In an experiment **similar to** ASTM D86 test, 100 ml of the desired sample which is a liquid mixture whose composition (Weight Percent) is shown in Table 1, is poured into the distillation flask of the setup shown in the following figure. The sample is initially at the ambient temperature. It is then heated gradually which results in its evaporation. The vapor is going through a condenser which is assumed to perform such that all the vapor is condensed (the condenser acts as a total condenser). The outlet of the condenser is collected as 10 ml samples in a Graduated cylinder. Right at the very end of each sampling (taken in a graduated cylinder) which is assumed to be at its bubble point, the temperatures of the vapor in the distillation flask and liquid sample are measured and recorded, hence the results of this experiment are the set of these temperatures in the following stages:

1. Right at the start of boiling which is called Initial Boiling Point (IBP).
2. At the very end of 10 ml. sampling for each collected sample.
3. When there is 5 ml. of the liquid left in the distillation flask which we **assume** to be Final Boiling Point (FBP) of the sample.

You are supposed to obtain these temperatures along with the compositions of the liquids in the distillation flask and graduated cylinder at each sampling stage, and draw a smooth curve representing the **ESTIMATED** ASTM D86 of this mixture based on cubic spline interpolation method. Furthermore, you should develop a function by which one can obtain the flask temperature depending on the volumetric percent of vaporized liquid. **Furthermore:**

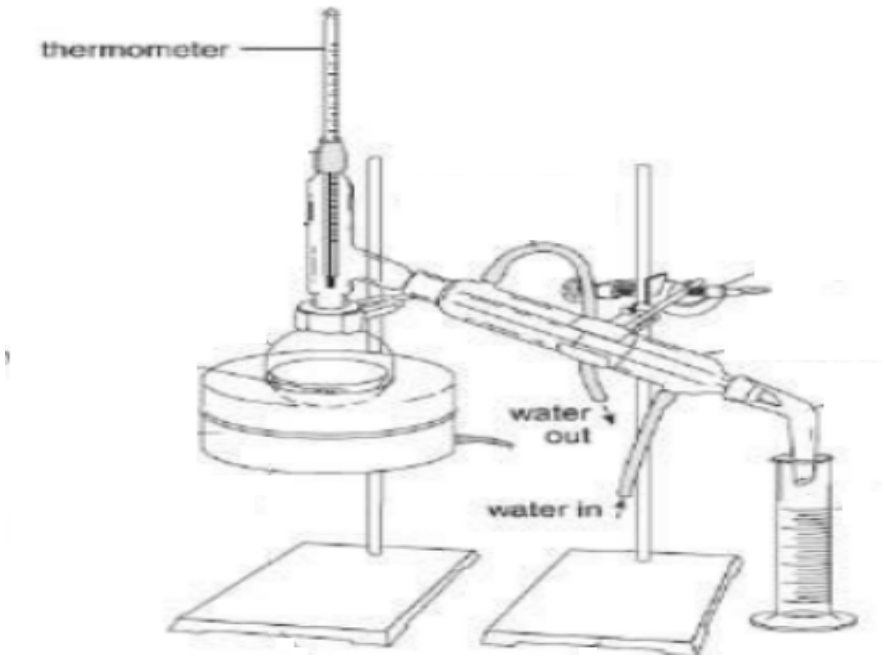
Obtain the total amount of the Minimum energy used to heat the flask at each step of sampling.

What does happen if we intend to get the last 5 ml of the mixture collected as liquid as lat batch? Is it possible, if the answer is yes what would be he composition of last droplet?

P.S: Not to forget to write down all the assumptions and thermodynamic model used to describe the properties of the mixture, and the reason why you use them.

Table1- Initial Composition of Liquid Mixture

Component	Composition (Weight %)			
	n-Paraffine	i-Paraffine	Naphtene	Aromatic
C10	6.03	6.53	8.73	8.3
C11	4.7	6.25	5.95	2.6
C12	3.98	5.92	4.28	4.09
C13	2.98	4.75	4.07	0.83
C14	2.26	4.81	2.34	0.6
C15	3.21	4.31	2.1	0.38



Good luck