

## Chapter 2

$$2.1 \quad C_u = \frac{D_{60}}{D_{10}} = \frac{0.41}{0.08} = \mathbf{5.13}$$

$$C_c = \frac{(D_{30})^2}{(D_{10})(D_{60})} = \frac{(0.22)^2}{(0.08)(0.41)} = \mathbf{1.48}$$

$$2.2 \quad C_u = \frac{D_{60}}{D_{10}} = \frac{1.81}{0.24} = \mathbf{7.54}$$

$$C_c = \frac{(D_{30})^2}{(D_{10})(D_{60})} = \frac{(0.82)^2}{(0.24)(1.81)} = \mathbf{1.55}$$

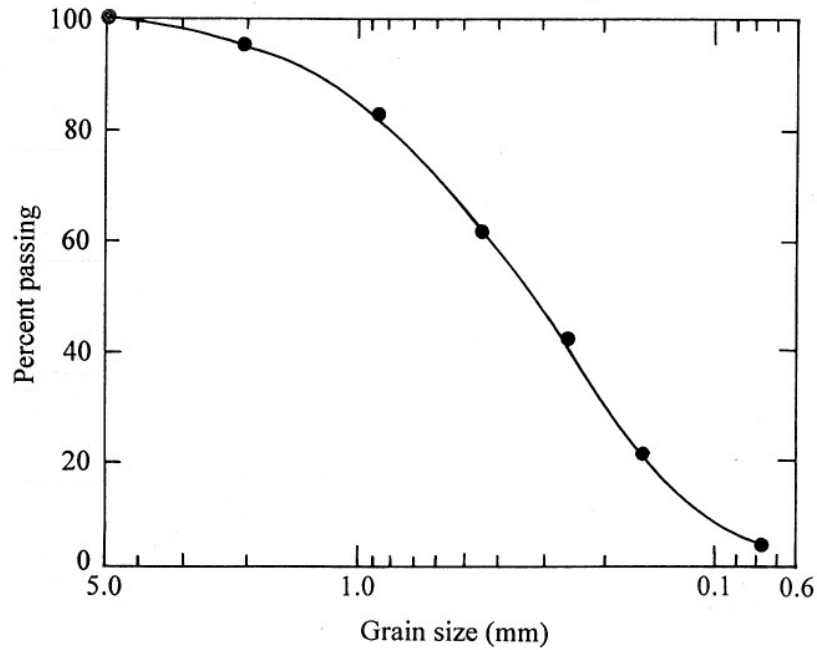
$$2.3 \quad C_u = \frac{D_{60}}{D_{10}} = \frac{0.78}{0.18} = \mathbf{4.33}$$

$$C_c = \frac{(D_{30})^2}{(D_{10})(D_{60})} = \frac{(0.32)^2}{(0.18)(0.78)} = \mathbf{0.73}$$

2.4 a.

Sieve no.	Mass of soil retained on each sieve (g)	Percent retained on each sieve	Percent finer
4	0.0	0.0	<b>100.0</b>
10	18.5	4.4	<b>95.6</b>
20	53.2	12.6	<b>83.0</b>
40	90.5	21.5	<b>61.5</b>
60	81.8	19.4	<b>42.1</b>
100	92.2	21.9	<b>20.2</b>
200	58.5	13.9	<b>6.3</b>
Pan	26.5	6.3	<b>0</b>
Σ 421.2 g			

The grain-size distribution is shown.



b.  $D_{60} = 0.4 \text{ mm}$ ;  $D_{30} = 0.22 \text{ mm}$ ;  $D_{10} = 0.12 \text{ mm}$

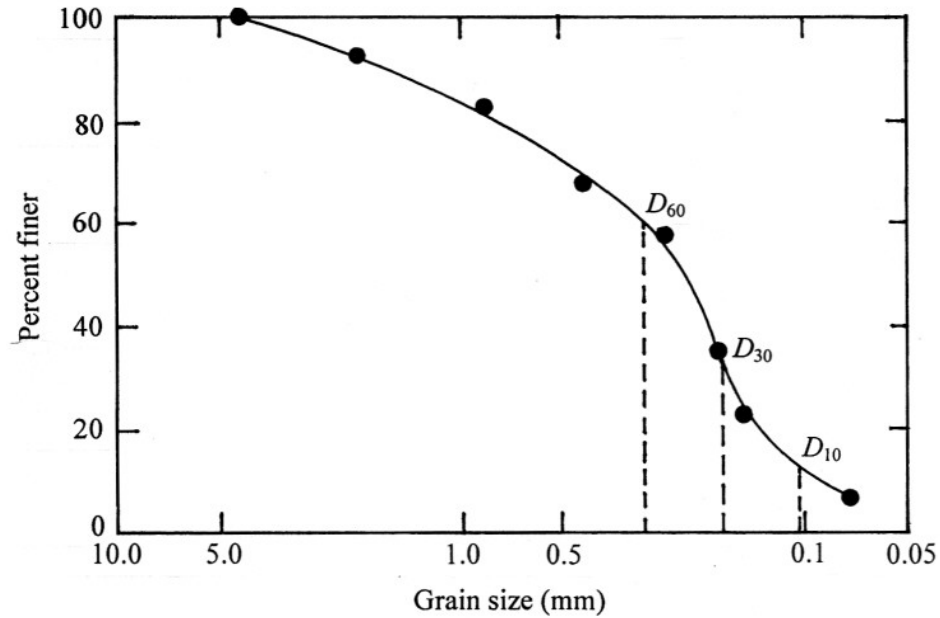
c.  $C_u = \frac{D_{60}}{D_{10}} = \frac{0.4}{0.12} = 3.33$

d.  $C_c = \frac{(D_{30})^2}{(D_{10})(D_{60})} = \frac{(0.22)^2}{(0.4)(0.12)} = 1.01$

2.5 a.

Sieve no.	Mass of soil retained on each sieve (g)	Percent retained on each sieve	Percent finer
4	0	0	<b>100</b>
10	44	7.99	<b>92.01</b>
20	56	10.16	<b>81.85</b>
40	82	14.88	<b>66.97</b>
60	51	9.26	<b>57.71</b>
80	106	19.24	<b>38.47</b>
100	92	16.70	<b>21.77</b>
200	85	15.43	<b>6.34</b>
Pan	35	5.34	<b>0</b>
$\Sigma 551 \text{ g}$			

The grain-size distribution is shown in the figure.



b. From the graph:  $D_{60} = 0.3 \text{ mm}$ ;  $D_{30} = 0.17 \text{ mm}$ ;  $D_{10} = 0.11 \text{ mm}$

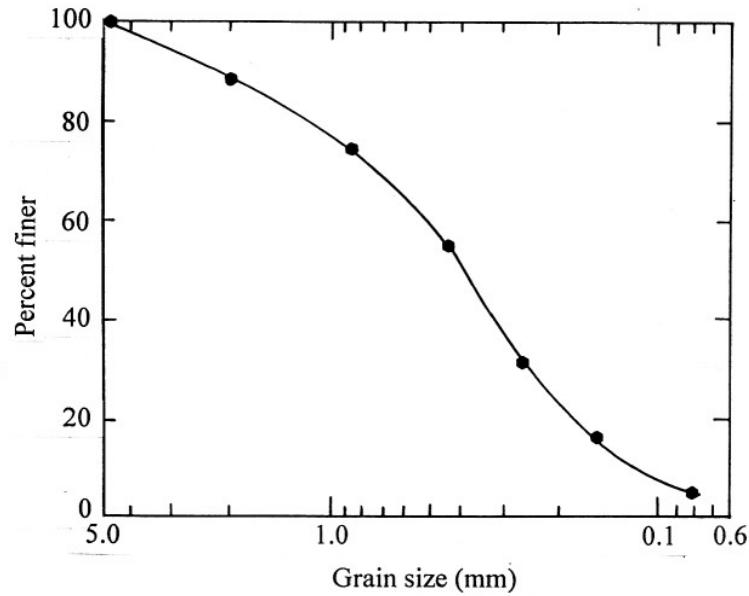
c. 
$$C_u = \frac{0.3}{0.11} = 2.73$$

d. 
$$C_c = \frac{(0.17)^2}{(0.11)(0.3)} = 0.88$$

2.6 a.

Sieve no.	Mass of soil retained on each sieve (g)	Percent retained on each sieve	Percent finer
4	0	0	<b>100</b>
10	41.2	10.7	<b>89.3</b>
20	55.1	14.2	<b>75.1</b>
40	80.0	20.8	<b>54.3</b>
60	91.6	23.8	<b>30.5</b>
100	60.5	15.7	<b>14.8</b>
200	36.5	9.2	<b>5.6</b>
Pan	21.5	5.6	<b>0</b>
$\Sigma 385.5 \text{ g}$			

The grain-size distribution is shown.



b.  $D_{60} = 0.50 \text{ mm}$ ;  $D_{30} = 0.26 \text{ mm}$ ;  $D_{10} = 0.14 \text{ mm}$

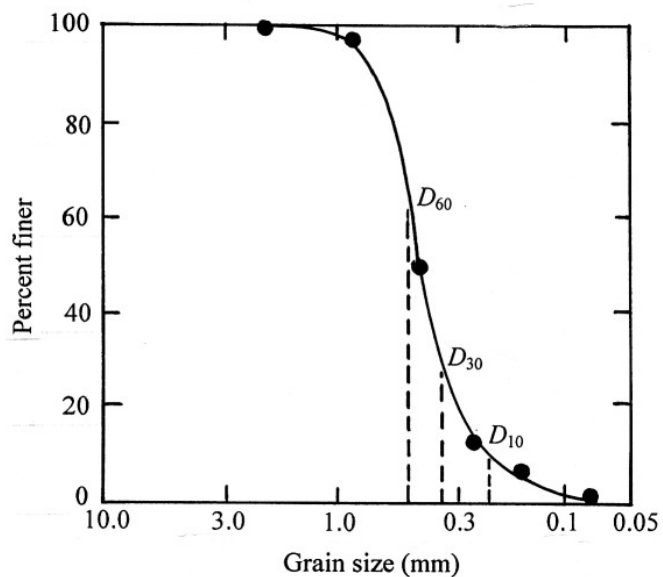
c.  $C_u = \frac{D_{60}}{D_{10}} = \frac{0.50}{0.14} = 3.57$

d.  $C_c = \frac{(D_{30})^2}{(D_{10})(D_{60})} = \frac{(0.26)^2}{(0.14)(0.50)} = 0.97$

2.7 a.

Sieve no.	Mass of soil retained on each sieve (g)	Percent retained on each sieve	Percent finer
4	0	0	<b>100</b>
6	0	0	<b>100</b>
10	0	0	<b>100</b>
20	9.1	1.82	<b>98.18</b>
40	249.4	49.88	<b>48.3</b>
60	179.8	35.96	<b>12.34</b>
100	22.7	4.54	<b>7.8</b>
200	15.5	3.10	<b>4.7</b>
Pan	23.5	4.70	<b>0</b>
$\Sigma 500 \text{ g}$			

The grain-size distribution is shown.

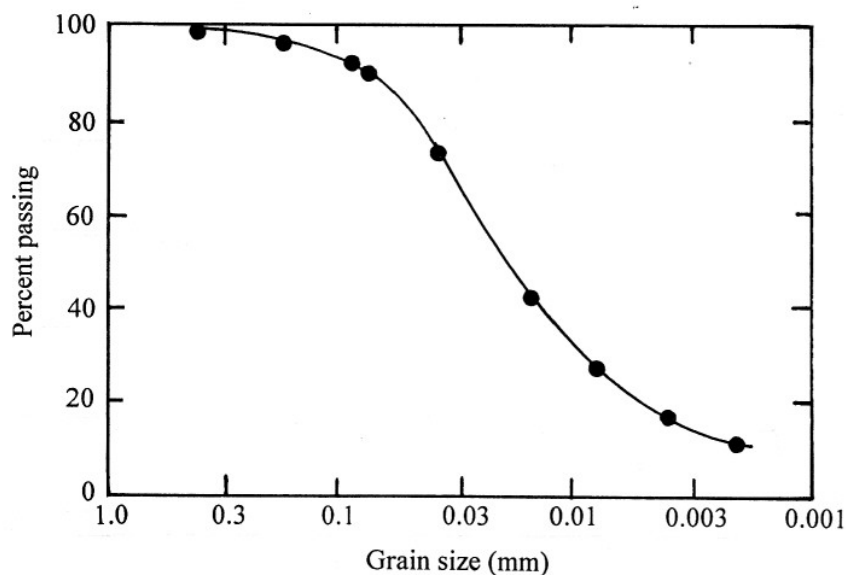


b. From the graph:  $D_{60} = 0.48$  mm;  $D_{30} = 0.33$  mm;  $D_{10} = 0.23$  mm.

c. 
$$C_u = \frac{0.48}{0.23} = 2.09$$

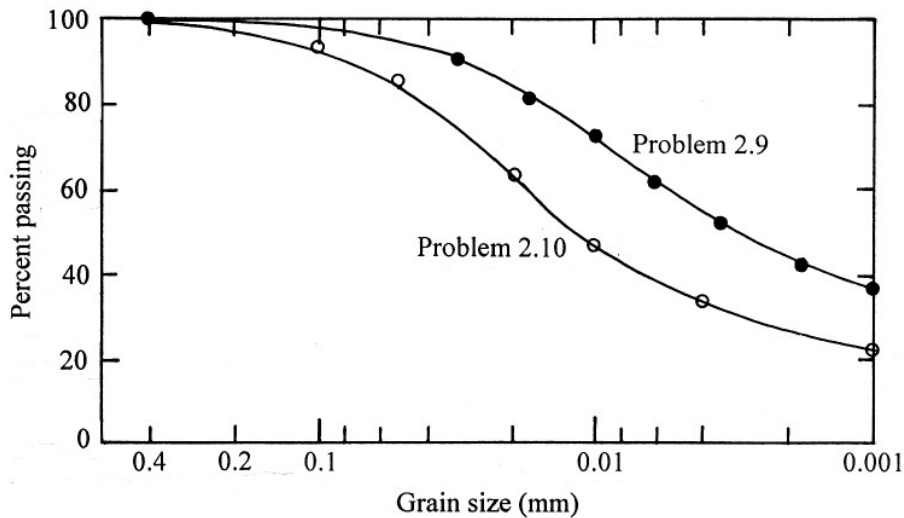
d. 
$$C_c = \frac{(0.33)^2}{(0.48)(0.23)} = 0.99$$

2.8 a. The grain-size distribution curve is shown.



- b. Percent passing 2 mm = 100  
 Percent passing 0.06 mm = 84  
 Percent passing 0.002 mm = 11
- GRAVEL:  $100 - 100 = 0\%$   
 SAND:  $100 - 84 = 16\%$   
 SILT:  $84 - 11 = 73\%$   
 CLAY:  $11 - 0 = 11\%$
- c. Percent passing 2 mm = 100  
 Percent passing 0.05 mm = 80  
 Percent passing 0.002 mm = 11
- GRAVEL:  $100 - 100 = 0\%$   
 SAND:  $100 - 80 = 20\%$   
 SILT:  $80 - 11 = 69\%$   
 CLAY:  $11 - 0 = 11\%$
- d. Percent passing 2 mm = 100  
 Percent passing 0.075 mm = 90  
 Percent passing 0.002 mm = 11
- GRAVEL:  $100 - 100 = 0\%$   
 SAND:  $100 - 90 = 10\%$   
 SILT:  $90 - 11 = 79\%$   
 CLAY:  $11 - 0 = 11\%$

2.9 The grain-size distributions are shown in the figure for Problems 2.9 and 2.10.



- Percent passing 2 mm = 100  
 Percent passing 0.05 mm = 94  
 Percent passing 0.002 mm = 42
- GRAVEL:  $100 - 100 = 0\%$   
 SAND:  $100 - 94 = 6\%$   
 SILT:  $94 - 42 = 52\%$   
 CLAY:  $42 - 0 = 42\%$

- 2.10 Percent passing 2 mm = 100  
 Percent passing 0.05 mm = 83  
 Percent passing 0.002 mm = 26
- GRAVEL:  $100 - 100 = 0\%$   
 SAND:  $100 - 83 = 17\%$   
 SILT:  $83 - 26 = 57\%$   
 CLAY:  $26 - 0 = 26\%$

2.11  $G_s = 2.60$ ; temperature =  $24^\circ$ ;  $R = 43$ ; time = 60 min. Referring to Table 2.7,  
 $L = 9.2$ .

$$\text{Eq. (2.5): } D \text{ (mm)} = K \sqrt{\frac{L \text{ (cm)}}{t \text{ (min)}}}$$

From Table 2.6 for  $G_s = 2.60$  and temperature =  $24^\circ$ ,  $K = 0.01321$ .

$$D = 0.01321 \sqrt{\frac{9.2}{60}} = \mathbf{0.0052 \text{ mm}}$$

2.12 For  $G_s = 2.70$  and temperature =  $23^\circ$ ,  $K = 0.01297$ ,  $R = 25$  (Table 2.6).  
 $L = 12.2$  (Table 2.7).

$$D \text{ (mm)} = K \sqrt{\frac{L \text{ (cm)}}{t \text{ (min)}}} = 0.01297 \sqrt{\frac{12.2}{120}} = \mathbf{0.0041 \text{ mm}}$$