



SNS COLLEGE OF TECHNOLOGY

Vazhiampalayam, Coimbatore-35

(An Autonomous institution)

Accredited by **NBA-AICTE** and Re-Accredited by **NAAC-UGC with A+ Grade**

Approved by **AICTE**, New Delhi & Affiliated to **Anna University**, Chennai



DEPARTMENT OF CHEMISTRY

**COURSE NAME : 23CHT102- CHEMISTRY OF ENGINEERING
MATERIALS**

I YEAR / II SEMESTER

UNIT : 3. FUELS AND COMBUSTION

TOPIC : 4. SYNTHETIC PETROL



BRAINSTORMING WITH RECAP



LIQUID FUEL- PETROLEUM



- The gasoline obtained from the fractional distillation of crude petroleum oil is not enough to meet the requirement of the present community due to vast increase of automobiles.
- Hence an alternate source need of finding out to manufacture synthetic petrol.





CLASSIFICATION



Hydrogenation of Coal

- Coal contains only 4.5 % hydrogen whereas 18 % of hydrogen is present in petroleum. So, coal is hydrogen deficient compound.
- *The conversion of solid fuel into liquid fuel is known as hydrogenation of coal or synthetic petrol.*
- Generally, 2 methods are available for the manufacturing of liquid fuels from solid coal. They are as follows:
 - **(a) Fischer – Tropsch process (or indirect method)**
 - **(b) Bergius process (or direct method)**

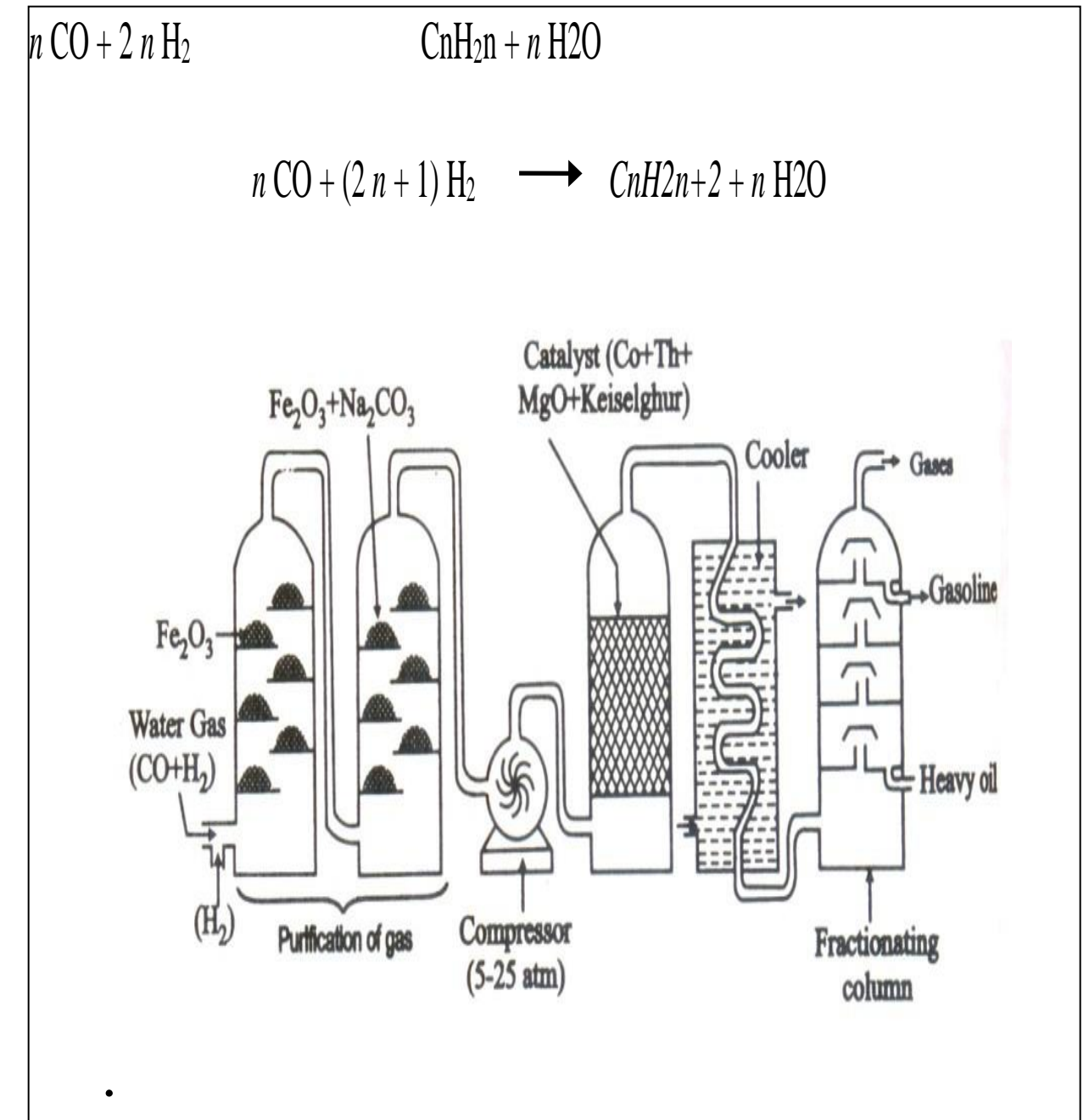




FISCHER – TROPSCH PROCESS/ INDIRECT METHOD)

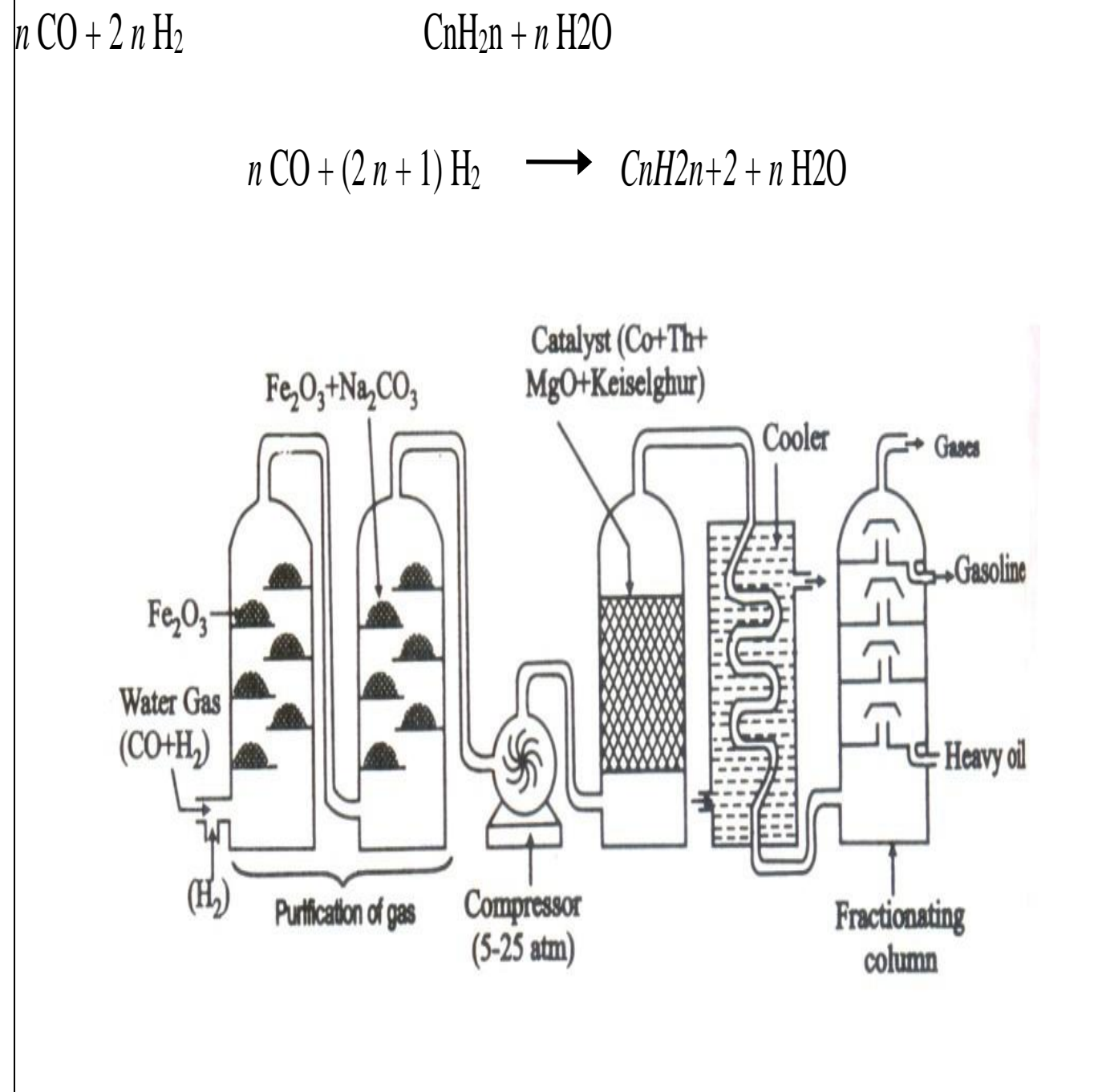


- Coal is first converted into coke.
- Then *water gas* ($\text{CO} + \text{H}_2$) is produced by passing steam over red hot coke at 1200°C .
- Water gas is mixed with hydrogen and the mixture is compressed to 5-25 atmospheres.
- The compressed gases are then led through a converter which is maintained at a temperature of $200\text{--}300^\circ\text{C}$.
- The converter is provided with a suitable catalyst consisting of a mixture of 100 parts cobalt, 5 parts thoria, 8 parts magnesia and 200 parts kieselguhr.





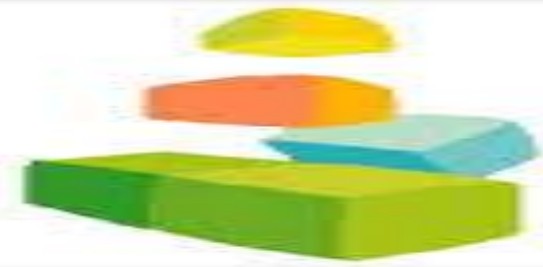
FISCHER – TROPSCH PROCESS/ INDIRECT METHOD)



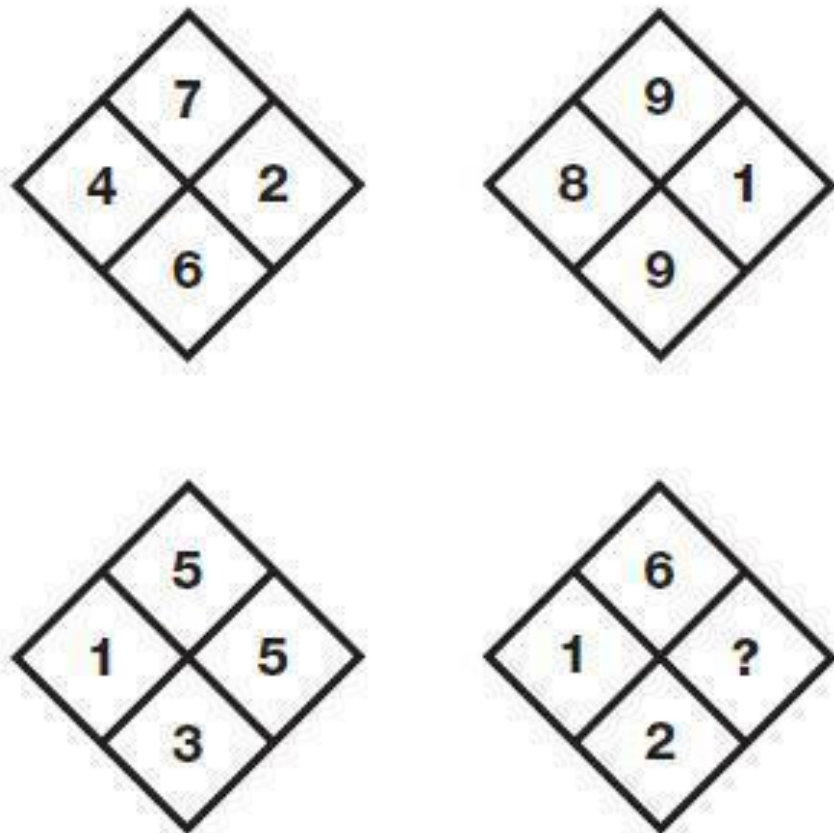
- A mixture of saturated and unsaturated hydrocarbons occurs as a result of polymerization.
- The reactions are strongly exothermic.
- Hence, the hot out coming gaseous mixture is led to a cooler where a liquid similar to crude oil is obtained.
- The crude oil thus obtained is then fractionated to yield gasoline and high boiling heavy oil.
- The heavy oil is used for cracking to get more gasoline



Activity



- Find the missing number



- Ans : 12

- Solve the logic puzzle

Solve the logic puzzle?

$$\text{Orange Circle} + \text{Pink Triangle} = 8$$

$$\text{Purple Star} - \text{Brown Square} = \text{Brown Square}$$

$$\text{Orange Circle} - \text{Pink Triangle} = 4$$

$$\text{Brown Square} + \text{Purple Star} = 12$$

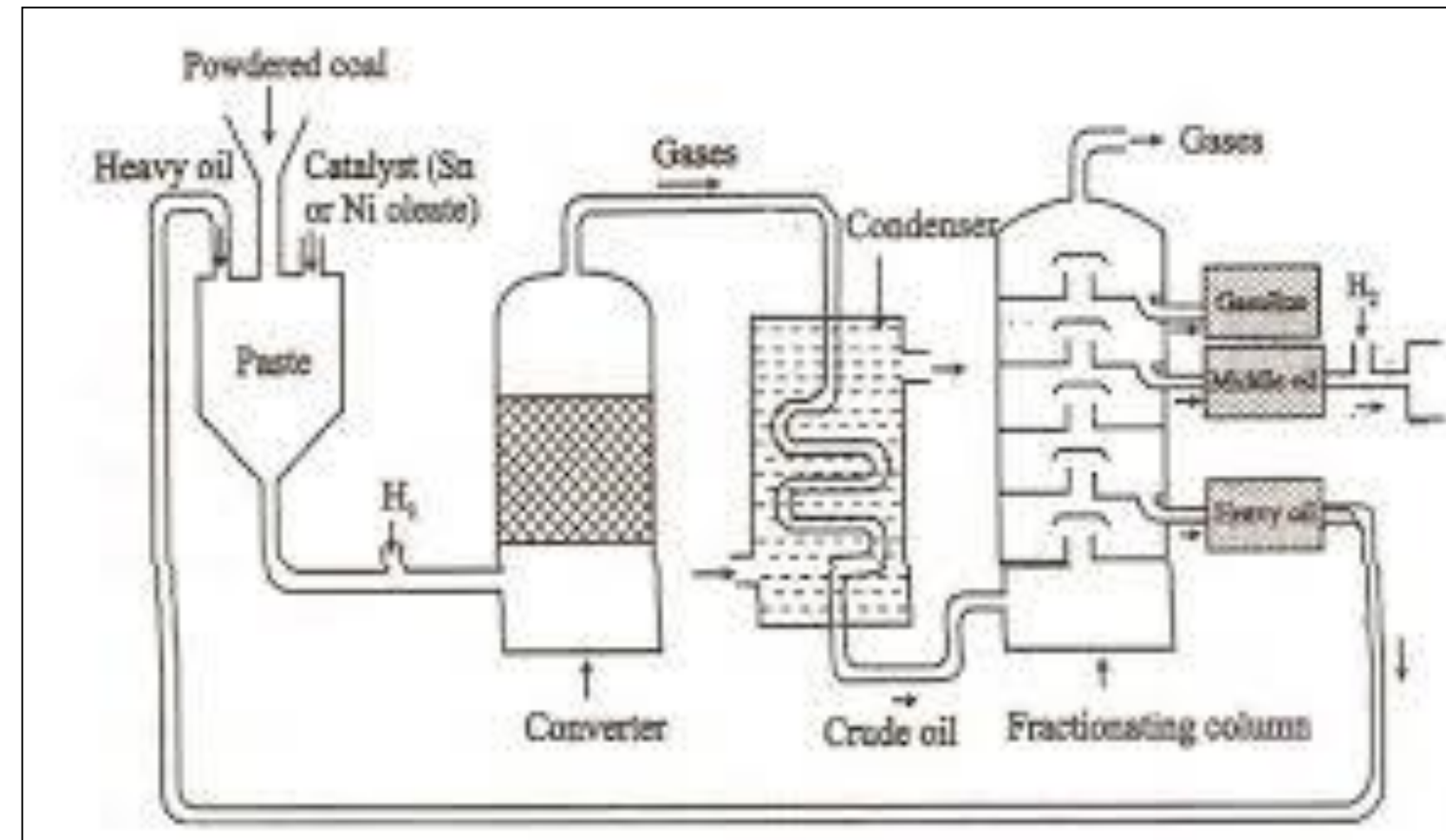
$$\text{Pink Triangle} + \text{Orange Circle} - \text{Purple Star} + \text{Brown Square} = ?$$

- Ans : 4

BERGIUS PROCESS / DIRECT METHOD)



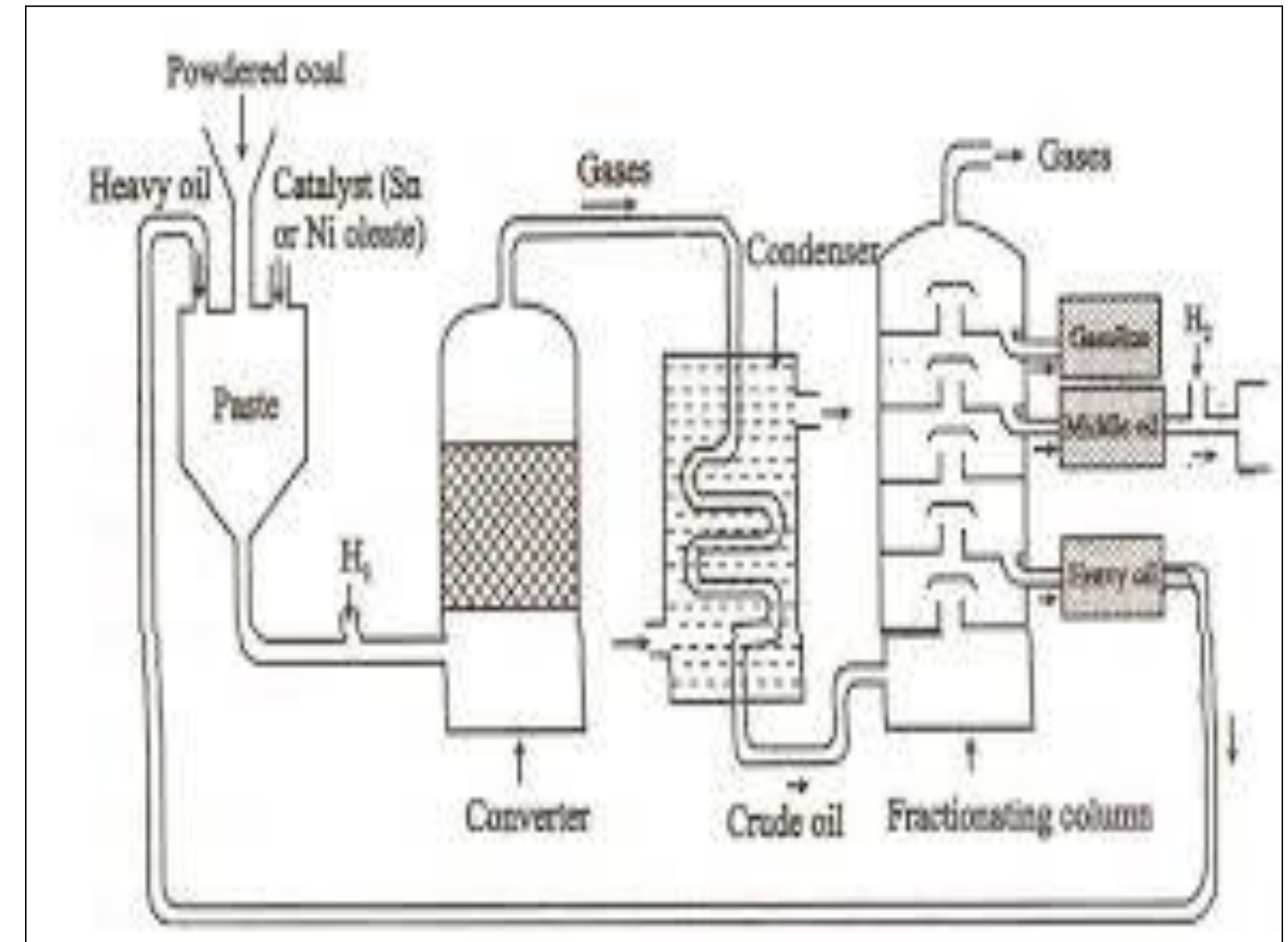
- This method was developed by Bergius in Germany during the First World War.
- The low ash coal is finely powdered and made into a paste with heavy oil
- Then a catalyst (composed of tin or nickel oleate) is included.
- The whole is heated with hydrogen at 450°C and under a pressure 200-250 atm for about 1.5 hours
- During which hydrogen combines with coal to form saturated hydrocarbons, which decompose at high temperature and pressure to yield low-boiling liquid hydrocarbons.





BERGIUS PROCESS / DIRECT METHOD)

- When this mixture is passed to condenser, the crude oil is obtained which is then fractionated to get:
- (i) gasoline
- (ii) middle oil
- (iii) heavy oil.
- The heavy oil produced is used again for making paste with fresh coal dust.
- The middle oil is further hydrogenated to yield more gasoline.
- The yields of gasoline is about 60% of the coal dust used.





SUMMARY



REFERENCES



1. O.G. Palanna, “Engineering Chemistry ”Tata McGraw-Hill Pub. Co. Ltd, New Delhi.2017.
2. Wiley, “Engineering Chemistry”, John Wiley & Sons. InC, USA.
3. P.C.Jain & Monicka Jain, “Engineering Chemistry” , Dhanapat Rai Publising Company Pvt. Ltd. 2017.
4. R. Sivakumar andN Sivakumar, “Engineering Chemistry” Tata McGraw-Hill.Pub.Co.Ltd. New Delhi.2009.

THANK YOU