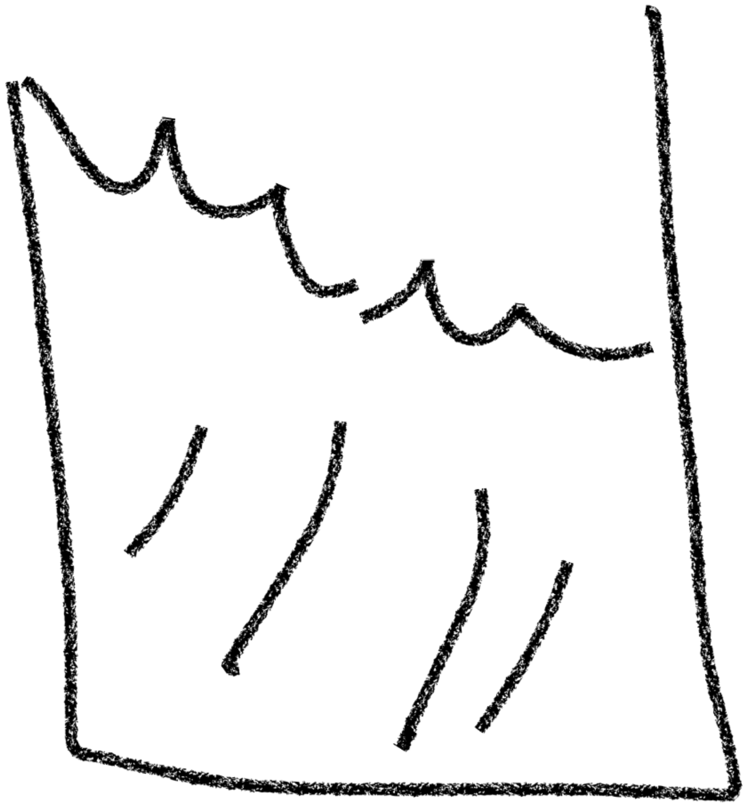
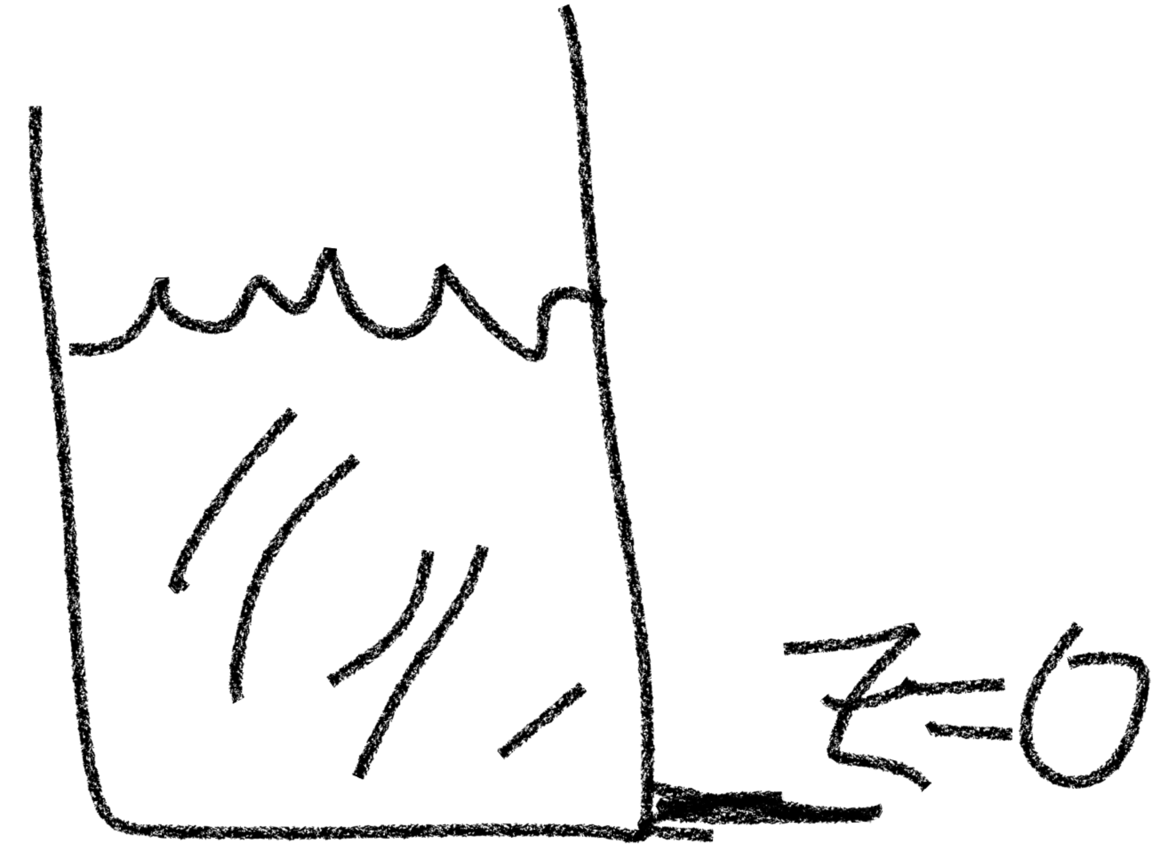
Compute
Potential Energy

(a)  (b) 

Two buckets, same mass of H_2O

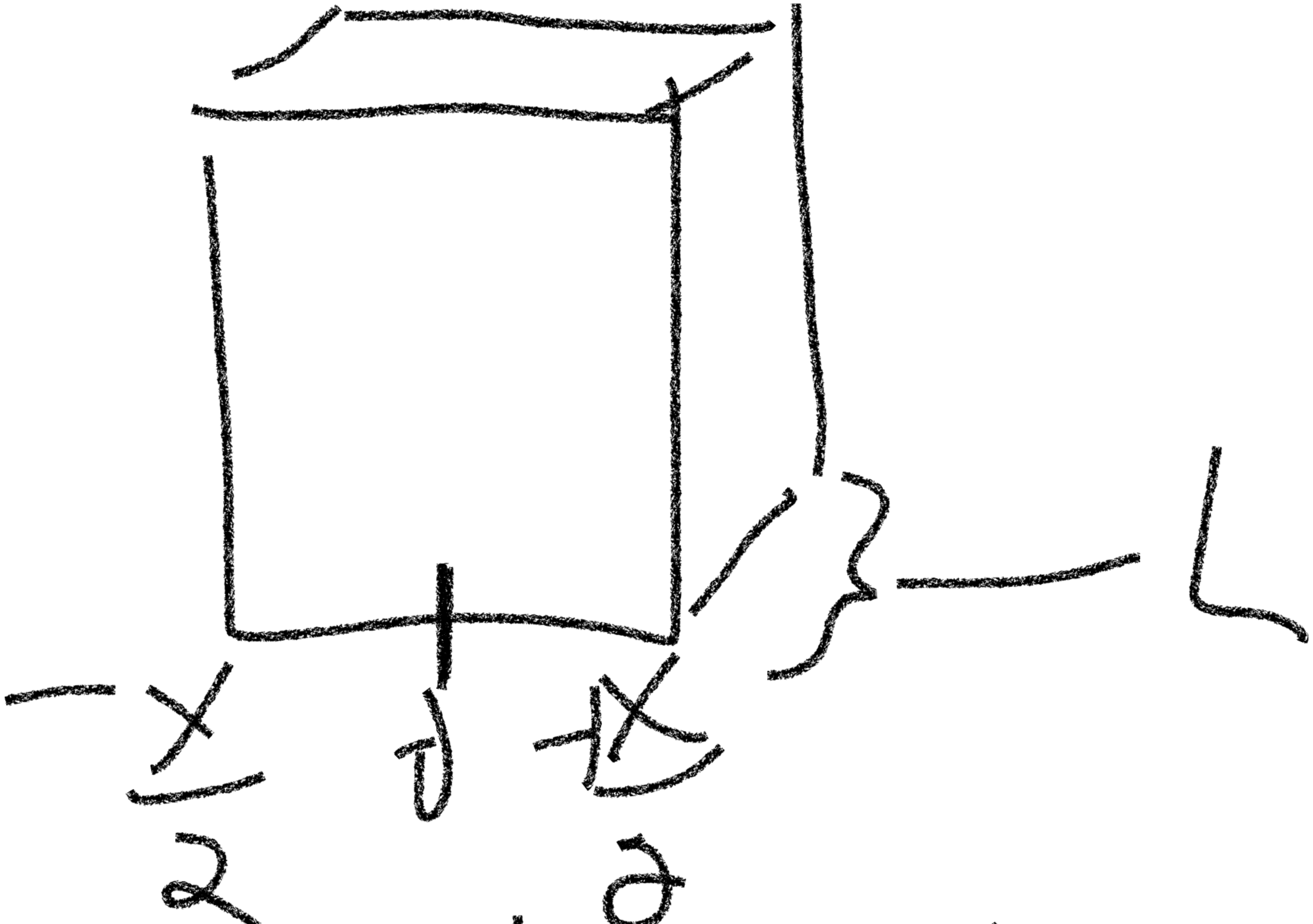
PE = ?

For parcel of water, $\therefore$ $pe = \rho g z$

z = dist. above bottom

Bucket is square, with

depth in y of L
and x coordinates
from $-\frac{X}{2} \leftrightarrow +\frac{X}{2}$



for bucket (b) depth $= h_0$

for (a), depth $= h_0 + \Delta x$

$$P_h = \int_y \int_x \int_0^{h(x)} (\rho g z)\, dz\, dx\, dy$$

$$= L \int_{-x/2}^{+x/2} \int_0^{h_0} \rho g z\, dz\, dx$$

$$= \rho g L \int_{-X/2}^{+X/2} \left. \frac{z^2}{2} \right|_0^{h_0} dx$$

$$= \rho g L \frac{h_0^2}{2} x \Big|_{-X/2}^{X/2}$$

$$= \rho g L X \, h_0^2/2$$

$$PE = \int_y \int_x \int_0^{h(x)} \rho g z \, dz \, dx \, dy$$

$$= L \int_x \frac{\rho g z^2}{2} \Big|_0^{h_0 + \Delta x} dx$$

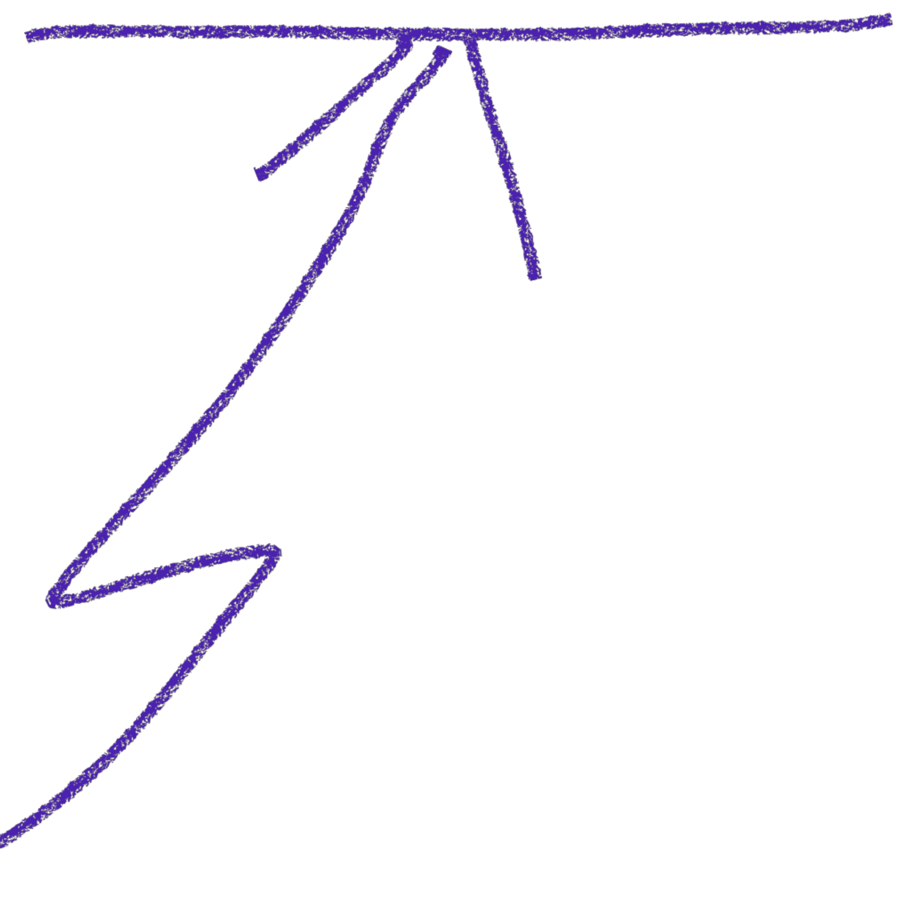
$$= \frac{\rho g L}{2} \int_{-X/2}^{+X/2} (h_0 + \Delta x)^2 \, dx$$

$$= \frac{\rho g L}{2} \int_{-X/2}^{+X/2} \left(h_0^2 + 2h_0 \Delta x + \Delta^2 x^2 \right) dx$$

$$= \frac{\rho g L}{2} \left\{ h_0^2 X + 0 + \frac{\Delta^2}{3} \left(\frac{2X^3}{8} \right) \right\}$$

$$PE^{(a)} = PE^{(b)} + \frac{\rho g L X}{24} (\Delta X)^2$$

A.P.E.



In atmosphere:

$$APE \propto \frac{1}{V}\int \frac{\overline{(\Theta')^2}}{\overline{\Theta}^2}\,dV$$

V = volume of atmosphere

Θ = average θ on p-sfcs.

$\theta' = \theta - \bar{\theta}$

observations

$\frac{APE}{\text{total PE}} \sim \frac{1}{200}$ $\quad \frac{KE}{APE} \sim \frac{1}{10}$