	Marks
• The freezing point of a sample of seawater is measured as –2.15 °C at 1 atm pressure. Assuming that the concentrations of other solutes are negligible, determine the molality (in mol kg^{-1}) of NaCl in this sample. The molal freezing point depression constant for H_2O is 1.86 °C kg mol^{-1}.	**3**

The freezing point depression, ΔT_f, is given by,

$$\Delta T_f = K_f\, m$$

where K_f is the molal freezing point depression and m is the molality. The molality is the number of moles of ions dissolved in a kilogram of solvent.

If ΔT_f = 2.15 °C and K_f = 1.86 °C m^{-1}:

$$m_{ions} = \Delta T_f / K_f = (2.15\ °C) / (1.86\ °C\ m^{-1}) = 1.156\ m^{-1} = 1.156\ mol\ kg^{-1}$$

A mole of NaCl dissolves to give two particles (Na^+ and Cl^-) so (1.156 / 2) mol = 0.578 mol of NaCl per kilogram of water is needed:

$$m_{NaCl} = 0.578\ mol\ kg^{-1}$$

Answer: **0.578 mol kg^{-1}**

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.