Background Chemistry Concepts for NaCl-water solutions:

* Molality is the number of moles of the solute, NaCl /1 kg of the solvent, H2O.

*m* = moles NaCl / 1 kg H2O

* 1 tablespoon of table salt is approximately 20 grams of NaCl.
* The molar mass of NaCl = 23.0 (for Na) + 35.5 (for Cl) = 58.5 g/mole NaCl
* 1 cup of water is 237 grams of H2O.
* The temperature depression, ∆T, of the normal freezing point of a solvent containing a solute with particles or ions in molal concentration, *m*, is given by the equation:

∆T = - (Kf) (*m*) (*i*) = the freezing point of the solution in °C

where:

Kf is the cryoscopic constant specific to the solvent. For water, Kf = 1.86 °C/*m*. *m* is the molality concentration of the solvent in the solution.

*i* is the *“*van’t Hoff factor” and equals the number of ions or particles per

individual formula unit of solute. For NaCl, *i* = 2; for MgCl3, *i* = 3.

Freezing Temperatures for the Various Saltwater Solutions

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| Solution | NaCl  (tbsp.) | NaCl  (g) | NaCl  (moles) | Water  (kg) | Water  (mL) | Water  (cups) | molality  (*m*) | Freezing  Pt (°C) | Freezing  Pt (°F) |
| A | 1 | 20 | 0.34 | 0.059 | 59 | 0.25 | 5.76 | -21 | -7 |
| B | 1 | 20 | 0.34 | 0.084 | 84 | 0.35 | 4.05 | -17 | 2 |
| C | 1 | 20 | 0.34 | 0.118 | 118 | 0.50 | 2.88 | -11 | 13 |
| D | 1 | 20 | 0.34 | 0.236 | 236 | 1.00 | 1.44 | -5.4 | 22. |