Yes, U can!

CV3013 Nov/Dec 2014

## Section A

1. (a) ii
   (b) iii
   (c) iv
   (d) ii
   (e) ii
   (f) i
   (g) i
   (h) iii
   (i) iii
   (j) ii
   (k) ii
   (l) iv
   (m) iv
   (n) iii
   (o) ii

## Section B

2. (a) mantle
   (b) powdered
   (c) mica
   (d) cleavage
   (e) oxygen
   (f) pressure
   (g) temperature
   (h) quartz sandstone
   (i) rivers
   (j) fossil succession
   (k) perpendicular
   (l) sheeting
   (m) hand
   (n) cross-cutting relationship
   (o) fault / intrusion

Yes, I can!

3. (a) - angular conformity
- below layer 3

(b) Similarities

- both conglomerate and breccia are sedimentary rocks.

Differences

- Particles in conglomerate are rounded as they are transported, most frequently by streams.
- Particles in breccia are angular indicate they were not transported very far from their source prior to deposition, and hence less weathered.

(c) - The law of superposition
- In an undisturbed sequence of sedimentary rocks or surface-deposited igneous rock, each bed is older than the one above, and younger than the one below.
- According to this law, layer 1 is younger than layer 2.
- When the rocks are disturbed, this law no longer hold as the sequences are disturbed.

(d) - layer 7 is younger
- layer 7 contain inclusion of layer 6
- the rock mass containing the inclusions is younger than the rock that provided the inclusion.

Yes, We Can!

4. (a) - convergent boundary
- zones where plates move together
- compression

(b) Area A
- contact metamorphism
- rocks found near the surface of Earth maybe subjected to intense heat when they are intruded by magma.

Area B
- hydrothermal metamorphism
- chemical alterations that occur as hot ion-rich water circulates through fractures in rock.

(c) - slate < phyllite < schist < greiss
- all of the metamorphic rocks are foliated.

5. (a) Soil A

% gravel = 0
% sand = 90%
% fines = 10%

⇒ coarse grained
⇒ sand (S)

% fine = 10%
⇒ dual symbol

$I_p = w_L - w_p$
$= 30 - 16$
$= 14$

$C_u = \frac{D_{60}}{D_{10}}$
$= \frac{1.18}{0.075}$
$= 15.733 > 6$

$C_z = \frac{(D_{30})^2}{D_{60} \times D_{10}}$
$= \frac{0.3^2}{1.18 \times 0.075}$
$= 1.017$
$1 < C_z < 3$
⇒ SW

$I_p = 14$, $w_L = 30$
⇒ above A-line, $I_p > 7\%$
⇒ SC

∴ soil A is SW-SC

5. (a) Soil B

% gravel = 0%

% sands = 78%

% fines = 22%

$I_p = w_L - w_P$

$= 60 - 20$

$= 40\%$

$\Rightarrow$ coarse grained

$\Rightarrow$ sand > 50%

$\Rightarrow$ S

$I_p = 40\%$, $w_L = 60\%$

$\Rightarrow$ above A-Line, $I_p > 7\%$

$\Rightarrow$ SC

$\Rightarrow$ % fines > 12%

$\Rightarrow$ SM or SC

$\therefore$ Soil B is SC

5. (b) (i) $q = kh\left(\frac{N_f}{N_d}\right)$

$= (2\times10^{-4}) \times 9 \times \left(\frac{4}{12}\right)$

$= 0.0006 \ m^3/s/m \ run$

(ii) $\Delta h = \frac{9}{12}$

$= 0.75m$

From the upstream end, total head at point C = $9 - 2.2\Delta h$

$= 9 - 2.2(0.75)$

$= 7.35m$

Elevation head = 0 (taking downstream as reference)

Pressure head at C, $h_c = 7.35 - 0$

$= 7.35m$

$u_c = 7.35 \times 10$

$= 73.5 \ kPa$

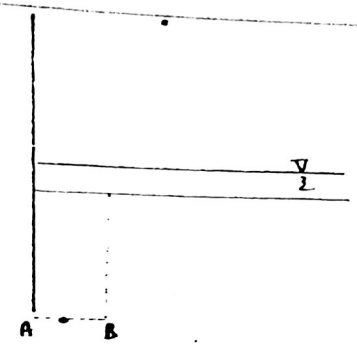
Total vertical stress at C = $3(10) + 6(18)$

$= 138 \ kPa$

Effective stress = $138 - 73.5$

$= 64.5 kPa$

5. (b)(iii)




Average total head AB = 3.5 Δh

= 1.625 m

Average hydraulic gradient $i_m = \frac{h_m}{d}$

$= \frac{1.625}{4}$

$= 0.656$

$i_{cr} = \frac{\gamma'}{\gamma_w}$

$= \frac{18-10}{10}$

$= 6.8$

$FS = \frac{i_{cr}}{i_m}$

$= \frac{0.8}{0.656}$

$= 1.22$ ✗

(b)(iv) $G_s = 2.5$

$\rho_s = 2500\ kg/m^3$

$\rho_w = 1000\ kg/m^3$

$\gamma_{sat} = 18\ kN/m^3$

$\gamma_{sat} = \frac{M}{V}$

$\therefore M = 1800\ kg$

assume $V = 1 m^3$

$V = V_s + V_w$ (saturated sand)

$M = M_s + M_w$

$1800 = \rho_s V_s + \rho_w V_w$

$1800 = 2500 V_s + 1000 V_w$

$18 = 25 V_s + 10 V_w$ —— ①

sub $1 = V_s + V_w$,

$18 = 25 V_s + 10(1 - V_s)$

$18 = 25 V_s + 10 - 10 V_s$

$8 = 15 V_s$

$V_s = 0.533\ m^3$

$V_w = 0.467\ m^3$

$e = \frac{V_v}{V_s}$

$= \frac{V_w}{V_s}$

$= \frac{0.467}{0.533}$

$= 0.88$

6. (a) $\Delta\sigma_v = 5 \times 18$

$= 90\ kPa$

Before filling, $u_s = 7(10)$

$= 70\ kPa$

After 1 year filling, $u = 155.5\ kPa$

$u_e = u - u_s$

$= 155.5 - 70$

$= 85.5\ kPa$ ✱

(b) $\frac{z}{d} = 1$

$U_z = 1 - \frac{u_e}{u_i}$

$= 1 - \frac{85.5}{90}$

$= 0.05$

From the chart $\frac{z}{d}$ against $U_z$, $T_v = 0.10$

$T_v = \frac{c_v t}{d^2}$

$0.10 = \frac{c_v \times 1}{4^2}$

$c_v = 1.6\ m^2/yr$ ✱

(c) $c_v = 1.6\ m^2/yr$

$t = 2$

$d = 4$

$T_v = \frac{c_v t}{d^2}$

$= \frac{1.6 \times 2}{4^2}$

$= 0.2$

$\frac{z}{d} = 1$

$\Rightarrow U_z = 0.23$

$u_e = (1 - 0.23) \times 90$

$= 69.3\ kPa$

$u = 69.3 + 70$

$= 139.3\ kPa$ ✱

Yes, U can!

6. (d) Total vertical stress = 18 (5) + 20 (3) + 16 (4)

= 214 kPa

$u$ = 139.3 kPa

$\sigma'$ = 214 - 139.3

= 74.7 kPa

(e) $\frac{z}{a} = 2$, $U_z = 1$

pore water pressure, $u = u_e + u_s$

= 0 + 11 × 10

= 110 kPa

$\sigma$ = 18 (5) + 20 (3) + 16 (8)

= 278 kPa

$\sigma'$ = 278 - 110

= 168 kPa

(f) $\sigma'_o$ = 54 kPa

$\sigma'_2$ = 74.7 kPa

$\sigma'_f$ = 144 kPa

⇒ normally consolidated clay, $S_c = \frac{H}{1+e_o} C_c \log\left(\frac{\sigma'_f}{\sigma'_o}\right)$

final settlement = $\frac{8}{1+1.2}(0.2) \log\left(\frac{144}{54}\right)$

= 0.3098 m

$T_v = 0.2$, $U = 50.5\%$

$S_c$ after 2 years = $0.3098 \times \frac{50.5}{100}$

= 0.156 m