The COP for a refrigeration system is defined as:

$$\text{COP} = \frac{W_C}{Q_{\text{evap}}}$$

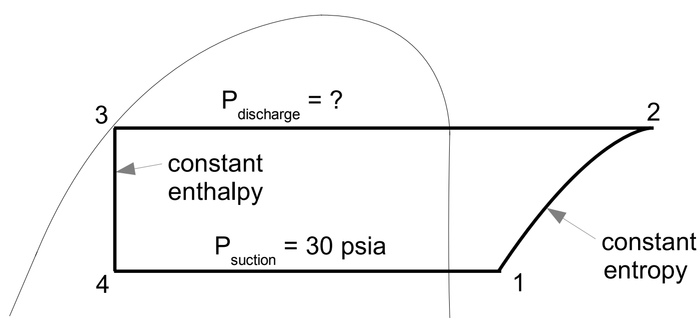
that is, as the ratio of the compressor power over the heat absorbed at the evaporator (evaporation effect). If the compressor inlet is designated as "1", compressor discharge as "2", evaporator inlet as "3" and evaporator outlet as "4", we have:

$$\text{COP} = \frac{h_1 - h_4}{h_2 - h_1} \quad (1)$$

Using a *P-h* diagram and a saturated table for ammonia (such as the ones available for free download at the "resources" section of www.SlaythePE.com) we can obtain the enthalpy at the compressor discharge, $h_1 \approx 620\ \text{Btu/lb}$. Now, insert this into equation (1) to get:

$$4 \cdot h_2 + h_4 = 3110\ \text{Btu/lb} \quad (3)$$

Consider the *P-h* representation of the refrigeration cycle: Here we see that $h_4 = h_3$, so equation (3) can be written as: $4 \cdot h_2 + h_3 = 3110\ \text{Btu/lb}$. We therefore have to find the pressure P_2 that satisfies this requirement.



This has to be done by trial and error. First, check with $P_2 = 100\ \text{psia}$ (in other words, plug in one of the answer choices). In this case, following a line of constant entropy from point 1 up to the 200 psia line, we determine that $h_2 \approx 700\ \text{Btu/lb}$. Also, for $P_2 = 100\ \text{psia}$ we find $h_3 = 104.3\ \text{Btu/lb}$ from the saturated ammonia table. With these values, $4 \cdot h_2 + h_3 = 2904\ \text{Btu/lb}$.

If we repeat this process with, say, $P_2 = 200\,\text{psia}$ we find $h_2 \approx 750\,\text{Btu/lb}$ and $h_3 = 150.6\,\text{Btu/lb}$.

Therefore, $4 \cdot h_2 + h_3 = 3150\,\text{Btu/lb}$. The table below summarizes our iterations:

Iteration #	P_2	$4 \cdot h_2 + h_3$	$\Delta = (4 \cdot h_2 + h_3) - 3110$
1	100	2904	-206
2	200	3150	40

So, by linear interpolation, the value that would gives us a residual $\Delta = 0$ would be $P_2 \approx 184\,\text{psia}$ .The correct answer is (B).