

Supplement 1 – One-Dimensional Flow Examples

(a) Find: Pressure Head, Elevation Head and Total Head, Seepage Velocity

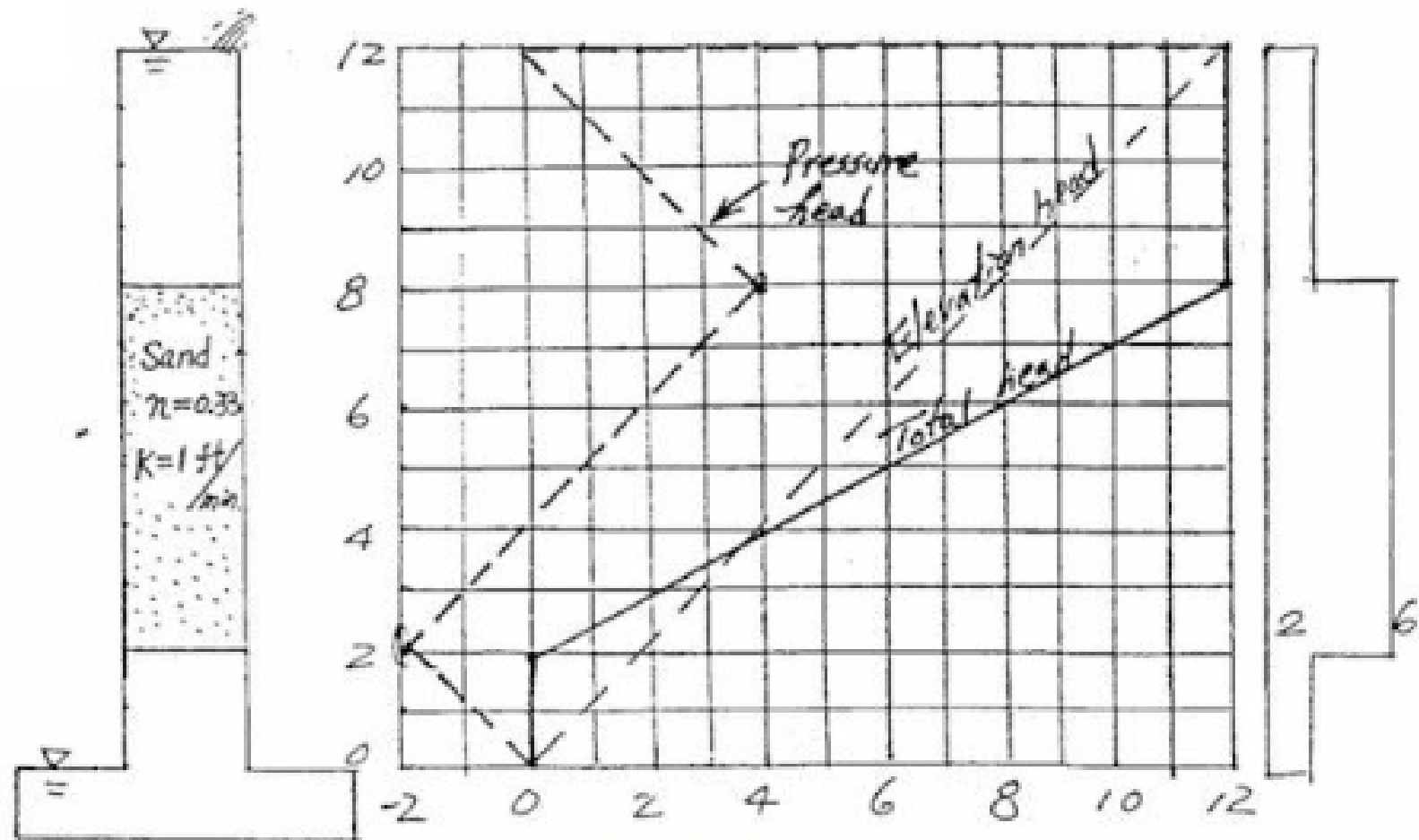


Diagram (a)

$$V = Ki = 1 \times \frac{12}{6} = 2$$

$$V_s = \frac{2}{0.33} = 6$$

(b) Upward Flow

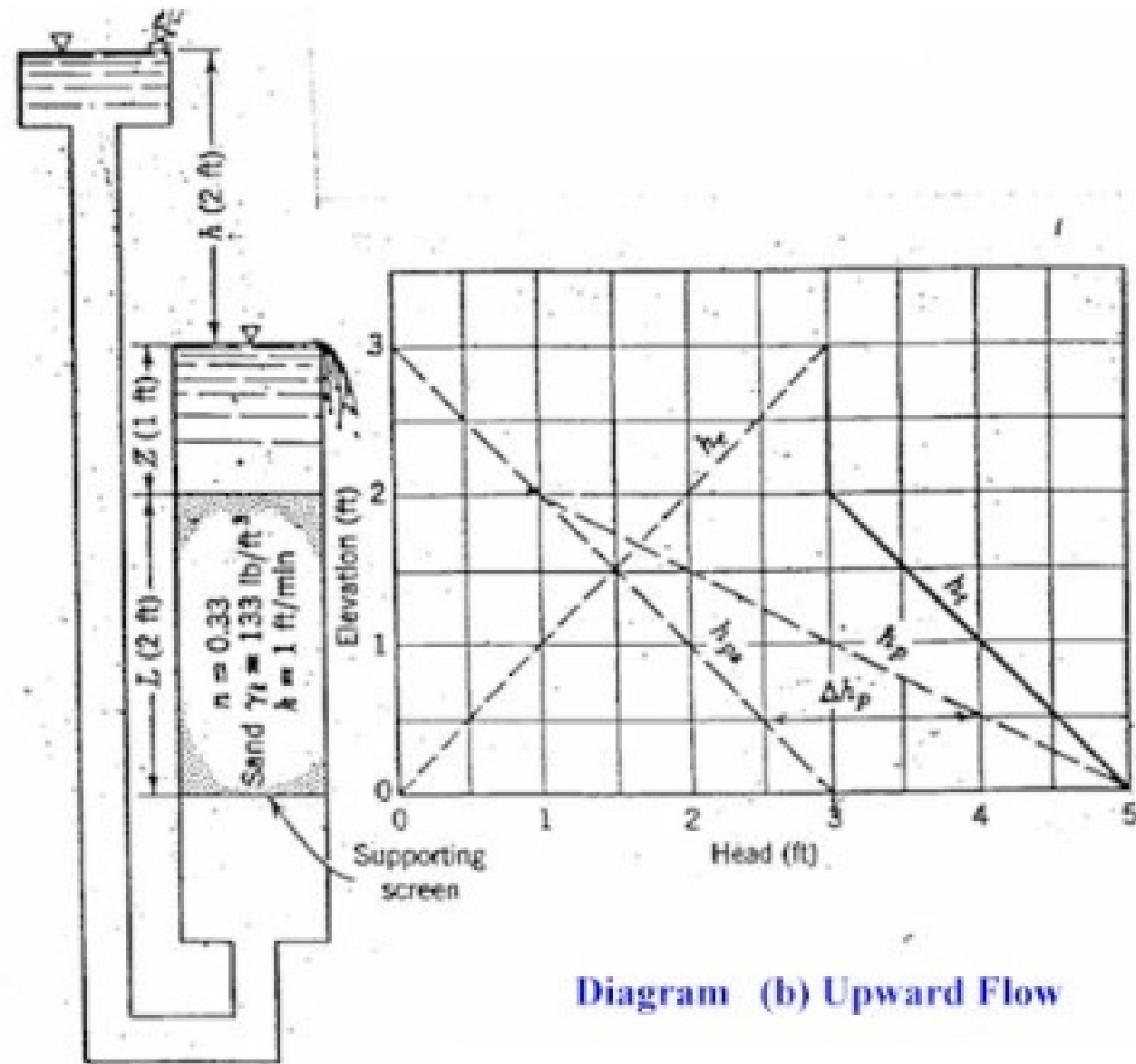


Diagram (b) Upward Flow

(c) Unit Seepage Force j

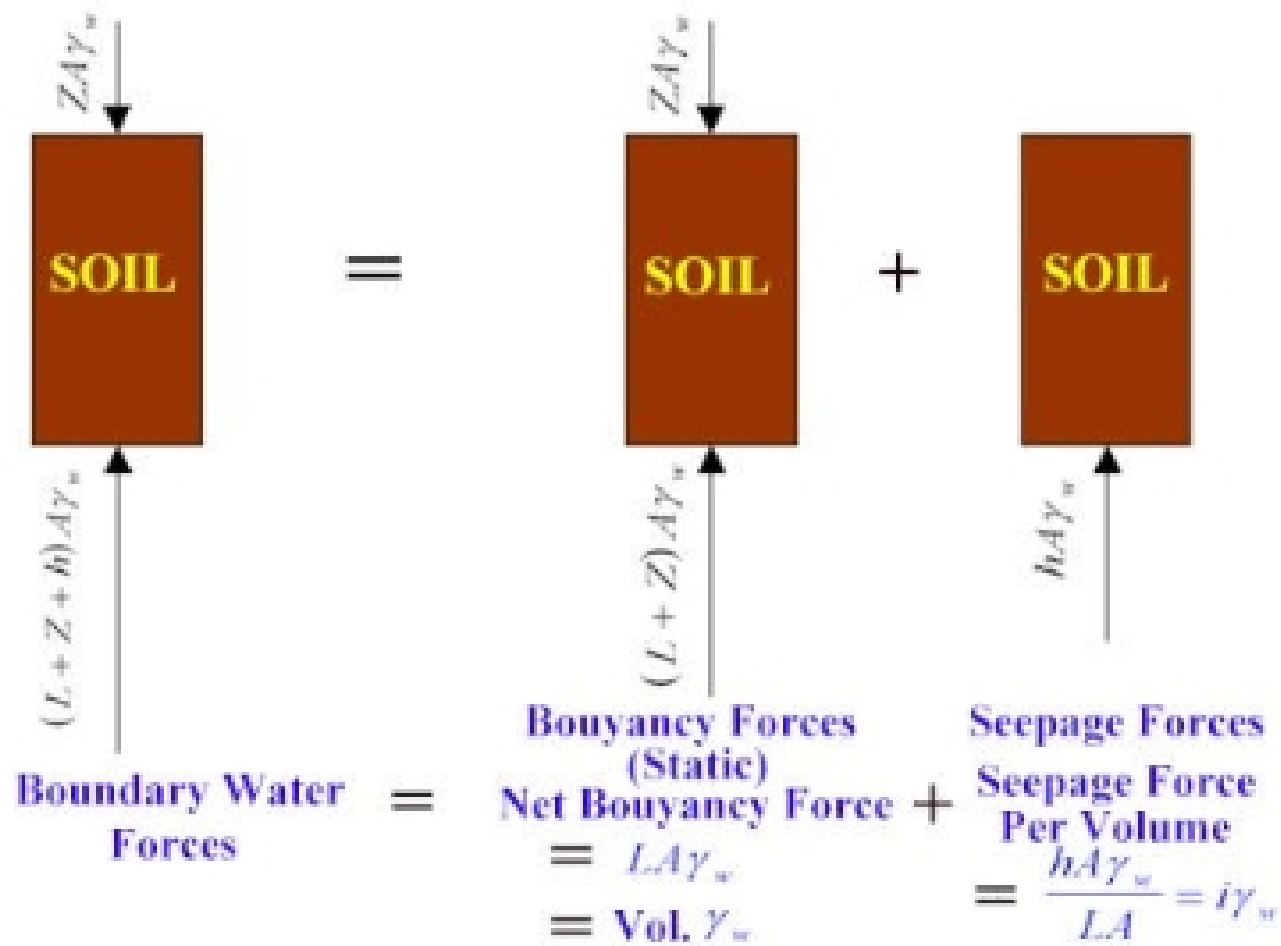
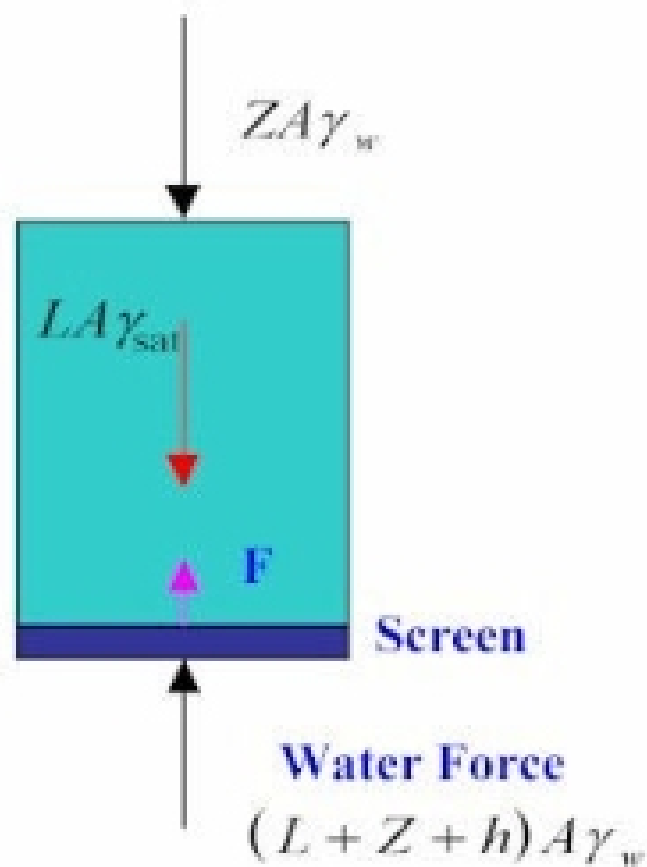


Fig. 17.15 Water Forces On Soi Sample

(d) Screen Reaction

(Force Equilibrium)

Free body diagram for solving the reaction on the screen.



F: Screen Support Force

$$\begin{aligned} F &= ZA \gamma_w + LA \gamma_{\text{sat}} - (L + Z + h)A \gamma_w \\ F &= (\gamma_{\text{sat}} - \gamma_w)AL - hA \gamma_w \\ F &= (L \gamma_s - h \gamma_w)A \end{aligned}$$

(e) Quick Condition (quick is used to refer a condition rather than a material)

If $F = 0$ then

$$\begin{aligned} L \gamma_s &= h \gamma_w \\ i_c &= \gamma_s / \gamma_w \end{aligned}$$

This is the critical gradient to cause quick condition
