Question#20400

a student mixes 1.0L of water at 40 degree Celsius with 1.0L of ethyl alcohol at 20 degree Celsius. if heat exchange is limited to the mixture what is the final temperature of the mixture?.

Solution:

Let:

$V_1 = 1\ L = 1000\ cm^3$

$V_2 = 1\ L = 1000\ cm^3$

$T_1 = 40\ ℃$

$T_2 = 20\ ℃$

$T_m - ?\quad the\ temperature\ of\ the\ mixture$

The temperature of water is more on it water gives heat.

Write an equation of thermal balance:

$V_1 * c_{water} * (T_1 - T_m) = V_2 * c_{alcohol} * (T_m - T_2)$

Were:

c_{water} - is the volumetric heat capacity of the water,

$c_{alcohol}$ - is the volumetric heat capacity of the ethyl alcohol.

$$\boldsymbol{T_m = \frac{V_1 c_{water} T_1 + V_2 c_{alcohol} T_2}{V_1 c_{water} + V_2 c_{alcohol}}}$$

$$\boldsymbol{c_{water} = 4.1796\ \ \mathrm{J/cm^3 * K}}$$

$$\boldsymbol{c_{alcohol} = 1.925\ \mathrm{J/cm^3 * K}}$$

$$\boldsymbol{T_m = \frac{1000*4.1796*40 + 1000*1.925*20}{1000*4.1796 + 1000*1.925} = 33.7\ ℃}$$

Answer: 33.7 ^{0}C