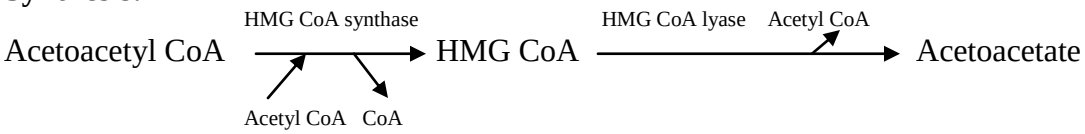
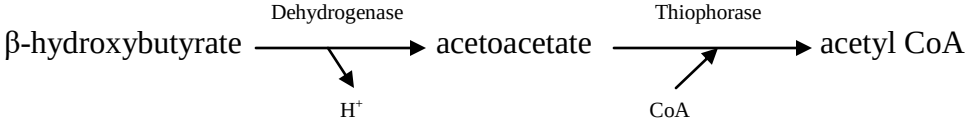
Unit IV – Problem 1 – Biochemistry: Ketogenesis and Diabetic Ketoacidosis

- **Ketogenesis (process of synthesizing ketone bodies in the liver):**
  - **Site**: liver and mitochondria.
  - **What are the three ketone bodies?**
    - ✓ Acetoacetate.
    - ✓ β-hydroxy butyrate.
    - ✓ Acetone (this is considered as a non-metabolized side product).
      Note: Ketone bodies are important sources of energy especially during prolonged periods of starvation.
  - **Ketone bodies are water-soluble and are used in:**
    - ✓ Cardiac and skeletal muscles.
    - ✓ Brain.
    - ✓ Kidneys.
  - **Synthesis:**



    Acetoacetate can be converted to:
    - ✓ Acetone: by removing CO_2
    - ✓ β-hydroxybutyrate: by adding hydrogen.
  - **ketolysis**: the use of ketone bodies by peripheral tissues



  - **The enzyme (thiophorase) is not present in the liver. Therefore, ketone bodies cannot be utilized as a source of energy in the liver.**
- **Diabetic ketoacidosis:**
  - One of the most common complication of type-I diabetes.
  - **Cause**: Excess fat breakdown and increased ketogenesis from increased fatty acids, which are then made into ketone bodies (mentioned above).
  - **Clinical manifestations:**
    - ✓ Kussmaul breathing (rapid and deep pattern).
    - ✓ Nausea and vomiting.
    - ✓ Abdominal pain.
    - ✓ Psychosis and delirium.
    - ✓ Fruity breath odor (due to exhaled acetone).
  - **Laboratory investigations will show:**
    - ✓ Hyperglycemia.
    - ✓ Acidosis.
    - ✓ Increased blood ketone levels.
  - **Complications:**
    - ✓ Cerebral edema.
    - ✓ Cardiac arrhythmias.
    - ✓ Heart failure.
  - **Treatment:**
    - ✓ IV fluids.
    - ✓ IV insulin.
    - ✓ K^+ (to replete intracellular stores).