Organic Compound Identification Through Reactions

https://gemini.google.com/app/24ea74d1033123f3

Response: Here is the step-by-step breakdown to solve this question:

1. Reaction with $\mathrm{NaNO_2/dilute\ HCl}$

- Primary aliphatic amines react with $\mathrm{NaNO_2/HCl}$ (nitrous acid) to form aliphatic diazonium salts, which spontaneously evolve $\mathrm{N_2}$ gas and yield an **alcohol** ($\mathbf{B}$).
- Since $\mathbf{B}$ is formed via diazotization of $\mathbf{A}$, compound $\mathbf{A}$ must contain a **primary aliphatic amine group** ($-\mathrm{CH_2NH_2}$ or $-\mathrm{CH(R)NH_2}$).

2. Oxidation of Compound B with Acidified $\mathrm{K_2Cr_2O_7}$

- When treated with acidified aqueous $\mathrm{K_2Cr_2O_7}$, the solution turns **green** (due to the reduction of orange $\mathrm{Cr_2O_7^{2-}}$ to green $\mathrm{Cr^{3+}}$).
- This indicates that $\mathbf{B}$ is **oxidizable**, which means the alcohol group in $\mathbf{B}$ must be either **primary (1°) or secondary (2°)**. A tertiary (3°) alcohol cannot be oxidized under these conditions.
- Therefore, the primary amine group in $\mathbf{A}$ must be attached to a carbon with **at least one hydrogen** (i.e., a 1° or 2° amine carbon):
    - Option (1) has a tertiary amine carbon: $\mathrm{CH_3-C(CH_3)(NH_2)-\ldots}$, which forms a 3° alcohol upon diazotization. A 3° alcohol will **not** turn $\mathrm{K_2Cr_2O_7}$ green. $\rightarrow$ **Eliminate (1)**.

3. Reaction with Fehling's Reagent

- **Compound A does NOT give a brick-red precipitate** when treated with Fehling's reagent.
- Fehling's test gives a positive result (brick-red precipitate of $\mathrm{Cu_2O}$) specifically for **aliphatic aldehydes** ($-\mathrm{CHO}$).
- Since $\mathbf{A}$ gives a **negative** Fehling's test, $\mathbf{A}$ **cannot contain an aliphatic aldehyde group**.
    - Option (3) contains an aliphatic aldehyde ($-\mathrm{CH_2CHO}$). $\rightarrow$ **Eliminate (3)**.
    - Option (4) contains an aliphatic aldehyde ($-\mathrm{CH_2CH_2CHO}$). $\rightarrow$ **Eliminate (4)**.

4. Evaluating Options (2) and (5)

Let's look at Option (2):

- Structure: $\mathrm{CH_3 - CH(NH_2) - CH_2 - C(=O) - CH_3}$
- **Primary amine group attached to a secondary carbon:** Yields a 2° alcohol ($\mathbf{B}$), which **will oxidise** with acidified $\mathrm{K_2Cr_2O_7}$ turning the solution green.
- **Functional groups:** Contains a ketone ($-\mathrm{C(=O)}-$), which **does not** give a brick-red precipitate with Fehling's reagent.

Now looking at Option (5):

- Structure: Has a tertiary amine-bearing carbon: $-\mathrm{C(CH_3)_2(NH_2)}$. Like option (1), this would yield a 3° alcohol, which cannot be oxidized by $\mathrm{K_2Cr_2O_7}$. $\rightarrow$ **Eliminate (5)**.

Conclusion

The correct compound is **(2)**.
