

Vapor pressure depression.

$$\Delta P = \chi_s P_0$$

ΔP Vapor pressure depression.

χ_s Mole fraction of solute.

P_0 Vapor pressure of pure solvent.

Boiling-point elevation

$$\Delta T = K_b m$$

ΔT Boiling-point elevation ($^{\circ}\text{C}$ or K).

K_b B.P. elevation constant ($\text{K}\cdot\text{kg}\cdot\text{mol}^{-1}$).

m Molality of solute ($\text{mol}\cdot\text{kg}^{-1}$).

Freezing-point depression

$$\Delta T = K_f m$$

ΔT Freezing-point depression ($^{\circ}\text{C}$ or K).

K_f F.P. elevation constant ($\text{K}\cdot\text{kg}\cdot\text{mol}^{-1}$).

m Molality of solute ($\text{mol}\cdot\text{kg}^{-1}$).

Osmotic pressure

$$\pi V = n R T$$

π Osmotic pressure (atm).

V Volume of solution (L).

n Number of moles of solute (mol).

R Ideal gas constant ($0.082 \text{ atm}\cdot\text{L}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$).

T Absolute temperature (K).

Selected Freezing-point depression and Boiling-point elevation constants

Compound	K_f $\text{K}\cdot\text{kg}\cdot\text{mol}^{-1}$	K_b $\text{K}\cdot\text{kg}\cdot\text{mol}^{-1}$	Freezing-point ($^{\circ}\text{C}$)	Boiling-point ($^{\circ}\text{C}$)
Water	1.86	0.52	0	100.0
Acetic acid	3.9	2.93	17	118.1
Benzene	5.12	2.53	5.4	80.2
Acetone	2.40	1.71	-94.8	56.2
Carbon tetrachlorine	29.8	4.95	-22.8	76.8
Cyclohexane	20.1	2.79	6.5	81.4

Vapor pressure of water at different temperatures

T ($^{\circ}\text{C}$)	P (mmHg)	T ($^{\circ}\text{C}$)	P (mmHg)	T ($^{\circ}\text{C}$)	P (mmHg)
0	4.579	35	42.175	80	355.1
5	6.543	40	55.324	85	433.6
10	9.209	45	71.88	90	525.76
15	12.788	50	92.51	95	633.90
20	17.535	55	118.04	100	760.00
25	23.756	60	149.38	105	906.07
30	31.824	70	233.7	110	1074.56