= 2 @.@ 1 x 10 ? 7 [J K ? 1 mol ? 2 / 3] . For water one can further use V =
18 ml / mol and TC = 647 K (374 ° C) .
A variant on Eötvös is described by Ramay and Shields :
<formula>
where the temperature offset of 6 kelvins provides the formula with a better fit to reality at lower temperatures .
Guggenheim @-@ Katayama :
<formula>
<formula> is a constant for each liquid and n is an empirical factor , whose value is 11 / 9 for organic liquids . This equation was also proposed by van der Waals , who further proposed that <formula> could be given by the expression , <formula> , where <formula> is a universal constant for all liquids , and <formula> is the critical pressure of the liquid (although later experiments found <formula> to vary to some degree from one liquid to another) .
Both Guggenheim @-@ Katayama and Eötvös take into account the fact that surface tension reaches 0 at the critical temperature , whereas Ramay and Shields fails to match reality at this endpoint .

= = = = Influence of solute concentration = = = =

Solutes can have different effects on surface tension depending on their structure :
Little or no effect , for example sugar
Increase surface tension , inorganic salts
Decrease surface tension progressively , alcohols
Decrease surface tension and , once a minimum is reached , no more effect : surfactants
What complicates the effect is that a solute can exist in a different concentration at the surface of a solvent than in its bulk . This difference varies from one solute / solvent combination to another .
Gibbs isotherm states that : <formula>
<formula> is known as surface concentration , it represents excess of solute per unit area of the surface over what would be present if the bulk concentration prevailed all the way to the surface . It has units of mol / m2
<formula> is the concentration of the substance in the bulk solution .
<formula> is the gas constant and <formula> the temperature
Certain assumptions are taken in its deduction , therefore Gibbs isotherm can only be applied to ideal (very dilute) solutions with two components .

= = = = Influence of particle size on vapor pressure = = = =

The Clausius ? Clapeyron relation leads to another equation also attributed to Kelvin , as the Kelvin equation . It explains why , because of surface tension , the vapor pressure for small droplets of liquid in suspension is greater than standard vapor pressure of that same liquid when the interface is flat . That is to say that when a liquid is forming small droplets , the equilibrium concentration of its vapor in its surroundings is greater . This arises because the pressure inside the droplet is greater than outside .
<formula>
<formula> is the standard vapor pressure for that liquid at that temperature and pressure .
<formula> is the molar volume .
<formula> is the gas constant
<formula> is the Kelvin radius , the radius of the droplets .
The effect explains supersaturation of vapors . In the absence of nucleation sites , tiny droplets must form before they can evolve into larger droplets . This requires a vapor pressure many times the vapor pressure at the phase transition point .
This equation is also used in catalyst chemistry to assess mesoporosity for solids .
The effect can be viewed in terms of the average number of molecular neighbors of surface

molecules (see diagram) .
The table shows some calculated values of this effect for water at different drop sizes :
The effect becomes clear for very small drop sizes , as a drop of 1 nm radius has about 100 molecules inside , which is a quantity small enough to require a quantum mechanics analysis .

= = Surface tension of water and of seawater = =

The two most abundant liquids on Earth are fresh water and seawater . This section gives correlations of reference data for the surface tension of both .

= = = Surface tension of water = = =

The surface tension of pure liquid water in contact with its vapor has been given by IAPWS as
<formula>
where both T and the critical temperature , TC = 647 @.@ 098 K , are expressed in kelvin . The region of validity the entire vapor @-@ liquid saturation curve , from the triple point (0 @.@ 01 ° C) to the critical point . It also provides reasonable results when extrapolated to metastable (supercooled) conditions , down to at least ? 25 ° C. This formulation was originally adopted by IAPWS in 1976 , and was adjusted in 1994 to conform to the International Temperature Scale of 1990 .
The uncertainty of this formulation is given over the full range of temperature by IAPWS . For temperatures below 100 ° C , the uncertainty is <formula> 0 @.@ 5 % .

= = = Surface tension of seawater = = =

Nayar et al. published reference data for the surface tension of seawater over the salinity range of 20 ? S ? 131 g / kg and a temperature range of 1 ? t ? 92 ° C at atmospheric pressure . The uncertainty of the measurements varied from 0 @.@ 18 to 0 @.@ 37 mN / m with the average uncertainty being 0 @.@ 22 mN / m . This data is correlated by the following equation
<formula>
where <formula> is the surface tension of seawater in mN / m , <formula> is the surface tension of water in mN / m , S is the Reference Salinity in g / kg , and t is temperature in degrees Celsius . The average absolute percentage deviation between measurements and the correlation was 0 @.@ 19 % while the maximum deviation is 0 @.@ 60 % .
The range of temperature and salinity encompasses both the oceanographic range and the range of conditions encountered in thermal desalination technologies .

= = Data table = =

= = Gallery of effects = =