Answer on Question #55290 - Chemistry - General chemistry

Question:

How many grams of water must be used to dissolve 50 grams of sucrose, $C_{12}H_{22}O_{11}$, to prepare a 1.25 M solution of sucrose? At what temperature will the solution freeze?

Solution

Molar concentration c = $\frac{n}{V} = \frac{m}{MV}$;

V = $\frac{m}{cM}$;

Molar mass of sucrose is 342.3 g/mol

V = 50/(1.25x342.3) = 0.117 L, m = 0.117 kg = 117 g

The temperature the solution freeze can be calculated using cryoscopic constant K_f

$$\triangle T_f = K_f \cdot m \cdot i$$

Where m is molality; i = 1; K_f = 1.853 K×kg/mol

The mass of solvent is about 0.117 kg, so m = 1.25 mol/kg

$$\Delta T = 1.853 \times 1.25 = 2.316\ K$$

Answer: 117 g; 2.316 K