Effect of temperature on the rate of evaporation (Room Conditions Vs. Field Conditions)

- Rate of evaporation computed at 293 K with given experimental molecular diffusivity and vapor pressure (partial pressure at the interface) evaluated using the Antione equation. The same equation is used to compute vapor pressure at 318 K.
- Molecular diffusivity is scaled to 318 K using the temperature dependence of the diffusivity using

$$\frac{D_{AB2}}{D_{AB1}} = \left(\frac{T_2}{T_1}\right)^{1.75}$$

Example 6.2-2: Diffusion of Water Through Stagnant, Nondiffusing Air

Computation of vapor pressure using Antoine eqation

$\log_{10}(P) = A - (B / (T + C))$

P = vapor pressure (bar)

T = temperature (K)

Component	Antoine equation constants (K, bar) (Source: NIST)				
Water	a	b	c	T (K)	P (Pa)
256 - 373 K	4.6543	1435.264	-64.848	293	2,309.28
256 - 373 K	4.6543	1435.264	-64.848	318	9,654.42

Water @ 293 K			**Diffusivity water @ 318 K**			**Water @ 318 K**		
T	293	K	T_1	293	K	T	318	K
P	1.01E+05	Pa	D_AB1	2.50E-05	Pa	P	1.01E+05	Pa
D_AB	2.50E-05	m2/s	T_2	318	K	D_AB	2.89E-05	m2/s
p_A1	2.309E+03	Pa	D_AB2	2.89E-05	m2/s	p_A1	9.65E+03	Pa
p_A2	0.00E+00	Pa	Change	15.4	%	p_A2	0.00E+00	Pa
p_B1	9.90E+04	Pa				p_B1	9.17E+04	Pa
p_B2	1.01E+05	Pa				p_B2	1.01E+05	Pa
p_BM	1.00E+05	Pa				p_BM	9.64E+04	Pa
dZ	0.1524	m				dZ	0.1524	m
N_AZ	1.57E-07	(kg mol A)/(s.m^2)				N_AZ	7.26E-07	(kg mol A)/(s.m
						Change	361.8	%

$$N_A = \frac{D_{AB}}{(z_2 - z_1)} \frac{P}{RT} \frac{p_{A1} - p_{A2}}{p_{BM}}$$