Commodity Swaps:

- Commodity swap are similar to interest rate Swaps. Swaps are contracts between two willing parties to exchange cash flows over an agreed period based upon a market variable above or below an agreed bench mark.

- Fixed rate value is the swap rate for interest rate Swaps, where as Commodity Swap Price is for Commodity Swap.

- At beginning of the Swap, value of the Swap in both cases is Zero and can vary with time and market input variables.

- Interest Swaps have interest rates and forward rates as key inputs; for Commodity Swaps in addition to interest and forward rates, Commodity forward prices are required. Therefore Commodity Swaps have more risk considerations. Additionally Commodity swaps also need to consider seasonality of the commodity markets. For example, heating oil consumption is higher in winter times than in summer.

- Swap rate in an Interest rate Swap is weighted average of forward rates, here weights are corresponding discount factors of forward rates.

$$\textbf{Swap Rate} = \frac{\sum_{1}^{T}(ForwarddiscountFactor)_t * (ForwardRate)_t}{\sum_{1}^{T}(ForwarddiscountFactor)_t}$$

For Commodities

$$\textbf{Swap Price} = \frac{\sum_{1}^{T}(ForwarddiscountFactor)_t * (Forward\ Pr\ iceofCom\ mod\ ity)_t}{\sum_{1}^{T}(ForwarddiscountFactor)_t}$$

Example: An Investor wants to hedge 1 million barrels crude oil, currently trading one year forward prices at $103.10 and at $104.23 for two year periods. The current 1-year and 2-year treasury rates are 1.5 % and 1.65 %. Calculate 2 year Swap rate:

1 year forward rate discount factor: $\dfrac{1}{(1+0.015)} = 0.985222$

2 year forward rate discount factor: $\dfrac{1}{(1+0.0165)^2} = 0.967799$

$$\text{Swap Price} = \frac{(0.985222 * 103.10 + 0.967799 * 104.23)}{(0.985222 + 0.967799)} = \$103.66$$

If 2- year treasury rate was not given, but if 1 year treasury rate and 1 year forward rate is given then 2 –year rate can be calculated as:

$(1 + 1 \text{ year rate}) * (1 + 1 \text{ year rate in year 2}) = (1 + 2 \text{ year rate})^2$.

Example: If Investor wants to pay fixed swap price and receive market price in both years as in above example, at first settlement date if spot price for crude is at $ 98.23, Then cash flow to Investor at the settlement date is:
$$(\$98.23 - \$103.66) = \textbf{- \$ 5.43} \text{ per barrel.}$$

Prepaid Swaps:
> Investor may choose to pay the amount at inception of the contract. This amount is present value of the forward commodity price.

This is calculated as an average present price of year one and year two forward prices:

In this example it should be $\dfrac{(0.985222 * 103.10 + 0.967799 * 104.23)}{2}$
$$= \$101.23 \text{ per barrel}$$

Key Points in Swaps:

1. The value of any swap is present value of settlement cash flows.

2. At the inception, Swap value is always zero.

3. Both Interest and Commodity Swaps change with interest and forward rates, where as Commodity Swaps also change with commodity prices.

4. Value of both Interest rate and Commodity Swaps change over time even market rates and prices do not change.

Swap Risks:

1. Prepaid Swaps have credit risk (delivery default), market risk (change in prices), and financial risk (interest rate changes).

2. Financially settle commodity swaps have less credit risk but have financial and market risks. Credit risks can sway back and forth between two counter parties.

3. To remove all noncredit risk from Commodity Swaps both counter parties need to hedge interest rate risk with interest rate Swaps.

4. Commodity transactions need to consider Seasonality of commodities.