Q1- A sample of soil has volume (0.0183) m^3 and a mass of (30.6) kg, when it dried out in an oven its mass was reduced to (27.2) kg. If it is known that the specific gravity of the solid is (2.65) and volume of solid is (0.01) m^3 then determine:
1- water content 2- void ratio 3- porosity 4- degree of saturation

Q2- A full saturated soil sample was tested in the laboratory and the following results were obtained: mass of solid particles (18) g, volume of water (4.6) cm^3, volume of solid (6.2) cm^3. Determine:
1- Porosity 2- void ratio 3- moisture content 4- water content

Q3- From a laboratory testing on a sample providing the following results:
Total pore volume = 3 cm^3
Solid mass = 7 g
Volume of solid = 4.6 cm^3
Water content = 40%
Determine:
1- Moisture content 2- porosity 3- void ratio 4- degree of saturation

Q4- A sample of soil had a mass of (22.8) kg and a volume of (9840) cm^3 in its natural state , its dry mass was (18.5)kg. If it is known that the total volume of solid particles is 5890 m^3, calculate:
1- volume of air 2- void ratio 3- porosity 4- degree of saturation

Q5:A sample of soil has a mass of 168g , after drying the mass becomes 142g .The volume of the sample is 90cm^3 and the specific gravity of the sand is 2.65, Determine:
1- Water content 2- Dry unit weight 3- Void ratio 4- Porosity
5- Bulk density 6- Degree of saturation.

Q6: A full saturated sample was tested at the laboratory and the following results were obtained:
Mass of solid particles (g) = 15
Volume of water (cm^3) = 4.4
Volume of solids (cm^3) = 5.6
Determine:
1- porosity 2- void ratio 3- moisture content 4-water content

Q7: The total volume of a soil sample is 500cm^3, its total mass is 800g and the mass and volume of its solid particles are 700g and 260cm^3 respectively. Find:

1-porosity 2-void ratio 3-water content 4-moisture content 5-degree of saturation

Q8: The following results were computed from testing of a soil sample:

water content = 35%

volume of soil particles = 4cm^3

mass of solid particles = 11g

volume of air = 0.15cm^3

Determine :

1-moisture content 2- void ratio 3- porosity 4-degree of saturation

Q9: A sample of soil had a mass of 18.112 kg and a volume of 9340 cm^3 in its natural state. Its dry mass was 15.667 kg. If you know that the total volume of solid particles was 5860cm^3, calculate:

1-volume of air 2- void ratio 3- porosity 4- degree of saturation

Q10- A bedding plane dips 300°/30°, and a slope surface inclines at 300°/40°. Assuming there are release surfaces and the friction angle of the bedding is 29°, will sliding occur? Plot the data stereographically. (C = 0)

Q11:- A fault plane is dipping 180°/50°, and a slope surface is dipping 360°/40° , the friction angle of the fault is 28°. Discuss the possibility of sliding of the fault plane if it is known that the cohesion is zero.

Q 12- A bedding plane dipping 090°/50° intersects a fault plane is dipping 350°/60°,the slope surface is inclined at 040°/60° and the friction angle of the intersection line for the bedding plane and the fault is 33°. Discuss the type and possibility of sliding if it is known that the cohesion is zero.

Q13-In a triaxial shear test conducted on a soil sample having cohesion of 25 kN/m^2 and angle of internal friction of 36°, the cell pressure was 200 kN/m^2. Determine the value of deviator stress at failure.

Q14-A fault plane is dipping 180°/30°, and a slope surface is dipping 180°/40°, the friction angle of the fault is 33°. Discuss the possibility of sliding for the fault plane if it is known that the cohesion is zero.

Q15-Classify the soils in the table below according to the Unified soil classification (use the chart if it is necessary).

Sample no.	1	2	3	4
Sieve no.	Percentage mass retained	Percentage mass retained	Percentage mass retained	Percentage mass retained
No.4	62%	23%	36%	52%
No.200	35%	22%	46%	38%
Pan	3%	55%	18%	10%
Cc	2	4	5	2.5
Cu	3	1	7	6
L.L	40%	45%	42%	39%
P.L	30%	25%	32%	18%

Q16 -Determine the discharge and the saturated thickness of an aquifer with area of 424000m^2 if it is known that the transmissivity is 18 m^2/day and the hydraulic conductivity is 1.4 m/day (i = 0.06).

Q17-Determine the potential evapotranspiration values for Harir basin and the monthly water Surplus and water Deficit by using a suitable method for the data in the table below.

Month	P	T	r
October	19.87	24.72	8.16
November	53.35	13.98	5.21
December	70.66	11.23	4.15
January	81.15	8.33	4.28
February	54.71	9.08	5.54
March	76.09	12.32	5.92
April	50.82	17.18	6.57
May	15.83	23.98	8.41
June	1.74	29.37	10.36
July	0.58	32.55	10.12
August	0	31.53	10.15
September	1	27.31	9.04

Q18-A triaxial compressive test was performed on a soil sample, and the following data in the table below were obtained. Determine the shear strength parameters of the soil and its Coloumb equation.

Soil sample	s_3	s_1
A	69	345
B	138	466
C	207	590

Q19-Classify the soils according to the Unified soil classification for the data in the following Table:

	Sample 1	Sample 2
Percent retained on sieve 4.75mm	63%	40%
Percent retained on sieve 200mm	34%	59%
Percent retained on the pan	3%	1%
Cc	2	2.5
Cu	3	7
L.L	38%	40%

P.L	29%	19%

Q20- A sample of soil has a volume 0.0183 m^3 and a mass of 30.6 kg .The dry mass is 27.2 kg and the volume of solid is 0.01,if it is known that the specific gravity of the soil grain is 2.65 then determine the bulk density, dry density ,water content ,void ratio ,porosity and the degree of saturation.

Q21-The following data refer to a sample of soil:

Percent passing 4.75 mm sieve = 54 %
Percent passing 0.075 mm sieve = 9 %
Uniformity Coefficient = 5.5
Coefficient of Curvature = 2.7
Liquid Limit = 35
Plasticity Index = 20

Classify the soil according to the Unified soil classification (use the following chart if it is necessary).

Q22- A sample of soil has a mass of 168g , after drying the mass becomes 142g .The volume of the sample is 90cm^3 and the specific gravity of the sand is 2.65, Determine:

1- Water content 2- Dry unit weight 3- Void ratio 4- Porosity
5- Bulk density 6- Degree of saturation.

Q23- The following data refer to a sample of soil:

Percent passing 4.75 mm sieve = 64 %
Percent passing 0.075 mm sieve = 11 %
Uniformity Coefficient = 5
Coefficient of Curvature = 2.5
Mass of dry soil = 15.35g
Mass of water =6.91g
No. of blows =30
Plasticity limit = 23 %

Classify the soil according to the Unified soil classification (use the following chart if it is necessary).

Q24-A direct shear test was conducted on a sample of dry sand, by applying a normal stress of 205 kN/m^2 ,the shear stress at failure was 140 kN/m^2. Find the shear strength parameters and shear strength equation of the sample .If a normal load of 400N is applied on the same sample ,then determine the shear force at failure (sample diameter is 50mm)?

Q25- A bedding plane dips N/30°, and a slope surface inclines at N/40°. If the friction angle of the bedding is 32°, discuss the type and possibility of sliding (C = 0)?

Q26- A sample of soil subjected to confining pressure of 115kPa, Determine the deviator stress if the inclination of the failure plane is 56^o and the cohesion is 180kpa?

Q27-Classify the soils in the table below according to the Unified soil classification (use the chart if it is necessary).

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	retained mass%	retained mass%	retained mass%	retained mass%	retained mass%
Sieve no.4	62%	23%	35%	36%	52%
Sieve no.200	35%	22%	62%	46%	38%

Pan	3%	55%	3%	18%	10%
Cc	2	4	1.5	5	2.5
Cu	3	1	9	7	6
L.L	40%	45%	40%	42%	39%
P.L	30%	25%	32%	32%	18%

Q28- A triaxial test was conducted on samples of a soil. The results are obtained in the table below. Determine the shear strength parameters and inclination of the failure plane ?

Soil Sample	Confining pressure (kPa)	Deviator stress at failure (kPa)
A	100	645
B	150	700
C	200	764

Q29- Determine the liquid limit for the following experimental test by using Casagrande method?

Test No.	1	2	3
Number of blows	30	23	18
Mass of can + moist soil (g)	34.06	32.47	37.46
Mass of can + dry soil (g)	27.15	25.80	29.00
Mass of can (g)	11.80	11.61	11.69

Q30- A sample of soil has a volume 464 cm^3 and a mass of 793 g .The dry mass is 735 g and the volume of solid is 274cm^3, if it is known that the specific gravity of the soil grain is 2.68 then determine the following:

1- Bulk density 2- Dry density 3-Water content 4-Void ratio
5- Porosity 6- Degree of saturation.

Q31- Classify the soils in the table below according to the Unified soil classification (use the chart if it is necessary).

	Sample 1	Sample 2
Percent mass retained on sieve no. 4	52%	35%
Percent mass retained on sieve no. 200	38%	62%
Water content	45%	34%
No. of blows	30	22
Cc	2.5	1.5
Cu	6	3
P.L	16%	25%

Q32- The total volume of a soil sample is 500cm^3, its total mass is 800g. The mass and volume of the solid particles are 700g and 260cm^3 respectively. Find:

a) porosity b) void ratio c) water content d) moisture content e) degree of saturation

Q 33. The following results were computed from testing of a soil sample:

water content = 35%, volume of soil particles = 4cm^3, mass of solid particles = 11g, volume of air = 0.15cm^3.

Determine the moisture content, void ratio, porosity and degree of saturation of the sample.

Q34) Two fully saturated soil samples were tested at the laboratory and the following results were obtained. Determine the porosity, void ratio, moisture content, water content of each sample.

Sample	**1**	**2**
Mass of solid particles (g)	15	20
Volume of water (cm^3)	4.4	4.2
Volume of solids (cm^3)	5.6	7.4

Q 35. The mass of the soil sample was 18.112 Kg and a volume was 9340 cm^3 in its natural state. The dry mass was 15.667 Kg. If you know that the total volume of solid particles was 5860cm^3, calculate the volume of air, void ratio, porosity and the degree of saturation of the sample.

Q 36. Pore volume of the soil sample was 3cm^3, mass of solid particles was 7gm, volume of solid particles was 4.6cm^3 and the water content was 40%. It is required to determine:

moisture content, porosity, void ratio and degree of saturation.

Q 37 . A full saturated soil has a mass of 212g. When oven-dried, the mass is 162g and the total volume of this sample is 110cm$^{3.}$

Determine the dry unit weight, dry density, specific gravity of the soil particles and the water content of the sample.

Q 38. A- Determine the bulk density, dry density, saturated density and degree of saturation from the following data:

$e = 0.75$ $V_s = 1\ m^3$ $w\% = 18\%$ $\rho_s = 2650\ kg/m^3$

B- What will be the water content when the soil is fully saturate? (Sr% = 100%)

Q 39 -Determine the water content, bulk unit weight, dry unit weight, true unit weight, void ratio and degree of saturation from the following data:

Total volume: 8625 cm^3

Oven-dry weight: 140N
Total weight: 165N
Specific gravity of soil particles: 2.7

Q 40) By using the following sieve analysis results, determine the amount of gravel, sand and fine particles in percentage and then draw grain size distribution curve and determine the parameters of Cu and Cc for the soil sample.

Sieve No.	Diameter (mm)	Mass of soil retained (g)			
4	4.75	20.4			
10	2.00	4.2			
20	0.850	9.2			
40	0.425	31.6			
60	0.250	45.4			
80	0.180	70.4			
100	0.150	149			
200	0.075	8.8			
Pan		1			
		ΣM =			

Q 41) The results below were obtained in a sieve analysis of a soil sample (coarse grain part of the sample). Draw grain size distribution curve for the soil sample and determine the amount of gravel, sand and fine particles in percentage.

Sieve No.	Diameter (mm)	Mass of soil retained (g)			
4	4.75	0			
10	2.00	80			
20	0.850	120			
40	0.425	178			
60	0.250	280			
80	0.180	244			
100	0.150	420			
200	0.075	112			
Pan		366			
		ΣM =			

Q42. Complete the grain size distribution curve by using the following readings that obtained from the hydrometer analysis of the fine grain part of the soil sample and after that determine the Uniform coefficient and Coefficient of concavity the soil sample. In addition find the percentage for the soil (Gravel, Sand and fine grain)?

Mass of soil sample: 50g

Specific Gravity of solid particles: 2.65

Meniscus Correction: +1

Zero Correction: +5

Elapsed Time (min.)	Temp. (C°)	Actual reading (Ra)	Reading corrected for meniscus (R)	L	K	D (mm)	C_T	a	Corrected Reading (Rc)	Finer percent (F %)	Adjusted Finer percent (F_A %)

2	22	40									
4	22	34									
8	22	32									
15	22	30									
30	21	27									
60	21	21									
240	20	18									
1440	19	13					-				

Q 43) In the laboratory the following result have been collected from different experiments, Determine the liquid limit, plastic limit and plasticity index.

A- Liquid limit test (Casagrande method):

Test No.	1	2	3
Can No.	A-1	A-2	A-3
Number of blows	30	23	18
Mass of can + moist soil (g)	34.06	32.47	37.46
Mass of can + dry soil (g)	27.15	25.80	29.00
Mass of can (g)	11.80	11.61	11.69
Mass of water (g)			
Mass of dry soil (g)			
Water content (%)			

Plastic limit test:

Test No.	1	2
Can No.	A-4	A-5
Mass of can + moist soil (g)	15.47	16.27
Mass of can + dry soil (g)	14.79	15.46

Mass of can (g)	11.56	11.68
Mass of water (g)		
Mass of dry soil (g)		
Water content (%)		
Plastic limit (%) =		

Q 44. Determine the liquid limit, plastic limit and plasticity index from the following test results.

Liquid limit test (Cone penetration method):

Test No.	1		2		3		4	
Can No.	B-1		B-2		B-3		B-4	
Cone penetration (mm)	15.5	15.1	19	19	22.0	21.8	25.4	25.2
Average penetration (mm)								
Mass of can + moist soil (g)	46.78		57.20		63.60		71.72	
Mass of can + dry soil (g)	32.51		38.31		41.64		45.78	
Mass of can (g)	8.31		8.35		8.26		8.29	
Mass of water (g)								
Mass of dry soil (g)								
Water content (%)								

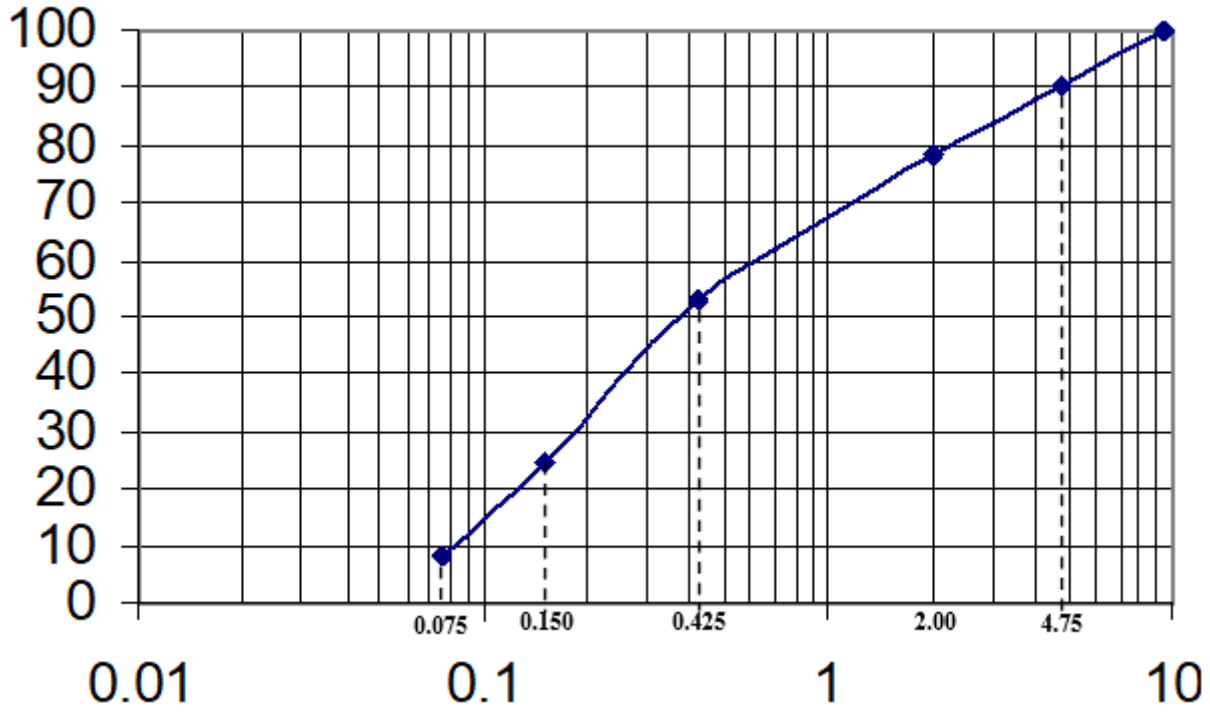
Plastic limit test:

Test No.	1	2	3
Can No.	C-1	C-2	C-3
Mass of can + moist soil (g)	14.99	15.06	17.62
Mass of can + dry soil (g)	13.48	13.60	15.58
Mass of can (g)	7.94	7.99	7.97
Mass of water (g)			
Mass of dry soil (g)			
Water content (%)			
Plastic limit (%) =			

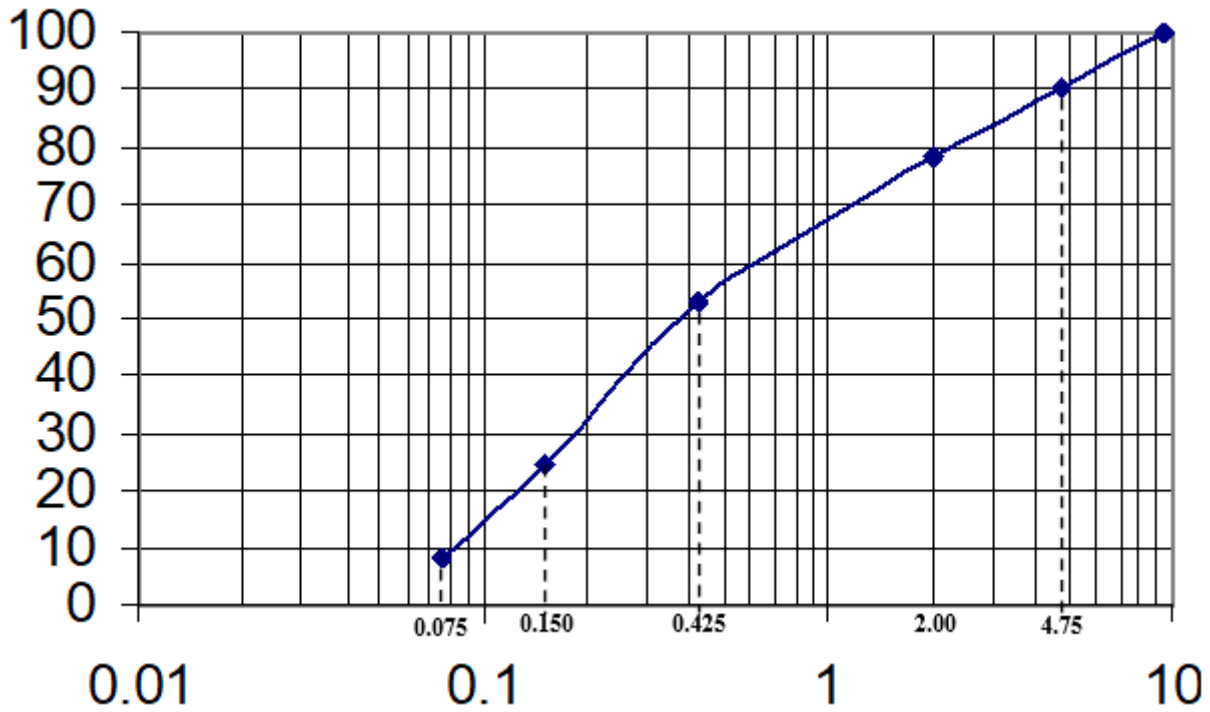
Q 45) The Five soil samples were tested in the laboratory and the following results has been collected by using grain size analysis and Atterberg limit. It is required to classify soil samples according to the Unified Soil Classification system (USCS).

Sample No.		1	2	3	4	5
Sieve No.	D. (mm)	Finer%	Finer%	Finer%	Finer%	Finer%
1 in.	25.0	100	100	100	100	100
3/4 in.	19.00	85	100	100	100	100
3/8 in.	9.50	60	100	100	100	100
No. 4	4.75	48	100	100	94	88
No. 10	2.00	30	85.6	100	63	82
No. 40	0.425	16	72.3	94	10	75
No. 100	0.150	10	65.2	66	5	69
No. 200	0.075	2	58.8	45	3	63
Liquid limit		–	46.2%	40%	–	23
Plastic limit		NP (nonplastic)	21.9%	30%	NP (nonplastic)	17

Q 46) A samples of soil were tested in the laboratory and the following grain size distribution curve was constructed by plotting the obtained results. Knowing that the liquid and plastic limits are 39% and 31% respectively, Classify the soil according to the Unified Soil Classification system.



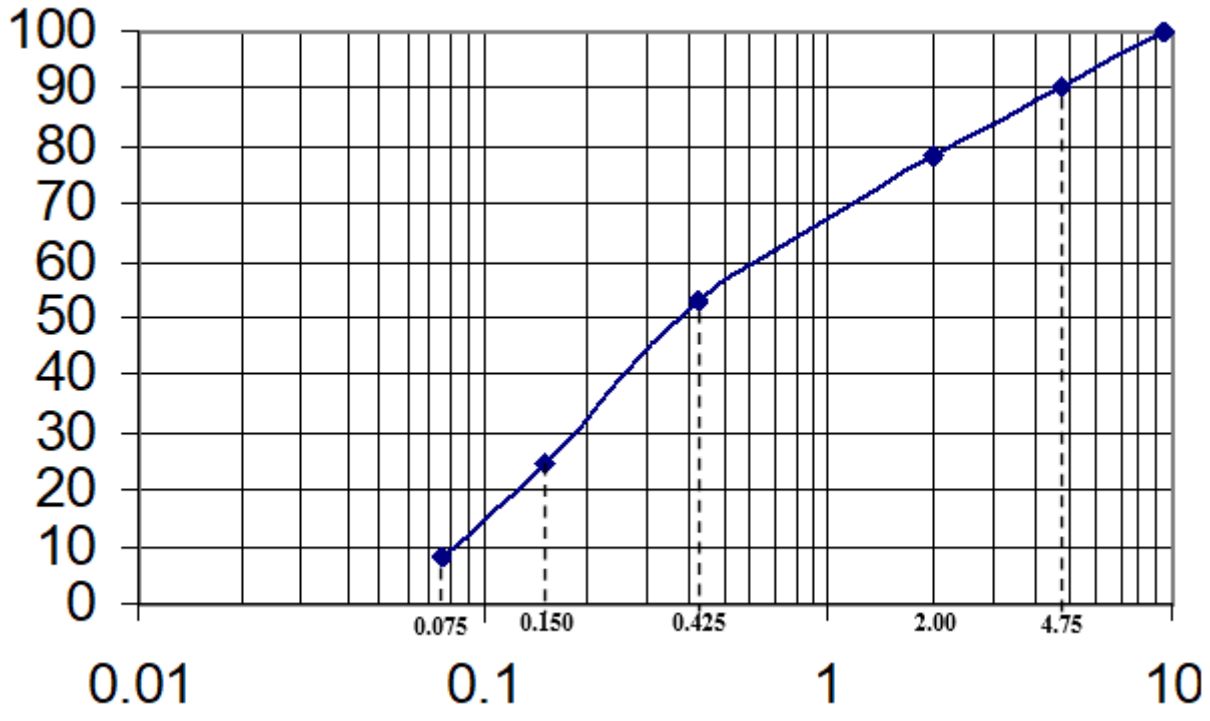
Q 47) A samples of soil were tested in the laboratory and the following grain size distribution curve was constructed by plotting the obtained results. Classify the soil according to the Unified Soil Classification system.



Q 48) A samples of soil were tested in the laboratory and the following grain size distribution curve was constructed by plotting the obtained results. Knowing that the liquid and plastic limits are 23% and 17% respectively, Classify the soil according to the Unified Soil Classification system.

Sample No.		1
Sieve No.	D. (mm)	Finer%
1 in.	25.0	100
3/4 in.	19.00	100
3/8 in.	9.50	100
No. 4	4.75	88
No. 10	2.00	82
No. 40	0.425	75
No. 100	0.150	69
No. 200	0.075	63
Liquid limit		23
Plastic limit		17

Q 49- A samples of soil were tested in the laboratory and the following grain size distribution curve was constructed by plotting the obtained results. Knowing that the liquid and plastic limits are 10% and 31% respectively, Classify the soil according to the Unified Soil Classification system.



Q 50 A samples of soil were tested in the laboratory and the following grain size distribution curve was constructed by plotting the obtained results. Knowing that the liquid and plastic limits are 5% and 20% respectively, Classify the soil according to the Unified Soil Classification system.

Sample No.		1
Sieve No.	D. (mm)	Finer%
1 in.	25.0	100
3/4 in.	19.00	85
3/8 in.	9.50	60
No. 4	4.75	48
No. 10	2.00	30
No. 40	0.425	16
No. 100	0.150	10
No. 200	0.075	2