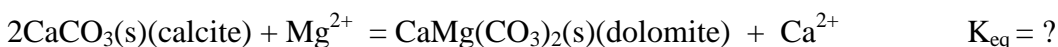


OCN400 - Problem Set #1
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1. The boiling point of seawater is elevated relative to that of distilled water. Give a brief explanation in terms of the structure of water and ionic solutions.
2. One way we can get the equilibrium constant for a reaction we are interested in is to combine other reactions for which we know the constants. Show how this is done by deriving the equilibrium constant for the reaction of calcite with Mg^{2+} to form the CaMg carbonate mineral called dolomite as written below:



This is an important reaction used to describe the conversion of limestone in dolomite rock over geological time frames.

- a. Combine (by addition or subtraction as necessary) the K_{eq} values for the following reactions (for 25°C) to get the K_{eq} (at 25°C) for the reaction of CaCO_3 with Mg^{2+} given above.



- b. Derive an equation that expresses K_{eq} in terms of the K_{so} listed above.
 - c. The ratio of the concentration of Ca to Mg measured in Florida ground waters is 0.8 ± 0.1 . Could these ground waters be in equilibrium with both calcite and dolomite phases simultaneously.
3. The equilibrium constant for this reaction can also be calculated from the values of free energy of formation. From thermodynamic data tables (e.g. Stumm and Morgan, 1981; Drever, 1997) we obtain the following standard free energies of formation at 25°C .
 - a) Calculate the standard free energy of reaction (ΔG_r°)
 - b) Calculate the equilibrium constant K_{eq} at 25°C .
 - c) Is this the same value as obtained in Problem 2? Comment.

<u>Substance</u>	<u>ΔG_f° (kJ mol⁻¹)</u>
$\text{CaCO}_3(\text{calcite})$	-1128.8
$\text{CaMg}(\text{CO}_3)_2$ (dolomite)	-2161.7
Ca^{2+}	-553.54
Mg^{2+}	-454.8

