

Answer on Question #69961, Chemistry / General Chemistry

A solution is prepared by dissolving 8.00 g of glycerin (C₃H₈O₃) in 201 g of ethanol. The freezing point of the solution is _____ °C. The freezing point of pure ethanol is at 1 atm. The molal-freezing-point-depression constant (K_f) for ethanol is 1.99 °C/m. The molar masses of glycerin and of ethanol are 92.1 g/mol and 46.1 g/mol, respectively.

-115.5

-113.7

-122.2

0.860

-107.0

Solution:

We use the following equation:

$$\Delta T = i K_f m$$

The van't Hoff factor, $i = 1$

The freezing point constant for ethanol is $K_f = 1.99 \text{ } ^\circ\text{C}/\text{m}$

The freezing point of pure ethanol is $-114.6 \text{ } ^\circ\text{C}$

Find the molality of the solution

$$\text{molality} = \frac{8.00 \text{ g} \times (1 \text{ mol} / 92.1 \text{ g})}{0.201 \text{ kg}}$$

$$\text{molality} = 0.433 \text{ m}$$

$$\Delta T = 1.99 \text{ } ^\circ\text{C}/\text{m} \times 0.433 \text{ m} = 0.862 \text{ } ^\circ\text{C}$$

$$\text{Freezing point} = -114.6 \text{ } ^\circ\text{C} - 0.862 \text{ } ^\circ\text{C} = -115.5 \text{ } ^\circ\text{C}$$

Answer: -115.5 °C