

Answer on Question #45690- Physics-Molecular Physics-Thermodynamics

Can someone explain the formula and calculate the atmospheric pressure if the boiling point of water is 81 degrees Celsius?

Solution

You know that at the boiling point, the vapor pressure of the water is equal to the atmospheric pressure. The vapor pressure of water can be calculated using the Antoine Equation:

$$\log P = A - \left[\frac{B}{C + T} \right],$$

Where P is pressure in mmHg, $A = 8.07131$, $B = 1730.63$, $C = 233.426$, T = temperature in °C.

For example, at your chosen 81°C.

$$\log P = 8.07131 - \left[\frac{1730.63}{233.426 + 81} \right] = 8.07131 - 5.5041 = 2.567.$$

$$P = 10^{2.567} = 369 \text{ mmHg.}$$

That's why the atmospheric pressure is

$$P_{atm} = P = 369 \text{ mmHg.}$$

From the tables water boils at 81°C when the atmospheric pressure is 365 mmHg. It agrees well with the above.