Osmotic pressure of tall trees

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Solution: We calculate the needed hydrostatic pressure:

$$\Pi = \rho g h$$

Substituting in the values in MKS units
(note the density x 1000)

$$\Pi = (1000\ \frac{kg}{m^3})(9.8\ \frac{m}{s^2})(50\ m)$$

and obtain a pressure in atm:

$$\Pi = 4.9\ x\ 10^5\ Pa = 4.9\ bars = 4.835\ atm$$

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Using the pressure

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In the osmotic pressure formula (van't Hoff equation)

$$c = \frac{\Pi}{RT} = \frac{4.835\ atm}{\left(0.08206\ \frac{Latm}{molK}\right)(298\ K)}$$

We calculate a colligative molarity of

$$c = 0.197\ M$$

The initial concentration of the salt is one half this large or

$$c = 0.099\ M$$