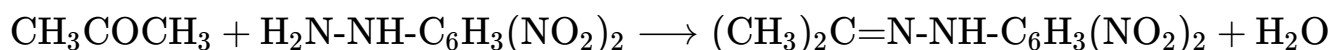


Chemical Analysis of Acetone 2,4-DNP Reaction

<https://gemini.google.com/app/8096738103a7fcec>

Response: The reaction between acetone (a carbonyl compound) and 2,4-dinitrophenylhydrazine (2,4-DNP) proceeds via **nucleophilic addition followed by elimination (dehydration)**, overall classified as a **nucleophilic addition-elimination condensation reaction**:



Analysis of Statements

- **(a) It is a two-step reaction where the second step is a dehydration reaction.**
 - **Correct.** The first step is the nucleophilic addition of the —NH_2 group to the carbonyl carbon to form a tetrahedral intermediate (a hydroxyalkylhydrazine derivative). The second step is the elimination of a water molecule (dehydration) to yield the 2,4-dinitrophenylhydrazone derivative containing a $\text{C}=\text{N}$ double bond.
- **(b) The product formed in the first step of this reaction can be isolated.**
 - **Incorrect.** The initial tetrahedral addition intermediate rapidly loses water under acidic conditions to form the conjugated 2,4-dinitrophenylhydrazone precipitate and cannot be isolated.
- **(c) The structure of the coloured product formed in this reaction is $\text{H}_3\text{C} - \text{C}(\text{OH})(\text{CH}_3) - \text{N} = \text{N} - \text{C}_6\text{H}_3(\text{NO}_2)_2$.**
 - **Incorrect.** The structure shown in statement (c) depicts an intermediate with an —OH group and an azo linkage ($\text{—N} = \text{N—}$). The actual final coloured precipitate is **acetone 2,4-dinitrophenylhydrazone**, which features a hydrazone linkage ($> \text{C} = \text{N} - \text{NH—}$) and no free —OH group:
$$(\text{CH}_3)_2\text{C} = \text{N} - \text{NH} - \text{C}_6\text{H}_3(\text{NO}_2)_2$$
- **(d) This reaction can be used to distinguish acetone from acetic acid.**
 - **Correct.** 2,4-DNP reacts with aldehydes and ketones (like acetone) to form a characteristic yellow/orange/red crystalline precipitate. Carboxylic acids (like acetic acid) do not react with 2,4-DNP because the resonance donation from the hydroxy oxygen reduces the electrophilicity of the carbonyl carbon.

Conclusion

The correct statements are **(a)** and **(d)**.
