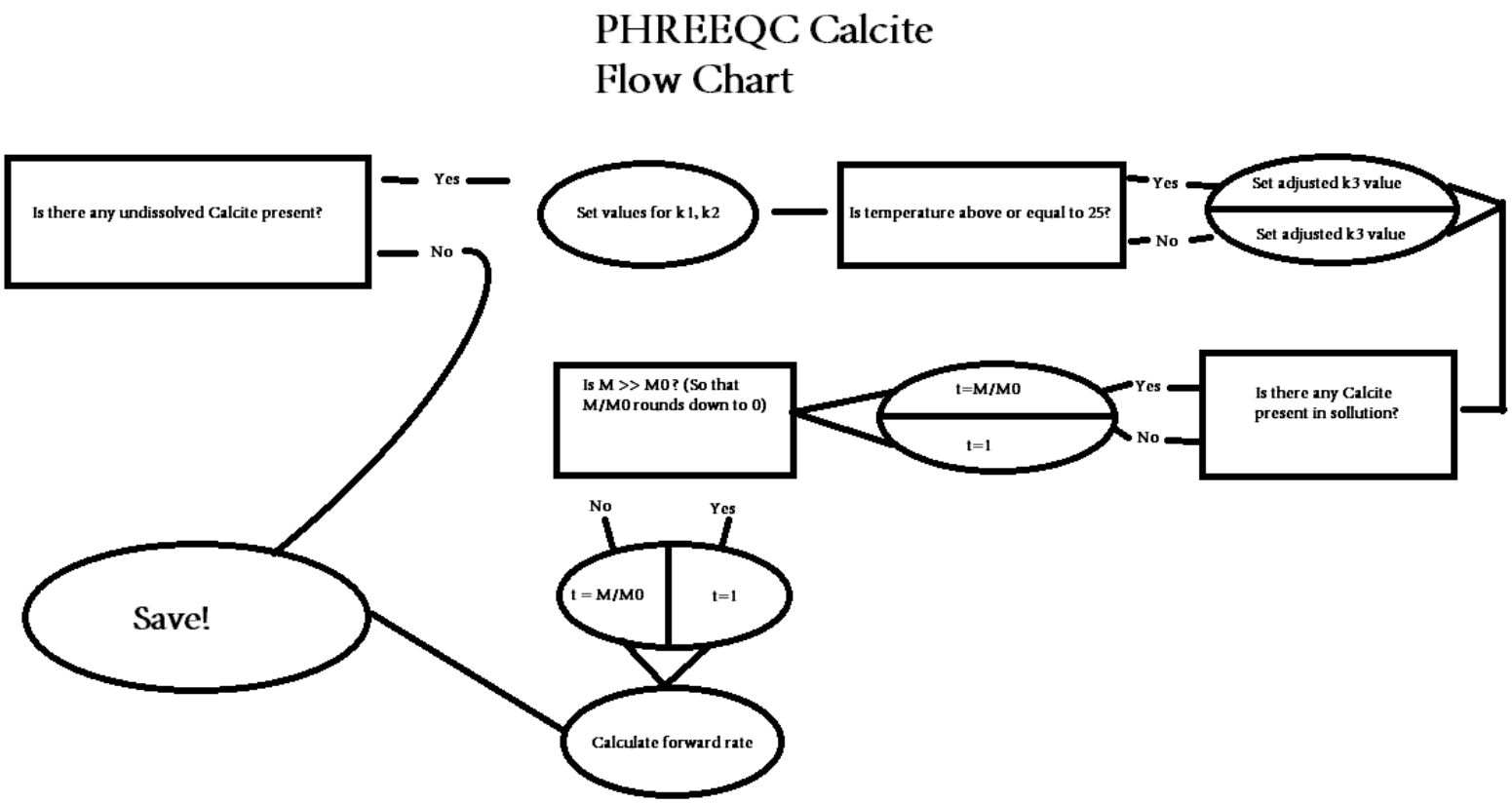
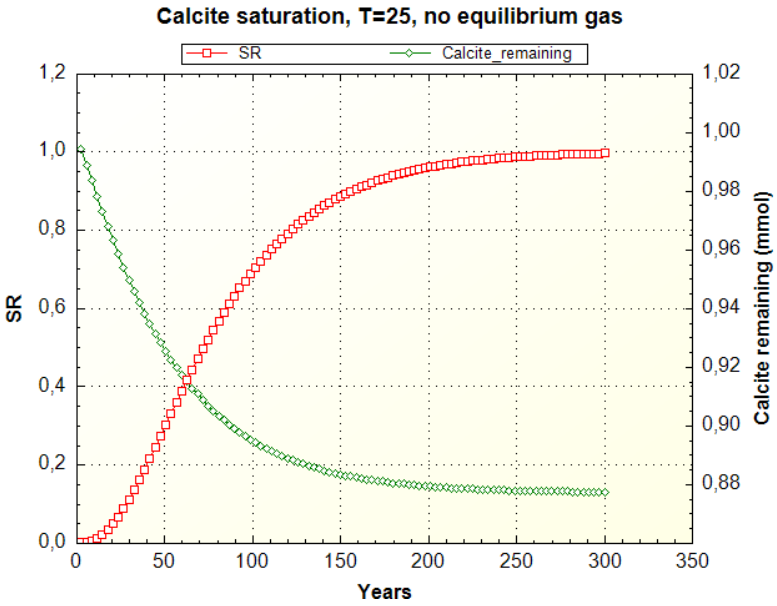
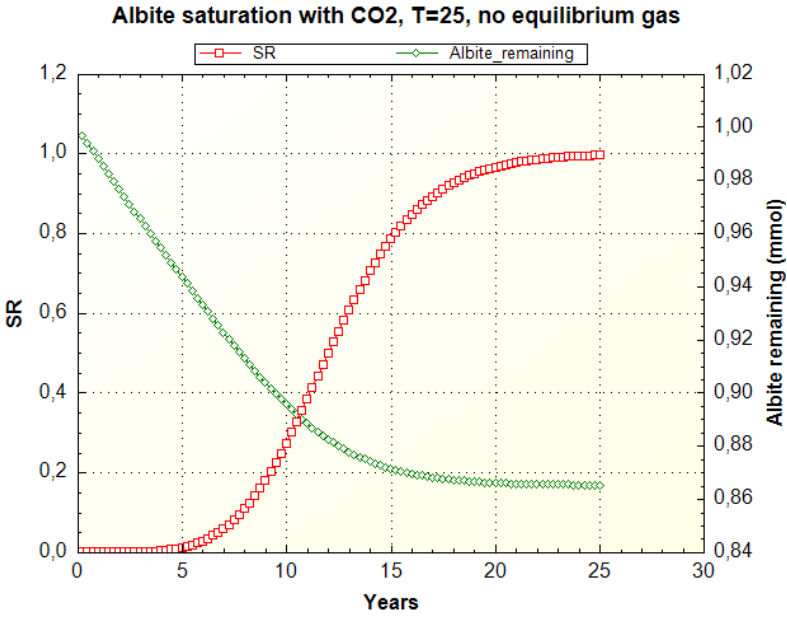
Task 1:



Flow chart showing how the method for calcite dissolution included in the phreeqc database.

Task 2/3/4:





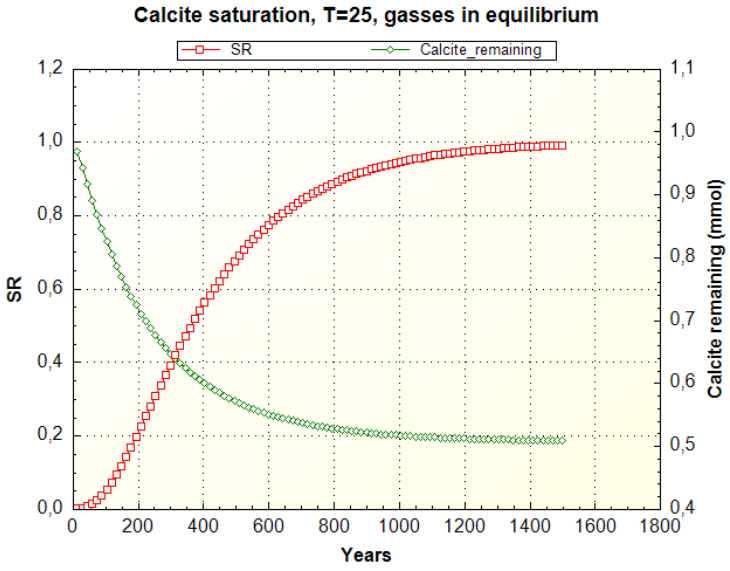
Calcite:

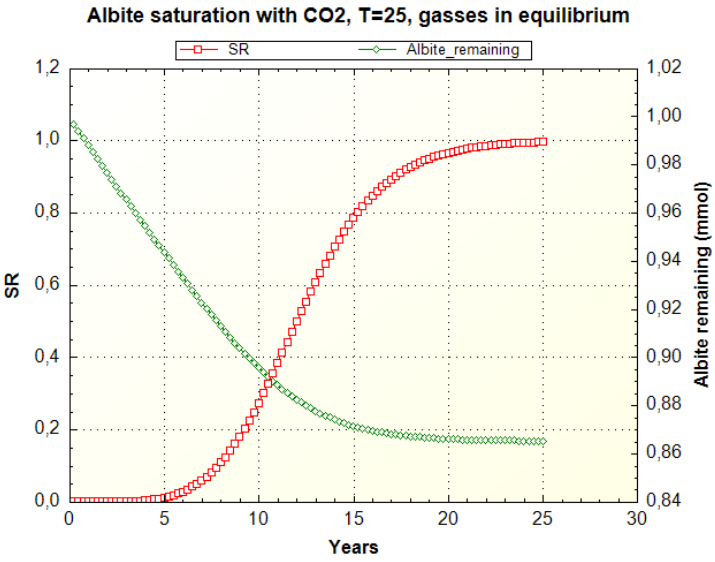
Equilibrium is reached after about 250 years. 0.13mmol of calcite has reacted to reach equilibrium.

Albite:

Equilibrium reached after ~23 years. Around 0.14mmol of albite has reacted

Task 5)





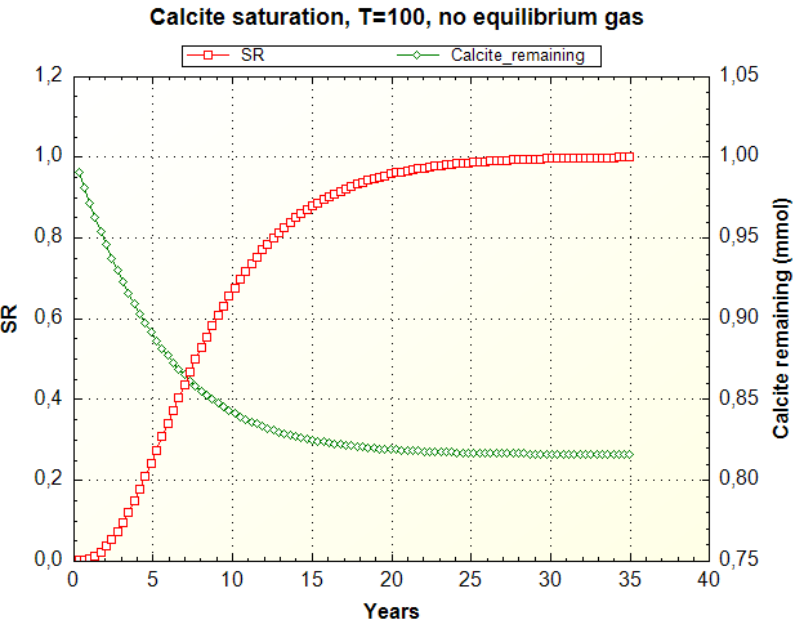
Calcite:

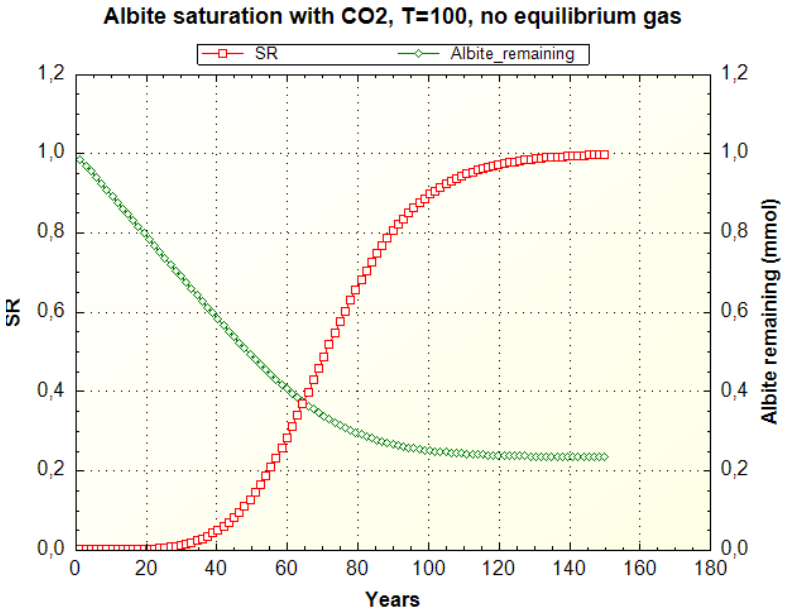
The addition of atmospheric gasses in equilibrium has caused the dissolution to be drastically reduced. From 250 to reach equilibrium up to almost 1400 years. On the other hand, much more of the calcite gets dissolved into the solution, 0.50mmol compared to 0.13mmol without gasses.

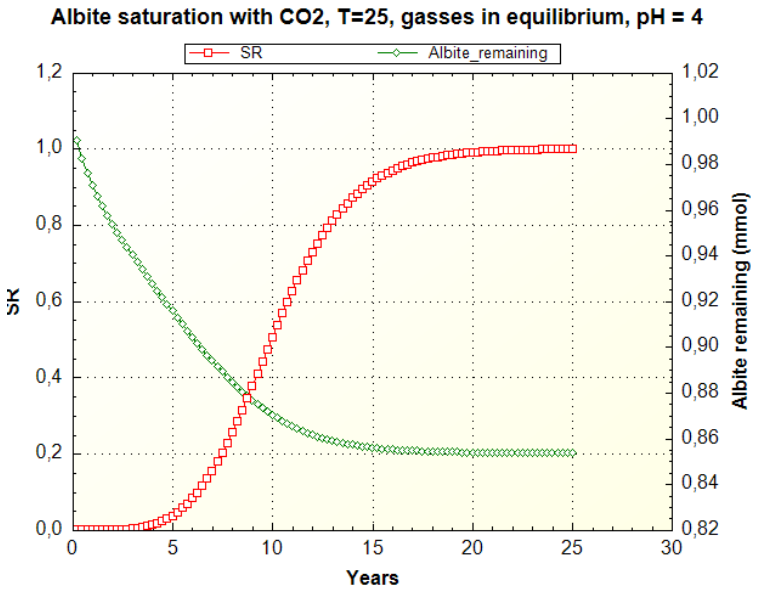
Albite:

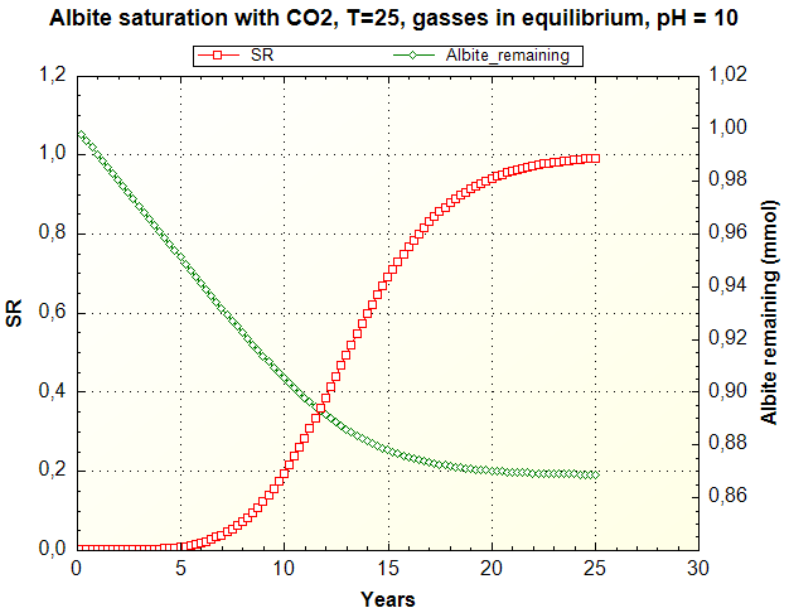
For the dissolution of Albite, the atmospheric gasses do not appear to have any great effect on the rate nor the amount of Albite being dissolved.

Task 6:









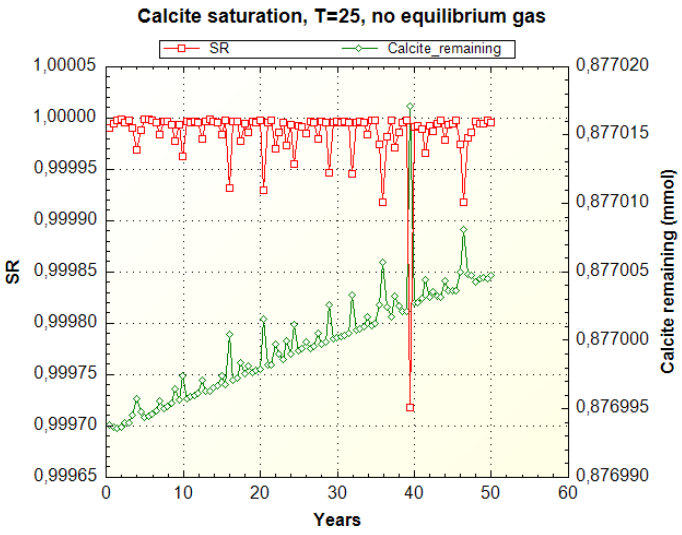
Calcite:

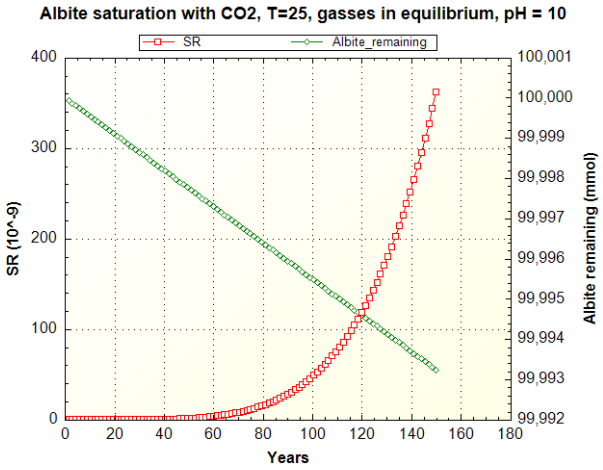
The increase in temperature corresponded with an increase in the dissolution rate. Equilibrium at 100 degrees Celsius occurred after only about 20 years, but the amount of calcite dissolved remained fairly the same, 0.15mmol at 100 degrees compared to 0.13mmol at 25 degrees.

Albite:

The increase in temperature causes the point of equilibrium occurring much later, around 130 compared to 23 years at 25 degrees Celsius. The amount of albite being dissolved has greatly increased, from 0.14mmol up to 0.76mmol at 100 degrees Celsius.

As can be seen in the bottom two graphs, the pH also has an effect on the dissolution rate. Decreasing the initial pH to 4 caused the equilibrium to be reached sooner, while increasing it to 10 slowed the rate down. Using the 15 year line as a marker, it can be observed by the graph that for pH = 7, the SR is 0.8, for pH = 4 the SR at 15 years is 0.9 while for pH = 10 it is 0.7.





Task 7:

Calcite:

This graph makes no sense and is most definitely a result of error in the code. The rate used is identical to the one found in the database while the rest of the script is unchanged.

Albite:

This might be correct, but regardless of time steps or duration the graphs produced were identical and did not catch the entire reaction.