$$y_{CO_2} = \frac{(10)\left[12 + 2\,(16)\right]}{(10)\left[12 + 2\,(16)\right] + 11\left[2\,(1) + 16\right] + 58.435\left[2\,(14)\right]} = 0.19 = 19\%$$

Answer B

47.67 A $1500cfm$ two-pipe fan coil unit with electric reheat maintains a room at $74°F$ and 50% relative humidity. The supply air from the unit is $58°F$. The cooling coil discharge condition is $48°F$ db / $46°F$ wb. There is $1°F$ of temperature rise across the fan. Neglecting losses, how much power is required to run the reheat coil?

A. $4300W$

B. $4700W$

C. $5200W$

D. $5700W$

The electric reheat coil provides sensible heating only. Use the sensible heating rule of thumb for air.

$$\dot{Q}_{htg} = 1.08cfm\Delta T$$

The volume flow rate is given. Air enters the heating coil after leaving the cooling coil at a dry bulb temperature of $48°F$. Since the fan adds $1°F$ of temperature rise to achieve the $58°F$ supply air temperaure from the unit, the air leaving the reheat coil and entering the fan is $57°F$. Solve for the reheat load, and convert units to W.

$$\dot{Q}_{htg} = 1.08\,(1500)\,(57 - 48) = 14,580\frac{Btu}{hr}\left(\frac{1W}{3.412\frac{Btu}{hr}}\right) = 4273W$$

Answer A

47.68 A pump located $10ft$ above an open water tank at sea level transports $80gpm$ of $80°F$ water. The head loss in the suction piping is $15ft$. The net positive suction head required is $4ft$. What is the net positive suction head available?

A. $8ft$

B. $18ft$

C. $28ft$

D. $38ft$

Net Positive Suction Head Available is a function of the physical layout of the pump, piping, and source. The Net Positive Suction Head Required is determined from the manufacturer's specifications and has no bearing on the NPSHA. The criterion for avoiding cavitation is that $NPSH_A > NPSH_R$. Since this problem only requires calculating NPSHA, the NPSHR is extra information.

Sketch and label the system. Work through each term in the NPSHA formula.

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

The first term, h_p, is the atmospheric pressure. Use the conversion factor rule of thumb for water to convert from psi to ft.

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

The second term, h_z, is the elevation term and is taken as negative becasue the pump is *above* the water source, thereby *reducing* the head available at the pump inlet. Sometimes the operator before this term is written as "plus or minus" $\pm$ to reflect this arrangement. It is fine to regard the value as positive as long as in the final step it is subtracted.

$$h_z = -10ft$$

The third term, h_{vpa}, is the vapor pressure and is a function of the temperature of the water. The vapor pressure is always subtracted. The higher the water temperature, the higher the vapor pressure, and the harder it will be to avoid cavitation. Use the Properties of Saturated Water and Steam (Temperature) table to look up the saturation pressure at $T = 80°F$. Use the conversion factor rule of thumb for water to convert from psi to ft.

$$T = 80°F$$

$$P_{sat} = 0.51psia\left(2.31\frac{ft}{psi}\right) = 1.178ft$$

The fourth term, h_f, is always subtracted since losses reduce the available head. The value for h_f was given.

$$h_f = 15ft$$