33.37 A pump transfers water at $70°F$ from an open tank to a location at a higher elevation. The friction loss in the suction pipe is $8ft$ and the net positive suction head available is $12ft$. What is the suction lift?

A. $-37ft$

B. $-13ft$

C. $13ft$

D. $37ft$

Suction lift is the h_z term in the Net Positive Suction Head Available equation. If positive, suction lift implies the pump is located below the water level of the source tank. If the suction lift is negative, the pump is above the level of the source. Regardless of the sign of h_z, the $NPSH_A$ must always be positive and sufficiently large to avoid caviation and to meet the manufacturers requirements: $NPSH_A > NPSH_R$.

$$NPSH_A = h_p + h_z - h_{vpa} - h_f$$

The $NPSH_A$ and the friction losses are given.

The atmospheric pressure can be converted from psi to ft using the rule of thumb conversion factor for water: $2.31\frac{ft}{psi}$.

$$h_p = 14.7psi\left(2.31\frac{ft}{psi}\right) \approx 34ft$$

The vapor pressure can be determined by looking up the saturation pressure for water at $70°F$ in the Properties of Saturated Water and Steam table. Convert to ft by using the rule of thumb conversion factor for water again: $2.31\frac{ft}{psi}$.

$$p_{sat@70°F} = 0.36psi\left(2.31\frac{ft}{psi}\right) = 0.83ft$$

Substitute into the $NPSH_A$ equation and solve for h_z.

$$12ft = 34ft + h_z - 8ft - 0.83ft$$

$$h_z = -13ft$$

Answer B