No.: 15 – 16

CV2013

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1.

(a)

(i)

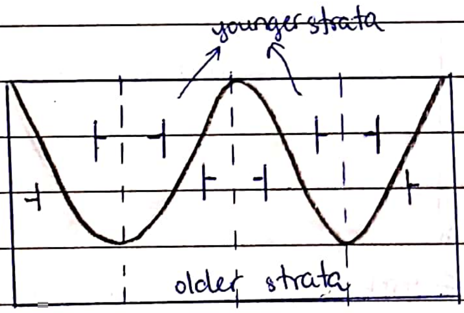
	Felsic	Intermediate	Mafic
Coarse-grained	Granite	Diorite	Gabbro
Fine-grained	Rhyolite	Andesite	Basalt

(ii) Granite, diorite and gabbro are intrusive igneous rocks. Rhyolite, andesite and basalt are extrusive igneous rocks. Intrusive igneous rocks have phaneritic (coarse-grained) texture. Extrusive igneous rocks have aphanitic (fine-grained) texture. Higher rate of cooling leads to crystallization of finer grained rocks

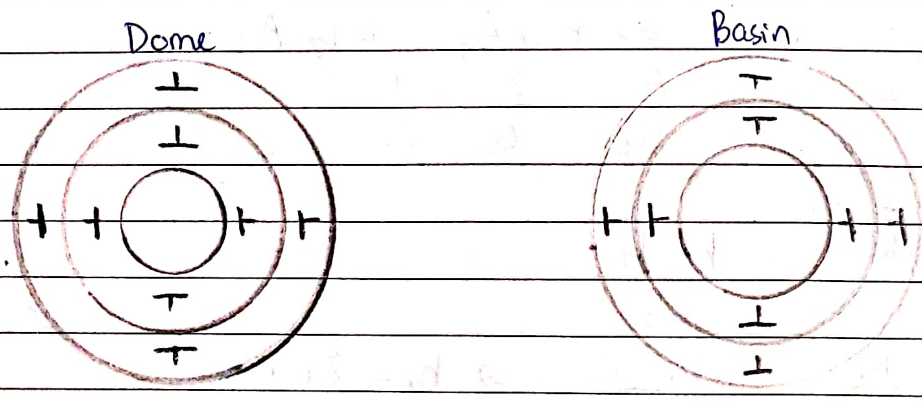
(iii) felsic = feldspar + silica. Poor in iron + Mg but rich in feldspar + Si
mafic = magnesium + iron ferromanesian

(b)

(i)

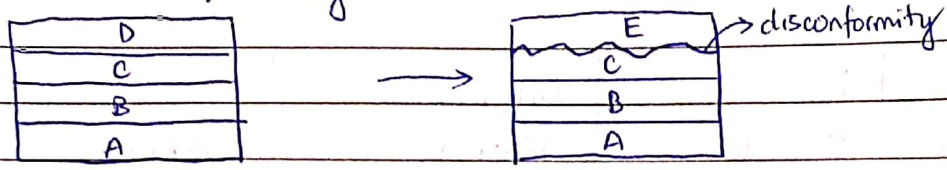


(ii)

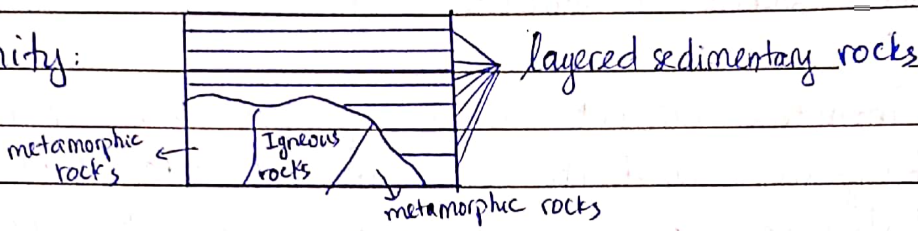


(c) Geological processes giving rise to an unconformity.
- Sea level drops, erosion, sedimentation creates disconformity
- Tectonic processes, erosion & sedimentation creates angular unconform
- Sedimentation on igneous or metamorphic rocks → nonconformity

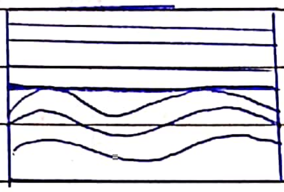
Disconformity



Nonconformity:

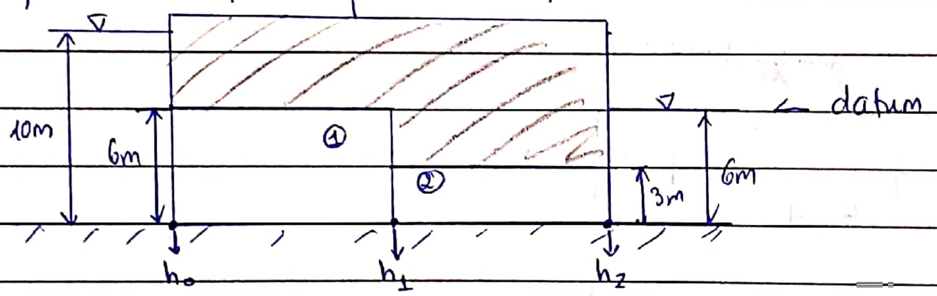


Angular unconformity



3.

(a) $q = 1\ m^3/hr$ per m of trench



$h_0 = h_{p_0} + z_0 = 10\,m - 6\,m = 4\,m$

$h_2 = h_{p_2} + z_2 = 6\,m - 6\,m = 0\,m$

Since $q_1 = q_2 \Rightarrow k i_1 A_1 = k i_2 A_2$

$\Rightarrow \frac{i_1}{i_2} = \frac{A_2}{A_1} = \frac{3}{6} = \frac{1}{2}$

$\Rightarrow 2 i_1 = i_2$

$\Rightarrow 2\,\frac{h_0 - h_1}{L_1} = \frac{h_1 - h_2}{L_2}$

$\Rightarrow 2\,\frac{4 - h_1}{200} = \frac{h_1 - 0}{200} \Rightarrow h_1 = 2.67\,m$

$k = \frac{q_1}{i_1 A_1} = \frac{(1)\ \text{width}}{\frac{4 - 2.67}{200} \times (200\ \text{width})} = 0.752\ m/hr$

4.

(a) $u_A = 10(2.2 + 4.5) = 67$ kPa

Before the placement of the sand fill:

$\sigma_{v_{A_0}} = 4.5 \times 16 = 72$ kPa

$u_{A_0} = 10 \times 4.5 = 45$ kPa

$\sigma'_{v_{A_0}} = 72 - 45 = 27$ kPa

Applied load: $q = u_i = 20 \times 2 = 40$ kPa.

$u_e = u_A - u_{A_0} = 67 - 45 = 22$ kPa

$U_z = 1 - \frac{u_e}{u_i} = 1 - \frac{22}{40} = 0.45$

Single drainage $\Rightarrow d = H = 9$ m

$z = 4.5$ m $\Rightarrow z/d = 0.5$

From the isochrones, $T_v = 0.20$

$\Rightarrow c_v = \frac{T_v d^2}{t} = \frac{0.20 \times 9^2}{2} = 8.1$ m²/yr (ans)

$s(t=2) = 0.505$ m

$T_v = 0.20 \Rightarrow U = 0.505$

$U = \frac{s(t=2)}{s_c} \Rightarrow s_c = 1$ m

$\sigma'_p = OCR \times \sigma'_{v_0} = 1.2 \times 27 = 32.4$ kPa

After 2 years: $\Delta\sigma'_v = u_i - u_e = 40 - 22 = 18$ kPa

$\sigma'_v = \sigma'_{v_0} + \Delta\sigma'_v = 27 + 18 = 45$ kPa

$$s_c = \frac{H}{1+e_0}\left(C_r \log\frac{\sigma'_p}{\sigma'_{v_0}} + C_c \log\frac{\sigma'_v}{\sigma'_p}\right)$$

$$\Rightarrow 1 = \frac{9}{1+1.6}\left(0.05C_c \log\frac{32.4}{27} + C_c \log\frac{45}{32.4}\right)$$

$\Rightarrow C_c = 1.97$

(b) $T_v = \frac{c_v t}{d^2} = \frac{8.1 \times 4}{9^2} = 0.4$

- At point A: $z/d = 0.5 \Rightarrow U_z = 0.66$

$\Rightarrow u_e = u_i(1 - U_z) = 40(1 - 0.66) = 13.6$ kPa

$u_A = u_e + u_{A_0} = 45 + 13.6 = 58.6$ kPa

No.: ....

• At point B:

$u_{B_0} = 10(9-2.25) = 67.5$ kPa

$z/d = \frac{(9-2.25)}{9} = 0.75 \rightarrow U_z = 0.56$

$u_e = u_i(1-U_z) = 40(1-0.56) = 17.6$ kPa

$u_B = u_{B_0} + u_e = 85.1$ kPa

(c) $T_v = 0.4 \Rightarrow U = 0.70$

$\Rightarrow s(t=4) = U \times s_c = 0.70 \times 1 = 0.70$ m

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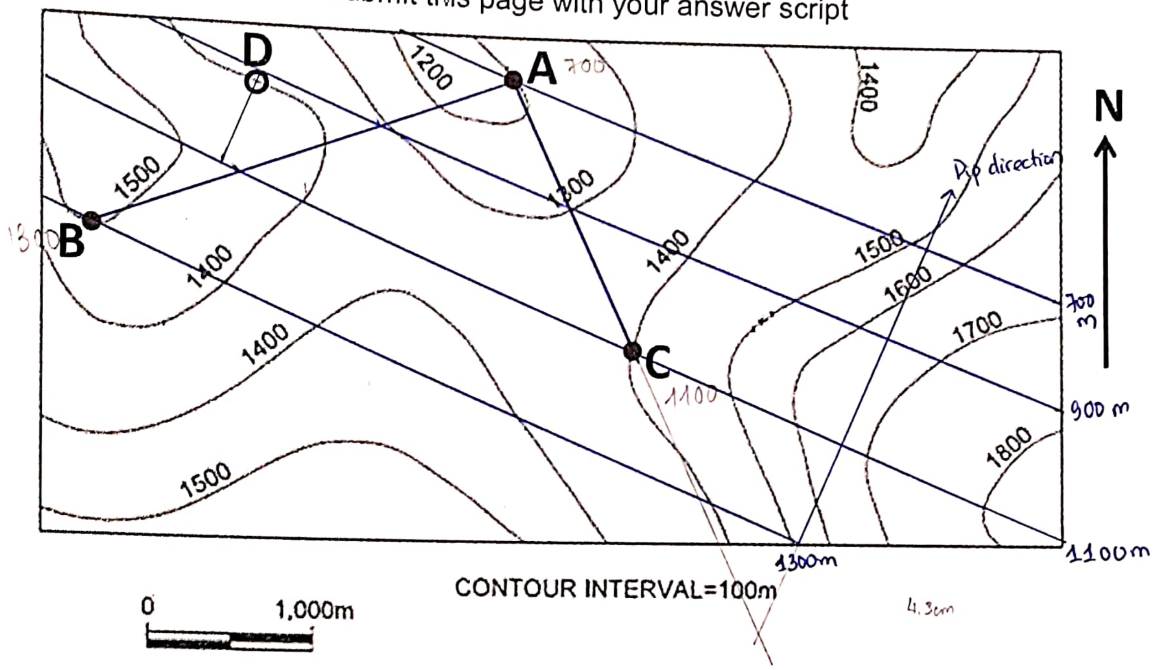
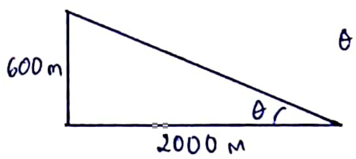


Location	Depth to top of coal seam	Elevation of the top of the coal seam
A	500 m	1200 − 500 = 700m
B	200 m	1500 − 200 = 1300 m
C	300 m	1400 − 300 = 1100m

(a) (i) Draw structural contours, and determine Dip direction/Dip of the top of the coal seam:



$\theta = \tan^{-1}\left(\frac{600}{2000}\right) = 16.7°$

Dip dir / Dip = 023 / 16.7

(ii) The orientation of the top of the coal seam in Strike/Dip: 113 / 16.7N

(iii) Depth of the top of the coal seam below location D: 477 m

(b) (i) Thickness of coal seam in horizontal direction: ~~50.1 m~~ 16.7m

(ii) Stratigraphic thickness of the coal seam: ~~1.44 m~~ 4.79 m

(c) (i) Apparent dip of the coal seam perpendicular to dip direction: 0°

(ii) Apparent dip of the coal seam in the direction of the line AC: 11.4°