1) One of the most important analytical applications of differential scanning calorimetry (DSC) is the determination of the purity of solid samples.

a) Explain why this determination is only valid when the sample purity is very high (typically when the weight% is greater than 98%).

b) The fusion of naphthalene was studied by DSC and the corresponding fusion enthalpy was obtained as $\Delta_{fus}H$ = 18.17 kJ·mol^{-1}. It was also found that a plot of the fusion temperature, *T*, as a function of the melted fraction, *F*, could be described by the equation:

$$T = -\frac{0.09}{F} + 346.57$$

Estimate the molar fraction of impurity contained in the naphthalene sample and the melting temperature of 100% pure naphthalene.

Note: R = 8.31451 J·K^{-1}·mol^{-1}; $T = T_o - RT_o^2 x / (F\Delta_{fus}H)$

2) A study of the thermal decomposition of a 10 mg calcium oxalate sample by thermogravimetry led to the results in Figure 1. Show that these results are compatible with the following reaction:

$$CaC_2O_4(s) \rightarrow CaCO_3(s) + CO(g) \qquad (1)$$

(*Note:* $M(CaC_2O_4)$ = 128.0970 g·mol^{-1}; $M(CaCO_3)$ = 100.0869 g·mol^{-1}; $M(CO)$ = 28.0101 g·mol^{-1})

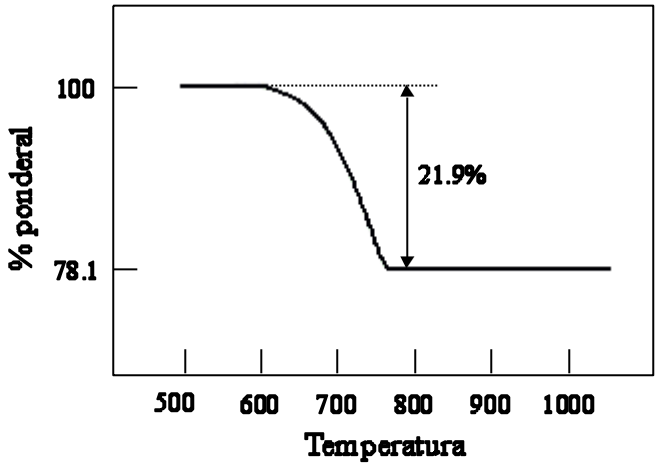

Figura 1