Waste Generation and Sustainability

- Atom economy and E –factor (Unfriendliness co-efficient)
- Instead of looking at a particular reaction we expand our scope to the life cycle
- Cradle to Grave
- The place from where material is taken is called ***Cradle***
- Disposing off through various processes back to the atmosphere is referred to as ***Grave.***
- Hidden emissions : embodied emissions
- Concept of this lifecycle thing is called Life cycle assessment.
- Can be done by mass and energy balance
- Mass and energy balance are very useful.
- Let's say we have two alternative catalyst catalyst 1 and catalyst 2
- Catalyst 1 produce 1 kg of waste
- Catalyst 2 produces 2 kg of waste
- When we go to utilization catalyst 2 is more efficient than catalyst 1.
- Net amount of emissions come out to be same
- ISO provides four main parts to be done for LCA
- First is ***Goal And Scope***
- Let's say we have catalyst 1 and catalyst 2
- Our goal is to find whether preparation of cat. 1 is more sustainable than cat. 2 or not.
- Goal is the objective of the LCA study
- The scope that we consider is from mining to catalyst synthesis.
- Gate: Process boundary is referred to as gate.
- The overall life cycle is referred to as Cradle to Grave
- And depending on the scenario we look at Cradle to Gate

- One parameter is missing whether catalyst 1 and 2 will do same function or not.
- Suppose we went to buy paint so rather than looking at the amount of paint we look for amount of wall to be painted.
- This **sufficiency** is called functional unit.
- A functional unit is defined as the quantity of product of system of products on the basis of it's performance and its end to end application
- The functional units are application specific.
- Let's say we produce catalyst in Kanpur and one in Bangalore
- Therefore emissions and transportation availability depends on location
- We need additional processes so additional amount of emissions
- Inventory analysis is nothing but mass and energy balance
- As long as we have data on emission in producing energy we don't need to perform energy or mass balance on whole cradle to grave
- To tell others that our product is much more sustainable than our competitors we sell it with a product label
- Third party verification.
- ISO only sets the standards
- Goals are set by the person who is interested in LCA
- Some companies they define scope as
- Scope 1 emissions happening within their premises
- Scope 2 energy purchases they make and offset even those emissions
- Scope 3 everything else
- Carbon neutral involves scope 1 and scope 2
- Net Zero involves scope 1, 2 and 3.

- Like unfriendliness quotient Here to mark the impact on global scale we use a factor
- Like 1kg methane > 25 kg co2
- So we find CO2 equivalent like if ½ ton methane and 1 ton co2 is emitted we have co2 e to be ½ *25 +1