Ethanol boils at 78.5oC. If 10 g of sucrose is dissolved in 150 g of ethanol, at what temperature will the solution boil?Assume Kb = 1.20°C/M for the alcohol.

Since sucrose is a nonvolatile solution and it is being dissolved in a solvent(ethanol), it will raise the boiling point of the solvent .The boiling point elevation can be found by using the equation:

$$\Delta T_b = K_b \cdot M$$

ΔTb is the boiling point elevation.Kb is the elevation constant and M is the molality of the solution. Molality is the number of moles of solute per a kg of solvent.Therefore we must find the moles of solute.

$$Moles\_of\_solute = \frac{grams\_solute}{molecular\_wt\_solute}$$

We know the grams_solute .

grams_solute := 10

We can get the molecular formula using a MatDeck form and the common name of the element.

form25124 := CHEMICAL_INFO_Form("form25124")

Chemical Tool

SMILES String

OC[C@H]1O[C@H](O[C@]2(CO)O[C@H](CO)[C@@H](O)

Get by SMILES

IUPAC name or Common Name

(2R,3R,4S,5S,6R)-2-[(2S,3S,4S,5R)-3,4-dihydroxy-2,5-

Get by Name

Molecular Formula

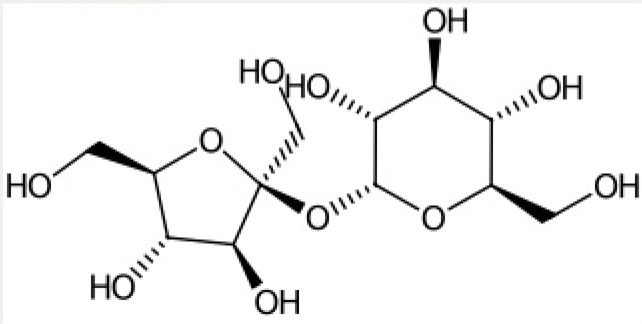
C12H22O11

Common Names

Molecular mass

99.99

Molecular Image



formula25124 := chemical_info_formula(form25124)

formula25124 = "C12H22O11"

We can now use the Periodic table to find the molecular weight of sucrose

We can now use the Periodic table to find the molecular weight of sucrose

CWeight := 12.011
HWeight := 1.008
OWeight := 15.999

Now we have all the information to find the moles of solute.

$molecular\_wt\_solute := CWeight \cdot 12 + HWeight \cdot 22 + OWeight \cdot 11$
$molecular\_wt\_solute = 342.297$
$$Moles\_of\_solute := \frac{grams\_solute}{molecular\_wt\_solute}$$
$Moles\_of\_solute = 0.029$

Now we find the Molality of the solution using the following equation.

$$Molality = \frac{Moles\_of\_solute}{Kilogram\_of\_solvent}$$

We have 150 g of solvent which is equivalent to 0.15 kg of solvent

$Kilogram\_of\_solvent := 0.15$
$$Molality := \frac{Moles\_of\_solute}{Kilogram\_of\_solvent}$$
$Molality = 0.195$

We know the Molality of the solution and elevation constant, now we can find out the elevation of the boiling point.

$K_b := 1.2\ ^{\circ}C$
$M := Molality$
$Elevation\_of\_the\_boiling\_point := K_b \cdot M$
$Elevation\_of\_the\_boiling\_point = 273.384\ K$

Now we add the the elevation of the boiling point to the original boiling point to figure out the boiling point of the solution.

$Original\_boiling\_point := 78.5\ ^{\circ}C$
$Current\_boiling\_point := Original\_boiling\_point + Elevation\_of\_the\_boiling\_point$
$Current\_boiling\_point = 351.884\ K$

The boiling point of the new solution is 78.734°C.