Determine the molality of a solution of 25% ethylene glycol by volume (anti-freeze $HOCH_2CH_2OH$) in water. The density of antifreeze is 1.12 gm/cm^3.

Determine the molality of a 25% by volume solution of ethylene glycol in water. The density of ethylene glycol is 1.12 gm/cm^3.

Solution: The molality is measured by kg of solvent. We must add enough anti-freeze to make a 25% solution, which is 333 mL. We need to convert this value into moles using the density and molar mass and then we are done since that will be the number of moles per 1000 g.

$$n_{C_2O_2H_6} = \frac{\rho_{C_2O_2H_6} V}{M_{m,C_2O_2H_6}} = \frac{(1.12\ gm/cm^3)(333 cm^3)}{62\ gm/mol}$$

$$n_{C_2O_2H_6} = 6.0\ mol$$

The solution is 6 molal of ethylene glycol.