**Catalysis and Sustainable Chemistry**

A rate of reaction can be measured by:

*
*

 : explains how different variables change the rate of a reaction

The rate of reaction depends on the of successful between the reactant particles.

The four main variables that can change the rate of a reaction are:

*
*
*
*

A catalyst is

Catalysis is

Energy Profiles

**Un-catalysed:**

Ea is the energy.

Energy

The

needs to be for a

 reaction and product

to be formed.

Progress of Reaction

**Catalysed:**

The

is lower/higher with a catalyst present

The catalyst has provided an alternative

pathway with

energy

Energy

Progress of Reaction

Boltzmann Distribution

The area underneath the curve is

Number of particles

Energy

The activation energy of the catalysed reaction means that a proportion of particles have energy to be

Remember the going over the ! We provide an
with lower/higher energy, we **do not** lower the energy of the original pathway.

There are two types of catalyst:

*
*

 catalysts have reagents and catalysts which are in a

For example: Hydrogenation of ethane on a nickel surface

Reactants

Bonds

Bonds

New bonds
form

Product

Catalytic Converters

Three reactions which take place at the catalyst surfaces:

1. of nitrogen oxides:
2. of carbon monoxide:
3. of hydrocarbons:

catalysts have reagents and catalysts which are in the

For example: Destruction of the ozone by CFC’s

* Ozone breakdown:
* Reaction of intermediate with oxygen atom:
* Overall reaction:

Note: the catalyst is as they do not undergo

Transition Metals in Catalysts

Transition metals and their compounds function as catalysts for two reasons:

*
*

Zeolite catalysts are solids which contain pores and channels within their structure. They can act as catalysts because chemical reactions can take place at active sites within their

Iron in the Haber process – produces

 + 🡪

Nylon 6 production – has high and

Current synthetic methods:

1.

 + (NH2OH)2H2SO4 + 2NH3 🡪 + By-products

 + Oleum + H2SO4 🡪 + ½ (NH4)2SO4



1.

 + H2O2 + NH3 🡪 🡪 🡪

New one-step process:


 + Air + NH3 🡪 🡪

Benefits of the new process (in terms of sustainable chemistry):