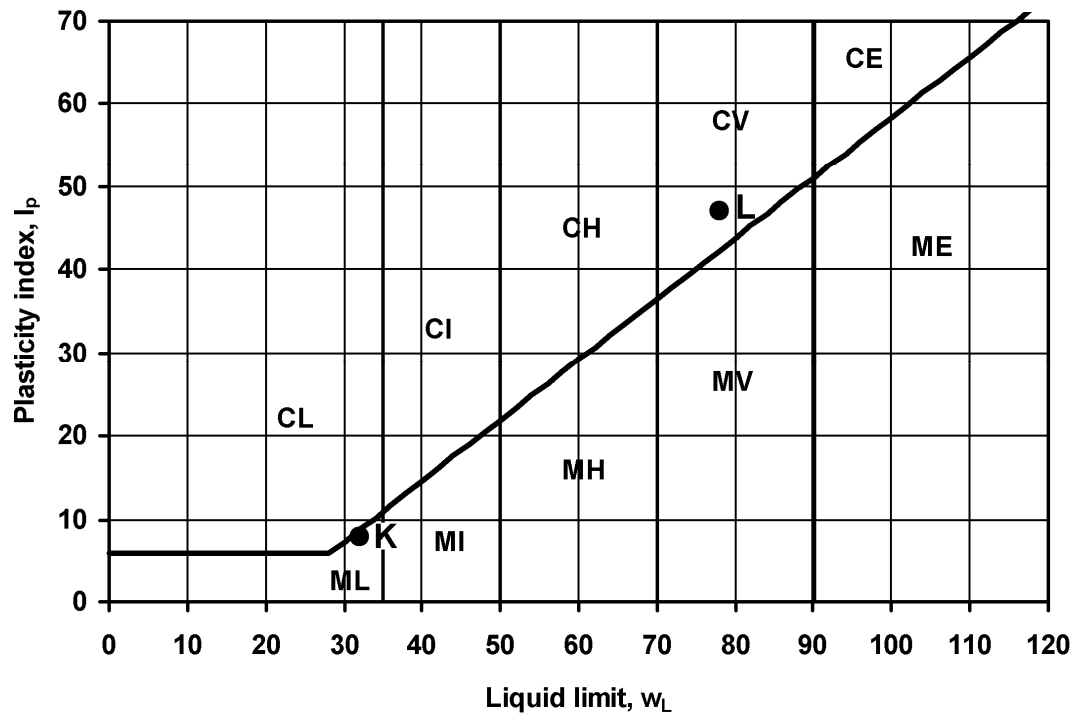
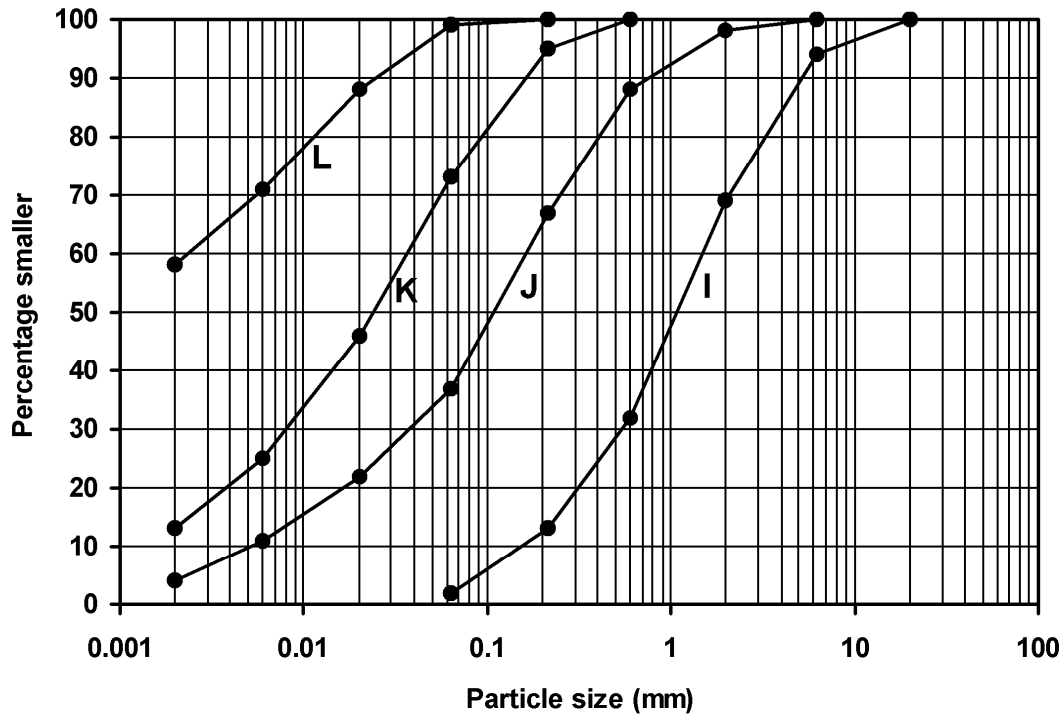


Working:

Output :



	Craig's Soil Mechanics: Ninth Edition	
	Chapter 1: Basic characteristics of soils	Author: JAK, RFC
	Problem No. : 1.1	Page No. : 2 of 2

Working:	Output :
Soil I consists of 98% coarse material (31% gravel size; 67% sand size) and 2% fines. It is classified as SW: well-graded gravelly SAND or, in greater detail, well-graded slightly silty very gravelly SAND.	SW
Soil J consists of 63% coarse material (2% gravel size; 61% sand size) and 37% non-plastic fines (i.e. between 35 and 65% fines); therefore, the soil is classified as MS: sandy SILT.	MS
Soil K consists of 73% fine material (i.e. between 65 and 100% fines) and 27% sand size. The liquid limit is 32 and the plasticity index is 8 (i.e. $32 - 24$), plotting marginally below the A-line in the ML zone on the plasticity chart (Figure 1.12). Thus the classification is ML: SILT (M-SOIL) of low plasticity.	ML
Soil L consists of 99% fine material (58% clay size; 47% silt size). The liquid limit is 78 and the plasticity index is 47 (i.e. $78 - 31$), plotting above the A-line in the CV zone on the plasticity chart (Figure 1.12). Thus the classification is CV: CLAY of very high plasticity.	CV

	Craig's Soil Mechanics: Ninth Edition	
	Chapter 1: Basic characteristics of soils	Author: JAK, RFC
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Working:	Output :
From Equation 1.19: $1 + e = G_s (1 + w) \frac{\rho_w}{\rho} = 2.70 \times (1.095) \times \frac{1.00}{1.91} = 1.55$ Using Equation 1.16: $S_r = \frac{w G_s}{e} = \frac{0.095 \times 2.70}{0.55} = 0.466$ Using Equation 1.21: $\rho_{sat} = \frac{G_s + e}{1 + e} \rho_w = \frac{2.70 + 0.55}{1.55} \times 1.00$ From Equation 1.16, with $S_r = 1$: $w = \frac{e}{G_s} = \frac{0.55}{2.70} = 0.204$	$e = 0.55$ $S_r = 46.6\%$ $\rho_{sat} = 2.1 \text{ Mg/m}^3$ $w = 20.4\%$

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Working:	Output :
Equations similar to 1.21–1.22 apply in the case of unit weights; thus: $\gamma_d = \frac{G_s}{1+e} \gamma_w = \frac{2.72}{1.70} \times 9.81$ $\gamma_{sat} = \frac{G_s + e}{1+e} \gamma_w = \frac{2.72 + 0.70}{1.70} \times 9.81$ Using Equation 1.20a with $S_r = 0.75$: $\gamma = \frac{G_s + S_r e}{1+e} \gamma_w = \frac{2.72 + (0.75 \times 0.70)}{1.70} \times 9.81$ Using Equation 1.16: $w = \frac{S_r e}{G_s} = \frac{0.75 \times 0.70}{2.72} = 0.193$ No attempt should be made to memorize the above equations: Figure 1.15(b) should be drawn and, from a knowledge of the definitions, relevant expressions can be written by inspection.	$\gamma_d = 15.7 \text{ kN/m}^3$ $\gamma_{sat} = 19.7 \text{ kN/m}^3$ $\gamma = 18.7 \text{ kN/m}^3$ w = 19.3%

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	Chapter 1: Basic characteristics of soils	Author: JAK, RFC
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Working:	Output :
Volume of specimen, V: $V = \frac{\pi}{4} \times 38^2 \times 76$	
Therefore: $\rho = \frac{Mass}{V} = \frac{168.0 \times 10^{-6}}{86200 \times 10^{-9}}$	V = 86200 mm³
Water content is given by: $w = \frac{168.0 - 130.5}{130.5} = 0.287$	$\rho = 1.95 \text{ Mg/m}^3$
From Equation 1.19: $1 + e = G_s (1 + w) \frac{\rho_w}{\rho} = 2.73 \times (1.287) \times \frac{1.00}{1.95} = 1.80$	w = 28.7%
Using Equation 1.16: $S_r = \frac{wG_s}{e} = \frac{0.287 \times 2.73}{0.80} = 0.98$	e = 0.8
	<u>S_r = 98%</u>

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	Chapter 1: Basic characteristics of soils	Author: JAK, RFC
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Working:	Output :
From Equation 1.22: $e = \frac{G_s \rho_w}{\rho_d} - 1$ The maximum and minimum values of void ratio are therefore given by: $e_{\max} = \frac{G_s \rho_w}{\rho_{d,\min}} - 1$ $e_{\min} = \frac{G_s \rho_w}{\rho_{d,\max}} - 1$ From Equation 1.23: $I_D = \frac{G_s \rho_w \left(\frac{1}{\rho_{d,\min}} - \frac{1}{\rho_d} \right)}{G_s \rho_w \left(\frac{1}{\rho_{d,\min}} - \frac{1}{\rho_{d,\max}} \right)}$ $= \frac{\left(\frac{1}{\rho_{d,\min}} - \frac{\rho_{d,\min}}{\rho_d} \right) \frac{1}{\rho_{d,\min}}}{\left(\frac{1}{\rho_{d,\min}} - \frac{\rho_{d,\min}}{\rho_{d,\max}} \right) \frac{1}{\rho_{d,\min}}}$ $= \frac{(\rho_d - \rho_{d,\min})}{(\rho_{d,\max} - \rho_{d,\min})} \times \frac{\rho_{d,\max}}{\rho_d}$ $= \left(\frac{1.72 - 1.54}{1.81 - 1.54} \right) \times \frac{1.81}{1.72}$ $= 0.70$	$I_D = 70\%$

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	Chapter 2: Seepage	Author: JAK, RFC
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Working:	Output :
The coefficient of permeability is determined from Equation 2.6: $k = 2.3 \frac{al}{At_1} \log\left(\frac{h_0}{h_1}\right)$ where $a = \frac{\pi \times 0.005^2}{4} \text{ m}^2$ $A = \frac{\pi \times 0.1^2}{4} \text{ m}^2$ $l = 0.2 \text{ m}$ $t_1 = 3 \times 60^2 \text{ s}$ The initial head was $h_0 = 1.00 \text{ m}$, dropping to $h_1 = 0.35 \text{ m}$ at time t_1, so that $\log\left(\frac{h_0}{h_1}\right) = \log\left(\frac{1.00}{0.35}\right) = 0.456$ $k = 2.3 \times \frac{1.96 \times 10^{-5} \times 0.2}{7.85 \times 10^{-3} \times 10800} \times 0.456$	
	$a = 1.96 \times 10^{-5} \text{ m}^2$ $A = 7.85 \times 10^{-3} \text{ m}^2$ $t_1 = 10800 \text{ s}$ $k = 4.8 \times 10^{-8} \text{ m/s}$