



A solution of 5.00 g of an unknown substance in 0.100 kg of benzene freezes at 4.1°C (T_f). What is the molar mass of the unknown substance? K_f (benzene) = 5.12°C/m; T_f° (benzene) = 5.50°C.

Step 1 Use $T_f = T_f^\circ - \Delta T_f$
to calculate ΔT_f

Step 2 Use $\Delta T_f = m \cdot K_f$
to calculate m

Step 3 Use $m = \text{moles} / \text{kg solvent}$
to calculate moles

Step 4 Divide mass (g) of unknown with moles to get molar mass of unknown
183.15 g/mol



Calculate the osmotic pressure of the solution containing 1.5g of ethylene glycol ($C_2H_6O_2$) in 50ml of solution at $25^\circ C$

Step 1 Convert mass (g) to moles

Step 2 Use $M = \text{moles} / L$
To calculate molarity M

Step 3 Use $\Pi = MRT$
(T in kelvin)

$$\underline{\underline{\Pi = 11.81}}$$



A solution containing 27.55 mg of an unknown protein per 25ml solution has an osmotic pressure of 3.22 torr at 25°C. What is the molar mass of the protein

**6.36 X 10³
g/mol**