

Equilibria Calculations

Aims

This spreadsheet is for use when introducing the calculation of initial and final concentrations of species taking part in an equilibrium reaction. The two examples used are relatively straightforward so that students can then work on more difficult calculations using traditional methods.

It is intended to be used as a whole class activity but it can be revisited by students after the lesson for further practice of the calculations.

Prior Knowledge

Students need to have an understanding of systems at equilibrium and the use of mole ratios for calculating reacting quantities.

How to use the spreadsheet

Students need to be able to calculate initial and equilibrium concentrations of all the components in a system at equilibrium if they are given complete data about one of the components. To simplify this calculation while students grasp the basic concepts in both these systems a reaction vessel of 1dm^3 is used thus removing the need to change amounts into concentration values. The spreadsheet model can be explained as giving initial and equilibrium amounts under slightly different temperature conditions (these conditions are not specified but this would explain the fact that the value of K_c , the equilibrium constant alters as the data is recalculated).

The teacher should choose one of the values for the group to calculate and then select this using one of the buttons. This will then hide the value chosen and recalculate all the data on the sheet.

C ₂ H ₅ OH(aq) +	
Initial	18.38
Eqbm	18.04
Initial	<input type="checkbox"/>
Equilibrium	<input checked="" type="checkbox"/>

Select value to calculate

When students have calculated the hidden value the answer can be checked using the 'tick' button. This simply reveals the hidden value.

It is of course possible to calculate the values for more than one component as long as two pieces of data are given about one component and one piece of data is given about each other component. If more than one value is to be calculated then simply select each value using the relevant button and check in the same way.

This process can be repeated as many times as necessary.

Two equilibrium reactions have been simulated, it is suggested that the esterification example is used initially as it has simple mole ratios. The methane example can then be used to look at more complication ratios.

Interactivity

This resource offers interactivity through the instant revealing of results to calculations. If used with an interactive whiteboard then amounts of each reactant or product used up or produced can be written onto the board to help with calculations. It may also help to write up how these values have been calculated.

Possible Difficulties using the Spreadsheet

This spreadsheet involves the use of a large number of macros (small bits of programming) that are essential to hiding and revealing data. If you are asked on loading Excel if you wish to enable macros then click yes (this is a security feature protecting against viruses that may be imbedded in macros). If you have trouble with getting the spreadsheet to work at all then this is most likely to be related to security settings on your computer.

When closing the spreadsheet you will be asked if you want to save changes, always choose no.

The numerical values in the spreadsheet are generated by using random numbers. This means that very occasionally a negative value will be generated. This is obviously not chemically correct so students should be told to click the relevant tick box and then hide the value again. (There is of course an interesting point here that could be discussed with students about looking at their data and working out if it is reasonable).

The mathematical functions and macros behind this spreadsheet would be hard to adapt to individual teachers preferences but screen colours and fonts etc can be easily altered. The font size has been set to fit on a medium sized interactive whiteboard but can be enlarged.

	C(s)	+	2H ₂ (g)	⇌	CH ₄ (g)
Initial	5.75		0.00		38.68
Eqbm	2.69		6.13		41.75

Initial	✓	Initial	✓	Initial	✓
Equilibrium	✓	Equilibrium	✓	Equilibrium	✓

The species were mixed in a vessel of volume 1 dm³
 The data refers to number of moles of each present
 Select a value to calculate by clicking a button. Check with the ✓

Screen Shot Showing Methane Equilibrium Calculation