Uses of Catalysts – Industry
→ Allow reactions to take place at lower temperatures
→ Enable different reactions to be used
→ Are often enzymes
→ Economic Importance in production:
  Poly(ethene), Sulphuric Acid, Ammonia, Ethanol
→ Can Reduce Pollution:
  Catalytic Convertors

Radiation and Matter
Changes occur in molecules when they absorb certain frequencies of radiation.
Energy changes are quantised: separated by fixed energy levels
Difference in energy between levels corresponds to a frequency/wavelength in the electromagnetic spectrum
Different molecules, different energy levels

Infrared and Warming:
Absorption of IR causes bonds in molecules to vibrate more
This increases the KE of the molecule
Collisions pass this KE to other molecules raising the average KE of surrounding molecules
A rise in the average KE of molecules = a rise in TEMPERATURE
When molecules absorb High Energy UV/Vis Radiation:
Bond Fission:
  • Heterolytic Fission
    \[ X : Y \rightarrow X^+ + Y^- \]
    Unequal sharing of bonding electrons – ions formed
  • Homolytic Fission
    \[ X : Y \rightarrow X\cdot + Y\cdot \]
    Equal sharing of bonding electrons – radicals formed
Radicals: Atom or group of atoms with one or more unpaired electron, 2 unpaired electron (eg. O atom) is a Bi-radical
Radical Reactions:
  ~ Occur in the gas phase / non-polar solvent
  ~ Initiated by light or heat
  ~ Very Fast
  Eg. Combustion reactions, explosions, many reactions occurring in the troposphere and stratosphere
Radical Substitution Reactions: Chain reactions/multi-step reactions where a reactive product causes additional reactions to take place
3 Stages:
1. Initiation: A molecule absorbs high energy UV radiation, homolytic fission occurs forming radicals, always endothermic
2. Propagation: Radicals react with molecules forming new radicals/molecules – chain reaction
3. Termination: Radicals combine, forming a stable molecule, always exothermic

Radical Halogenation of Alkanes:
Depending on concentrations of halogen, the final product may change (CH₄ or CCl₄)
Photodissociation of Bromine:
When bromine is exposed to light photodissociation occurs where the Br–Br bond is broken homolytically and two Bromine radicals are formed
These radicals are then able to react via a substitution reaction with hexane
This reaction of bromine causes it to lose its colour