Earth Sci 2B03
Laboratory #2
Particle Size Analysis

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Part 1: Sieving Analysis

Sieving Analysis		
Question	Soil #1	Soil #2
1	Initial Mass Of Sample $W_s = W_2 - W_1$ $W_s = 224.65 - 149.72$ $W_s = 74.93$ grams	Initial Mass Of Sample $W_s = W_2 - W_1$ $W_s = 217.63 - 140.27$ $W_s = 77.36$ grams
2	Weight Of Soil In Sieve (1) $W_{s1} = W_{ds1} - W_{d1}$ $W_{s1} = 171.56 - 158.15$ $W_{s1} = 13.41$ grams Weight Of Soil In Sieve (2) $W_{s2} = W_{ds2} - W_{d2}$ $W_{s2} = 149.69 - 145.58$ $W_{s2} = 4.11$ grams Weight Of Soil In Sieve (3) $W_{s3} = W_{ds3} - W_{d3}$ $W_{s3} = 156.47 - 153.33$ $W_{s3} = 3.14$ grams Weight Of Soil In Sieve (4) $W_{s4} = W_{ds4} - W_{d4}$ $W_{s4} = 175.59 - 168.66$ $W_{s4} = 6.93$ grams Weight Of Soil In Sieve (5) $W_{s5} = W_{ds5} - W_{d5}$ $W_{s5} = 161.70 - 139.88$ $W_{s5} = 21.82$ grams Weight Of Soil In Sieve (6) $W_{s6} = W_{ds6} - W_{d6}$ $W_{s6} = 165.53 - 157.65$ $W_{s6} = 7.88$ grams Weight Of Soil In Sieve (7) $W_{s7} = W_{ds7} - W_{d7}$ $W_{s7} = 166.88 - 147.70$ $W_{s7} = 19.18$ grams	Weight Of Soil In Sieve (1) $W_{s1} = W_{ds1} - W_{d1}$ $W_{s1} = 59.42 - 51.48$ $W_{s1} = 7.94$ grams Weight Of Soil In Sieve (2) $W_{s2} = W_{ds2} - W_{d2}$ $W_{s2} = 72.90 - 71.10$ $W_{s2} = 1.80$ grams Weight Of Soil In Sieve (3) $W_{s3} = W_{ds3} - W_{d3}$ $W_{s3} = 77.10 - 73.97$ $W_{s3} = 3.13$ grams Weight Of Soil In Sieve (4) $W_{s4} = W_{ds4} - W_{d4}$ $W_{s4} = 92.46 - 81.46$ $W_{s4} = 11.0$ grams Weight Of Soil In Sieve (5) $W_{s5} = W_{ds5} - W_{d5}$ $W_{s5} = 117.17 - 84.86$ $W_{s5} = 32.31$ grams Weight Of Soil In Sieve (6) $W_{s6} = W_{ds6} - W_{d6}$ $W_{s6} = 47.37 - 40.99$ $W_{s6} = 6.38$ grams Weight Of Soil In Sieve (7) $W_{s7} = W_{ds7} - W_{d7}$ $W_{s7} = 96.74 - 82.60$ $W_{s7} = 14.14$ grams

3	<u>Total Weight Of Sample Sieve</u> $W_t = W_{s1} + W_{s2} + W_{s3} + W_{s4} + W_{s5} + W_{s6} + W_{s7}$ $W_t = 13.41 + 4.11 + 3.14 + 6.93 + 21.82 + 7.88 + 19.18$ $W_t = 76.47$ grams	<u>Total Weight Of Sieve Sample</u> $W_t = W_{s1} + W_{s2} + W_{s3} + W_{s4} + W_{s5} + W_{s6} + W_{s7}$ $W_t = 7.94 + 1.80 + 3.13 + 11.0 + 32.31 + 6.38 + 14.14$ $W_t = 76.70$ grams
4	<u>Percentage Of Soil Caught</u> % Caught = $(W_{s1} / W_t) \times 100\%$ % Caught = (13.41 / 76.47) x 100% % Caught = 17.53628874 % Caught ≈ 17.54% % Caught = $(W_{s2} / W_t) \times 100\%$ % Caught = (4.11 / 76.47) x 100% % Caught = 5.374656728 % Caught ≈ 5.37% % Caught = $(W_{s3} / W_t) \times 100\%$ % Caught = (3.14 / 76.47) x 100% % Caught = 4.106185432 % Caught ≈ 4.11% % Caught = $(W_{s4} / W_t) \times 100\%$ % Caught = (6.93 / 76.47) x 100% % Caught = 9.062377403 % Caught ≈ 9.06% % Caught = $(W_{s5} / W_t) \times 100\%$ % Caught = (21.82 / 76.47) x 100% % Caught = 28.53406565 % Caught ≈ 28.53% % Caught = $(W_{s6} / W_t) \times 100\%$ % Caught = (7.88 / 76.47) x 100% % Caught = 10.30469465 % Caught ≈ 10.30% % Caught = $(W_{s7} / W_t) \times 100\%$ % Caught = (19.18 / 76.47) x 100% % Caught = 25.0817314 % Caught ≈ 25.08%	<u>Percentage Of Soil Caught</u> % Caught = $(W_{s1} / W_t) \times 100\%$ % Caught = (7.94 / 76.70) x 100% % Caught = 10.35202086 % Caught ≈ 10.35% % Caught = $(W_{s2} / W_t) \times 100\%$ % Caught = (1.80 / 76.70) x 100% % Caught = 2.346805737 % Caught ≈ 2.35% % Caught = $(W_{s3} / W_t) \times 100\%$ % Caught = (3.13 / 76.70) x 100% % Caught = 4.08083442 % Caught ≈ 4.08% % Caught = $(W_{s4} / W_t) \times 100\%$ % Caught = (11.0 / 76.70) x 100% % Caught = 14.3415906 % Caught ≈ 14.34% % Caught = $(W_{s5} / W_t) \times 100\%$ % Caught = (32.31 / 76.70) x 100% % Caught = 42.12516297 % Caught ≈ 42.13% % Caught = $(W_{s6} / W_t) \times 100\%$ % Caught = (6.38 / 76.70) x 100% % Caught = 8.318122555 % Caught ≈ 8.32% % Caught = $(W_{s7} / W_t) \times 100\%$ % Caught = (14.14 / 76.70) x 100% % Caught = 18.43546284 % Caught ≈ 18.44%

5	<u>Percent Cumulative Passing</u> % Cum. Passing In Top Sieve = 100 – (% Caught In Top Sieve) % C.P. (2.00 mm) = 100 – 17.54 % C.P. (2.00 mm) = 82.45%	<u>Percent Cumulative Passing</u> % Cum. Passing In Top Sieve = 100 – (% Caught In Top Sieve) % C.P. (2.00 mm) = 100 – 10.35 % C.P. (2.00 mm) = 89.66%
6	<u>Percent Cumulative Passing</u> % Cum. Pas. = (% Cum. Pas. From Above Sieve) – (% Caught From Current Sieve) % C.P. (1.41 mm) = 82.45 – 5.37 % C.P. (1.41 mm) = 77.08% % C.P. (1.00 mm) = 77.08 – 4.11 % C.P. (1.00 mm) = 72.97% % C.P. (0.50 mm) =72.97 – 9.06 % C.P. (0.50 mm) = 63.91% % C.P. (0.125 mm) = 63.91 – 28.53 % C.P. (0.125 mm) = 35.38% % C.P. (0.074 mm) = 35.38 – 10.30 % C.P. (0.074 mm) = 25.08% % C.P. (Bottom Pan) = 25.08 – 25.08 % C.P. (Bottom Pan) = 0%	<u>Percent Cumulative Passing</u> % Cum. Pas. = (% Cum. Pas. From Above Sieve) – (% Caught From Current Sieve) % C.P. (1.41 mm) = 89.66 – 2.35 % C.P. (1.41 mm) = 87.31% % C.P. (1.00 mm) = 87.31 – 4.08 % C.P. (1.00 mm) = 83.23% % C.P. (0.50 mm) = 82.23 – 14.34 % C.P. (0.50 mm) = 68.89% % C.P. (0.125 mm) = 68.89 – 42.13 % C.P. (0.125 mm) = 26.76% % C.P. (0.074 mm) = 26.76 – 8.32 % C.P. (0.074 mm) = 18.44% % C.P. (Bottom Pan) = 18.44 – 18.44 % C.P. (Bottom Pan) = 0%

Soil 1					
Sieve Pore Size (i) (mm)	Mass Of Empty Weighing Dish, W_{di} (g)	Mass Of Weighting Dish + Soil Caught In Sieve (i), W_{dsi} (g)	Mass Of Soil Caught In Sieve (i), W_{si} (g) (W_{dsi} – W_{di})	Percent Caught (%)	Cumulative Passing Percent (%)
2.00	158.15	171.56	13.41	17.54	82.45
1.41	145.58	149.69	4.11	5.37	77.08
1.00	153.33	156.47	3.14	4.11	72.97
0.500	168.66	175.59	6.93	9.06	63.91
0.125	139.88	161.70	21.82	28.53	35.38
0.074	157.65	165.53	7.88	10.30	25.08
Bottom Pan	147.70	166.88	19.18	25.08	0.0

W_t (g) = 76.47

Soil 2					
Sieve Pore Size (i) (mm)	Mass Of Empty Weighing Dish, W_{di} (g)	Mass Of Weighting Dish + Soil Caught In Sieve (i), W_{dsi} (g)	Mass Of Soil Caught In Sieve (i), W_{si} (g) (W_{dsi} – W_{di})	Percent Caught	Cumulative Passing Percent
2.00	51.48	59.42	7.94	10.35	89.66
1.41	71.10	72.90	1.80	2.35	87.31
1.00	73.97	77.10	3.13	4.08	83.23
0.500	81.46	92.46	11.0	14.34	68.89
0.125	84.86	117.17	32.31	42.13	26.76
0.075	40.99	47.37	6.38	8.32	18.44
Bottom Pan	82.60	96.47	14.14	18.44	0.0

W_t (g) = 76.70

Part 2: Hydrometer Analysis

Hydrometer Analysis		
Question	Soil #1	Soil #2
1	Actual Mass Of Sample $W_T = W_{dT} - W_d$ $W_T = 260.56 - 180.53$ $W_T = 80.03$ grams	Actual Mass Of Sample $W_T = W_{dT} - W_d$ $W_T = 79.9 - 1.97$ $W_T = 77.93$ grams
2	Total Concentration $C_T = W_T/V_T$ $C_T = 80.03 / 1.0$ $C_T = 80.03$ g/L	Total Concentration $C_T = W_T/V_T$ $C_T = 77.93 / 1.0$ $C_T = 77.93$ g/L
3	Corrected Hydrometer Readings $C_{t(0.5)} = R_t - R_L$ $C_{t(0.5)} = 21 - 4$ $C_{t(0.5)} = 17$ g/L $C_{t(1)} = R_t - R_L$ $C_{t(1)} = 20 - 4$ $C_{t(1)} = 16$ g/L $C_{t(1.5)} = R_t - R_L$ $C_{t(1.5)} = 18.5 - 4$ $C_{t(1.5)} = 14.5$ g/L $C_{t(2)} = R_t - R_L$ $C_{t(2)} = 17 - 4$ $C_{t(2)} = 13$ g/L $C_{t(3)} = R_t - R_L$ $C_{t(3)} = 16.5 - 4$ $C_{t(3)} = 12.5$ g/L $C_{t(5)} = R_t - R_L$ $C_{t(5)} = 15 - 4$ $C_{t(5)} = 11$ g/L $C_{t(10)} = R_t - R_L$ $C_{t(10)} = 12 - 4$ $C_{t(10)} = 8$ g/L	Corrected Hydrometer Readings $C_{t(0.5)} = R_t - R_L$ $C_{t(0.5)} = 12 - 3$ $C_{t(0.5)} = 9$ g/L $C_{t(1)} = R_t - R_L$ $C_{t(1)} = 12 - 3$ $C_{t(1)} = 9$ g/L $C_{t(1.5)} = R_t - R_L$ $C_{t(1.5)} = 12 - 3$ $C_{t(1.5)} = 9$ g/L $C_{t(2)} = R_t - R_L$ $C_{t(2)} = 11 - 3$ $C_{t(2)} = 8$ g/L $C_{t(3)} = R_t - R_L$ $C_{t(3)} = 10 - 3$ $C_{t(3)} = 7$ g/L $C_{t(5)} = R_t - R_L$ $C_{t(5)} = 9 - 3$ $C_{t(5)} = 6$ g/L $C_{t(10)} = R_t - R_L$ $C_{t(10)} = 7 - 3$ $C_{t(10)} = 4$ g/L

	$C_{t(30)} = R_t - R_L$ $C_{t(30)} = 8 - 4$ $C_{t(30)} = 4$ g/L $C_{t(60)} = R_t - R_L$ $C_{t(60)} = 7 - 4$ $C_{t(60)} = 3$ g/L $C_{t(90)} = R_t - R_L$ $C_{t(90)} = 6.6 - 4$ $C_{t(90)} = 2.6$ g/L $C_{t(120)} = R_t - R_L$ $C_{t(120)} = 6.15 - 4$ $C_{t(120)} = 2.15$ g/L	$C_{t(30)} = R_t - R_L$ $C_{t(30)} = 5 - 3$ $C_{t(30)} = 2$ g/L $C_{t(60)} = R_t - R_L$ $C_{t(60)} = 4 - 3$ $C_{t(60)} = 1$ g/L $C_{t(90)} = R_t - R_L$ $C_{t(90)} = 4 - 3$ $C_{t(90)} = 1$ g/L $C_{t(120)} = R_t - R_L$ $C_{t(120)} = 3 - 3$ $C_{t(120)} = 0$ g/L
4	Summation Percentage $P_{0.5} = (C_t/C_T) \times 100\%$ $P_{0.5} = (17/80.03) \times 100\%$ $P_{0.5} = 21.24203424\%$ $P_{0.5} \approx 21.24\%$ $P_1 = (C_t/C_T) \times 100\%$ $P_1 = (16/80.03) \times 100\%$ $P_1 = 19.99250281\%$ $P_1 \approx 19.99\%$ $P_{1.5} = (C_t/C_T) \times 100\%$ $P_{1.5} = (14.5/80.03) \times 100\%$ $P_{1.5} = 18.11820567\%$ $P_{1.5} \approx 18.12\%$ $P_2 = (C_t/C_T) \times 100\%$ $P_2 = (13/80.03) \times 100\%$ $P_2 = 16.24390853\%$ $P_2 \approx 16.24\%$ $P_3 = (C_t/C_T) \times 100\%$ $P_3 = (12.5/80.03) \times 100\%$ $P_3 = 15.61914282\%$ $P_3 \approx 15.62\%$	Summation Percentage $P_{0.5} = (C_t/C_T) \times 100\%$ $P_{0.5} = (9/77.93) \times 100\%$ $P_{0.5} = 11.64294955\%$ $P_{0.5} \approx 11.64\%$ $P_1 = (C_t/C_T) \times 100\%$ $P_1 = (9/77.93) \times 100\%$ $P_1 = 11.64294955\%$ $P_1 \approx 11.64\%$ $P_{1.5} = (C_t/C_T) \times 100\%$ $P_{1.5} = (9/77.93) \times 100\%$ $P_{1.5} = 11.64294955\%$ $P_{1.5} \approx 11.64\%$ $P_2 = (C_t/C_T) \times 100\%$ $P_2 = (8/77.93) \times 100\%$ $P_2 = 10.26562299\%$ $P_2 \approx 10.27\%$ $P_3 = (C_t/C_T) \times 100\%$ $P_3 = (7/77.93) \times 100\%$ $P_3 = 8.982420121\%$ $P_3 \approx 8.98\%$

	$P_5 = (C_t/C_T) \times 100\%$ $P_5 = (11/80.03) \times 100\%$ $P_5 = 13.74484568\%$ $P_5 \approx 13.74\%$ $P_{10} = (C_t/C_T) \times 100\%$ $P_{10} = (8/80.03) \times 100\%$ $P_{10} = 9.996251406\%$ $P_{10} \approx 10.00\%$ $P_{30} = (C_t/C_T) \times 100\%$ $P_{30} = (4/80.03) \times 100\%$ $P_{30} = 4.998125703\%$ $P_{30} \approx 5.00\%$ $P_{60} = (C_t/C_T) \times 100\%$ $P_{60} = (3/80.03) \times 100\%$ $P_{60} = 3.748594277\%$ $P_{60} \approx 3.75\%$ $P_{90} = (C_t/C_T) \times 100\%$ $P_{90} = (2.6/80.03) \times 100\%$ $P_{90} = 3.248781707\%$ $P_{90} \approx 3.25\%$ $P_{120} = (C_t/C_T) \times 100\%$ $P_{120} = (2.15/80.03) \times 100\%$ $P_{120} = 2.686492465\%$ $P_{120} \approx 2.69\%$	$P_5 = (C_t/C_T) \times 100\%$ $P_5 = (6/77.93) \times 100\%$ $P_5 = 7.699217246\%$ $P_5 \approx 7.70\%$ $P_{10} = (C_t/C_T) \times 100\%$ $P_{10} = (4/77.93) \times 100\%$ $P_{10} = 5.132811497\%$ $P_{10} \approx 5.13\%$ $P_{30} = (C_t/C_T) \times 100\%$ $P_{30} = (2/77.93) \times 100\%$ $P_{30} = 2.566405749\%$ $P_{30} \approx 2.57\%$ $P_{60} = (C_t/C_T) \times 100\%$ $P_{60} = (1/77.93) \times 100\%$ $P_{60} = 1.283202874\%$ $P_{60} \approx 1.28\%$ $P_{90} = (C_t/C_T) \times 100\%$ $P_{90} = (1/77.93) \times 100\%$ $P_{90} = 1.283202874\%$ $P_{90} \approx 1.28\%$ $P_{120} = (C_t/C_T) \times 100\%$ $P_{120} = (0/77.93) \times 100\%$ $P_{120} = 0\%$
5	<u>Effective Hydrometer Depth</u> $h_{0.5} = (-0.164)(R_t) + 16.3$ $h_{0.5} = (-0.164)(21) + 16.3$ $h_{0.5} = 12.856$ cm $h_1 = (-0.164)(R_t) + 16.3$ $h_1 = (-0.164)(20) + 16.3$ $h_1 = 13.02$ cm $h_{1.5} = (-0.164)(R_t) + 16.3$ $h_{1.5} = (-0.164)(18.5) + 16.3$ $h_{1.5} = 13.266$ cm	<u>Effective Hydrometer Depth</u> $h_{0.5} = (-0.164)(R_t) + 16.3$ $h_{0.5} = (-0.164)(12) + 16.3$ $h_{0.5} = 14.332$ cm $h_1 = (-0.164)(R_t) + 16.3$ $h_1 = (-0.164)(12) + 16.3$ $h_1 = 14.332$ cm $h_{1.5} = (-0.164)(R_t) + 16.3$ $h_{1.5} = (-0.164)(12) + 16.3$ $h_{1.5} = 14.332$ cm

	$h_2 = (-0.164)(R_t) + 16.3$ $h_2 = (-0.164)(17) + 16.3$ $h_2 = 13.512$ cm $h_3 = (-0.164)(R_t) + 16.3$ $h_3 = (-0.164)(16.5) + 16.3$ $h_3 = 13.594$ cm $h_5 = (-0.164)(R_t) + 16.3$ $h_5 = (-0.164)(15) + 16.3$ $h_5 = 13.84$ cm $h_{10} = (-0.164)(R_t) + 16.3$ $h_{10} = (-0.164)(12) + 16.3$ $h_{10} = 14.332$ cm $h_{30} = (-0.164)(R_t) + 16.3$ $h_{30} = (-0.164)(8) + 16.3$ $h_{30} = 14.988$ cm $h_{60} = (-0.164)(R_t) + 16.3$ $h_{60} = (-0.164)(7) + 16.3$ $h_{60} = 15.152$ cm $h_{90} = (-0.164)(R_t) + 16.3$ $h_{90} = (-0.164)(6.6) + 16.3$ $h_{90} = 15.2176$ cm $h_{120} = (-0.164)(R_t) + 16.3$ $h_{120} = (-0.164)(6.15) + 16.3$ $h_{120} = 15.2914$ cm	$h_2 = (-0.164)(R_t) + 16.3$ $h_2 = (-0.164)(11) + 16.3$ $h_2 = 14.496$ cm $h_3 = (-0.164)(R_t) + 16.3$ $h_3 = (-0.164)(10) + 16.3$ $h_3 = 14.66$ cm $h_5 = (-0.164)(R_t) + 16.3$ $h_5 = (-0.164)(9) + 16.3$ $h_5 = 14.824$ cm $h_{10} = (-0.164)(R_t) + 16.3$ $h_{10} = (-0.164)(7) + 16.3$ $h_{10} = 15.152$ cm $h_{30} = (-0.164)(R_t) + 16.3$ $h_{30} = (-0.164)(5) + 16.3$ $h_{30} = 15.48$ cm $h_{60} = (-0.164)(R_t) + 16.3$ $h_{60} = (-0.164)(4) + 16.3$ $h_{60} = 15.644$ cm $h_{90} = (-0.164)(R_t) + 16.3$ $h_{90} = (-0.164)(4) + 16.3$ $h_{90} = 15.644$ cm $h_{120} = (-0.164)(R_t) + 16.3$ $h_{120} = (-0.164)(3) + 16.3$ $h_{120} = 15.808$ cm
6	<u>Sedimentation Parameter</u> $q_{0.5} = (Bh)^{0.5}$ $q_{0.5} = ((9.9x10^{-5})(12.856))^{0.5}$ $q_{0.5} = 0.035675537\ cm \cdot sec^{0.5}$ $q_{0.5} \approx 46.057\ \mu m \cdot min^{0.5}$ $q_1 = (Bh)^{0.5}$ $q_1 = ((9.9x10^{-5})(13.02))^{0.5}$ $q_1 = 0.035902367\ cm \cdot sec^{0.5}$ $q_1 \approx 46.350\ \mu m \cdot min^{0.5}$	<u>Sedimentation Parameter</u> $q_{0.5} = (Bh)^{0.5}$ $q_{0.5} = ((9.9x10^{-5})(14.332))^{0.5}$ $q_{0.5} = 0.037667864\ cm \cdot sec^{0.5}$ $q_{0.5} \approx 48.629\ \mu m \cdot min^{0.5}$ $q_1 = (Bh)^{0.5}$ $q_1 = ((9.9x10^{-5})(14.332))^{0.5}$ $q_1 = 0.037667864\ cm \cdot sec^{0.5}$ $q_1 \approx 48.629\ \mu m \cdot min^{0.5}$

	$q_{1.5} = (Bh)^{0.5}$ $q_{1.5} = ((9.9x10^{-5})(13.266))^{0.5}$ $q_{1.5} = 0.03623995$ cm$\cdot$sec$^{0.5}$ $q_{1.5} \approx 46.786$ µm$\cdot$min$^{0.5}$ $q_{2} = (Bh)^{0.5}$ $q_{2} = ((9.9x10^{-5})(13.512))^{0.5}$ $q_{2} = 0.036574417$ cm$\cdot$sec$^{0.5}$ $q_{2} \approx 47.217$ µm$\cdot$min$^{0.5}$ $q_{3} = (Bh)^{0.5}$ $q_{3} = ((9.9x10^{-5})(13.594))^{0.5}$ $q_{3} = 0.036685228$ cm$\cdot$sec$^{0.5}$ $q_{3} \approx 47.360$ µm$\cdot$min$^{0.5}$ $q_{5} = (Bh)^{0.5}$ $q_{5} = ((9.9x10^{-5})(13.84))^{0.5}$ $q_{5} = 0.037015672$ cm$\cdot$sec$^{0.5}$ $q_{5} \approx 47.787$ µm$\cdot$min$^{0.5}$ $q_{10} = (Bh)^{0.5}$ $q_{10} = ((9.9x10^{-5})(14.332))^{0.5}$ $q_{10} = 0.037667864$ cm$\cdot$sec$^{0.5}$ $q_{10} \approx 48.629$ µm$\cdot$min$^{0.5}$ $q_{30} = (Bh)^{0.5}$ $q_{30} = ((9.9x10^{-5})(14.988))^{0.5}$ $q_{30} = 0.03852028$ cm$\cdot$sec$^{0.5}$ $q_{30} \approx 49.729$ µm$\cdot$min$^{0.5}$ $q_{60} = (Bh)^{0.5}$ $q_{60} = ((9.9x10^{-5})(15.152))^{0.5}$ $q_{60} = 0.038730453$ cm$\cdot$sec$^{0.5}$ $q_{60} \approx 50.001$ µm$\cdot$min$^{0.5}$ $q_{90} = (Bh)^{0.5}$ $q_{90} = ((9.9x10^{-5})(15.2176))^{0.5}$ $q_{90} = 0.038814203$ cm$\cdot$sec$^{0.5}$ $q_{90} \approx 50.109$ µm$\cdot$min$^{0.5}$ $q_{120} = (Bh)^{0.5}$ $q_{120} = ((9.9x10^{-5})(15.2914))^{0.5}$ $q_{120} = 0.038908207$ cm$\cdot$sec$^{0.5}$ $q_{120} \approx 50.230$ µm$\cdot$min$^{0.5}$	$q_{1.5} = (Bh)^{0.5}$ $q_{1.5} = ((9.9x10^{-5})(14.332))^{0.5}$ $q_{1.5} = 0.037667864$ cm$\cdot$sec$^{0.5}$ $q_{1.5} \approx 48.629$ µm$\cdot$min$^{0.5}$ $q_{2} = (Bh)^{0.5}$ $q_{2} = ((9.9x10^{-5})(14.496))^{0.5}$ $q_{2} = 0.037882766$ cm$\cdot$sec$^{0.5}$ $q_{2} \approx 48.906$ µm$\cdot$min$^{0.5}$ $q_{3} = (Bh)^{0.5}$ $q_{3} = ((9.9x10^{-5})(14.66))^{0.5}$ $q_{3} = 0.038096456$ cm$\cdot$sec$^{0.5}$ $q_{3} \approx 49.182$ µm$\cdot$min$^{0.5}$ $q_{5} = (Bh)^{0.5}$ $q_{5} = ((9.9x10^{-5})(14.824))^{0.5}$ $q_{5} = 0.038308954$ cm$\cdot$sec$^{0.5}$ $q_{5} \approx 49.457$ µm$\cdot$min$^{0.5}$ $q_{10} = (Bh)^{0.5}$ $q_{10} = ((9.9x10^{-5})(15.152))^{0.5}$ $q_{10} = 0.038730453$ cm$\cdot$sec$^{0.5}$ $q_{10} \approx 50.001$ µm$\cdot$min$^{0.5}$ $q_{30} = (Bh)^{0.5}$ $q_{30} = ((9.9x10^{-5})(15.48))^{0.5}$ $q_{30} = 0.039147413$ cm$\cdot$sec$^{0.5}$ $q_{30} \approx 50.539$ µm$\cdot$min$^{0.5}$ $q_{60} = (Bh)^{0.5}$ $q_{60} = ((9.9x10^{-5})(15.644))^{0.5}$ $q_{60} = 0.039354237$ cm$\cdot$sec$^{0.5}$ $q_{60} \approx 50.806$ µm$\cdot$min$^{0.5}$ $q_{90} = (Bh)^{0.5}$ $q_{90} = ((9.9x10^{-5})(15.644))^{0.5}$ $q_{90} = 0.039354237$ cm$\cdot$sec$^{0.5}$ $q_{90} \approx 50.806$ µm$\cdot$min$^{0.5}$ $q_{120} = (Bh)^{0.5}$ $q_{120} = ((9.9x10^{-5})(15.808))^{0.5}$ $q_{120} = 0.039559979$ cm$\cdot$sec$^{0.5}$ $q_{120} \approx 51.072$ µm$\cdot$min$^{0.5}$

7	All ‘q’ values, in question 6, are multiplied by: (10mm/1cm)(1000µm/1mm)(1min$^{0.5}$/60$^{0.5}$sec$^{0.5}$) → (10000/60$^{1/2}$) (q) Refer to question 6 for the calculations for question 7	
8	<u>Particle Diameter</u> $X_{0.5} = qt^{-0.5}$ $X_{0.5} = (46.057)0.5^{-0.5}$ $X_{0.5} = 65.13443404$ µm $X_{0.5} \approx 0.0651$ mm $X_1 = qt^{-0.5}$ $X_1 = (46.350)1^{-0.5}$ $X_1 = 46.350$ µm $X_1 \approx 0.0464$ mm $X_{1.5} = qt^{-0.5}$ $X_{1.5} = (46.786)1.5^{-0.5}$ $X_{1.5} = 38.20060904$ µm $X_{1.5} \approx 0.0382$ mm $X_2 = qt^{-0.5}$ $X_2 = (47.217)2^{-0.5}$ $X_2 = 33.38746089$ µm $X_2 \approx 0.0334$ mm $X_3 = qt^{-0.5}$ $X_3 = (47.360)3^{-0.5}$ $X_3 = 27.34330875$ µm $X_3 \approx 0.0273$ mm $X_5 = qt^{-0.5}$ $X_5 = (47.787)5^{-0.5}$ $X_5 = 21.37099609$ µm $X_5 \approx 0.0214$ mm $X_{10} = qt^{-0.5}$ $X_{10} = (48.629)10^{-0.5}$ $X_{10} = 15.37784003$ µm $X_{10} \approx 0.0154$ mm $X_{30} = qt^{-0.5}$ $X_{30} = (49.729)30^{-0.5}$ $X_{30} = 9.079231687$ µm $X_{30} \approx 0.00908$ mm	<u>Particle Diameter</u> $X_{0.5} = qt^{-0.5}$ $X_{0.5} = (48.629)0.5^{-0.5}$ $X_{0.5} = 68.77179132$ µm $X_{0.5} \approx 0.0688$ mm $X_1 = qt^{-0.5}$ $X_1 = (48.629)1^{-0.5}$ $X_1 = 48.629$ µm $X_1 \approx 0.0486$ mm $X_{1.5} = qt^{-0.5}$ $X_{1.5} = (48.629)1.5^{-0.5}$ $X_{1.5} = 39.70541233$ µm $X_{1.5} \approx 0.0397$ mm $X_2 = qt^{-0.5}$ $X_2 = (48.906)2^{-0.5}$ $X_2 = 34.58176424$ µm $X_2 \approx 0.0346$ mm $X_3 = qt^{-0.5}$ $X_3 = (49.182)3^{-0.5}$ $X_3 = 28.39524094$ µm $X_3 \approx 0.0284$ mm $X_5 = qt^{-0.5}$ $X_5 = (49.457)5^{-0.5}$ $X_5 = 22.11784279$ µm $X_5 \approx 0.0221$ mm $X_{10} = qt^{-0.5}$ $X_{10} = (50.001)10^{-0.5}$ $X_{10} = 15.81170453$ µm $X_{10} \approx 0.0158$ mm $X_{30} = qt^{-0.5}$ $X_{30} = (50.539)30^{-0.5}$ $X_{30} = 9.227116778$ µm $X_{30} \approx 0.00923$ mm

	$X_{60} = qt^{-0.5}$ $X_{60} = (15.152)60^{-0.5}$ $X_{60} = 1.9561147789\ \mu m$ $X_{60} \approx 0.00196$ mm $X_{90} = qt^{-0.5}$ $X_{90} = (15.2176)90^{-0.5}$ $X_{90} = 1.604075884\ \mu m$ $X_{90} \approx 0.00160$ mm $X_{120} = qt^{-0.5}$ $X_{120} = (15.2914)120^{-0.5}$ $X_{120} = 1.395907453\ \mu m$ $X_{120} \approx 0.00140$ mm	$X_{60} = qt^{-0.5}$ $X_{60} = (50.806)60^{-0.5}$ $X_{60} = 6.559026396\ \mu m$ $X_{60} \approx 0.00656$ mm $X_{90} = qt^{-0.5}$ $X_{90} = (50.806)90^{-0.5}$ $X_{90} = 5.355422627\ \mu m$ $X_{90} \approx 0.00536$ mm $X_{120} = qt^{-0.5}$ $X_{120} = (51.072)120^{-0.5}$ $X_{120} = 4.662214409\ \mu m$ $X_{120} \approx 0.00466$ mm

Soil 1						
Time, t (min)	Concentration Of Soil In Suspension At Time, t, (Hydrometer Reading) R_t (g/L)	Corrected Concentration Ct (g/L) (R – RL)	Summation Percentage, P (%)	Effective Hydrometer Depth, h (cm)	Sedimentation Parameter, q ($\mu m \cdot min^{0.5}$)	Particle Diameter, X (µm)
0.5	21	17	21.24	12.86	46.057	65.13
1	20	16	19.99	13.02	46.350	46.35
1.5	18	14.5	18.12	13.27	46.786	38.20
2	17	13	16.24	13.51	47.217	33.39
3	16.5	12.5	15.62	13.59	47.360	27.34
5	15	11	13.74	13.84	47.787	21.37
10	12	8	10.00	14.33	48.629	15.38
30	8	4	5.00	14.99	49.729	9.08
60	7	3	3.75	15.15	50.001	1.96
90	6.6	2.6	3.25	15.22	50.109	1.60
120	6.15	2.15	2.69	15.29	50.230	1.40

R_L = 4 g/L C_T = 80.03 g/L

Soil 2						
Time, t (min)	Concentration Of Soil In Suspension At Time, t, (Hydrometer Reading) R_t (g/L)	Corrected Concentration Ct (g/L) (R – RL)	Summation Percentage, P (%)	Effective Hydrometer Depth, h (cm)	Sedimentation Parameter, q ($\mu m \cdot min^{0.5}$)	Particle Diameter, X (µm)
0.5	12	9	11.64	14.33	48.629	68.77
1	12	9	11.64	14.33	48.629	48.63
1.5	12	9	11.64	14.33	48.629	39.71
2	11	8	10.27	14.50	48.906	34.58
3	10	7	8.98	14.66	49.182	28.40
5	9	6	7.70	14.82	49.457	22.12
10	7	4	5.13	15.15	50.001	15.81
30	5	2	2.57	15.48	50.539	9.23
60	4	1	1.28	15.64	50.806	6.56
90	4	1	1.28	15.64	50.806	5.36
120	3	0	0	15.81	51.072	4.66

R_L = 3 g/L C_T = 77.93 g/L

Questions

Describe some of the disadvantages and advantages of each particle size method. List some possible sources of error associated with each method

Mechanical sieving involves measuring the mass of soil caught in each sieve against the original total weight of the sample. The advantage to this method is that it is relatively quick, taking an average of 25 minutes to complete from start to finish. However, there are many disadvantages (sources of error) to this method. Firstly, the soil sample is assumed to be 100% soil, but it really isn't. There are visible organic materials such as grass clumps, roots, branches, etc. These impurities affect the weight of soil caught in each sieve, and skew the original total weight, as well as percent of soil that has passed through each sieve. For instance, these impurities are rather large and will affect (increase) the weight of the large soil particles. Secondly, soil particles get stuck in the mesh of the sieves, and small soil particles clump together to form larger particles which remain in the wrong section of the sieve. Soil particles getting stuck in the mesh of the sieves affects the total weight and percent of soil that has passed through the sieve. When soil particles stick together and don't pass through the following sieves, the weight for the sieve they are stuck in, goes up and skews the final data. And lastly, the transferring of soil from crucible to sieve, and sieve to crucible, causes a reduction in the total weight and the weight for each respective soil particle size. This is a major disadvantage because a substantial amount of soil is lost when transferring between utensils.

The hydrometer method involves placing a soil sample in a cylinder of water and measuring the density of water that is displaced by the soil particles as they settle out of suspension with a hydrometer. The disadvantages to this method is time taken to carry out the experiment. The hydrometer method takes a minimum of two hours to complete, as opposed to the 25 minutes by mechanical sieving. Furthermore, the hydrometer equipment is expensive, costing up to a grand. After considering the cost and time, this method is not feasible in the environment, and limited to laboratory experiments and testing. Also, it can be a little difficult to take readings off of the hydrometer, because of its constant movement, giving you less accurate results. An advantage to the hydrometer is that adding a dispersion agent can significantly reduce errors caused by the presence of soluble salts or gypsum, that cause clay particles to clump together. Another advantage to the hydrometer method is that it requires you to take only one measurement, making it simple and easy to operate.

Explain how both mechanical sieving and the hydrometer method could be modified slightly and adapted to provide insight on soil structure instead of only soil texture

Mechanical sieving can be modified to provide insight on soil structure by adding a few more steps that involve checking permeability of the soil. After all data is collected and the sorted soil is still in the crucible, it can be transferred to a narrow glass. Once all the soil is transferred to their independent tubes, a little bit of water can be added to the top of the tubes and the movement of water can be tested. So, if the water moves relatively rapidly, the structure must be granular. If the water moves moderately, the the structure of soil is either blocky or prismatic. And finally, if the water moves very slowly, relatively, the structure must be platy.

The hydrometer method can be modified to provide insight on soil structure by measuring the time it takes for the hydrometer to submerge more and more in the water. For instance, if the hydrometer sinks quickly, then the structure of the soil must be platy or massive because big particles drown first. If the hydrometer takes a long time, then majority of the particles must be small, indicating that the structure of the soil must be granular or fine-grained because small particles take longer to drown because they have less energy.

In a few words, what is the difference between the particle size distribution curve obtained by the hydrometer method compare to the curve obtained by the sieving method for the loam soil? How are the two particle distribution methods related to the type of soil?

The curve obtained by the hydrometer method is on bottom of the graph, while the curve obtained by the sieve method is near the top of the graph. This means that the hydrometer method accounts for small particles, and the sieve method accounts for large particles. The hydrometer method, has particle size ranging from 0.0014mm to 0.075mm (these are small particles – clay). On the other hand, the sieve method accounts for particles in the range of 0.075mm to 2.00mm (these are large particles – sand). This relation is true because soil 1 has more small soil particles than large particles, and soil 2 is the opposite, with more big particles, and less small particles. This implies that soil 1 is has more clay than soil 2, and soil 2 is mainly silt and sand. This is because soil 2's particle distribution starts at 0.004mm, and for it to contain clay, it needs to start around 0.001mm, like soil 1 does.

Compare the grain size distribution curves for the sand and loam soil. Is there a lot of difference in the data? Is one of the soils more or less coarse than the other? Is one soil more or less well graded than the other?

No, the difference in the data is small. The soils are about the same in terms of coarseness and gradedness. There is a minor difference that can be duly noted. Soil 2 has a greater cumulative passing percent for big pores. This means that soil 2 has a higher amount of large soil particles than soil 1, and a lesser amount of small soil particles than soil 1. Simply put, soil 2 has more big particles, and soil 1 has more small particles. This means that soil 2 is coarser than soil 1, and soil 1 has clay. However, the difference is very minute, and only notable on a microscopic level.

Use the particle distribution curves to determine the percent of sand, silt and clay in the soil. Classify the soil (i.e. silty-loam, sandy-clay, etc.) by referring to the textural triangle in figure 4.6 – The major soil textural classes are defined by the percentages of sand, silt and clay according to the heavy boundary lines shown of the textural triangle, of your 2B03 textbook

Soil 1: Silt Loam
Soil 2: Sandy Loam

Based on your assigned textural classification of each soil type, what are some basic properties and/or behaviors you could expect to observe in these soils

Silt Loam

- Ranges from small particles (clay) to large particles (sand)
- Holds on to water better
- This kind of soil would be found in semi-arid environments
- Moderate for plants to grow

Sand Loam

- Ranges from silt-sized particles to sand-sized particles (little to no clay)
- Loses water quickly
- This kind of soil would be found in arid environments
- Hard for life (plants) to grow