Predicting equilibriums - sketch lines predicting the concentration changes over time for the reversible reaction equations and equilibrium positions described below.



A and B

C and D

A + B ⇄ C + D Starting concentrations as shown, Equilibrium is far to the right (favours products).

Given info:

* A and B are on the left in the equation, C and D are on the right.
* all coefficients are 1:1 – meaning any change to one of them cause the same size change in any others.
* Equilibrium is far to the right, favouring formation of the products - meaning having relatively high conc of C/D and a low conc of A/B.
* Initially A and B are present, but not C and D.

What to think:

* C and D have to end up at relatively high conc at equilibrium and A/B end up at relatively low concentration. Draw curved line upwards from C/D and downwards from A/B to arbitrary positions where the conc of C/D is relatively high compared to A/B. key points to remember: the increase in C/D must be the same as the decrease in A/B as all are 1:1 in the equation; the increase in C/D is limited by how how much A/B is present initially – the final C/D conc cannot go to or above the A/B initial conc (again because all are in a 1:1 ratio)
* Draw horizontal lines from each going forward to show conc’s remain constant.



A and B

C

A + 2B ⇄ C Starting concentrations as shown, Equilibrium is far to the right (favours products).

Given info:

* A and B are on the left in the equation, C is on the right.
* A and C have coefficients of 1, but B has a coeff of 2 – meaning any change in B must be twice the size of a change in A or C.
* Equilibrium is far to the right, favouring formation of the products meaning favours having relatively high conc of C and a low conc of A/B.
* Initially A and B are present, but not C.

What to think:

* C has to end up at a relatively high conc at equilibrium and A/B end up at relatively low concentration. **ALWAYS begin sketch with the reagent with the higher coeff.** Draw curved line for B downwards to an arbitrary low position. A will also decrease but only half as much as B. C will increase but, like A the change is only half that of B. This does not look like equilibrium is “far to the right”, but because the conc of B is so low it is. The change in B limits all the changes in other reagents, that why you start you sketch with the highest coeff.
* Draw horizontal lines from each going forward to show conc’s remain constant.

C

A

B

Given info:

* A and B are on the left in the equation, C is on the right.
* A and C have coefficients of 1, but B has a coeff of 2 – meaning any change in B must be twice the size of a change in A or C.
* Equilibrium is far to the right, favouring formation of the products meaning favours having relatively high conc of C and a low conc of A/B.
* Initially C is present, but not A and B.

What to think:

* C has to end up at a relatively high conc at equilibrium and A/B end up at relatively low concentration. **ALWAYS begin sketch with the reagent with the higher coeff.** Draw curved line for B upwards to an arbitrary low position. A will also increase to reach equilibrium, but only half as much as B. C will decrease to reach equilibrium, but like A the change is only half that of B.
* Draw horizontal lines from each going forward to show conc’s remain constant.



C

A and B

A + 2B ⇄ C Starting concentrations as shown, Equilibrium is far to the right (favours products).

B

A



A and B

C and D

A + B ⇄ C + D Starting concentrations as shown, Equilibrium is far to the left (favours reactants).

*Key marks:*

* *A,B,C,D are change by approx. the same amount.*
* *A and B decrease, C and D increase.*
* *Decrease in A and B, and the increase in C and D is minimal to reflect that the relative concentrations of A and B will still be high once equilibrium is reached (far to the left, favours formation of reactants)*
* *Line are curved appropriately and end in a horizontal slope.*



A and B

C

A + 2B ⇄ C Starting concentrations as shown, Equilibrium is far to the left (favours reactants).

A

B

*Key marks:*

* *A and C change by approx. the same amount.*
* *B changes by twice as much as A and C*
* *A and B decrease, C increases.*
* *Decrease in A and B, and the increase in C is minimal to reflect that the relative concentrations of A and B will still be high once equilibrium is reached (far to the left, favours formation of reactants)*
* *Line are curved appropriately and end in a horizontal slope.*



C

A and B

A + 2B ⇄ C Starting concentrations as shown, Equilibrium is far to the left (favours reactants).

A

B

C

*Key marks:*

* *A and C change by approx. the same amount.*
* *B changes by twice as much as A and C*
* *A and B increase, C decreases.*
* *Decrease in A and B, and the increase in C are significant to reflect that the relative concentrations of A and B will be high once equilibrium is reached (far to the left, favours formation of reactants)*
* *Line are curved appropriately and end in a horizontal slope.*



A and B

C and D

A + B ⇄ C + D Starting concentrations as shown, Equilibrium is in the middle (favours no reagents).

*Key marks:*

* *A, B, C, D all change in concentration by the same amount.*
* *A and B decrease, C and D increase.*
* *Increase in A and B, and the decrease in C and D are enough to show similar concentrations when equilibrium is reached (equilibrium is in the middle, no reagents favoured.*
* *Line are curved appropriately and end in a horizontal slope.*

*Key marks:*

* *A, B, D all change in concentration by the same amount.*
* *C changes by twice as much as the other changes.*
* *The concentrations at equilibrium show that A and B are similar to the combined C and D (Equilibrium is in the middle, favours no reagents).*
* *Line are curved appropriately and end in a horizontal slope.*



A and B

C and D

A + B ⇄ 2C + D Starting concentrations as shown, Equilibrium is in the middle (favours no reagents).

C

D



A, B, and C

D

A + B ⇄ C + D Starting concentrations as shown, Equilibrium is far right (favours products).

*Key marks:*

* *All reagents change in concentration by the same amount.*
* *C and D increase in concentration*
* *A and B decreaes but not to zero*
* *Decrease in A and B limit the increases in C and D (A and B do not fall to zero, must be above zero) (Equilibrium is in the middle, favours no reagents).*
* *Line are curved appropriately and end in a horizontal slope.*



A

C and D

A ⇄ 2C + D Starting concentrations as shown, Equilibrium is far to the left (favours reactants).



A

C and D

A ⇄ 2C + D Starting concentrations as shown, Equilibrium is far to the right (favours products).



C and D

A

A ⇄ 2C + D Starting concentrations as shown, Equilibrium is in the middle (favours no reagents).