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.

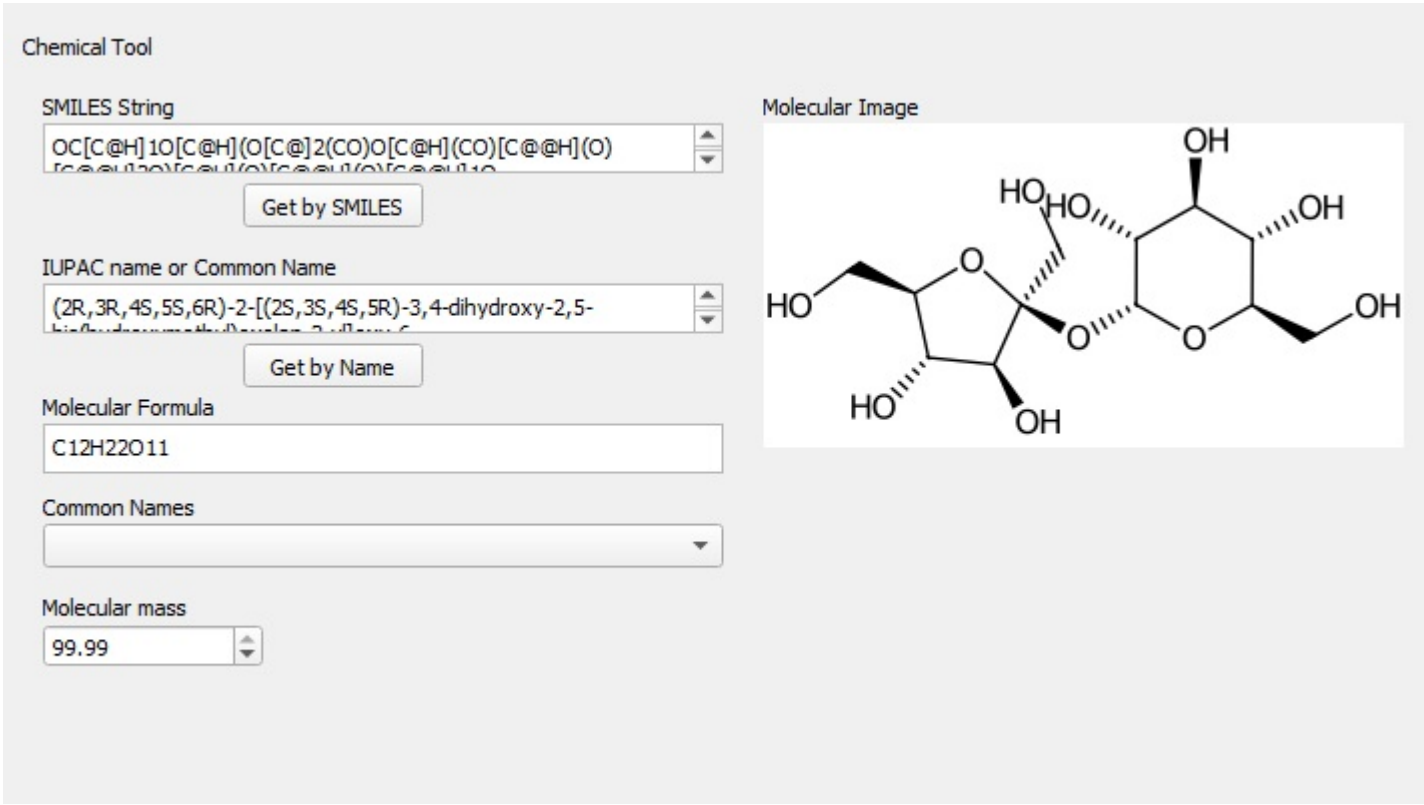
$$Moles\_of\_solute = \frac{grams\_solute}{molecular\_wt\_solute}$$

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")
```




```
formula25124 := chemical_info_formula(form25124)
formula25124 = "C12H22O11"
```

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

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

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

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

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

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

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

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

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

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

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

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

The boiling point of the new solution is 78.734^{o}C.