THINK-PAIR-SHARE ASSIGNMENT 1

TITLE: CHEMICAL INDUSTRIAL DESIGN (PRODUCTION OF AMMONIA)

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Type of process: Haber Process

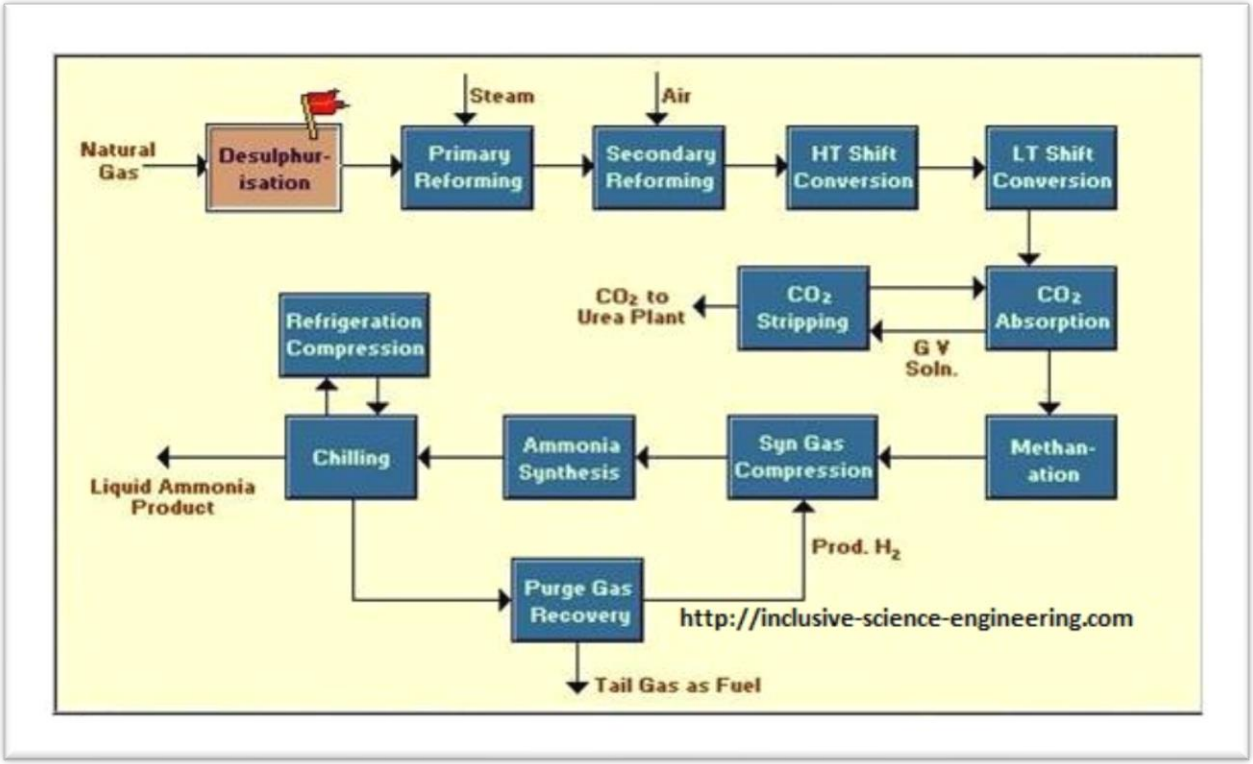

Figure 1: The process flow of the production of ammonia from natural gas.

List of unit operation

No.	Blocks	Unit Operation	Description
1	Desulphurization	Hydrogenation and Absorptions	Sulphur is reacted with hydrogen to form hydrogen sulphide and then absorbed on packed bed absorber
2	Primary reformer	Catalytic reforming	Methane converted to CO, H_2, CO_2

3	Secondary reformer	Catalytic autothermal reaction	Residual methane conversion to CO_2 and H_2
4	High temperature shit conversion	Water-gas shift reaction at high temperature	CO converted to CO_2
5	Low temperature shift conversion	Water-gas shift reaction at low temperature	Residual CO converted to CO_2
6	Carbon dioxide absorption	Chemical absorption	CO_2 absorbed by G.V solution
7	Carbon dioxide stripping	Stripping	CO_2 stripped from G.V solution
8	Methanator	Methanation	CO_2 and CO traces in process gas are converted to methane
9	Synthesis gas compressor	Centrifugal compression	To develop operating pressure for synthesis reactor
10	Ammonia synthesis reactor	Double Packed bed Reactor	Ammonia formation
11	Chilling	Heat exchanger	Ammonia vapor cooling
12	Refrigeration and compression	Screw compression	To liquefy ammonia for storage
13	Purge gas and recovery	Absorption, separation	To separate traces of nitrogen, argon, methane and hydrogen in the process

Chemical substances in each operation unit

No	**Unit Operation**	**Chemical Substance**
1	Hydrogenation and Absorptions	Sulphur, Hydrogen & Hydrogen sulphide
2	Catalytic reforming	Methane, CO, H_2 & CO_2
3	Catalytic autothermal reaction	Residual methane, CO_2 & H_2

4	Water-gas shift reaction at high temperature	CO & CO_2
5	Water-gas shift reaction at low temperature	Residual CO & CO_2
6	Chemical absorption	CO_2 & G.V solution
7	Stripping	CO_2 & G.V solution
8	Methanation	CO_2, CO traces & Methane
9	Centrifugal compression	Methane
10	Double Packed bed Reactor	Ammonia
11	Heat exchanger	Ammonia
12	Screw compression	Ammonia
13	Absorption, separation	Nitrogen, Argon, Methane & Hydrogen