Consider a balloon floating in the air. See sketch. There is a string tied to the balloon. The string has a weight of $W_{\text{string}}$, and a length $L$.

Define the following set of symbols.

$V_b =$ Volume of the balloon.

$W_b =$ Weight of the balloon.

$W_{He} =$ Weight of the helium within $V_b$.

$W_{air} =$ Weight of the air in a volume $V_b$.

$h =$ Length of the part which is in the air.

Choose the correct relation (neglect the string volume)

A) \[ W_{air} = W_{He} + W_{\text{string}} \left( \frac{h}{L} \right) . \]

B) \[ W_{He} = W_b + W_{\text{string}} . \]

C) \[ W_{air} = W_b + W_{He} + W_{\text{string}} . \]

D) \[ W_{air} = W_b + W_{He} + W_{\text{string}} \left( \frac{h}{L} \right) . \]

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Apply Archimedes’ principle.

The buoyant force equals to $W_{air}$, which lifts the weight of the portion of the object, which floats in the air.

Answer D

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