

Unit 2  
Alcohol and Carbonyl  
Compounds

## Go to question

- 1  Which of the following is an isomer of hexanal?
- 2  Which of the alcohols can be oxidised to give a ketone?
- 3  Which alcohol will produce two isomeric alkenes on dehydration?
- 4  Which structural formula represents a tertiary alcohol?
- 5  Ethanol is formed industrially from ethene. The reaction conditions are 300°C , high pressure of 60 atmospheres and phosphoric acid catalyst.
- 6  A compound underwent an oxidation reaction, the product from which reacted with Tollen's reagent. What was the initial compound?
- 7   $\text{CH}_3\text{OH}$  can be converted into a product that can be used to Plastics. The product produced is.....
- 8  Name the compound



1 Which of the following is an isomer of hexanol?

a. 2-methylbutanal

b. 3-methylpentan-2-ol

c. 2 - methylbutan-1-ol

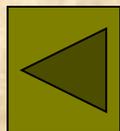
d. 3-ethylpentanal



# a hint!!!!

1<sup>st</sup> hint

What is the link between isomers and molecular formula?



2<sup>nd</sup> hint

Isomers have different structural formulae but identical..?



Which of the following is an isomer of hexanol?

**Correct** because.....

The molecular formula for hexanol is  $C_6H_{13}OH$ , or  $C_6H_{14}O$ .

An isomer has the same molecular formula but a different structural formula.

a. 2-methylbutanal  $C_5H_{10}O$

b. **3-methylpentan-2-ol**  **$C_6H_{14}O$**

c. 2-methylbutan-1-ol  $C_5H_{12}O$

d. 3-ethylpentanal  $C_7H_{14}O$



2 Which of the alcohols can be oxidised to give a ketone?

a. 2,3-dimethylbutan-1-ol

b. 2-methylpentan-1-ol

c. 2-methylpentan-2-ol

d. 3-methylpentan-2-ol



# a hint!!!!

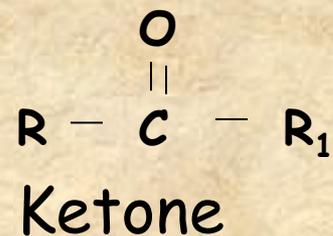
1<sup>st</sup> hint

Is this a primary or secondary alcohol?



2<sup>nd</sup> hint

A ketone has the following structure



# a hint!!!!

hint

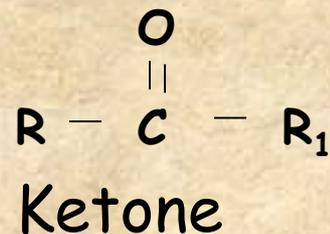
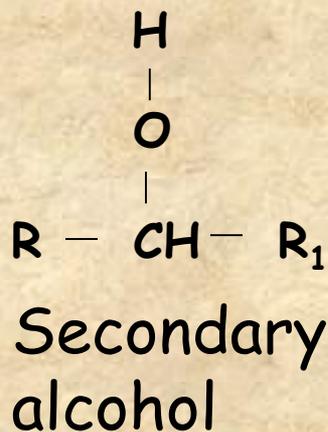
Is this a primary, secondary or tertiary alcohol?



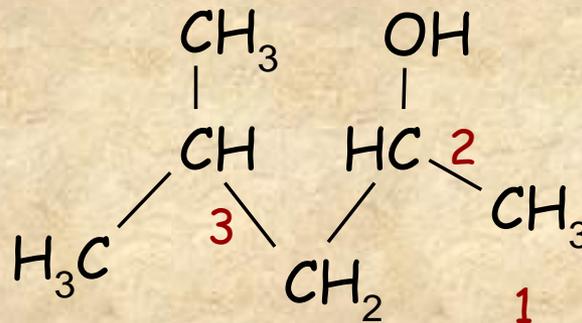
Which of the alcohols can be oxidised to give a ketone?

**Correct** because.....

Secondary alcohols can be oxidised to form ketones.



3-methylpentan-2-ol



3 Which alcohol will produce two isomeric alkenes on dehydration?

a. propan-2-ol

b. butan-1-ol

c. hexan-1-ol

d. pentan-2-ol



# a hint!!!!

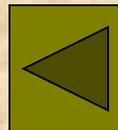
## 1<sup>st</sup> hint

Dehydration involves the loss of a water molecule to form an alkene, the hydroxyl group is removed.



## 2<sup>nd</sup> hint

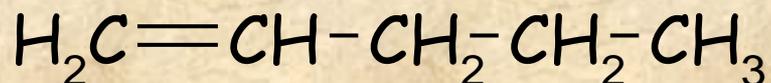
Consider how many possibilities there are for the position of the  $C=C$  which is formed when the hydroxyl group is lost.



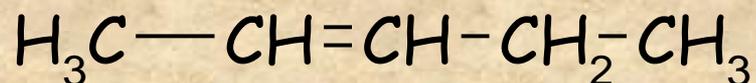
Which alcohol will produce two isomeric alkenes on dehydration?

**Correct** because.....

**pentan-2-ol** on losing a molecule of water will form pentene. Two structures are possible.



Pent-1-ene

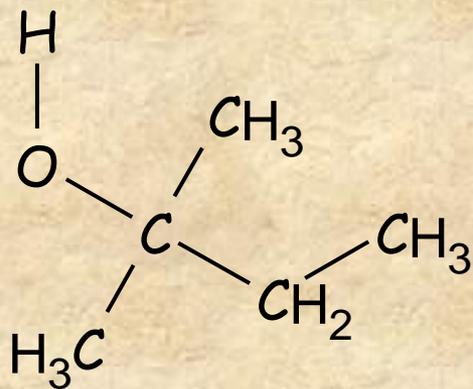


Pent-2-ene

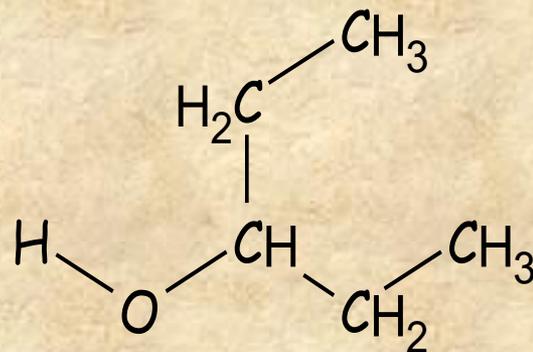


4 Which structural formula represents a tertiary alcohol?

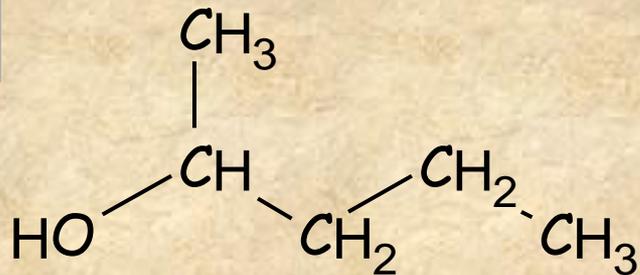
a.



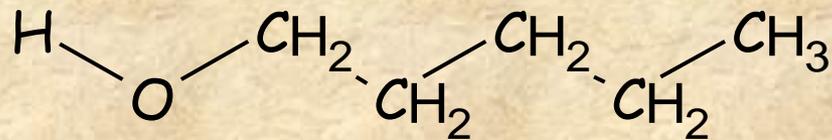
b.



c.

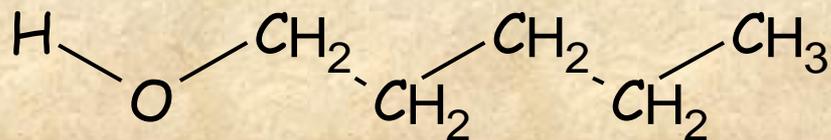
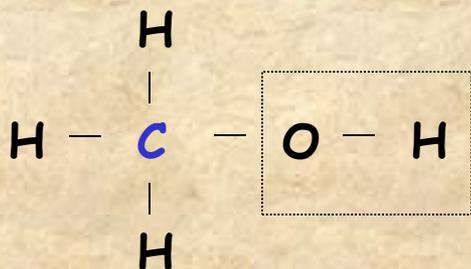
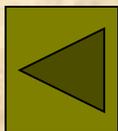


d.



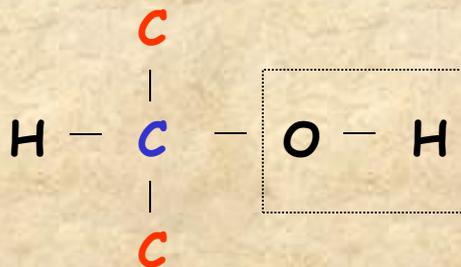
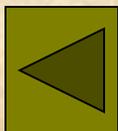
# a hint!!!!

This is a primary alcohol because the OH group is attached to a carbon which is bonded to only one other carbon.



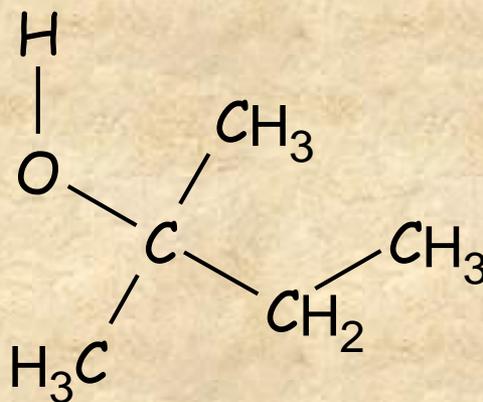
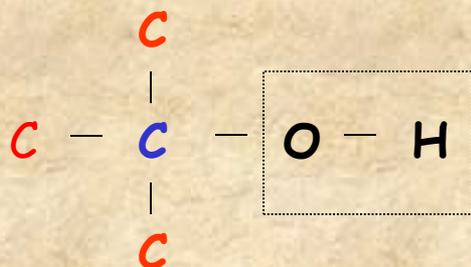
# a hint!!!!

This is a secondary alcohol. 2 C's joined to the  
C bonded to the OH group



Which structural formula represents a tertiary alcohol?

**Correct** because a tertiary alcohol has 3 **C** 's joined to the **C** bonded to the OH group



5 Ethene is formed from ethanol.  
The reaction conditions are  $170^{\circ}\text{C}$  , with excess concentrated sulphuric acid. This reaction is an example of..

a. Hydrolysis

b. Hydration

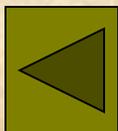
c. Dehydration

d. Hydrogenation



# a hint!!!!

Hydration involves the formation of the  $H^+$  ion or the Hydronium ion  $H_3O^+$



# a hint!!!!

Reacting water with an ester to form an alcohol and acid would be an example of this type of reaction.



# a hint!!!!

Reacting hydrogen with ethene to form ethane would be an example of this type of reaction.



Ethanol is formed industrially from ethene.

The reaction conditions are 300°C , high pressure of 60 atmospheres and phosphoric acid catalyst.

**Correct** because .....

### Dehydration

Dehydration is the removal of a water molecule from a reactant. Removing water from ethanol:

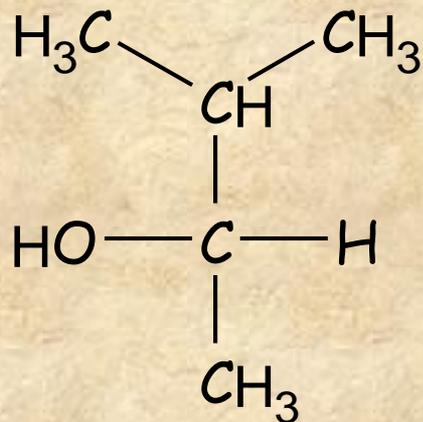


Alcohols such as ethanol can be produced commercially by the addition of water (a hydration reaction). The reverse of the above reaction.

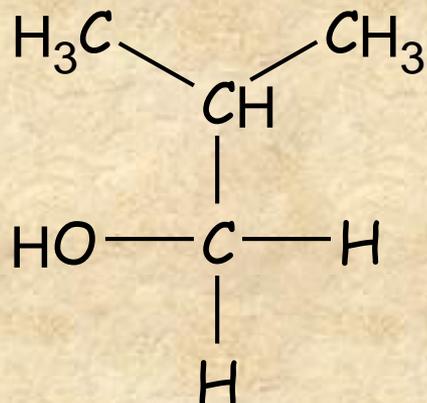


6 A compound underwent an oxidation reaction, the product from which reacted with Tollen's reagent. What was the initial compound?

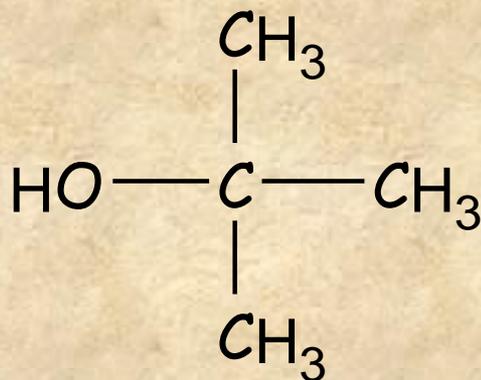
a.



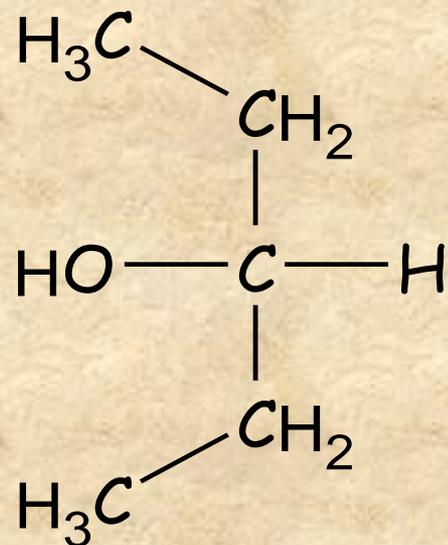
b.



c.

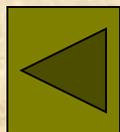


d.



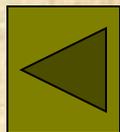
# a hint!!!!

Secondary alcohols oxidise to form ketones and cannot be oxidised further.



# a hint!!!!

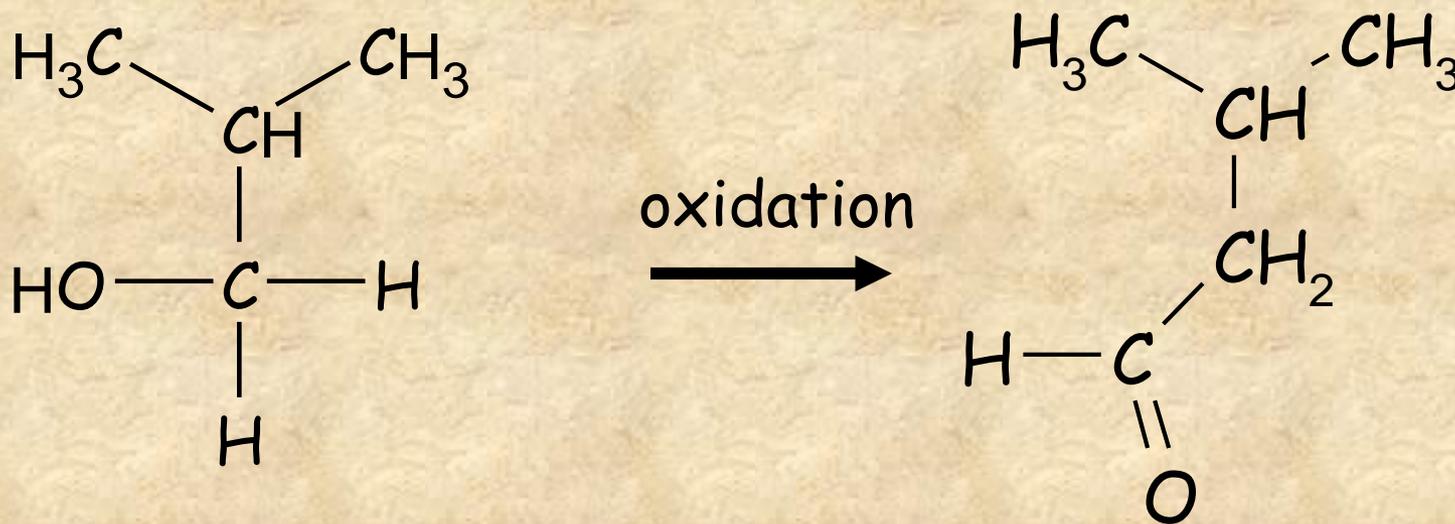
Tertiary alcohols do not oxidise in these reaction conditions.



A compound underwent an oxidation reaction, the **product** from which reacted with Tollen's reagent. What was the **initial** compound?

**Correct** because .....

Primary alcohols undergo oxidation to form aldehydes. Tollen's reagent, contains  $\text{Ag}^+$  ions, in the presence of an aldehyde, the  $\text{Ag}^+$  ions are reduced to  $\text{Ag}$ .



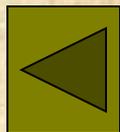
7  $\text{CH}_3\text{OH}$  can be converted into a product that can be used to make plastics. The reaction conditions used are zinc/chromium oxide catalysts  $350\text{-}450^\circ\text{C}$  and  $200\text{-}300$  atmospheres. The product produced is

- a. Ethanol
- b. Ethene
- c. Methanal
- d. Methane



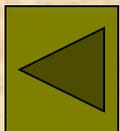
# a hint!!!!

These reaction conditions will oxidise methanol.



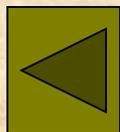
# a hint!!!!

**Ethanol**, will in the presence of strong acids, or when the vapour is passed over aluminium oxide, undergoes dehydration to form ethene.



# a hint!!!!

Methanal  $\text{HCHO}$  cannot form methane.



$\text{CH}_3\text{OH}$  can be converted into a product that can be used to make plastics. The reaction conditions used are zinc/chromium oxide catalysts  $350\text{-}450^\circ\text{C}$  and 200-300 atmospheres.

The product produced is.....

**Correct** answer.....

## Methanal

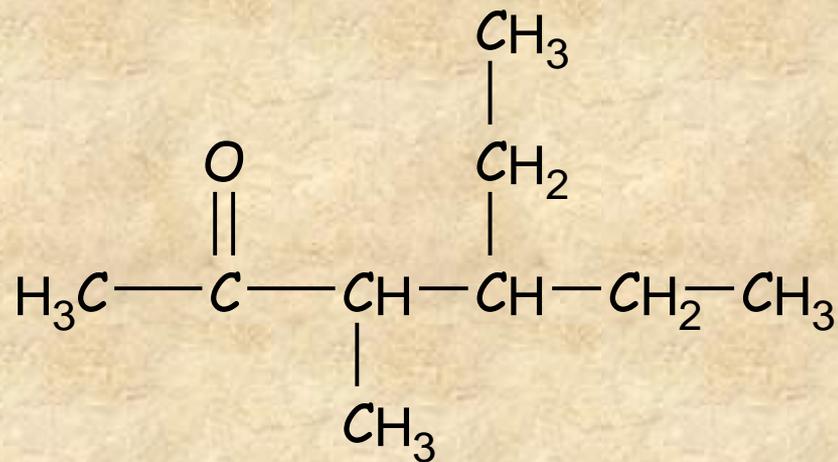
When a primary alcohol is oxidised an aldehyde is made.



Methanal is the starting point for poly(methanal) a particularly strong plastic from which machine parts such as gears are made. Methanal can also be reacted with urea to produce an excellent electrical insulator.



8 Name the compound



- a. 3-ethyl, 4-methylhexan-5-one
- b. 3-methyl, 4-ethylhexan-2-one
- c. 4-ethyl, 3-methylhexan-2-one
- d. 4-ethyl, 3-methylhexan-5-one



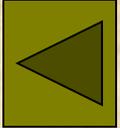
# a hint!!!!

Start with the functional group in numbering the longest carbon chain.



# a hint!!!!

Name the branches in alphabetical order.



Name the compound

**Correct** because .....

The longest carbon chain is 6 C's. This gives **HEX**  
**C 1** starts at the end nearest the functional group.  
The 2<sup>nd</sup> C has the >C=O functional group, hence **-2-one**.  
The branches are named in alphabetical order,  
**4-ethyl, 3-methyl**.

**4-ethyl, 3-methylhexan-2-one**

