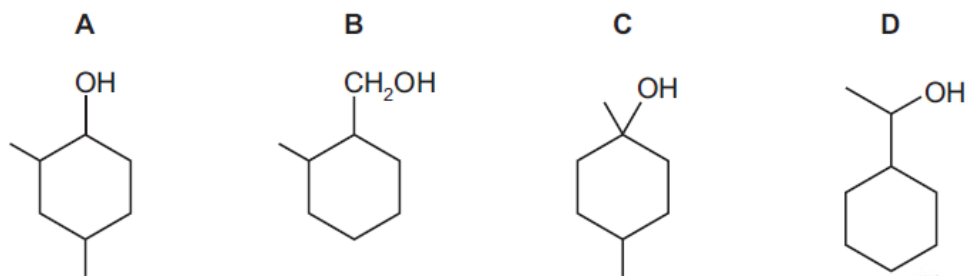


## Hydroxyl compounds – 2023 AS Chemistry 9701

1. Nov/2023/Paper\_9701/11/No.33

Alcohol X gives a yellow precipitate with alkaline  $I_2(aq)$ .

What is the structure of X?



2. Nov/2023/Paper\_9701/11/No.34

When ethanol reacts with sodium metal, ethoxide ions,  $CH_3CH_2O^-$ , are produced.

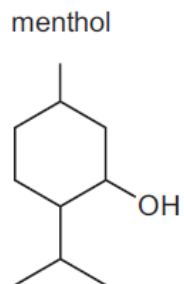
When water reacts with sodium metal,  $OH^-$  ions are produced.

Which statement about these reactions and the ethoxide ion is correct?

- A At the same temperature, the rate of reaction between sodium and ethanol is greater than that between sodium and water.
- B  $CH_3CH_2O^-$  is a stronger base than  $OH^-$  due to the electron-donating effect of the ethyl group.
- C The negative charge on the oxygen in an ethoxide ion is delocalised.
- D It is easier to deprotonate ethanol as it is more acidic than water.

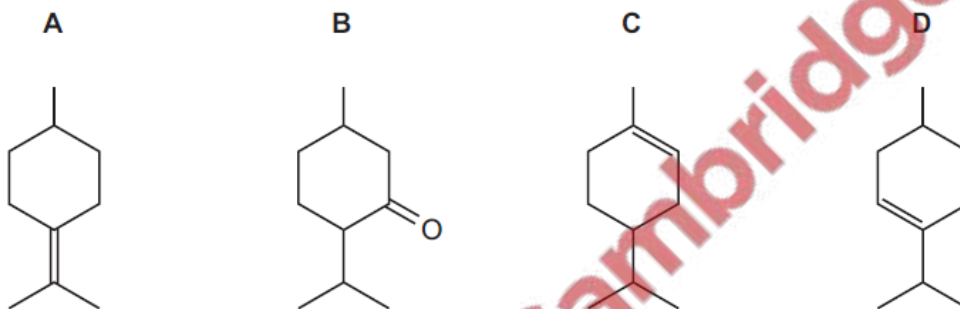
3. Nov/2023/Paper\_9701/11/No.35

Menthol is a naturally occurring alcohol.



When menthol is heated with concentrated sulfuric acid it reacts. The products formed include compound T.

What is the structure of compound T?

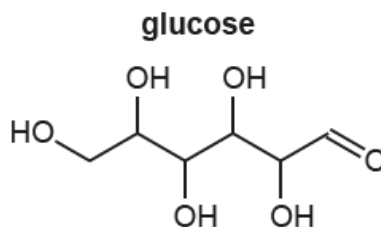


4. Nov/2023/Paper\_9701/12/No.34

Which alcohol reacts with alkaline  $I_2(aq)$  to produce ethanoate ions?

- A ethanol
- B methylpropan-2-ol
- C propan-2-ol
- D butan-2-ol

(e) The structure of glucose,  $C_6H_{12}O_6$ , is shown in Fig. 3.2.



**Fig. 3.2**

- (i) Complete Table 3.1 to identify the number of primary, secondary and tertiary alcohol groups present in the structure shown in Fig. 3.2.

**Table 3.1**

type of alcohol group	primary	secondary	tertiary
number of groups			

[1]

- (ii) Separate samples of aqueous glucose are tested with the reagents shown in Table 3.2.

Complete Table 3.2 with the observation for each reaction.

Write "no reaction" if applicable.

**Table 3.2**

reagent and conditions	observation with glucose
acidified $KMnO_4(aq)$ and warm	
Fehling's reagent and warm	
alkaline $I_2(aq)$ and warm	

[3]

- (iii) There are many structural isomers of  $C_6H_{12}O_6$ .

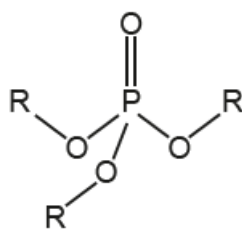
Define structural isomers.

.....

..... [1]

(d)  $\text{H}_3\text{PO}_4$  also reacts with alcohols to form organophosphates.

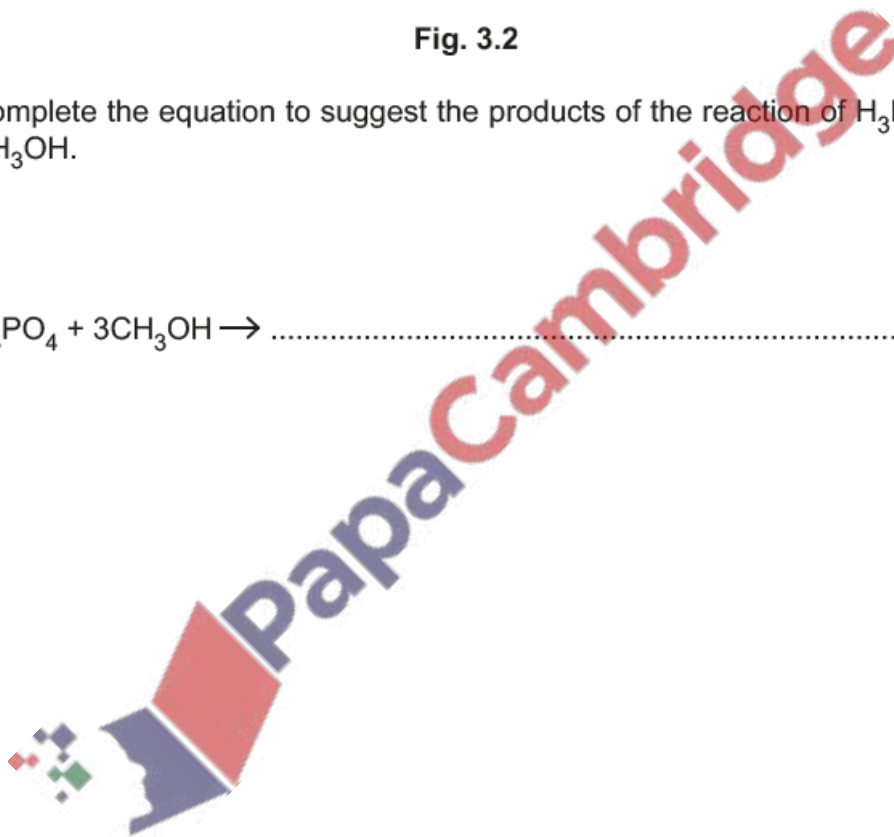
Organophosphates are compounds similar to esters. They have the general structure shown in Fig. 3.2.



R = alkyl group

Fig. 3.2

- (i) Complete the equation to suggest the products of the reaction of  $\text{H}_3\text{PO}_4$  with methanol,  $\text{CH}_3\text{OH}$ .



(ii) Compound **T** is a simple organophosphate.

The mass spectrum of **T** shows a molecular ion peak at  $m/e = 182$ . This peak has a relative intensity of 12.7.

The relative intensity of the  $M+1$  peak is 0.84.

Deduce the number of carbon atoms in **T**.  
Hence suggest the molecular formula of **T**.

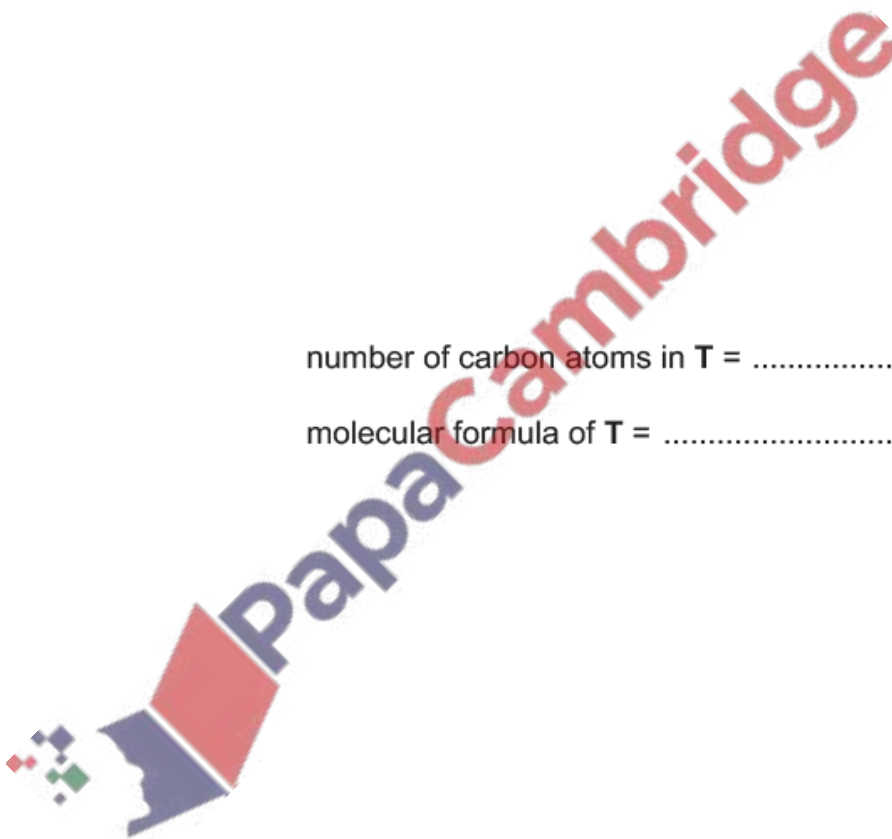
Assume that phosphorus and oxygen exist as single isotopes.

Show your working.

number of carbon atoms in **T** = .....

molecular formula of **T** = .....

[3]



## 7. June/2023/Paper\_9701/11/No.25

Which reagent will react with pentan-3-ol to give a mixture of stereoisomers?

- A acidified potassium dichromate  
 B concentrated sulfuric acid  
 C ethanoic acid in the presence of a little concentrated  $\text{H}_2\text{SO}_4$   
 D hydrogen chloride

## 8. June/2023/Paper\_9701/11/No.30

Which row describes the type of reaction that occurs when propan-1-ol reacts to form the named carbon-containing product?

	carbon-containing product	type of reaction
A	1-chloropropane	addition to propan-1-ol
B	carbon monoxide	complete combustion of propan-1-ol
C	propene	dehydration of propan-1-ol
D	propanal	reduction of propan-1-ol

## 9. June/2023/Paper\_9701/11/No.32

How many structurally isomeric secondary alcohols are there with the molecular formula  $\text{C}_5\text{H}_{12}\text{O}$ ?

- A 1                      B 2                      C 3                      D 4

## 10. June/2023/Paper\_9701/12/No.26

The general formula for a non-cyclic alcohol is  $\text{C}_n\text{H}_{2n+1}\text{OH}$ .

How many different structural isomers are there for  $n = 3$  and  $n = 4$ ?

	$n = 3$	$n = 4$
A	2	2
B	2	4
C	3	4
D	3	8

11. June/2023/Paper\_9701/12/No.27

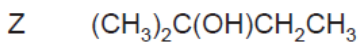
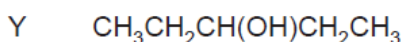
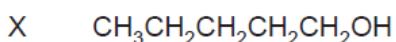
Compound X,  $C_5H_{10}O_3$ , has one chiral carbon atom per molecule. Compound X produces bubbles with Na but **not** with  $Na_2CO_3$ .

Which formula could represent compound X?

- A  $(CH_3)_2C(OH)CO_2CH_3$
- B  $HOCH_2CH(CH_3)CO_2CH_3$
- C  $CH_3CH_2C(CH_3)(OH)CO_2H$
- D  $CH_3CH(OH)CH(CH_3)CO_2H$

12. June/2023/Paper\_9701/12/No.33

X, Y and Z are three isomeric alcohols.



Separate samples of each alcohol are warmed with a mild oxidising agent and the results noted.

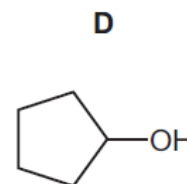
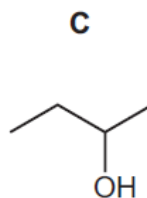
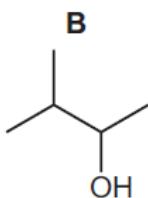
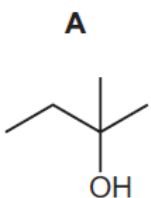
One of these alcohols, when dehydrated, will give a pair of cis-trans isomers with molecular formula  $C_5H_{10}$ .

Which row is correct?

	reacts with mild oxidising reagents	gives cis/trans isomers
<b>A</b>	X, Y and Z	Y only
<b>B</b>	X, Y and Z	Z only
<b>C</b>	X and Y only	Y only
<b>D</b>	X and Y only	Z only

13. June/2023/Paper\_9701/13/No.28

Which compound is a secondary alcohol that can be dehydrated to form an alkene with  $M_r = 70$ ?



14. June/2023/Paper\_9701/13/No.29

The conversion of propan-1-ol into propan-2-ol can be completed in a two-stage synthesis.

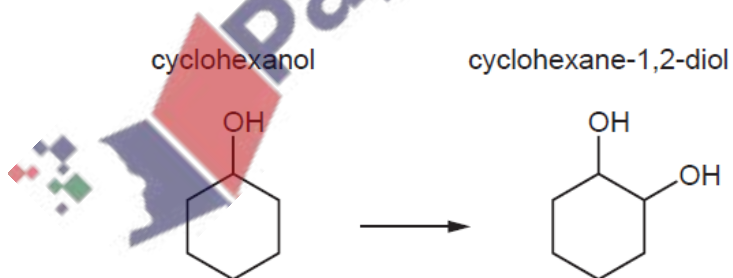
The first stage is to heat the propan-1-ol with concentrated sulfuric acid.

Which reagent would be needed to complete the second stage?

- A cold dilute acidified manganate(VII) ions
- B hot concentrated acidified manganate(VII) ions
- C steam with phosphoric acid
- D aqueous sodium hydroxide

15. June/2023/Paper\_9701/13/No.38

Which two-step process converts cyclohexanol into cyclohexane-1,2-diol?

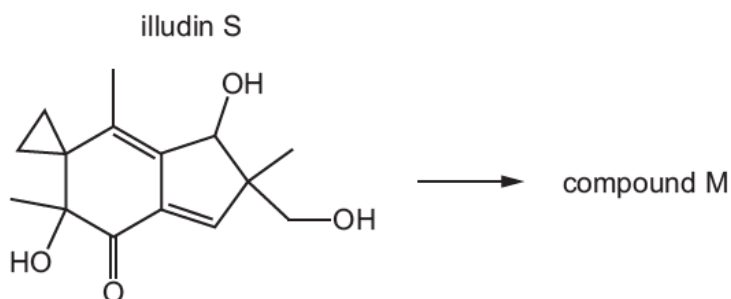


	step 1	step 2
<b>A</b>	heat strongly with $Al_2O_3$	add cold dilute $KMnO_4$ and $H_2SO_4$
<b>B</b>	heat strongly with $Al_2O_3$	heat with steam and $H_2SO_4$
<b>C</b>	reflux with ethanolic NaOH	add cold dilute $KMnO_4$ and $H_2SO_4$
<b>D</b>	reflux with ethanolic NaOH	heat with steam and $H_2SO_4$

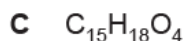
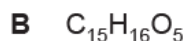
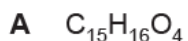


16. March/2023/Paper\_9701/12/No.28

When illudin S is heated under reflux with an excess of acidified potassium dichromate(VI), compound M is formed.



What is the molecular formula of compound M?



17. March/2023/Paper\_9701/12/No.35

Two isomeric alcohols, W and X, have molecular formula  $C_4H_9OH$ .

W is oxidised to carbonyl compound Y which gives a red precipitate with Fehling's solution.

X is oxidised to carbonyl compound Z which does **not** give a red precipitate with Fehling's solution.

Which of W and X gives a yellow precipitate with alkaline  $I_2(aq)$ ?

A insufficient data is given to answer this question

B W only

C X only

D neither W nor X

- (c) When propene reacts with CO and an excess of  $H_2$ , an alkane and a mixture of alcohols are formed instead. The alcohols are isomers of each other.

Suggest the molecular formulae of the alkane and the alcohols that are formed under these conditions.

molecular formula of alkane .....

molecular formula of alcohols .....

[2]

