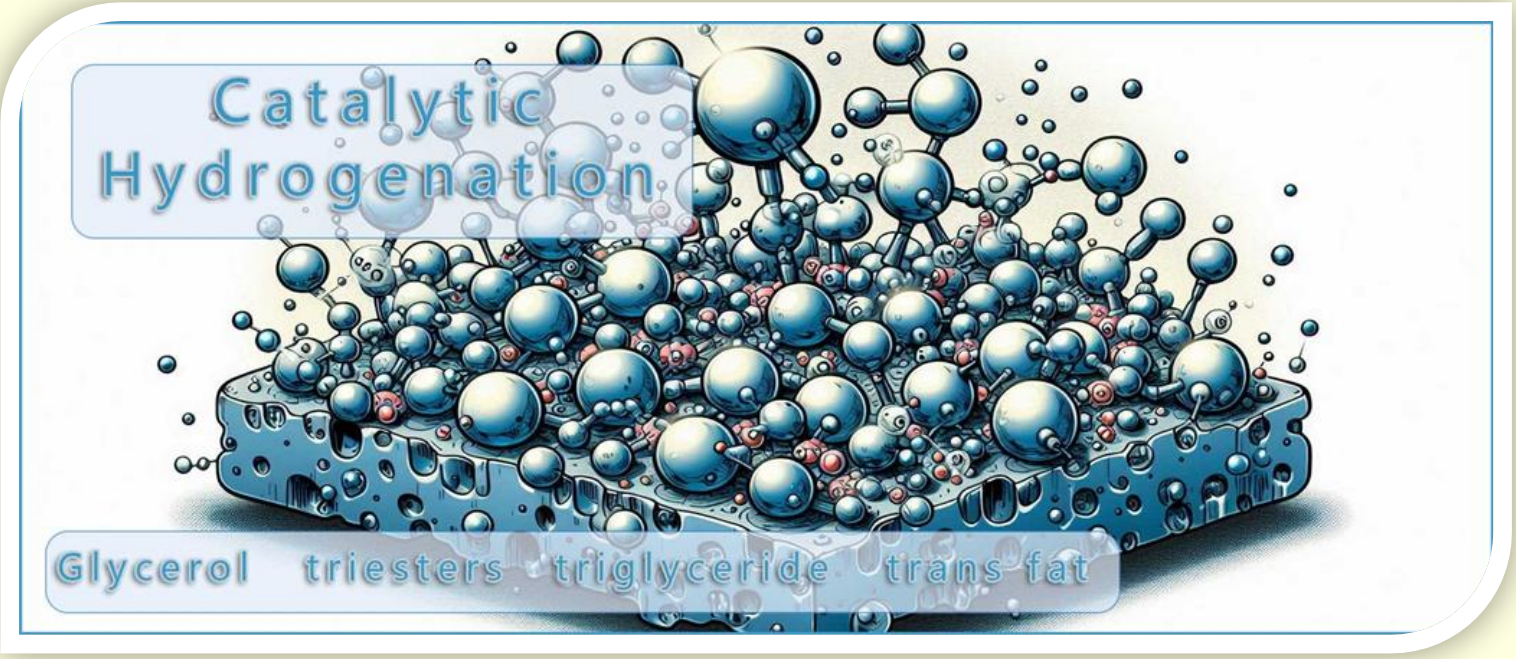

Answer all the questions below then check your answers

1. Which statement best describes a triglyceride?

- A. An ester formed from one fatty acid and glycerol
- B. A triester formed from glycerol and three fatty acids
- C. A polymer formed from fatty acids
- D. A hydrocarbon containing three ester groups

2. Which feature is responsible for the lower melting point of unsaturated fatty acids?

- A. Higher molar mass
- B. Stronger hydrogen bonding
- C. Presence of C=C bonds causing less efficient packing
- D. Greater number of ester groups

Section B: Short Answer Questions

3. Define the term fatty acid.

4. State one role of a metal catalyst in the hydrogenation of vegetable oils.

5. Explain why cis unsaturated fatty acids do not pack closely together.

Section C: Long Answer Questions

6. Explain how catalytic hydrogenation is used to harden vegetable oils.

7. Explain how trans fats can form during partial hydrogenation and why they are considered harmful.

Answers

1. Which statement best describes a triglyceride?

- A. An ester formed from one fatty acid and glycerol
- B. A triester formed from glycerol and three fatty acids
- C. A polymer formed from fatty acids
- D. A hydrocarbon containing three ester groups

Correct answer: B. A triglyceride is a triester formed from glycerol and three fatty acids.

2. Which feature is responsible for the lower melting point of unsaturated fatty acids?

- A. Higher molar mass
- B. Stronger hydrogen bonding
- C. Presence of C=C bonds causing less efficient packing
- D. Greater number of ester groups

Correct answer: C. C=C bonds (especially cis) prevent close packing, weakening intermolecular forces.

Section B: Short Answer Questions

3. Define the term fatty acid.

Answer: A fatty acid is a long-chain carboxylic acid, usually with between 12 and 20 carbon atoms.

4. State one role of a metal catalyst in the hydrogenation of vegetable oils.

Answer: The catalyst adsorbs reactants onto its surface and lowers the activation energy by providing an alternative reaction pathway.

5. Explain why cis unsaturated fatty acids do not pack closely together.

Answer: The cis geometry introduces a bend in the hydrocarbon chain, preventing close packing.

Section C: Long Answer Questions

6. Explain how catalytic hydrogenation is used to harden vegetable oils.

Answer:

Vegetable oils contain unsaturated fatty acids with C=C bonds. During catalytic hydrogenation, hydrogen and the oil molecules are adsorbed onto the surface of a metal catalyst such as nickel. Hydrogen adds across the C=C bonds, reducing them to C–C bonds. This increases saturation, allowing molecules to pack more closely together, strengthening intermolecular forces and raising the melting point.

7. Explain how trans fats can form during partial hydrogenation and why they are considered harmful.

Answer:

On the catalyst surface, the pi bond of a C=C bond is broken, allowing free rotation around the C–C bond. If the molecule leaves the surface before full hydrogenation, the double bond can reform in the trans configuration. Trans fats are more linear, pack closely and behave like saturated fats. They increase LDL cholesterol and reduce HDL cholesterol, increasing the risk of cardiovascular disease.