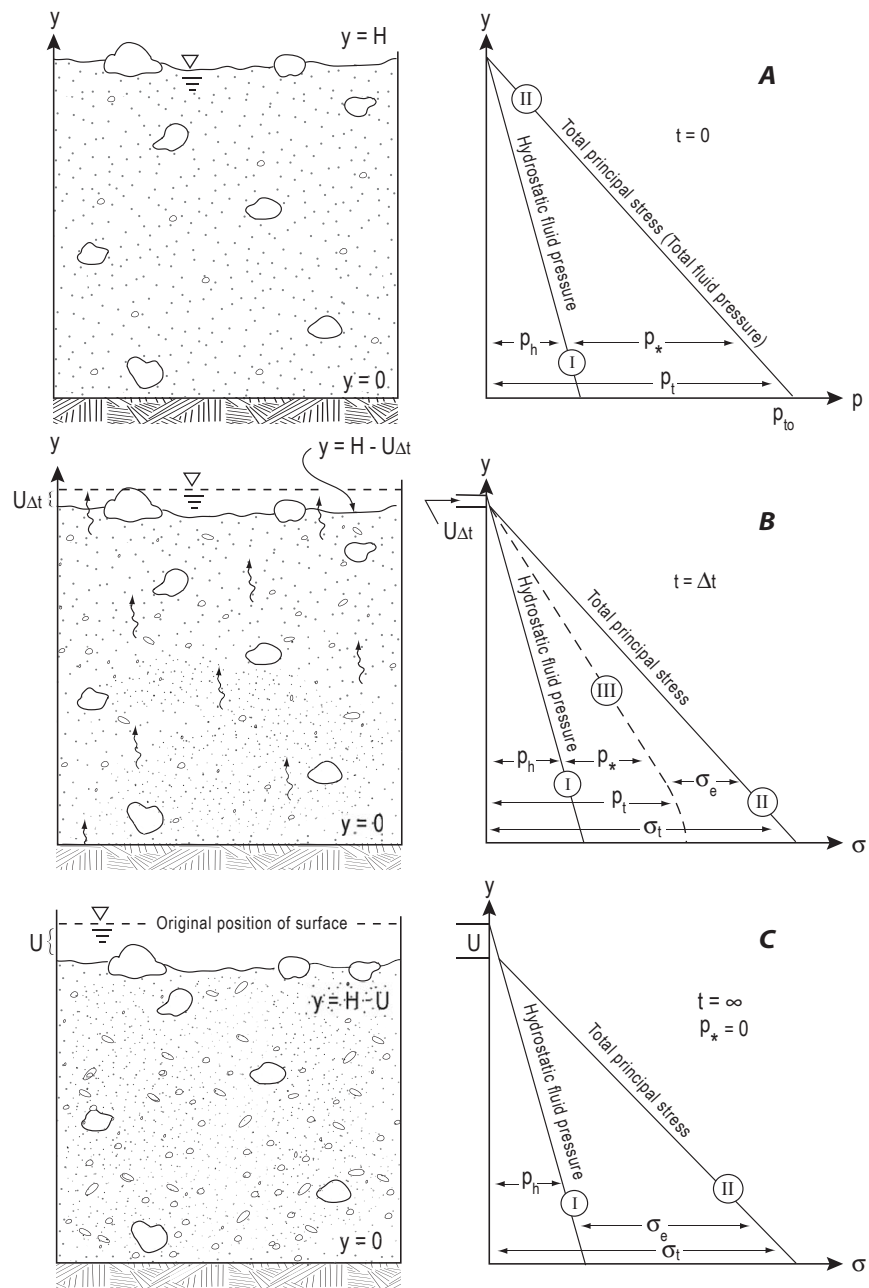


## Answers to Exercises Chapter 14

### Exercise 14.1

- (a)  $p_h = \rho_w g(h - y)$ , where  $\rho_w$  is water density and  $g$  is gravitational acceleration.  
 (b)  $\sigma_z = -\rho g(h - y)$ , where  $\rho$  is the bulk density of the saturated sediment  
 (c)  $\rho = \rho_w \phi + \rho_s(1 - \phi)$

### Exercise 14.2



Definition sketch of fluid pressure and stress fields for one-dimensional, gravity-driven consolidation of a lahar deposit overlying an impermeable bed.  $p_h$  is the hydrostatic fluid pressure;  $p^*$  is the fluid pressure in excess of hydrostatic;  $p_t$  is the total fluid pressure;  $p_{t0}$  is the initial value of the total fluid pressure;  $\sigma_t$  is the total normal stress ( $= \sigma_z$ );  $\sigma_e$  is the effective intergranular stress, and  $U$  represents the settlement of the deposit surface. **A.** Initial state of the saturated slurry. In this case, the total fluid pressure is initially equal to the unit weight of the slurry. A probe measuring fluid pressure at any depth would measure values along line II. **B.** Consolidation state at time  $\Delta t$ . Settling of buoyant grains generates excess fluid pressure that dissipates through Darcian seepage (laminar pore-fluid flow indicated by squiggles). A probe measuring fluid pressure at any depth would measure values along line III. As excess fluid pressure dissipates, the load is transferred to the sediment grains, which causes changes in grain packing, and line III shifts to the left. The magnitude of excess fluid pressure is defined by the width of the region between the profiles of hydrostatic pressure (I) and total fluid pressure (III). The total stress remains constant, and the effective intergranular stress represents the region between the profiles of total fluid pressure (III) and total stress (II). As excess fluid pressure decreases, effective stress increases. **C.** Static state. At infinite time, the excess pore fluid pressure has dissipated. A probe measuring fluid pressure at any depth would measure hydrostatic values along line I. The effective stress in this static state is defined by the region between the hydrostatic fluid pressure (I) and the total stress (II). Note that the deposit surface settled by an amount  $U$  in response to changes in grain packing.

### Exercise 14.3

- (a)  $2100 \text{ kg m}^{-3}$
- (b)  $\phi = 0.32$
- (c)  $1800 \text{ kg m}^{-3}$
- (d) That bulk densities of decelerating debris flows are comparable to those of deposits