※ 考生請注意：本試題 ☑可 □不可 使用計算機

1　Translate following terminologies to Chinese and explain its meaning: (24 分，每題 4 分)
　　(1) Consistency　(2) Quick sand　(3) Capillary　(4) Critical hydraulic gradient
　　(5) Thixotropy　(6) Diffuse double layer

2. Given a soil specimen with an undrained shear strength of 40 kPa, if the soil is normally consolidated and has a liquid limit of 50, a plastic limit of 25, a void ratio of 0.65, and a specific gravity of 2.70. Assume ground water level is at ground surface.　Estimate the depth in meter below the ground surface at which the specimen was obtained? (7 分)

3. A particle has a volume of $1,000 Å^3$ and an area of $50 Å^2$, the specific gravity of the solid particles is 2.72 ($1 Å = 10^{-10}$ m). Determine the specific area of the particle in m^2/gram. (7 分)

4. A constant head hydraulic conductivity test was run on a silty sand sample with a length of 40 cm and a cross sectional area of $10 cm^2$　The head loss across the sample was 40 cm. If the hydraulic conductivity is 0.01 cm/sec, estimate the time (in sec) it takes to permeate $6 cm^3$ of water through the sample. (7 分)

5. An "undisturbed" soil sample obtained from a boring and had the following properties:
　　Specific Gravity, $G_s = 2.68$,　　　Void ratio = 0.78,　　Water content, $\omega = 12\%$.
　　Determine the following properties of the soil:　　(16 分，每題 4 分)
　　(a) Wet unit weight, γ_m
　　(b) Dry unit weight, γ_d
　　(c) Degree of saturation.
　　(d) Porosity.

6. Triaxial compression tests were performed on a dry sand, $\phi = 30$ degrees. Prior to shear each specimen was subjected to an isotropic confining (cell) pressure of 200 kPa. Specimens were then sheared with the following four loading path. (24 分，每題 8 分)
　　a. Compression - axial stress increased to failure (lateral stress constant).
　　b. Compression - lateral stress decreased to failure (axial stress constant).
　　c. Extension - axial stress decreased to failure (lateral stress constant).
　　d. Extension - lateral stress increased to failure (axial stress constant).
　　For each of these loading paths complete the following:
　　(1) Construct the Mohr's circle for stresses at failure and locate the pole point (origin of planes)
　　(2) Determine the major and minor principal stresses at failure and indicate which of these is the axial stress and which is the lateral stress.
　　(3) Determine and illustrate by means of a sketch the orientation of the failure planes.

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7　An 8 meters clay layer beneath a building is overlain by a stratum of permeable sand and gravel and is underlain by impermeable bedrock. The total expected primary consolidation settlement for the clay layer due to the footing load is 8 cm. Assume ground water level is at ground surface. The coefficient of consolidation is 2.68×10^{-3} cm²/min. (15 分，每題 5 分)

(1) How many years will it take for 90% of the total expected primary consolidation settlement to take place?

(2) Compute the amount of primary consolidation settlement that will occur in one year.

(3) How many years will it take for primary consolidation settlement of 3.2 cm to take place?

$U(\%)$	T_v
10	0.0077
20	0.0314
30	0.0707
40	0.126
50	0.196
60	0.286
70	0.403
80	0.567
90	0.848
95	1.13
99	1.78
99.9	2.71
100	Infinity

Percent Primary Consolidation, U

Time Factor, T_v