

Question 1 (test 2013)

We study the depression of freezing point of water. Data for water:

$T_{\text{H}_2\text{O}}^* = 273.15 \text{ K}$, $\Delta_{\text{fus}}H_{\text{H}_2\text{O}} = 6.008 \text{ kJ/mol}$, $M_{\text{H}_2\text{O}} = 18.015 \text{ g/mol}$ and $\rho_{\text{H}_2\text{O}} = 0.997 \text{ g/cm}^3$.

- a) Estimate the depression of freezing point by dissolving AgCl in 1.00 L of water.
 $M_{\text{AgCl}} = 143.3 \text{ g/mol}$ and the solubility $s_{\text{AgCl}} = 1.31 \cdot 10^{-5} \text{ mol/L}$.
- b) We now add DMSO ($(\text{CH}_3)_2\text{SO}$) to 1.00 L of water. Estimate the mass of DMSO needed to lower the freezing point by 1.00°C .
 $M_{\text{DMSO}} = 78.13 \text{ g/mol}$. DMSO is soluble in water.

Question 2

The addition of 5.00 g of a compound to 250 g of naphthalene (C_{10}H_8) lowered the freezing point of the solvent by 0.780 K. Calculate the molar mass of the compound.

Data for naphthalene:

$T_{\text{melt}} = 354 \text{ K}$

$\Delta_{\text{fus}}H^\ominus = 18.80 \text{ kJ/mol}$

$T_{\text{boiling}} = 490.9 \text{ K}$

$\Delta_{\text{vap}}H^\ominus = 51.51 \text{ kJ/mol}$

$\Delta_{\text{f}}H^\ominus = 78.53 \text{ kJ/mol}$

$M_{\text{naphthalene}} = 128.18 \text{ g/mol}$

Additional material:**Question 3**

The molar mass of an enzyme was determined by dissolving it in water, measuring the osmotic pressure at 20°C .

The following data were obtained:

$c \text{ (mg cm}^{-3}\text{)}$	3.221	4.618	5.112	6.722
$h \text{ (cm)}$	5.746	8.238	9.119	11.990

Calculate the molar mass of this enzyme.