

SOIL

- Q.1** Which of the following soil formed by leaching action?
(a) Bentonite soil (b) Peat, muck soil
(c) Laterite soil (d) Alluvial soil
1. **(c)**
- Q.2** Select the incorrect pair
(a) Colluvial soil : Formed due to chemical weathering
(b) Lacustrine soil : Found at bed of still lake
(c) Black cotton soil: Formed due to weathering of basalt rock
(d) Peat soil: Highly organic soil
2. **(a)**
- Q.3** Which of the following range for property of soil is correct?
(a) $0 < n \leq 1$ (b) $e \neq 1$
(c) $0 \leq S \leq 1$ (d) $0 < n_a < 1$
where : n = Porosity e = Void ratio
 S = degree of saturation n_a = Percentage air voids
3. **(c)**
- Q.4** For a soil sample of volume 500 cc,
degree of saturation = 70% and
void ratio found to be 0.5.
The volume of air in soil is
(a) 50 cc (b) 150 cc
(c) 100 cc (d) 200 cc
4. **(a)**
- Q.5** To prepare embankment of 100 m^3 with void ratio of 0.5, _____ m^3 of
soil should be brought from borrow pit in which soil has void ratio of 0.8.
(a) 84 (b) 102
(c) 93 (d) 120
5. **(d)**

Q.6 Consider the following data for a soil sample and select the correct statement

Mass of soil in natural condition = 800 g

Mass of soil after over drying = 600 g

Volume of soil taken = 320 cc

Void ratio = 0.9, $G = 2.7$

- (a) Degree of saturation is 100%
- (b) Saturated unit weight is 2.3 g/cc
- (c) Dry unit weight is 1.75 g/cc
- (d) Water content is 25%

6. (a)

Q.7 Soil sample of uniformly graded soil with spherical particle found at site with natural void ratio of 0.5. The density index of soil is approx

- (a) 35%
- (b) 73%
- (c) 97%
- (d) 50%

7. (b)

Q.8 Which of the following form of water cannot be determined with water content test for soil

- (a) Film water
- (b) Hygroscopic water
- (c) Capillary water
- (d) Structural water

8. (d)

Q.9 Water displacement method is used to determine

- (a) Specific gravity
- (b) Water content
- (c) Unit weight of soil
- (d) Sensitivity of soil

9. (c)

Q.10 Pycnometer test is used to determine specific gravity as well as water content overdry and moist soil respectively

m_1 = mass of empty pycnometer

m_2 = mass of pycnometer and soil (dry or moist based on test)

m_3 = mass of pycnometer soil and water

m_4 = mass of pycnometer and water only.

Which of the following is/are correct?

$$1. \quad G = \frac{m_2 - m_1}{(m_2 - m_1) - (m_4 - m_3)}$$

$$2. \quad W = \left\{ \frac{m_2 - m_1}{m_3 - m_4} \left(\frac{G-1}{G} \right) \right\} - 1$$

$$3. \quad W = \left\{ \frac{m_2 - m_1}{m_4 - m_3} \left(\frac{G}{G-1} \right) \right\} - 1$$

$$4. \quad G = \frac{m_2 - m_1}{m_2 - m_1 + (m_4 - m_3)}$$

- (a) 1 and 2
- (b) 2 and 3
- (c) 2 and 4
- (d) 3 and 4

10. (c)

Q.11 Higher the value of I_f (flow index) signifies.

- (a) Higher permeability (b) Lesser shear strength
(c) Higher void ratio (d) Lesser saturation

11. (b)

Q.12 Liquidity index (w_L) can be determined as

- (a) $\frac{w_L - w}{w_L - w_P}$ (b) $\frac{w - w_L}{w_L - w_P}$
(c) $\frac{w - w_P}{w_L - w_P}$ (d) $\frac{w_P - w}{w_L - w_P}$

12. (c)

Q.13 Which of the following statement is correct?

- (a) Coefficient of uniformity i.e. C_u for uniformly graded soil > 4
(b) Coefficient of uniformity i.e. C_u for well graded gravel > 6

(c) Coefficient of curvature i.e. $C_c = \frac{D_{60}^2}{D_{30} \times D_{10}}$

- (d) Coefficient of curvature for well graded soil can't be less than 1

13. (d)

Q.14 If soil is existing in state of semi solid

- (a) $I_c > 1$ (b) $I_L < 1$
(c) $w_s < w < w_p$ (d) $s < 1$

Which of the above parameter is not correct?

14. (d)

Q.15 Soil particles will be categorized as silt if particle size is

- (a) $< 2\mu$ (b) $2\mu - 75\mu$
(c) $75\mu - 4.75 \text{ mm}$ (d) $4.75 \text{ mm} - 80 \text{ mm}$

15. (b)

Q.16 In a fine grained soil sample 30% is silt content. Which has liquid limit and plasticity index of 60 and 35 respectively. Activity of soil is

- (a) 0.5 (b) 1.17
(c) 2.8 (d) 1.2

16. (a)

Q.17 For a soil suspension hydrometer gives reading of 25 and correction for meniscus and dispersing agent observed to be 2, 1 respectively. The corrected density of soil suspension is

- (a) 1.028 g/cc (b) 1.025 g/cc
(c) 1.026 g/cc (d) 1.024 g/cc

17. (c)

Q.18 Consider the following data for a soil sample

Plastic limit = 27, liquid limit = 40

Percentage finer than $75 \mu = 75\%$

Soil can be classified as

- (a) CL (b) MI
(c) ML (d) CH

18. (b)

Q.19 Which of the following statement doesn't show property of GP-GC soil

- (a) It is a poorly graded clayey gravel
(b) It has coefficient of uniformity 2
(c) It has plasticity index more than 8
(d) Percentage finer than 75μ is 3%

19. (d)

Q.20 Consider following result of sieve set and find out sample which can be classified as SC i.e. clayey sand

- | | |
|---|---|
| (a) $\frac{40\%}{30\%} \frac{4.75\%}{75\mu}$ | (b) $\frac{5\%}{15\%} \frac{4.75 \text{ mm}}{75\mu}$ |
| (c) $\frac{30\%}{30\%} \frac{4.75 \text{ mm}}{75\mu}$ | (d) $\frac{10\%}{60\%} \frac{4.75 \text{ mm}}{75\mu}$ |

20. (d)

Q.21 Correct equation of U-line is

- (a) $I_p = 0.73 (w_L - 20)$ (b) $I_p = 0.9 (w_L - 20)$
(c) $I_p = 0.9 (w_L - 8)$ (d) $I_p = 0.73 (w_L - 8)$

21. (c)

Q.22 Height of capillary in soil is proportional to

- (a) Plasticity index (b) Grain size
(c) Void ratio (d) Water content

22. (a)

Q.23 Net charge over kaolinite mineral is

- (a) - 1 (b) +1
(c) 0 (d) -2

23. (c)

Q.24 Montmorillonite

- (a) is 2 : 1 mineral i.e. 2 octahedral unit and 1 silica tetrahedral unit
(b) is least compressible
(c) has net charge of +1
(d) result into maximum volume changes i.e. high activity value

24. (d)

Q.25 Disperse structure of clay

- (a) has lesser strength
(b) less permeable
(c) face to face orientation
(d) all of the above

25. (d)

Q.26 Match List-1 and List-2 with given code below.

List-1 (Clay mineral)

- A. Kalonite
B. Montmorillonite
C. Illite

List-2 (Example)

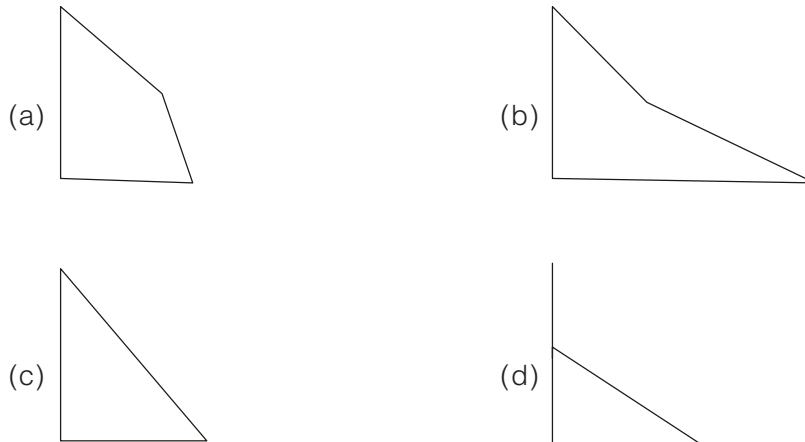
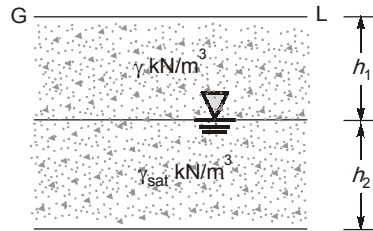
1. China clay
2. Laterite soil
3. Black cotton soil

Code:

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

26. (a)

Q.27 Select correct effective stress diagram for given ground condition



27. (a)

Q.28 Due to rise in capillary by h_c amount the effective stress at a section

- (a) increases by γh_c (b) decrease by $\gamma_w h_c$
 (c) increase by $\gamma_w h_c$ (d) decrease by γh_c

28. (c)

Q.29 Rise in WT doesn't affect the effective stress at a section if

- (a) WT is at G/L (b) WT is above G/L
 (c) WT is below G/L (d) All of the above

29. (b)

Q.30 Shrinkage limit of soil can be found as

- (a) $w_s = \frac{1}{G} - \frac{1}{G_D}$ (b) $w_s = \frac{G}{G_D}$
 (c) $w_s = \frac{G}{G_D} - \frac{1}{G}$ (d) $w_s = \frac{G_D}{G}$

30. (c)

Q.31 Relationship between average velocity (v) of flow and seepage velocity (v_s) is

- (a) $v_s = nV$ (b) $v = nV_s$
(c) $v = \frac{V_s}{n}$ (d) $vv_s = n$

31. (b)

Q.32 Coefficient of permeability of soil is proportional to

- (a) Presence of entrapped gases (b) Temperature
(c) Dynamic viscosity of fluid (d) Presence of adsorbed water

32. (b)

Q.33 In constant head permeability test 600 ml water collected through soil of c/s area of 60 cm² in 60 sec under hydraulic gradient of 0.5. The coefficient of permeability for soil is

- (a) 0.67 cm/s (b) 0.22 cm/s
(c) 0.33 cm/s (d) 0.87 cm/s

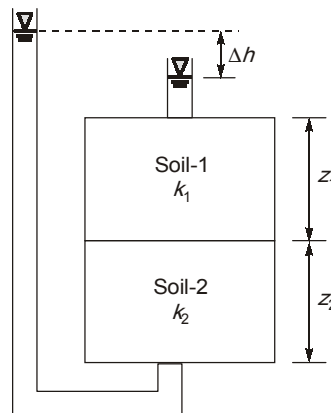
33. (c)

Q.34 Three observations of head are taken in falling head permeability test for same soil sample in similar time interval find out the most correct possible observation:

- (a) 20, 35, 50 (b) 20, 25, 30
(c) 20, 40, 80 (d) 20, 40, 60

34. (c)

Q.35 Consider the following flow condition. The equivalent permeability is



- (a) $k_{eq} = \frac{z_1 + z_2}{k_1 z_1 + k_2 z_2}$ (b) $k_{eq} = \frac{k_1 z_1 + k_2 z_2}{k_1 + k_2}$
(c) $k_{eq} = \frac{z_1 + z_2}{\frac{z_1}{k_1} + \frac{z_2}{k_2}}$ (d) $k_{eq} = \frac{z_1 + z_2}{\frac{k_1}{z_1} + \frac{z_2}{k_2}}$

35. (c)

- Q.36** In a 1 m thick soil skeleton ($e = 0.6$, $G = 2.6$) flow is taking place under head loss of 0.5 m, the FOS against piping failure is
(a) 1 (b) 2.5
(c) 2 (d) 3
- 36. (c)**
- Q.37** Quick sand condition occurs in
(a) Pure clay (b) Sandy silt
(c) Gravel (d) Well graded sand
- 37. (b)**
- Q.38** In downward seepage flow, at any section
(a) Pressure head increased by iz
(b) Effective stress increased by $iz\gamma_w$
(c) Total head remain same
(d) Pore water pressure increase by $iz\gamma_w$
- 38. (b)**
- Q.39** Flow net has which of the following property
(a) It is a graphical representation of Laplace equation
(b) discharge is parallel to flow line and perpendicular to equipotential line
(c) total head loss equally divided into equipotential line
(d) all of these
- 39. (d)**
- Q.40** By increasing compaction effort optimum moisture content _____ and maximum dry density _____.
(a) Increases, decreases (b) Decreases, decreases
(c) Increases, Increases (d) Decreases, Increases
- 40. (a)**
- Q.41** At dry side of optimum soil shows
(a) more swelling (b) more deficiency of water
(c) flocculent structure (d) all of these
- 41. (d)**
- Q.42** Which of the following equipment suitable for clayey soil?
(a) smooth wheeled roller (b) vibratory roller
(c) sheepfoot roller (d) none of these
- 42. (c)**

Q.43 Coefficient of consolidation is

(a) $c_v = \frac{m_v}{k\gamma_w}$

(b) $c_v = \frac{m_v K}{\gamma_w}$

(c) $c_v = \frac{\gamma_w}{km_v}$

(d) $c_v = \frac{K}{m_v \gamma_w}$

43. (d)

Q.44 For 10 cm thick clay sandwiched between two gravel layer and has $C_v = 0.002$ cm^2/s . The time required for 50% consolidation is _____ sec.

(a) 2084

(b) 1667

(c) 2500

(d) 2290

44. (c)

Q.45 If clay subjected to stress over soil in past history is more than stress in present, known as

(a) Under consolidated clay

(b) Over consolidated clay

(c) Normally consolidated clay

(d) Sensitive clay

45. (b)

Q.46 A 5 m thick layer subjected to stress of 100 kPa. The settlement of clay layer is _____ mm if coefficient of volume compressibility is $3 \times 10^{-4} \text{ m}^2/\text{kN}$

(a) 0.15

(b) 1.5

(c) 15

(d) 150

46. (d)

Q.47 In above question, calculate void ratio of clay after settlement if initial void ratio is 0.8

(a) 0.446

(b) 0.582

(c) 0.646

(d) 0.192

47. (a)

Q.48 The compression index of soil will be approx _____ if liquid limit of soil for undisturbed sample is 40%.

(a) 0.42

(b) 0.24

(c) 0.27

(d) 0.18

48. (c)

Q.49 Stress due to external load at any depth is

- (a) $\sigma_z \propto z^2$ (b) $\sigma_z \propto \frac{1}{z}$
(c) $\sigma_z \propto \frac{1}{z^2}$ (d) $\sigma_z \propto z$

49. (c)

Q.50 The unit for coefficient of compressibility is

- (a) cm^2/s (b) m^2/kN
(c) s/cm^2 (d) kN/m^2

50. (b)

Q.51 In the Mohr circle analysis for pure sand

- (a) Failure tangent starts from origin
(b) Critical angle $\theta_c = 45 + \frac{\phi}{2}$
(c) shear stress at failure is lesser than maximum shear strength
(d) all of the above

51. (d)

Q.52 Most suitable lab test of shear strength to be performed over soft clay

- (a) Direct shear test
(b) Vane shear test
(c) Unconfined compressive strength test
(d) any one the above

52. (b)

Q.53 In a Triaxial test performed on sandy soil having $\phi = 30^\circ$ the cell pressure applied is 100 kPa. The deviator stress is to applied for failure is _____.

- (a) 300 kPa (b) 200 kPa
(c) 100 kPa (d) 500 kPa

53. (b)

Q.54 The fastest condition to perform triaxial test is

- (a) CD test (b) UU test
(c) CU test (d) UD test

54. (b)

Q.55 Unconfined compressive strength of a saturated clay sample is 150 kPa, the shear strength of clay is _____ kPa.

- (a) 75 (b) 300
(c) 150 (d) 37.5

55. (a)

Q.56 In which of the following condition only one unique Mohr circle development is possible for clay

- (a) Total stress analysis U-U test
(b) Total stress analysis C-D test
(c) Effective stress analysis U-U test
(d) Effective stress analysis C-D test

56. (c)

Q.57 Select the incorrect statement regarding pore pressure parameter given by skempton

- (a) $B = \frac{\Delta u}{\Delta \sigma_3}$ (b) $\bar{A} = \frac{\Delta u}{\Delta \sigma_d}$
(c) $\bar{A} = AB$ (d) $\Delta u = B[\Delta \sigma_1 + A(\Delta \sigma_1 - \Delta \sigma_3)]$

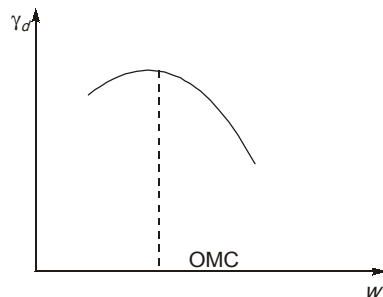
57. (d)

Q.58 The active earth pressure at top of vertical wall having pure cohesive soil as backfill is _____ kPa.

- (a) 0 (b) $-2C$
(c) $2C$ (d) 1

58. (b)

Q.59 The given compaction curve is for well graded sand



The curve will shift _____ for high compressible clay.

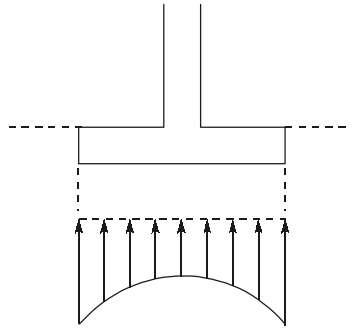
- (a) upward left side (b) downward rightside
(c) upward right side (d) upward left side

59. (b)

- Q.60** In active state of earth pressure
 (a) wall move away from backfill
 (b) shearing resistance mobilized upward
 (c) backfill tends to move along wall downward
 (d) all of the above
- 60. (d)**
- Q.61** For any angle of friction of soil
 (a) $K_P < K_O < K_A$
 (b) $K_O > K_A > K_P$
 (c) $K_P > K_O > K_A$
 (d) $K_A > K_P > K_O$
- 61. (c)**
- Q.62** Active earth pressure at bottom of wall of H height, will be _____ if backfill is saturated upto G/L.
 (a) $K_a \gamma_{\text{sat}} H + K_a \gamma_w H$
 (b) $K_a \gamma_{\text{sat}} H$
 (c) $K_a \gamma' H + \gamma_w H$
 (d) $K_a \gamma_{\text{sat}} H + \gamma_w H$
- 62. (c)**
- Q.63** Which of the following not included in Rankine theory of Earth pressure?
 (a) Inclined backfill
 (b) Wall friction
 (c) Cohesionless soil
 (d) Isotropic
- 63. (b)**
- Q.64** A pure cohesion soil ($\gamma = 16 \text{ kN/m}^3$, $c = 20 \text{ kPa}$) placed as backfill behind 6 m vertical wall. The depth of tension crack is
 (a) 5 m
 (b) 5.5 m
 (c) 2.5 m
 (d) 3.2 m
- 64. (c)**
- Q.65** Shear strength for a remoulded sample of clay and undisturbed sample of clay found to be 50 kPa and 75 kPa. The sensitivity of clay is
 (a) 1.5
 (b) 0.67
 (c) 1.8
 (d) 2
- 65. (a)**
- Q.66** Plate load test performed over a cohesive soil with a circular plate of 30 cm diameter which results into settlement of 20 mm. By keeping all parameter same, the settlement of 3 m diameter footing over same soil will be _____.
 (a) 20 mm
 (b) 200 mm
 (c) 0.2 mm
 (d) 2 mm
- 66. (b)**

- Q.67** Higher the SPT value for a soil
(a) stiffer the consistency (b) denser the soil
(c) higher the friction angle (d) all of the above
- 67. (d)**
- Q.68** Net ultimate bearing capacity of cohesive soil as per skempton will be _____ kPa if strip footing is built over ground level.
(a) 5.7 c (b) 5 c
(c) 6 c (d) 9 c
- 68. (b)**
- Q.69** Undreamed pile are suitable for
(a) Cohesive soil (b) Expansive soil
(c) Gravelly soil (d) Marine soil
- 69. (b)**
- Q.70** A strip footing built over sandy soil having water table at footing level. Net bearing capacity of soil can be calculated as
(a) $q_{nu} = \gamma D_F(N_q - 1) + 0.5 \gamma' B N_\gamma$ (b) $q_{nu} = \gamma' D_F(N_q - 1) + 0.5 \gamma' B N_\gamma$
(c) $q_{nu} = \gamma' D_F(N_q - 1) + \gamma' B N_\gamma$ (d) $q_{nu} = \gamma D_F(N_q - 1) + 0.5 \gamma_{sat} B N_\gamma$
- 70. (a)**
- Q.71** Property of general shear failure
(a) The soil has $I_D < 30\%$
(b) It doesnot result into heaving of soil
(c) Stress path doesn't reach upto G/L
(d) None of these
- 71. (d)**
- Q.72** SPT conducted over a soil having WT at G/L and observed SPT number is 23. What would be corrected SPT value if overburden pressure correction is 1.
(a) 19 (b) 28
(c) 23 (d) 12
- 72. (c)**

Q.73 Consider the given pressure distribution diagram



- (a) Flexible footing over clay soil (b) Rigid footing over sandy soil
(c) Flexible footing clayey soil (d) Rigid footing over clayey soil

73. (d)

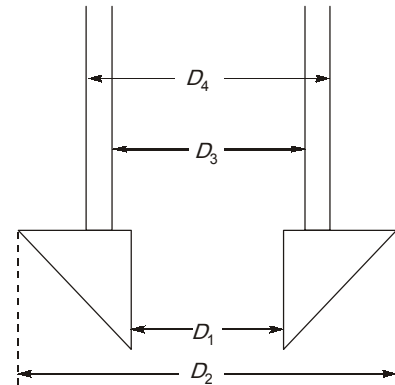
Q.74 Consider the following sampler and choose incorrect statements

(a) Inside clearance = $\frac{D_3 - D_1}{D_1} (1 - 3\%)$

(b) Outside clearance = $\frac{D_2 - D_4}{D_4} (0 - 2\%)$

(c) area ratio = $\frac{D_2^2 - D_1^2}{D_1^2} (10 - 20\%)$

(d) Recovery length < 1 for soil subjected to swelling



74. (d)

Q.75 Lime stabilization of plastic clay results into

- (a) decrement in swelling shrinkage
(b) decrement in plasticity index
(c) increment in dry density
(d) all of the above

75. (d)

