

## Tutorial 2

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### Problem 1

Table 1 gives the results from a series of cone penetrometer tests using a standard 80g, 30° cone.

Mass of empty tin (g)	18.2	19.1	17.7	18.6
Mass of tin + wet sample (g)	51.5	45.5	50.7	43.4
Mass of tin + dry sample (g)	37.8	35.6	39.7	36.3
Cone penetration d (mm)	25.0	14.2	8.5	5.1

Table 1: Data for Problem 1

- Determine the water content of each sample.
- Plot a graph of the water content against the natural logarithm of the penetration and estimate the liquid limit.

In a separate series of tests the soil plastic limit was found to be 22%.

- Calculate the plasticity index and classify the soil.

*Powrie (2004)*

### Problem 2

During a plastic limit test the following data were obtained for one of the samples:

Wet weight + container	22.12 g
Dry weight + container	20.42 g
Weight of container	1.50 g

What is the  $w_P$  for this soil?

*Holtz, R.D. and Kovacs, W. D. (1981)*

### Problem 3

Table 2 summarizes the Atterberg limits and natural (in-situ) water contents ( $w$ ) for a number of soils. For each soil determine the:

- Plasticity index,
- Liquidity index, and
- Classify the soil.

Soil	$w$ (%)	$w_L$ (%)	$w_P$ (%)
A	27	13	8
B	37	35	29
C	41	35	18
D	72	60	28

**Problem 4**

A soil has a liquid limit of 61 and a plastic limit of 30. A moisture content test was performed on an undisturbed sample of this soil and gave the following results:

Mass of soil + container before drying	96.2 g
Mass of soil + container after drying	71.9 g
Mass of container	20.8 g

For this soil compute the:

- (a) Plasticity index,
- (b) Moisture content and
- (c) Liquidity index.

How would you describe this soil?

*Coduto (1999)*

**Problem 5**

A soil has a plastic limit of 22 and a liquid limit of 49. What is the moisture content when the liquidity index is 0.5?

*Coduto (1999)*

**Problem 6**

Given the natural water content, liquid limit and plastic limits as listed below.

Soil	Description	w (%)	w <sub>L</sub> (%)	w <sub>P</sub> (%)
A	Soft sandy clay	27	38	17
B	Firm silty clay	29	49	20
C	Stiff clay	25	71	23

Find:

- (a) Plasticity index,
- (b) Liquidity index,

Also classify each soil according to the plasticity chart given in BS 5930.

**References**

BSI (1999) BS 5930:1999 + A2:2010 *Code of practice for site investigations*. London, British Standards Institution.

Coduto (1999) *Geotechnical Engineering: Principles and Practices*, Prentice Hall.

Holtz, R.D. and Kovacs, W. D. (1981) *An Introduction to Geotechnical Engineering*, Prentice Hall.

Powrie, W. (2004) *Soil Mechanics: Concepts and Applications*, Spon Press