joists, to roofing materials. Here are some of the main benefits that make structural steel such a reliable choice.

Hence, all options are correct.

92. Rolled steel beams are _____.

- A. mainly used to resist bending stress
- B. used as independent sections to resist compressive stress
- C. used as independent sections to resist tensile stress
- D. All options are correct

Ans. D.

An I-beam, also known as H-beam (for universal column, UC), w-beam (for "wide flange"), universal beam (UB), rolled steel joist (RSJ), or double-T is a beam with an I or H-shaped cross-section. The horizontal elements of the "I" are known as flanges, while the vertical element is termed the "web". I-beams are usually made of structural steel and are used in construction and civil engineering.

The web resists shear forces, while the flanges resist most of the bending moment experienced by the beam. Beam theory shows that the I-shaped section is a very efficient form for carrying both bending and shear loads in the plane of the web. On the other hand, the cross-section has a reduced capacity in the transverse direction, and is also inefficient in carrying torsion, for which hollow structural sections are often preferred.

Hence, all options are correct.

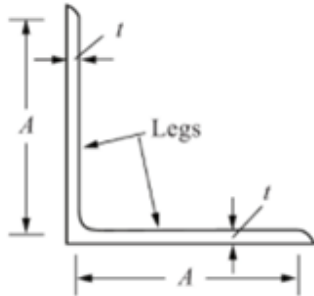
93. Rolled steel angle sections are classified as _____.

- A. equal angles
- B. unequal angles
- C. bulb angles
- D. All options are correct

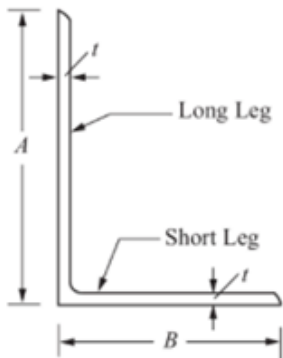
Ans. D.

Rolled steel angle sections are classified into the following two series:

1. Indian Standard Equal Angle – ISA
2. Indian Standard Unequal Angle – ISA.



(a) Rolled steel equal angle.



(b) Rolled steel unequal angle.

94. Pick up the correct statements from the following _____.

- A. Dead load includes self-weight of the structure and super-imposed loads permanently attached to the structure
- B. Dead loads change their positions and vary in magnitude
- C. Dead loads are known in the beginning of the design
- D. None of these

Ans. A.

The dead load includes loads that are relatively constant over time, including the weight of the structure itself, and immovable fixtures such as walls, plasterboard or carpet. The roof is also a dead load. Dead loads are also known as permanent or static loads. Building materials are not dead loads until constructed in permanent position. IS875 (part 1)-1987 give unit weight of building materials, parts, components. When the body remains at rest, the frictional force is called the static friction. Static friction is self-adjusting force.

95. When a load is transferred through one surface to another surface in contact, the stress is known as _____.

- A. tensile stress
- B. compressive stress
- C. shearing stress
- D. None of these

Ans. D.

When a load is exerted or transferred by the application of load through one surface for another surface in contact, the stress is known as bearing stress (σ_p). The bearing stress is calculated on net projected area of contact.

96. Assuming the values of maximum deviation ΔP and ΔE to be 25% of the computed value of P and E respectively, the minimum value of the factor of safety is _____.

- A. 1
- B. 0.67
- C. 1.67
- D. 2.67

Ans. C.

The factor of safety (f.o.s) of a conductor (or ground wire) is the ratio of the ultimate strength of the conductor (or ground wire) to the load imposed under assumed loading condition.

In the Working Stress Method (WSM) of design, the first attainment of yield stress of steel was generally taken to be the onset of failure as it represents the point from which the actual behavior will deviate from the analysis results. Also, it was ensured that non-linearity and buckling effects were not present. It was ensured that the stresses caused by the working loads are less than an allowable stress obtained by dividing the yield stress by a factor of safety. The factor of safety represented a margin for uncertainties in strength and load. The value of factor of safety in most cases is taken to be around 1.67.

$$\text{allowable Stress} = \frac{\text{Yield Stress}}{\text{Factor of Safety}}$$

97. The ratio of hydrostatic stress to the volumetric strain within the elastic range is called _____.

- A. modulus of elasticity
- B. shear modulus of elasticity
- C. Both modulus of elasticity and shear modulus of elasticity
- D. None of these

Ans. B.

The bulk modulus (K or B) of a substance is a measure of how incompressible/resistant to compressibility that substance is.

The bulk modulus, K, is the ratio of hydrostatic stress to the resulting volume change,

$$K = \frac{\text{pressure}}{\text{volume change}}$$

98. Cold driven rivets range from _____.

- A. 6 to 10 mm in diameter
- B. 10 to 16 mm in diameter
- C. 12 to 22 mm in diameter
- D. 22 to 32 mm in diameter

Ans. C.

A rivet that is driven and formed without being preheated.

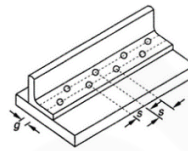
The size of a rivet is usually determined by considering the practical aspects of riveting as well as the strength of the structural element. It is economical to use a small number of large diameter rivets rather than a large number with small diameters. This is because for a given plate thickness, in case the shear controls the design, the strength is directly proportional to the square of the diameter of the rivet and large diameter rivets or rivets with double shear may be a choice. Whereas, if bearing controls the design, the strength is directly proportional to the rivet diameter only and in this case a large number of rivets with small diameter are preferred. The nominal diameter of a rivet is assumed to be between 12-25 mm for joining structural elements.

99. The distance measured along one rivet line from the center of a rivet to the center of adjoining rivet on an adjacent parallel rivet line is called _____

- A. pitch of rivet
- B. gauge distance of rivet
- C. staggered pitch
- D. All options are correct

Ans. C.

Staggered pitch is also known as alternate or reeled pitch. It is the distance measured along one rivet line, from the centre of a rivet on it to the centre of the adjoining rivet on a lower and parallel rivet line, as shown in below figure.



Staggered Pitch

100. When two plates are placed end to end and are joined by two cover plates, the joint is known as _____.

- A. lap joint
- B. butt joint
- C. chain riveted lap joint
- D. double cover butt joint

Ans. D.

Butt Joint: The two members to be connected are placed end to end. Additional plate/plates provided on either one or both sides, called cover plates, are placed and are connected to main plates. If the cover plate is provided on one side, it is called a single cover butt joint but if the cover plates are provided on both the sides of main plates it is called a double cover butt joint.
