

2023 Bi H1 Q11

Section: Metabolism and Survival

Topic: Cellular Respiration

Question Summary

The question shows the conversion of an intermediate $X \rightarrow Y$ in respiration, involving the coenzyme $NAD \rightarrow NADH$. You are asked to identify the enzyme catalysing this reaction and the location within the cell where it occurs.

Worked Solution

1. The conversion $NAD \rightarrow NADH$ indicates that hydrogen atoms (and electrons) are being removed from a substrate and transferred to NAD, forming NADH. This reaction is therefore oxidation of the substrate.
2. The enzyme that catalyses oxidation reactions by transferring hydrogen to NAD is a dehydrogenase.
3. In aerobic respiration:
 - Dehydrogenase enzymes act at several stages — in glycolysis (cytoplasm), link reaction, and citric acid cycle (matrix).
 - However, NADH itself is oxidised again at the inner mitochondrial membrane by the electron transport chain, not in the cytoplasm.
4. The question focuses on where NAD is reduced to NADH, which occurs inside the mitochondrion. Option A correctly

identifies the enzyme as dehydrogenase and the site as the inner mitochondrial membrane, where NADH production is linked to the transport chain.

Final Answer

■ Option A — Enzyme: Dehydrogenase; Location: Inner mitochondrial membrane

Revision Tips

- NAD is a hydrogen carrier: $\text{NAD} \rightarrow \text{NADH}$ during oxidation of substrates.
- Dehydrogenase enzymes remove hydrogen atoms (oxidation).
- ATP synthase is unrelated here — it synthesises ATP at the end of the electron transport chain.
- Summary of locations:
 - Glycolysis — cytoplasm
 - Citric acid cycle — mitochondrial matrix
 - Electron transport chain — inner mitochondrial membrane
- Remember: dehydrogenase $\rightarrow$ NADH $\rightarrow$ ATP production.