

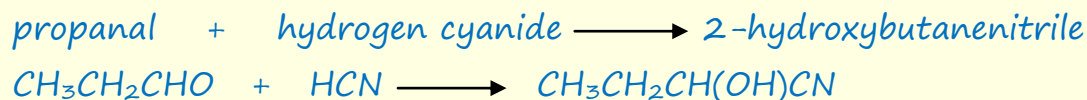
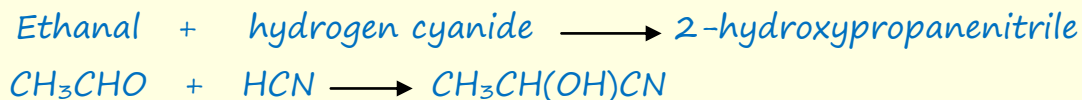
# nucleophilic addition

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

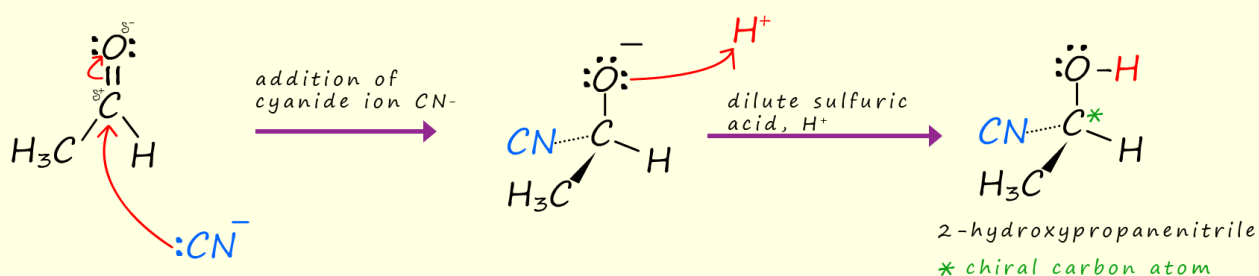
1. Write word and symbolic equations for the reaction of ethanal and propanal with an acidified potassium cyanide solution.
2. Draw the mechanism for the reaction of ethanal with an acidified potassium cyanide solution.
  - a. Name the type of mechanism for this reaction.
  - b. If a molecule is said to be optically active what does this mean?
  - c. What is an enantiomer?
  - d. What is a racemate or a racemic mixture?
  - e. The product of the reaction of ethanol with an acidified potassium cyanide solution is optically active yet the overall product of the reaction is optically inactive. Explain this apparent contradiction.
3. Write word and symbolic equations for the reaction of propanone with acidified potassium cyanide.
  - a. Explain why the product of this reaction is optically inactive.
  - b. Draw the displayed formula for the ketone butanone.
  - c. Write an equation for the reaction of butanone with acidified potassium cyanide solution.
    - i. Will the product of this reaction be optically active or inactive? Explain your answer.

## Answers

1. Write word and symbolic equations for the reaction of ethanal and propanal with an acidified potassium cyanide solution.



2. Draw the mechanism for the reaction of ethanal with an acidified potassium cyanide solution.



- a. Name the type of mechanism for this reaction.

Nucleophilic addition

- b. If a molecule is said to be optically active what does this mean?

Will rotate plane polarised light

- c. What is an enantiomer?

A molecule that exists as a mirror image pair. Each molecule in the pair will rotate plane polarised light by the same amount but in opposite directions.

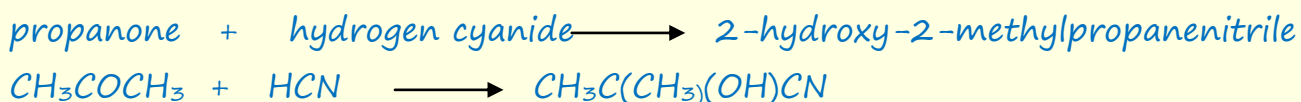
- d. What is a racemate or a racemic mixture?

A mixture of equal quantities of two enantiomers. The fact that both enantiomers are present in equal amounts will cancel out any rotation of plane polarised light. The mixture of enantiomers will be optically inactive.

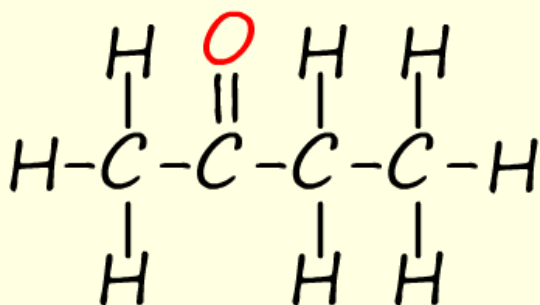
- e. The product of the reaction of ethanol with an acidified potassium cyanide solution is optically active yet the overall product of the reaction is optically inactive. Explain this apparent contradiction.

Each of the enantiomers produced in the reaction is optically active and will rotate polarised light. However each of the two enantiomers is produced in equal amounts so their effects on plane polarised light will cancel each other out. So overall the product of the reaction is an optically inactive mixture of the two enantiomers, it is a racemate or racemic mixture.

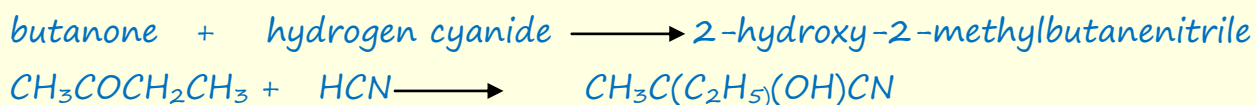
3. Write word and symbolic equations for the reaction of propanone with acidified potassium cyanide.



- a. Explain why the product of this reaction is optically inactive.  
It contains no chiral or asymmetric carbon atoms.
- b. Draw the displayed formula for the ketone butanone



- c. Write an equation for the reaction of butanone with acidified potassium cyanide solution.



- i. Will the product of this reaction be optically active or inactive? Explain your answer.

The product of the reaction contains a chiral or asymmetric carbon atom; that is two optically active enantiomers are produced; however they will be produced in equal amounts so the product of the reaction will be a racemate - that is optically inactive.