AY21/22_S1_CV2013

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1a)

igneous rock - the cooling and solidification of magma or lava.
Sedimentary rock - the lithification and cementation of sediments at Earth's surface and within bodies of water
metamorphic rock - form from sedimentary or igneous parent rock under high pressure and high temperature.

b) silicates, carbonates, oxides, sulphides, sulphates

c) Disconformity - An unconformity in which an upper sedimentary sequence overlies an erosional surface developed on an undeformed, still-horizontal lower sedimentary sequence.

Noncontomity - An unconfomity in which an upper sedimentary bed overlies other ~~rock~~ types of rock bed, that is, metamorphic or igneous rock.

Angular conformity - An unconformity in which the upper beds overlie lower beds that have been folded by tectonic processes and then eroded to an almost even plane.

d) Shrinkage joint - drying out of sediments / woling of molten lavas
columnar joint - Shrinkage cracks develop around regularly spaced centre towards which tensional stresses coverage.
Sheeting joint - shrinkage of woling large homogenous igneous masses, or for large daily rock surface temperature variations, stresses created during heating caused the near-surface zone of rock to expand and detach in thin labs.

~~e) (i) can be broken easily by hammer~~
~~(ii)~~

e) (i) moderately weathered Bukit Timah granite can be broken easily by hammer.
(ii) Highly weathered Bukit Timah granite can be broken easily by hand
(iii) slake test

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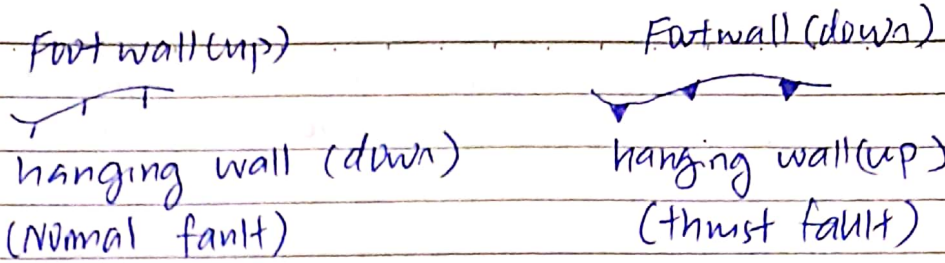
2a)



b) 260/60

c) apparent dip = 30°

$\beta = \frac{103^\circ - 13^\circ}{2}$

$= 45^\circ$

$\tan 30^\circ = \cos 45^\circ \times \tan(\text{true dip})$

true dip = 39.23°

d) principle of superposition

e) Rock material - the intact rock within the framework of discontinuities

Rock mass - a matrix consisting of rock materials and discontinuities

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5 a) $q = kiA$

q = the volume of water flowing per unit time
i = hydraulic gradient
k = coefficient of permeability
A = cross-sectional area of soil

b) $q_1 = q_2$ Let datum at the outlet

$k_1 i_1 A = k_2 i_2 A$

~~$k_1 \left(\frac{2-x}{0.5}\right) = 10k_1 \left(\frac{x-0.2}{0.5}\right)$~~

$10k_2 \left(\frac{2-x}{0.5}\right) = k_2 \left(\frac{x-0.2}{0.5}\right)$

$10(2-x) = x - 0.2$

$20 - 10x = x - 0.2$

$20.2 = 11x$

$x = 1.836\,m$

Total head at the interface = 1.836 m

c) $h_w = 1.836\,m - 0.7\,m$

$= 1.136\,m$

pore water pressure $= 1.136 \times 9.81$

$= 11.14\,kPa$

d) $q = kiA$

$3333 \times 10^{-6} = \left(\frac{2-1.836}{0.5}\right) k_1 (0.01)$

$k_1 = 1.016\,ms^{-1} \times 10^{-3}$

$q = 3333 \times 10^{-6} m^3 s^{-1}$

$A = 0.01 m^2$

$k_2 = 1.016 \times 10^{-4} ms^{-1}$

e) $V_1 = k_1 i_1$

$= (1.016 \times 10^{-3}) \left(\frac{2-1.836}{0.5}\right)$

$= 3.332 \times 10^{-4}\,ms^{-1}$

$V_2 = (1.016 \times 10^{-4}) \left(\frac{1.836-0.2}{0.5}\right)$

$= 3.324 \times 10^{-4}\,ms^{-1}$

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4a) $\gamma_{sat} = \frac{G\gamma_w(1+w)}{1+Gw}$

$19 = \frac{(2.7)(9.8)(1+w)}{1+2.7w}$

$19 + 51.3w = 26.46 + 26.46w$

$w(24.84) = 7.46$

$w = 0.3$

b) $\frac{S_c}{H} = \frac{\Delta e}{1+e_0}$

$\frac{20-16.5}{20} = \frac{\Delta e}{1+0.8}$

$\Delta e = 0.315$

e at the end of consolidation = 0.485

c) $\sigma_0 = (2)(20) + 4(21) + 1(19)$

$= 143 kPa$

$u_0 = (4+1)(9.81)$

$= 49.05 kPa$

$\sigma_0' = 93.95 kPa$

$\sigma_p' = 1.5 \times 93.95$

$= 140.93 kPa$

$\sigma_2' = 93.95 + 100$

$= 193.95 kPa$

$$S_c = (0.03)\left(\frac{2}{1+0.8}\right)\log\left(\frac{140.93}{93.95}\right) + (0.4)\left(\frac{2}{1+0.8}\right)\log\left(\frac{193.95}{140.93}\right)$$

$= 5.87 \times 10^{-3} + 0.0616$

$= 0.0675$

4a) ~~Sr = 1~~ ~~Sr e = wGs~~

$0.8 = w(2.7)$

$w = 0.296$

4d) To find Cv

$T_v = -0.933 \log(1-U) - 0.085$

when $U = 0.9$

$T_v = 0.848$

$$0.848 = \frac{C_v (80 \times 60)}{0.01^2}$$

$$C_v = 1.767 \times 10^{-8}$$

To find the time taken to reach $U_{ave} = 90\%$

$$0.848 = \frac{1.767 \times 10^{-8} (t)}{2^2}$$

$t = 1.92 \times 10^8 s$

$= 6.087$ years

e) For $\frac{z}{d} = 0.5$, $T_v = 0.848$

$U_z = 0.882$

$$0.882 = 1 - \frac{u_e}{100}$$

$u_e = 11.8$ kPa

$u = u_0 + u_e$

$= 49.05 + 11.8$

$= 60.85$

$u = \gamma h w$

$h_w = 6.20$ m

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