CV2013 13/14 Sem 1

Date No.

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

2. (a) continental
(b) oceanic
(c) powdered
(d) iron
(e) magnesium
(f) displacement
(g) Ultramafic
(h) Gabbro
(i) Rhyolite.
(j) ~~Quatz~~ Quartz
(k) temperature
(l) pressure
(m) marble
(n) expansion
(o) contraction

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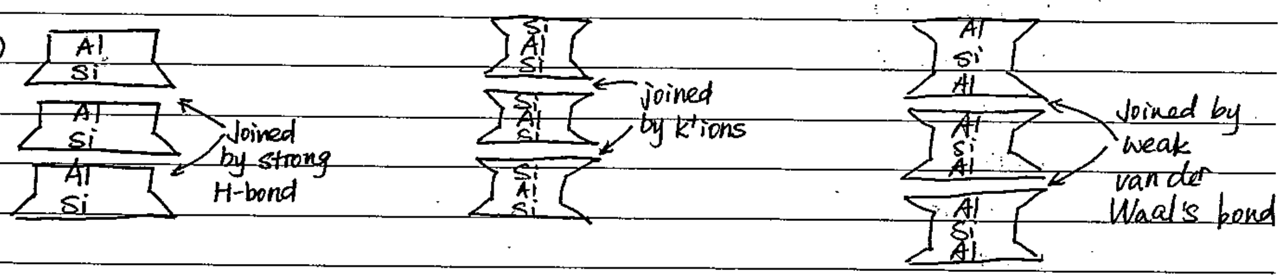
3. (a) Fault A is younger than the sandstone layer.
Principle of ~~ctt~~ cross-cutting relationships
When a ~~fatt~~ fault or intrusion cuts through another rock, the fault or intrusion is younger than the rocks cut through.
Fault B is older than the dike B.
Same principle: Fault B is ~~y~~older than the Batholith
Dike B is younger than the batholith
⇒ Fault B is older them ~~the~~ the dike B.

(b) The law of superposition
In an undeformed sequence of sedimentary rocks or surface-deposited rocks, each bed is older ~~than~~ than the one above, and younger than the one below.
Shale & conglomerate ~~are~~ layers are undeformed sedimentary rock and shale is above conglomerate, so shale ~~is~~ layer is younger than the conglomerate layer.

4. (a) Jurong Formation
Sedimentary origin
Younger than the Bukit Timah Granite

(b) G(III): Cannot be ~~broken~~ broken by hand
G(IV): Can be broken by hand
Does not slake in water
G(V): Slakes in water

(c)


Kaolinite Illite Montmorillonite

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Kaolinite consists of a structure based on a single sheet of silica combined with a single octahedral sheet. $ The combined silica-gibbsite sheets are held together relatively strongly by hydrogen bonding.

Illite has a basic structure consisting of gibbsite between and combined with two sheets of silica. In the silica sheet there is partial substitution of silicon by aluminium. The combined sheets are linked together by relatively weak bonding due to non-exchangeable potassium ions held between them

Montmorillonite has the same basic structure as illite.
In the octahedral sheet there is partial substitution of aluminium by ~~magnesian~~ magnesium and iron, and in the sillica sheet there is partial substitution of silicon by aluminium.
The space between the combined sheets is occupied by water molecules and exchangeable cations other than potassium, resulting in a very weak bond.

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5. (a) (i) $\frac{q}{A} = ki = k\frac{\Delta h}{L}$

$h_A = 0.1 + 0.6 = 0.7m$,

$h_B = -0.6 + 1.1 = 0.5m$.

$\Rightarrow \frac{q}{A} = 0.2 = 2 \times \frac{h_C - 0.5}{0.6}$

$\Rightarrow h_C = 0.56m$.

(ii) $i_{sediment} = \frac{\Delta h}{L} = \frac{0.7-0.56}{0.1} = 1.4$

$i_{soil} = \frac{\Delta h}{L} = \frac{0.56-0.5}{0.6} = 0.1$

(iii)

$\frac{q}{A} = ki \Rightarrow 0.2 = k \times 1.4 \Rightarrow k = \frac{1}{7}$

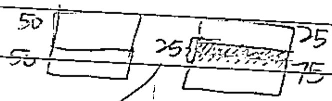
(b) $S_{r_1} = \frac{V_{w_1}}{V_v} = 0.5$ $\gamma_1 = \frac{W_1}{V} = 16.6 kN/m^3$

$S_{r_1} = \frac{V_{w_2}}{V_v} = 0.75$ $\gamma_2 = \frac{W_2}{V} = 17.7 kN/m^3$

Assume $V = 1m^3$

$\Rightarrow W_2 - W_1 = 1.1kN = W_{w2} - W_{w1} = V_{w2}\gamma_w - V_{w1}\gamma_w$

$\Rightarrow 1.1 = 0.25 V_v \gamma_w$



$\Rightarrow V_v = \frac{1.1}{0.25 \times 9.81} = 0.4485 m^3$

$\Rightarrow V_s = 1 - 0.4485 = 0.5515 m^3$.

$W_1 = 16.6 kN/m^3 \Rightarrow W_s = W_1 - W_{w1} = 16.6 - 0.5 \times 0.4485 \times 9.81 = 14.4 kN$

$G_s = \frac{W_s}{V_s \gamma_w} = \frac{14.4}{0.5515 \times 9.81} = 2.662$

$e = \frac{V_v}{V_s} = \frac{0.4485}{0.5515} = 0.813$

(c) (i) Well graded soil: no excess particles in any size range and no intermediate sizes are lacking.

Poor graded soil: 1) A high proportion of the particles have sizes within narrow limits (uniform soil)

2) Relative low proportion of particles of intermediate size (gap-graded soil)

(ii) Liquid limit and plastic limit are the upper and lower limits of the range of water content over which a soil exhibits plastic behaviour.
Above liquid limit is liquid. Below the plastic limit is semisolid state.

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6 (a) $\sigma = 4\times10+2\times15=70kPa$

$u = 6\times10 = 60kPa \Rightarrow \sigma' = 70-60 = 10kPa$

$OCR = \frac{10}{10} = 1$ ∴ Normally consolidated

(b) $\sigma = 5\times18+2\times15 = 120kPa$

$u = 6\times10 = 60kPa \Rightarrow \sigma'_f = 120-60 = 60kPa$

$\Rightarrow S_c = C_c \frac{H}{1+e_0} \log\frac{\sigma'_f}{\sigma'_i}$

$= 0.9\times\frac{4}{1+2.3}\times\log\left(\frac{60}{10}\right)$

$= 0.849m$.

(c) $T_v = \frac{C_v t}{d^2}$

$= \frac{0.806\times2}{4} = 0.403$

From the table $\Rightarrow U = 0.7 = 70\%$

(d) $\sigma'_i = 10kPa$

$\sigma'_f = 18\times5+2\times15-2\times10 = 100kPa$

$\Rightarrow S_c = C_c\frac{H}{1+e_0}\log\frac{\sigma'_f}{\sigma'_i}$

$= 0.9\times\frac{4}{1+2.3}\times\log\left(\frac{100}{10}\right)$

$= 1.091m$.

(e) $h = (4-1.091)\div2 = 1.4545m$.

$\sigma_1 = 5\times18+1.4545\times15 = 111.8175kPa$

$u_1 = 1.4545\times10 = 14.545kPa$

$\Rightarrow \sigma'_1 = \sigma - u = 97.2725 kPa$

$\sigma'_2 = 5\times18+1.4545\times15-10\times(5+1.4545) = 47.2725kPa$

$OCR = \frac{\sigma'_p}{\sigma'} = \frac{100}{47.2725} = 2.115$