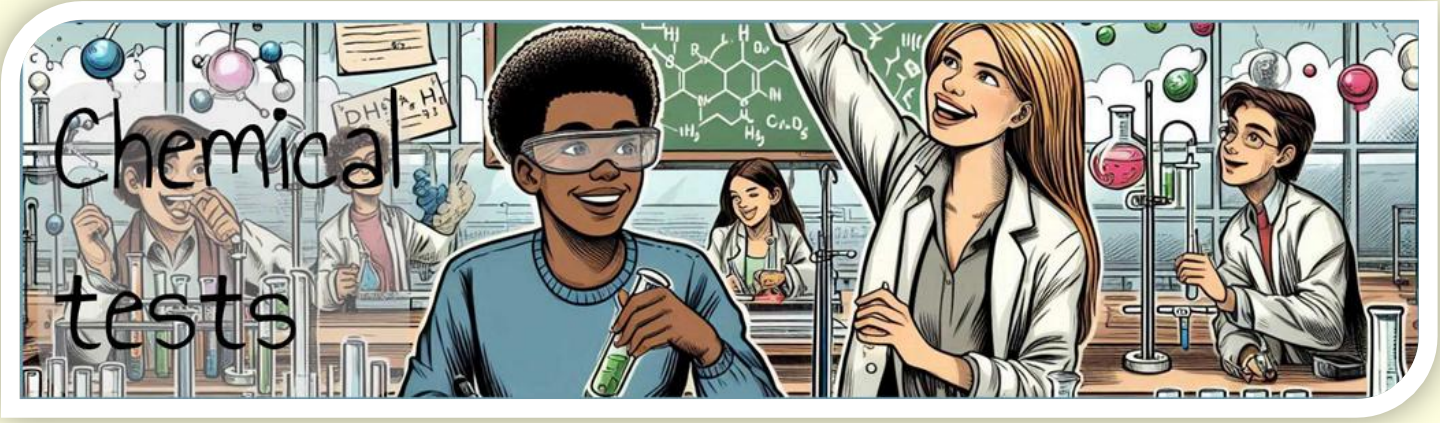

Answer all the questions below as fully as you can then check your answers

1. What is the active chemical found in Brady's reagent that reacts with carbonyl groups?
2. Draw the structure of the 2,4-dinitrophenylhydrazine molecule and circle the following groups found in this molecule:
   - The phenyl group
   - The nitro groups
   - The hydrazine group
3. What is Brady's reagent used to identify in a molecule?
4. What two substances are formed when Brady's reagent reacts with an aldehyde or a ketone?
5. Explain how you would use Brady's reagent to identify an aldehyde or a ketone.
6. Brady's reagent reacts with ethanal to produce a solid precipitate and water. What type of reaction is this?
7. What type of reagent are Tollens' and Fehling's solutions?
8. What colour change takes place when Tollen's and Fehling's solutions are warmed with an aldehyde and a ketone?
9. Write half-equations for the reduction, oxidation processes that occur in Fehling's solution when it is warmed with an aldehyde.

a. Combine these two half-equations in one overall equation.

10. Describe the colour change that takes place when Tollens' reagent is warmed with an aldehyde.

b. Write a half-equation for the reduction reactions that occurs when Tollen's reagent is warmed with an aldehyde.

11. When an acidified solution of potassium dichromate is warmed with an aldehyde describe the colour changes you would expect to see.

a. Write an equation to show the oxidation of ethanal with acidified potassium dichromate. Use [O] to represent the oxidising agent.

Answers

1. What is the active chemical found in Brady's reagent that reacts with carbonyl groups?

   2,4-dinitrophenylhydrazine

2. Draw the structure of the 2,4-dinitrophenylhydrazine molecule and circle the following groups found in this molecule:
   - The phenyl group
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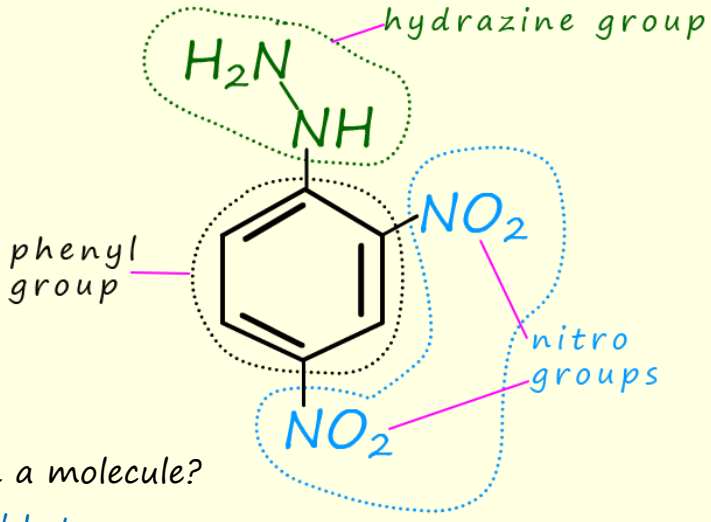


3. What is Brady's reagent used to identify in a molecule?

   The carbonyl group (C=O) in aldehydes and ketones.

4. What two substances are formed when Brady's reagent reacts with an aldehyde or a ketone?

   A solid precipitate and water.

5. Explain how you would use Brady's reagent to identify an aldehyde or a ketone.

   Addition of Brady's reagent to an aldehyde or a ketone will produce a coloured precipitate. Aliphatic aldehydes and ketones form orange and yellow precipitates while aromatic aldehydes and ketones tend to form red precipitates.

Aromatic carbonyl compounds form red precipitates with DNPH while aliphatic aldehydes and ketones form orange and yellow coloured precipitates.

6. Brady's reagent reacts with ethanal to produce a solid precipitate and water. What type of reaction is this?

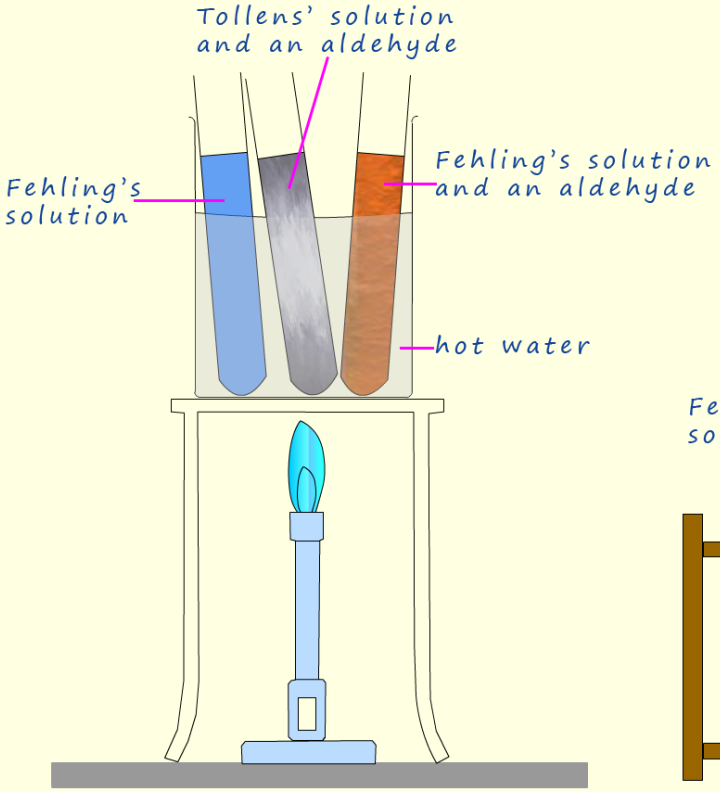
   Its a condensation reaction. That is a reaction where two small molecules join to form a larger one and release a small molecule, usually water.

7. What type of reagent are Tollens' and Fehling's solutions?

   Mild oxidising agents.

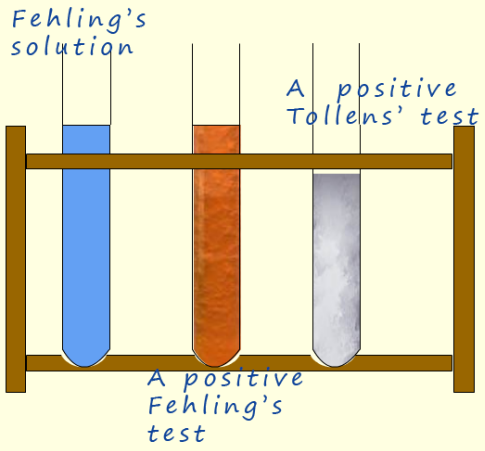
8. What colour change takes place when Tollen's and Fehling's solutions are warmed with an aldehyde and a ketone?

   Tollens' solution is a colourless solution which will form a silver mirror on the walls of the test-tube with an aldehyde. Tollens' solution is not a strong enough oxidising agent to oxidise a ketone, so no reaction will occur here. Fehling's solution will turn from blue to orange



If Fehling's and Tollens' reagents are added to test tubes sitting in a hot water bath and then a few drops of a suspected aldehyde are added.

A positive Fehling's test will show as an orange-red precipiate, while a positive Tollens' test will result in the formation of a silver mirror on the inside of the test tube.



9. Write half-equations for the reduction, oxidation processes that occur in Fehling's solution when it is warmed with an aldehyde.

The reduction reactions are the reduction of the Cu^{2+} ion to form the Cu^{+} ion.

There are lots of equations which are acceptable to example boards including

$2Cu^{2+} + H_2O + 2e \rightarrow Cu_2O + 2H^{+}$

Which can be simplified to

$Cu^{2+} + e \longrightarrow Cu^{+}$

Or we can write:

$Cu^{2+} + 2OH^{-} + 2e \rightarrow Cu_2O + H_2O$

The oxidation process is the conversion of the aldehyde into the carboxylic acid.

Again there a several possible equations which are acceptable to exam boards, these include:

$$RCHO + [O] \rightarrow RCOOH$$

OR

$$RCHO + 3OH^{-} \rightarrow RCOO^{-} + 2H_2O + 2e$$

a. Combine these two half-equations in one overall equation.

$$RCHO + 2Cu^{2+} + 5OH^{-} \rightarrow RCOO^{-} + Cu_2O + 3H_2O$$

10. Describe the colour change that takes place when Tollens' reagent is warmed with an aldehyde.

Colourless to silver

b. Write a half-equation for the reduction reactions that occurs when Tollen's reagent is warmed with an aldehyde.

The simplest equation would be the reduction of silver ions (Ag+) to silver atoms

$Ag+ + e \rightarrow Ag$

Or we can write:

$Ag(NH_3)_2^{+} + e \rightarrow Ag + 2NH_3$

11. When an acidified solution of potassium dichromate is warmed with an aldehyde describe the colour changes you would expect to see.

The acidified potassium dichromate is an orange coloured oxidising agent that will oxidise an aldehyde to a carboxylic acid. The Cr^{6+} ion present in the dichromate ion will be reduced to form the green Cr^{3+} ion. So colour change is orange to green

a. Write an equation to show the oxidation of ethanal with acidified potassium dichromate. Use [O] to represent the oxidising agent.

$$CH_3CHO + [O] \rightarrow CH_3COOH$$