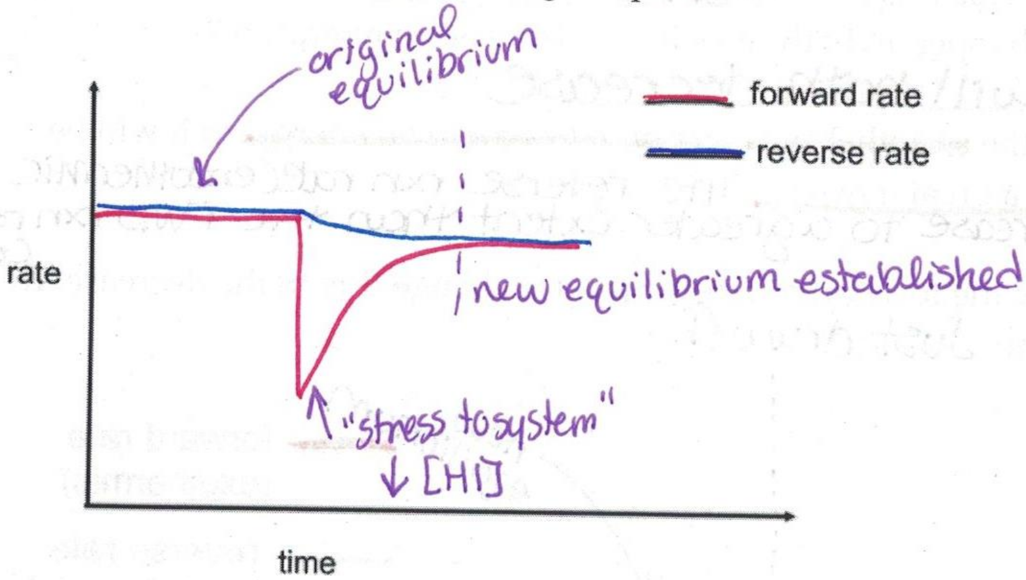
Graph how the rates change during the process:



LeChatelier's Principle:

What was the initial change? decrease in [HI](g)

What was the 'counteraction'? shift LEFT to favor reactants to temporarily produce more HI(g)

Why was it a 'new' equilibrium?
the rates + concentrations are lower than originally.

Note: The counteraction is always the…
shift that is the result of the initial disturbance.

Conclusion: Increasing the concentration of a substance causes a shift to the opposite side. Decreasing the concentration of a substance causes a shift to the same side.

Temperature Change

Consider the system:

$$2NO_{(g)} + Cl_{2(g)} \Leftrightarrow 2NOCl_{(g)} + \text{energy}$$

↓ Temp.

We can disturb this equilibrium by decreasing the temperature (remove energy from the system). The forward reaction is exothermic

$2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)}$ + ENERGY

RVS rxn has ↑ Ea ∴ is more altered by temp decrease

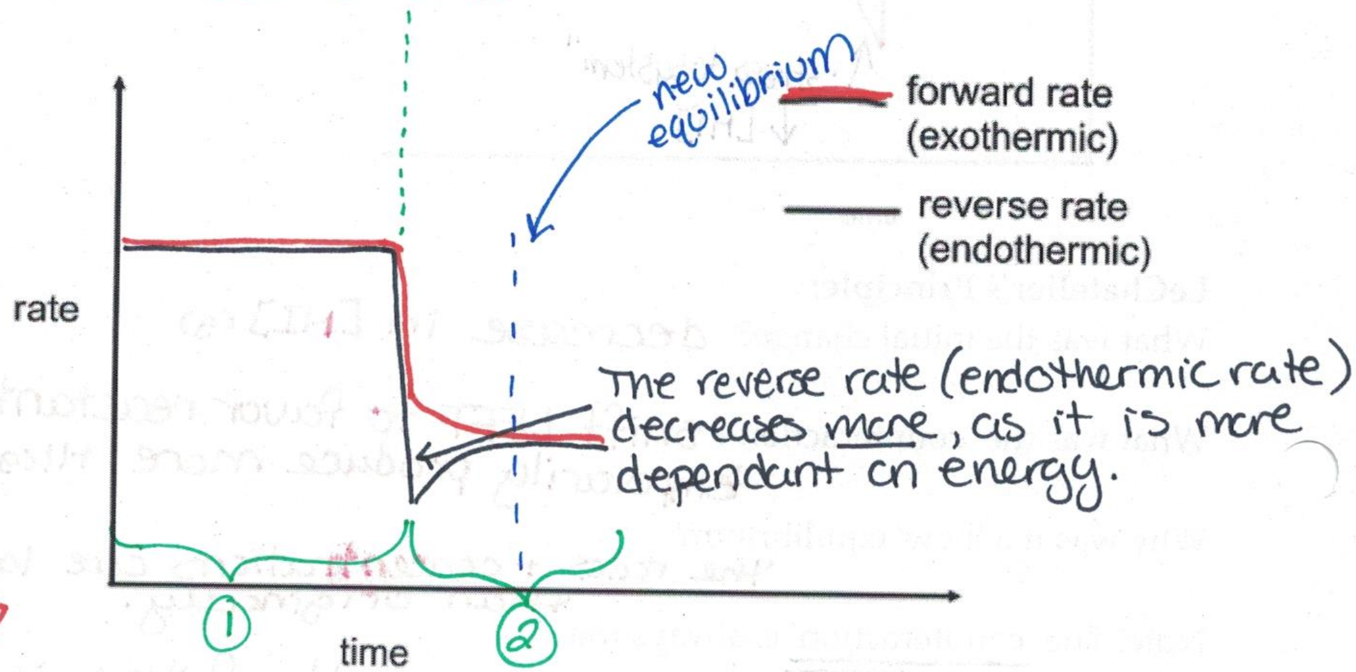
and the reverse reaction is endothermic.

What will happen to both rates if you decrease temperature?

they will both decrease

However, the endothermic reaction relies more on energy, so it will be affected to a greater extent. The reverse rxn rate (endothermic in this EX) will decrease to a greater extent than the FWD rxn rate (exothermic)

Graph how the forward and reverse rates change due to the decrease in temperature. Just draw ①



Therefore, which rate is temporarily greater? The FWD rate is temporarily greater

Therefore, there is a shift to the RIGHT (exothermic) and products are favoured.

This means, that for a time, products will be produced faster than they're being used (resulting in a net increase), and visa versa for reactants.

Eventually, the reverse (endo) rate will start to increase (build-up of products) and the forward (exothermic) rate will start to decrease until a NEW equilibrium is established.

Finish the rate graph on the ~~last~~ above page.

NOW DRAW ② on graph.

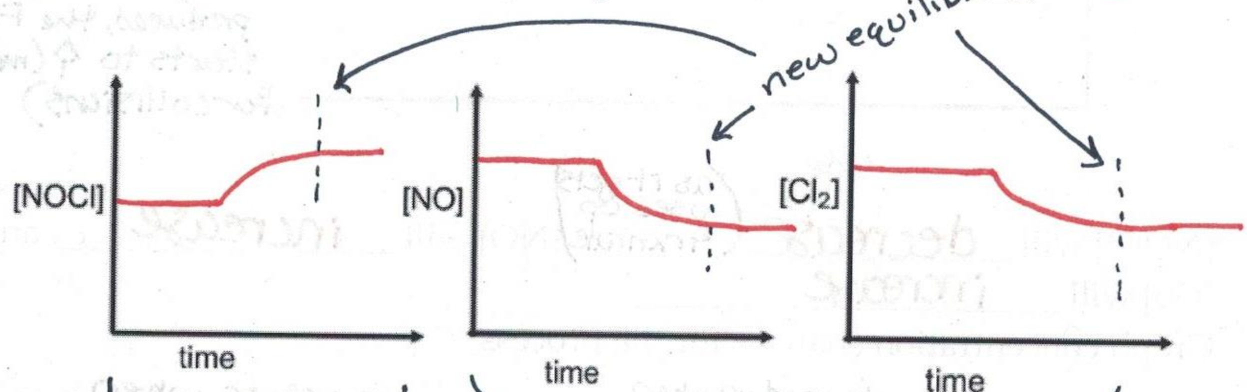
* An equilibriums endothermic direction is more sensitive to temperature changes, than the exothermic direction due to the Endothermic direction having ↑ activation energy

FWD (endothermic) Rxn has ↑Ea
RVS (exothermic) Rxn has ↓Ea

When equilibrium has been re-established, why are the rates lower than originally? Temperature is decreased, therefore both rates are lower than before because with ↓ K.E. there are less effective collisions and less forceful collisions ∴ ↓ RXN rates overall.

Due to the shift right (to the exothermic side), the [NOCl] increase, [NO] decrease, and $[Cl_2]$ decrease. } reactants are being used up.

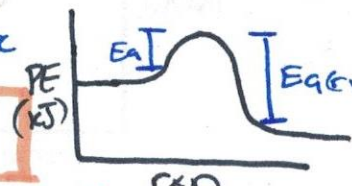
Graph how each changes during the process:



NOCl is produced faster than it is being used. FWD rxn rate (faster) > RVS rxn rate (slower)

reactants being used up as FWD rxn rate is faster.

Consider the system: $2NO_{(g)} + Cl_{2(g)} \Leftrightarrow 2NOCl_{(g)}$ + energy (exothermic)



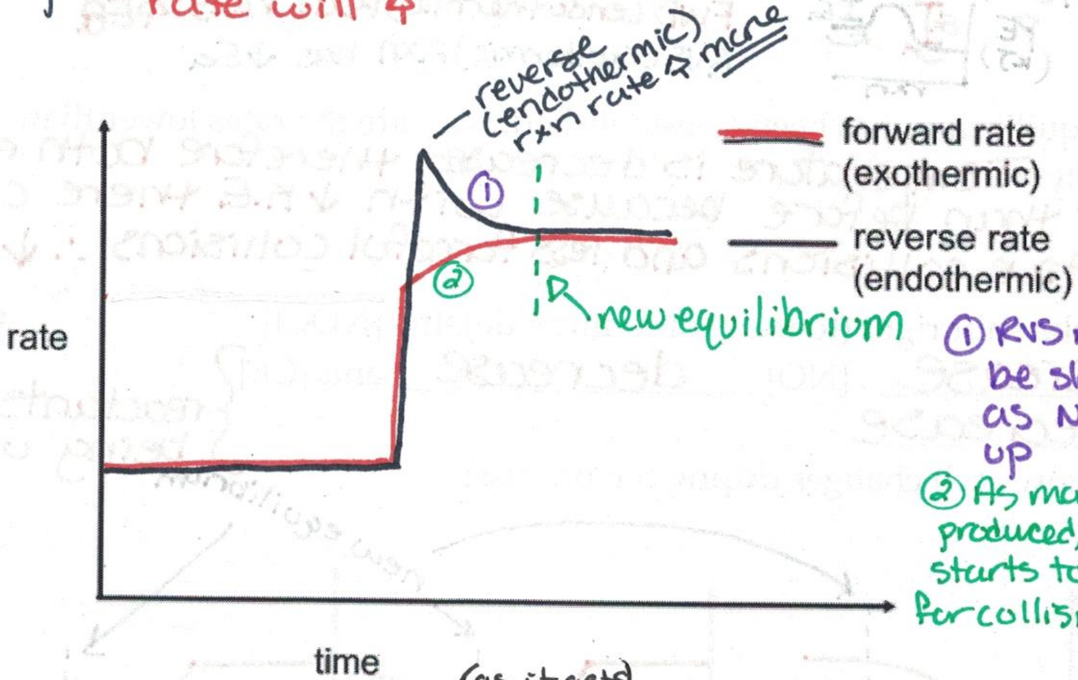
↑Temp If temperature was increased, both rates will increase (↑KE), but since endothermic (reverse reaction in this example) relies more on energy, it will increase more. Therefore the reverse (endothermic) rate will temporarily be higher than the Forward (exothermic) rate, causing a shift to the LEFT so that reactants. are favoured.

Draw a rate graph to model the entire process:

... next page

$2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)} + \text{energy}$.

↑Temp. = endothermic rxn rate will ↑

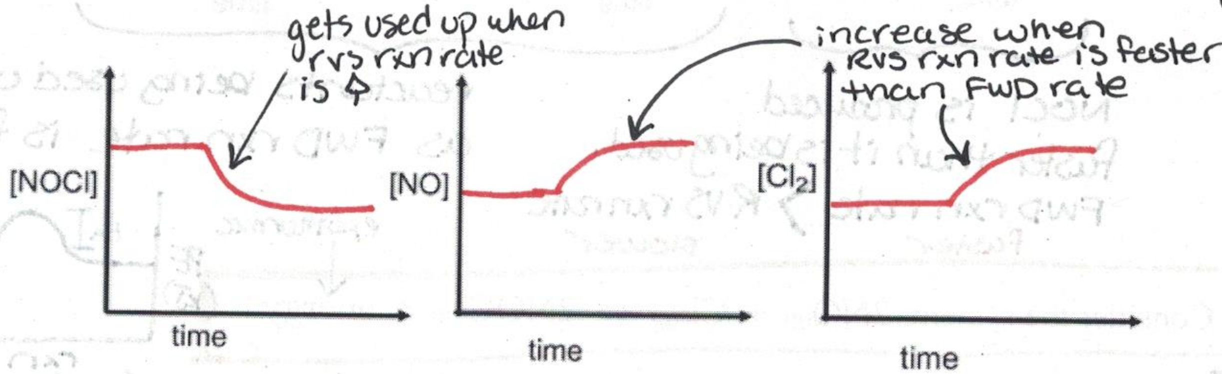


① Rvs rate is temp ↑ bc slows over time as $NOCl_{(g)}$ gets used up

② As more NO and Cl_2 are produced, the FWD rxn starts to ↑ (more particles for collisions)

[NOCl] will decrease (as it gets used up ↑rxn rate) [NO] will increase, and [Cl_2] will increase. (being produced faster than they are being used up.)

Graph concentration changes for the process:



Conclusion: Decreasing temperature results in a shift in the EXOTHERMIC direction. Increasing temperature results in a shift in the ENDOTHERMIC direction.

Complete assignment 2 for HW.

also work on Lab 19A due:

Thursday (blocks 2, 3 + 4)

Friday (block 6)