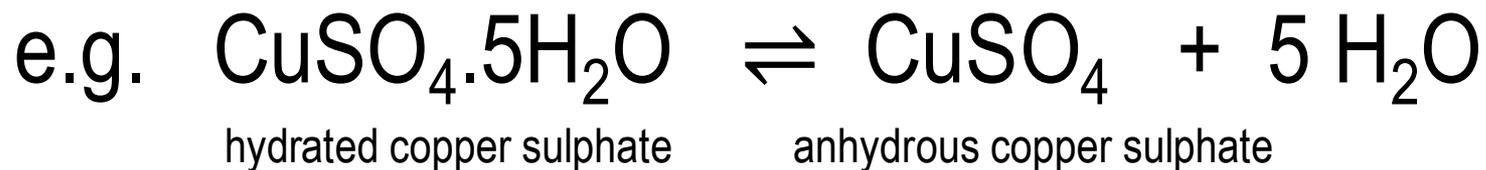




[WWW.CHEMSHEETS.CO.UK](http://www.chemsheets.co.uk)

DYNAMIC EQUILIBRIA

Many chemical reactions are reversible



blue



white



Click image to see
YouTube video of reaction

Many reversible reactions (in a closed system) can reach a state of **dynamic equilibrium**

Closed system – nothing can get in or out



at **dynamic equilibrium**

A reacts with B to make C

simultaneously, and at the **same rate**

C reacts with make A and B

@ Dynamic equilibrium

both reactions are taking place

- **simultaneously,**
- **and at the same rate**

static equilibrium

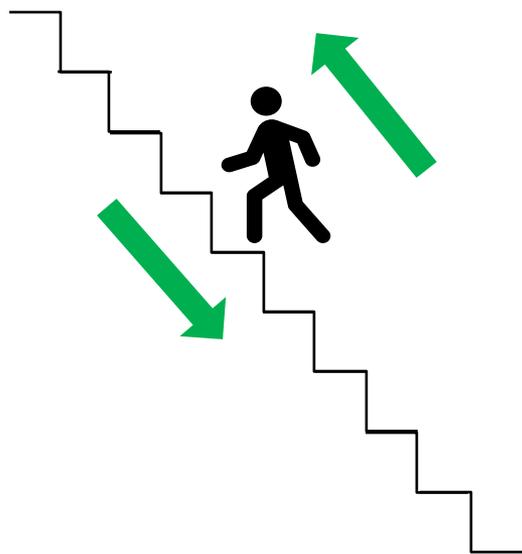


person standing still on stairs
nothing is changing
at **equilibrium**
but **STATIC**

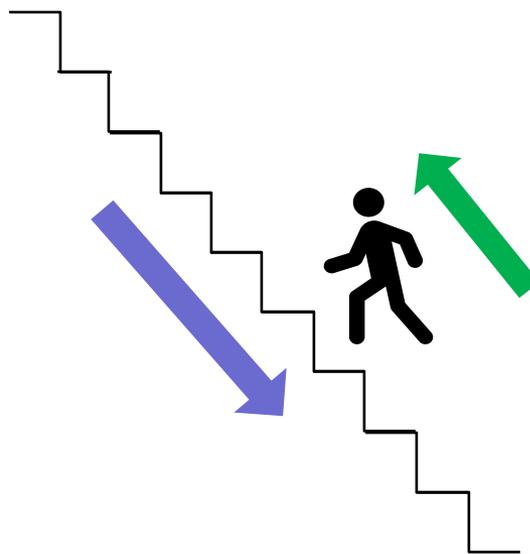
dynamic equilibrium



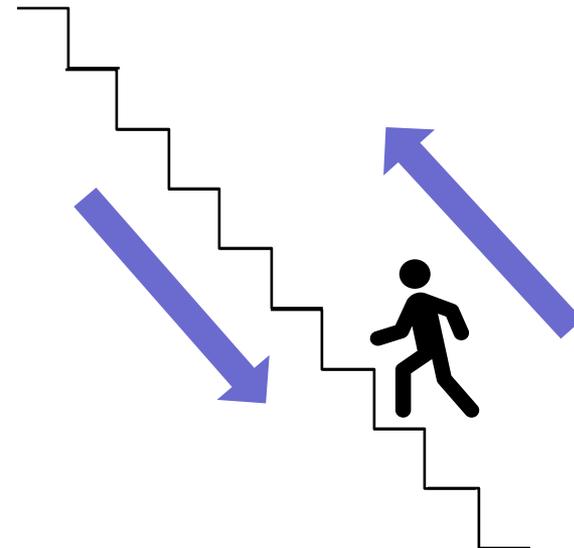
person walking up a down escalator
(at same speed as escalator)
nothing is changing
at **equilibrium**
but **DYNAMIC**



in dynamic equilibrium
rate down = rate up



not in equilibrium
rate down > rate up



new dynamic equilibrium
(in new position)
rate down = rate up

- if we speed up escalator we are no longer in equilibrium and person will start to move down
- but the person will walk/run faster to establish a new equilibrium – although the position of the equilibrium will have moved further to the right

Le Chatelier's Principle

If the conditions of a system at equilibrium are changed, the position of the equilibrium moves to oppose that change

Change	Action by equilibrium
Make it hotter	Cools it back down
Increase the pressure	Reduce the pressure
Add more of a chemical	Use it up to get rid of it

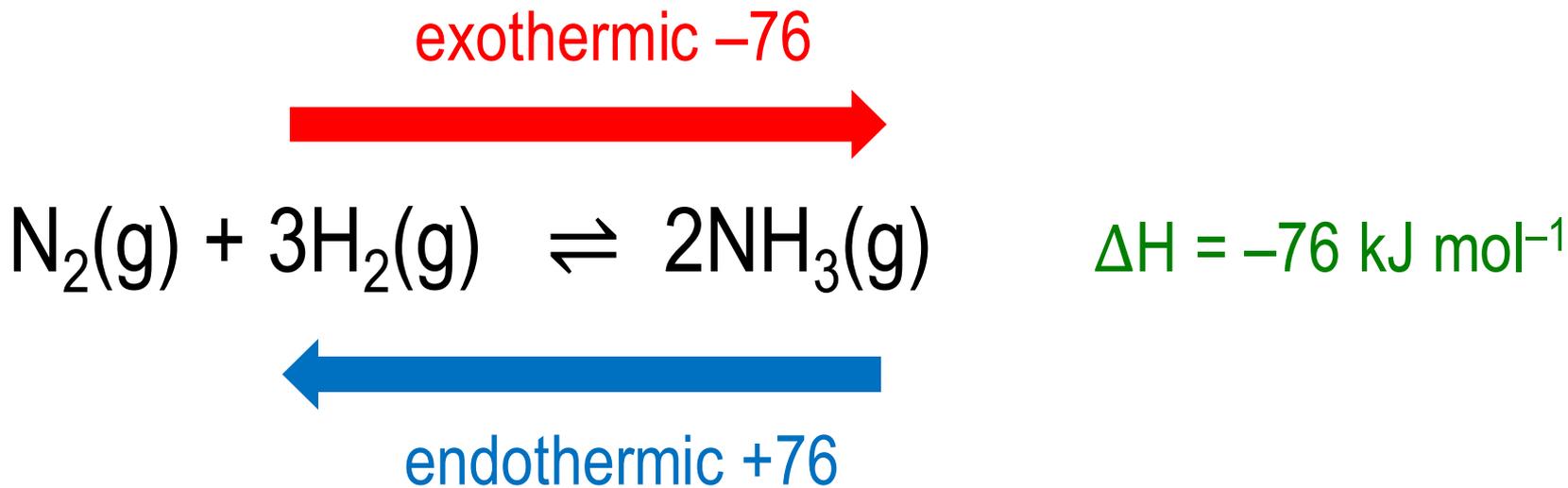
Le Chatelier's Principle - temperature

Exothermic reactions

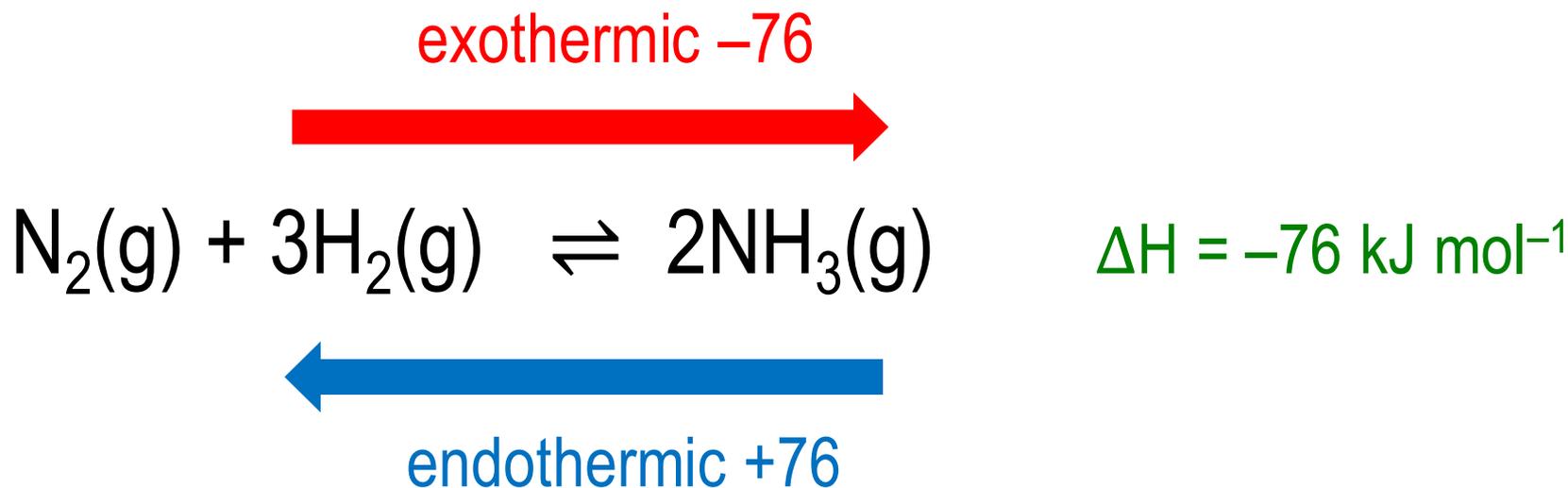
chemical energy \rightarrow heat energy
makes the system **hotter**

Endothermic reactions

heat energy \rightarrow chemical energy
makes the system **colder**



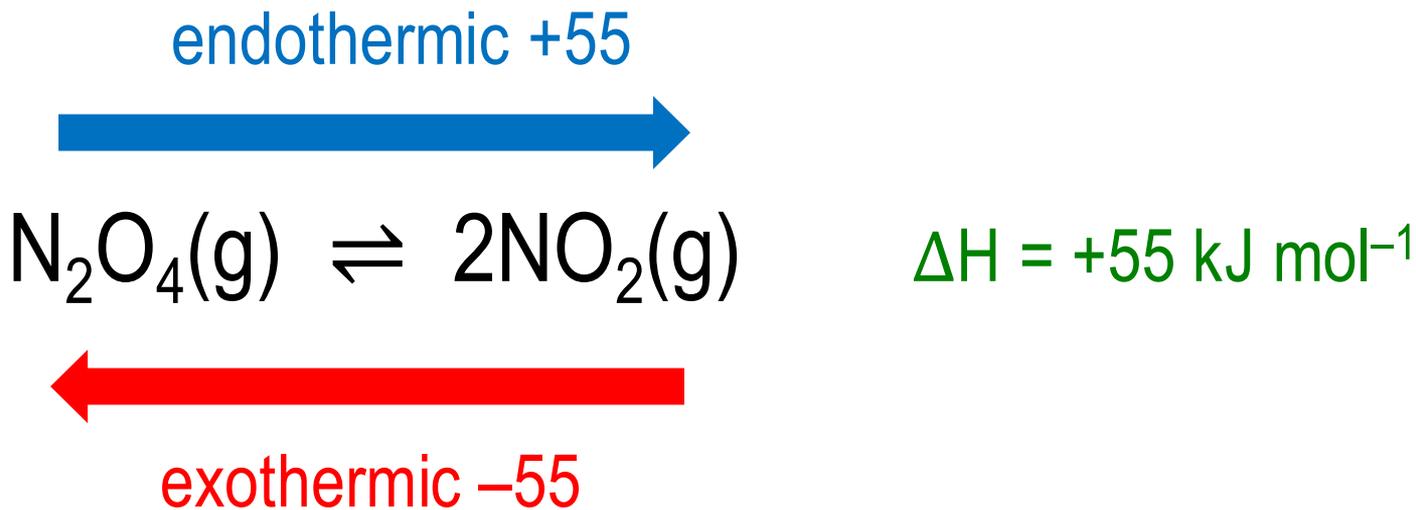
Le Chatelier's Principle - temperature



e.g. if T is increased

equilibrium position moves to oppose increase in T
by moving left in endothermic direction
decreases equilibrium yield of NH_3

Le Chatelier's Principle - temperature

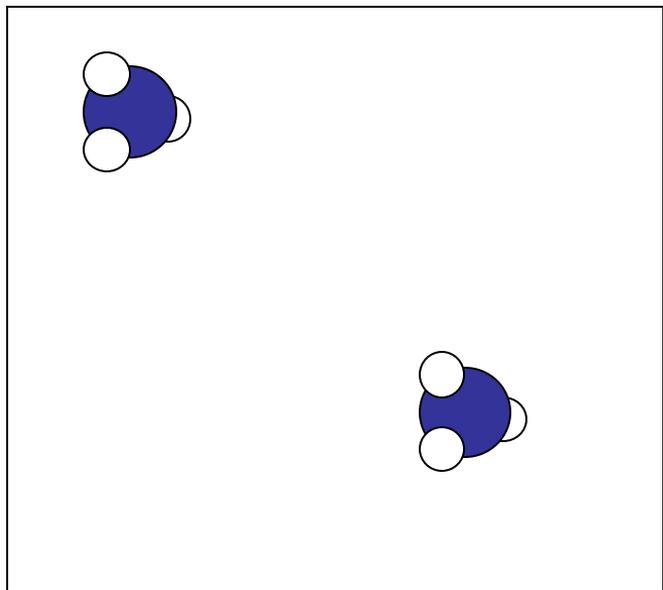


e.g. if T is increased

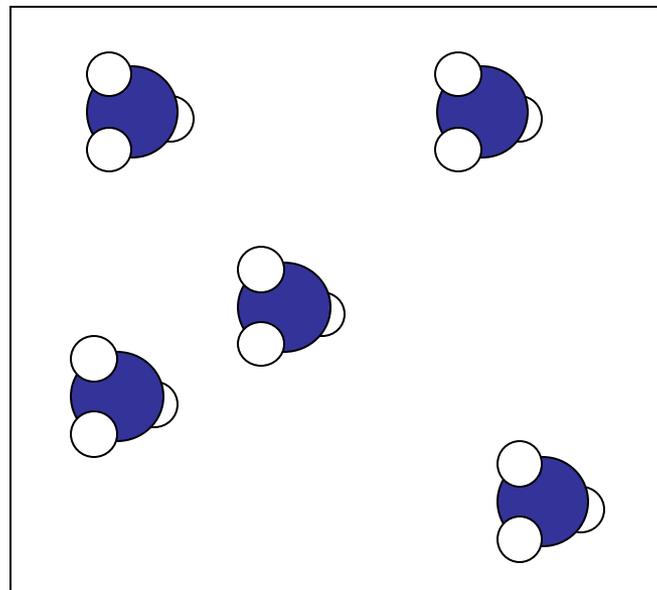
equilibrium position moves to oppose increase in T
by moving right in endothermic direction
increases equilibrium yield of NO_2

Le Chatelier's Principle - pressure

More gas molecules = more pressure

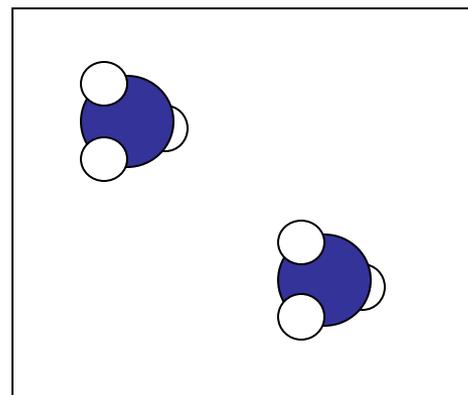
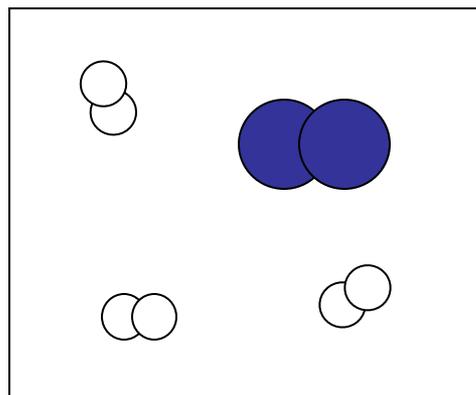
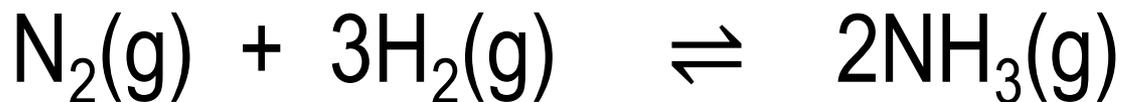


lower pressure



higher pressure

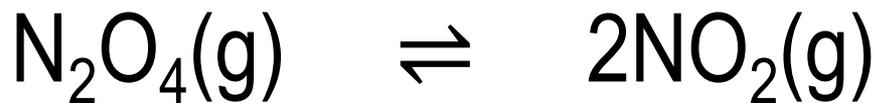
Le Chatelier's Principle - pressure



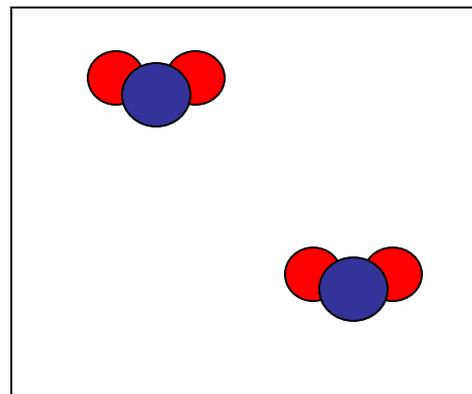
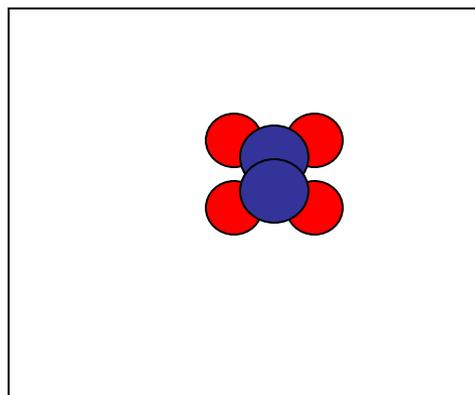
e.g. if P is increased

equilibrium position moves to oppose increase in P
by moving right to side with fewer gas molecules
increases equilibrium yield of NH_3

Le Chatelier's Principle - pressure



1 molecule
less pressure

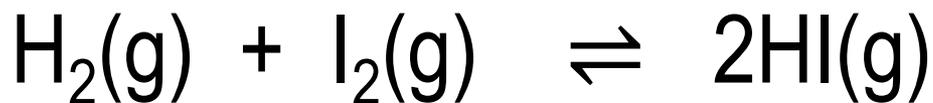


2 molecules
more pressure

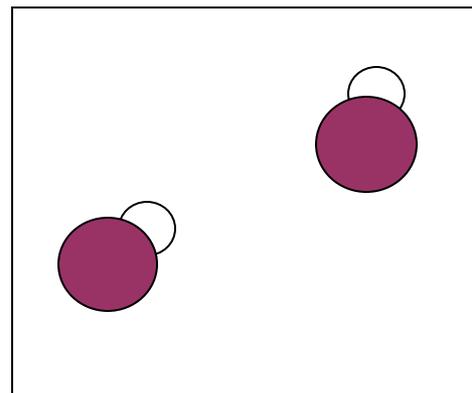
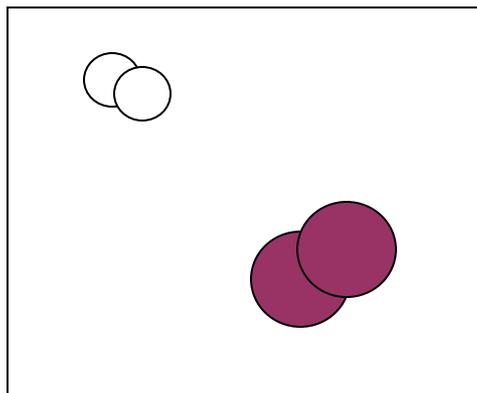
e.g. if P is increased

equilibrium position moves to oppose increase in P
by moving left to side with fewer gas molecules
decreases equilibrium yield of NO_2

Le Chatelier's Principle - pressure



2 molecules
same pressure



2 molecules
same pressure

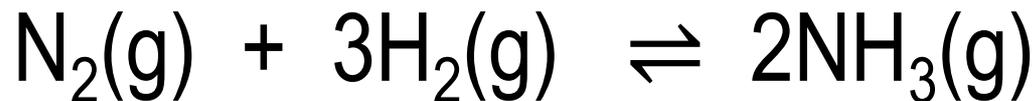
e.g. if P is increased

equilibrium does not move

as same number of gas molecules on each side

no effect on equilibrium yield of HI

Le Chatelier's Principle - concentration



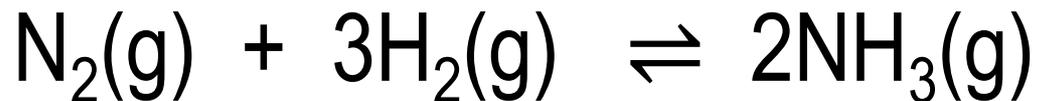
e.g. add more N_2

equilibrium position moves to oppose increase in N_2

by moving right to use it up

increases equilibrium yield of NH_3

Le Chatelier's Principle - concentration



e.g. remove some H_2

equilibrium position moves to oppose decrease in H_2
by moving left to make more of it
decreases equilibrium yield of NH_3