Answer the following questions then check your answers

1. True or False: Cracking is the process of breaking down smaller hydrocarbons into larger ones.

2. Fill in the Blank: The type of cracking that uses high temperatures and pressures is called _____ cracking.

3. Which of the following is NOT a typical product of cracking?

   A) Alkane

   B) Alkene

   C) Alcohol

   D) Hydrogen

4. Write word and symbolic equations for the cracking of decane to form octane and one other product.

5. Write the balanced chemical equation for the cracking of:

   - $C_{16}H_{34}$ into decane and octene.
   - Ethane into ethene and one other product

6. Why is cracking an important process in the petrochemical industry? Give two reasons.

7. The three main types of cracking—thermal, catalytic, and steam—each offer distinct advantages and disadvantages, making them suitable for different applications within the petrochemical industry.

Answers

1. True or False: Cracking is the process of breaking down smaller hydrocarbons into larger ones.

   False - it's the other way round; cracking is used to break down large unwanted hydrocarbon molecules in smaller more useful hydrocarbons.

2. Fill in the Blank: The type of cracking that uses high temperatures and pressures is called _____ cracking.

   Thermal -cracking

3. Which of the following is NOT a typical product of cracking?

   A) Alkane

   B) Alkene

   C) Alcohol

   D) Hydrogen

   Answer: C - alcohols are not produced as a product in cracking reactions.

4. Write word and symbolic equations for the cracking of decane to form octane and one other product.

   Decane → Octane + Ethene

   decane → pentane + ethene

   $C_{10}H_{22} \rightarrow C_8H_{16} + C_2H_4$

5. Write the balanced chemical equation for the cracking of:

- $C_{16}H_{34}$ into decane and octene.
- Ethane into ethene and one other product
- $C_{16}H_{34} \rightarrow C_{10}H_{22} + C_8H_{16}$
- $C_2H_6 \rightarrow C_2H_4 + H_2$

6. Why is cracking an important process in the petrochemical industry? Give two reasons.

To meet the demand for shorter-chain alkanes (e.g., petrol) which are in higher demand than longer-chain ones.

To produce alkenes which are valuable starting materials for making plastics and other chemicals.

7. The three main types of cracking—thermal, catalytic, and steam—each offer distinct advantages and disadvantages, making them suitable for different applications within the petrochemical industry.

Thermal Cracking:

Advantages:

Simple process, requiring no catalyst.

Relatively inexpensive to set up and operate.

Disadvantages:

Produces a wider range of products, including less valuable alkanes.

Requires very high temperatures and pressures, leading to higher energy costs.

Can produce more unwanted by-products like coke (carbon deposits).

Catalytic Cracking:

Advantages:

Lower energy costs due to lower operating temperatures.

Higher selectivity towards more valuable alkenes.

Produces a higher proportion of branched alkanes, which are better for petrol.

Zeolite catalysts can be regenerated and reused.

Disadvantages:

Requires more complex equipment and catalysts, increasing initial costs.

Catalyst can become deactivated over time and may require replacement.

Steam Cracking:

Advantages:

Very high selectivity for ethene, a crucial building block for plastics.

Can use a variety of feedstocks, including naphtha and natural gas liquids.

Produces very little coke compared to other methods.

Disadvantages:

Requires very high temperatures and large amounts of steam, leading to higher energy consumption.

More expensive to operate than thermal cracking.

Mainly limited to producing lighter alkenes like ethene and propene.