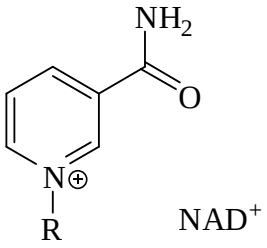
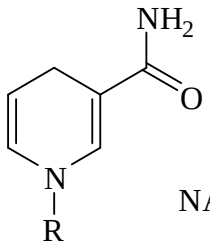
Marks 7

- NAD^+/NADH is a biological redox system. The two species may be represented by the structures below.



NAD^+



NADH

What are the requirements for a compound to be aromatic? Indicate which of NAD^+ and/or NADH fulfil these requirements.

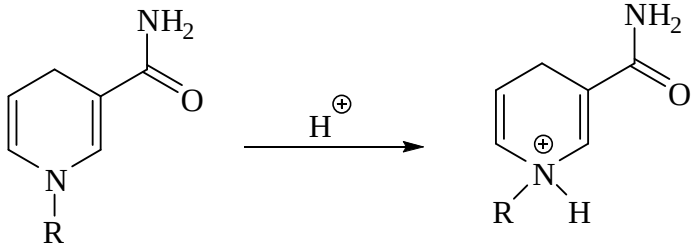
An aromatic compound must be cyclic, planar, conjugated, and have $4n+2$ π electrons (with *n* being an integer).

NAD^+ is aromatic – there are 2 × C=C and 1 × C=N bond each of which contributes 2 π electrons, giving a total of 6. This is aromatic with $n = 1$.

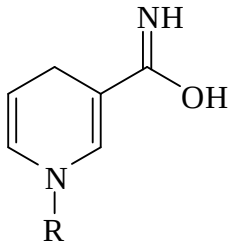
NADH is not aromatic. The presence of an sp^3 carbon atom breaks the conjugation.

Which of NAD^+ and/or NADH will react with cold dilute H^+ in an acid/base reaction? Using the structures above, give the chemical equation for the reaction and a brief explanation for your choice.

Only NADH will react.



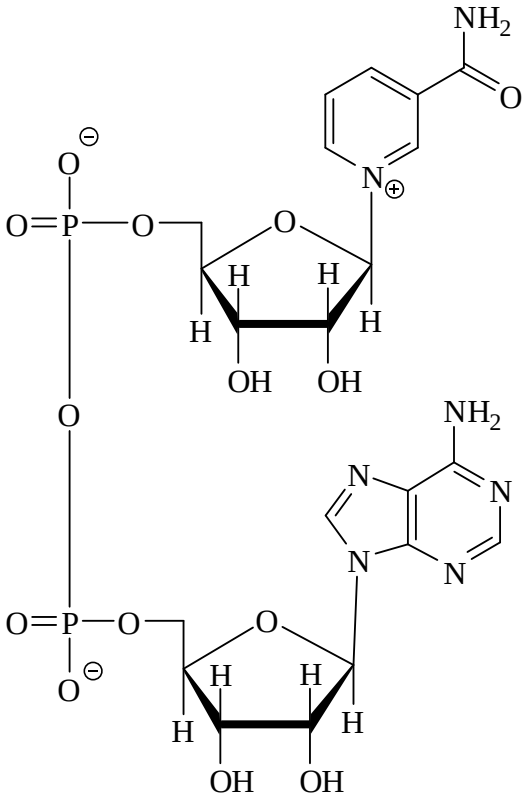
Draw the structure of a tautomer of NADH.



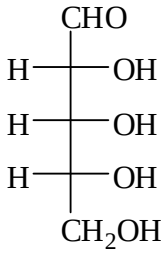
THIS QUESTION CONTINUES ON THE NEXT PAGE

Marks 4

The full structure of NAD^+ contains ribose, two phosphate groups and adenine.



Draw ribose as a Fischer projection.



Adenine is also a component of DNA used in forming complementary strands by hydrogen bonding. Indicate the sites of hydrogen bonding on adenine that are used in forming complementary strands in DNA and differentiate between those sites that are hydrogen bond donors and those that are hydrogen bond acceptors.