Marks
8

- Calcium chloride (3.42 g) is completely dissolved in 200 mL of water at 25.00 ºC in a 'coffee cup' calorimeter. The temperature of the water after dissolution is 27.95 ºC. Calculate the standard enthalpy of solution of $CaCl_2$ (in kJ mol^{-1}). The heat capacity of water is 4.184 J K^{-1} g^{-1}. Ignore the heat capacity of the $CaCl_2$.

Answer:

What would be the vapour pressure of water above this solution?
(P^0 (H_2O) = 3.17 kPa)

Answer:

What would be the freezing point of this solution? The molal freezing point depression constant (K_f) for water is 1.86 °C kg mol^{-1}.

Answer:

Which would you expect to cause the greater freezing point depression of water, 3.42 g of $CaCl_2$ or 3.42 g of NaCl? Explain your answer.

Marks
6

- Assume that NaCl is the only significant solute in seawater. A 1.000 L sample of seawater at 25 ºC and 1 atm has a mass of 1.0275 kg and contains 33.0 g of NaCl. At what temperature would this seawater freeze? The freezing point depression constant of water is 1.86 ºC kg mol^{-1}.

Answer:

The vapour pressure above pure H_2O is 23.76 mmHg at 25 ºC and 1 atm. Calculate the vapour pressure above this seawater under the same conditions.

Answer:

The desalination of seawater by reverse osmosis has been suggested as a way of alleviating water shortages in Sydney. What pressure (in Pa) would need to be applied to this seawater in order to force it through a semi-permeable membrane, yielding pure H_2O?

Answer:

Marks

- Lysozyme is an enzyme that breaks down bacterial cell walls. A solution containing 0.150 g of this enzyme in 210 mL of solution has an osmotic pressure of 0.00125 atm at 25 ^{o}C. What is the molar mass of lysozyme? **3**

Answer:

- What mass of ethylene glycol, $HOCH_2CH_2OH$, is required to lower the freezing point of 1.00 L of water to –10.0 °C? The freezing point depression constant of water is 1.86 °C kg mol^{-1}. Assume the density of water is 1.00 g mL^{-1} at 0 °C. **3**

Answer:

Marks
5

- 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, and that the salt does not significantly change the density of the water from 1.00 kg L^{-1}, determine the concentration (in mol L^{-1}) of NaCl in this sample. (The molal freezing point depression constant for H_2O is 1.86 °C m^{-1})

Answer:

In principle, it would be possible to desalinate this water by pumping it into a cylindrical tower, and allowing gravity to push pure water through a semipermeable membrane at the bottom. At 25 °C, how high would the tower need to be for this to work? (The density of liquid Hg at 25 °C is 13.53 g cm^{-3}.)

Answer:

Marks
3

- Explain why the freezing temperature of an aqueous salt solution is lower than that of pure water.

What mass of sugar (sucrose, MW 342 g mol^{-1}) would have to be dissolved in 1.0 L of water to lower the freezing point as much as a water solution containing 11.1 g L^{-1} of $CaCl_2$?

Answer:

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.