



PHYSICAL SCIENCES

Grade 12

ORGANIC CHEMISTRY

03 JULY 2014



Lesson Description

In this lesson we revise:

- Organic Chemistry by working through examination questions



Challenge Question

Butane is a hydrocarbon that is commonly used as a fuel. When butane burns in excess oxygen it produces carbon dioxide and water. How many grams of carbon dioxide are produced when 5,8g of butane is completely used up?

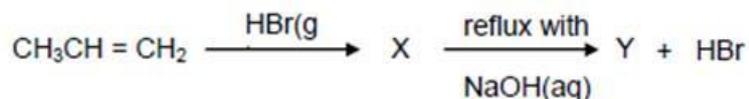


Test Yourself

Select the most correct answer from the options given. Write down only the correct letter

Question 1

A simple reaction scheme is shown below:

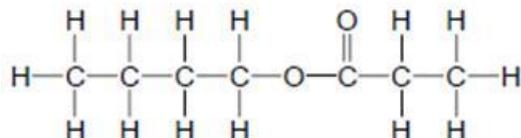


The formula for Y is...

- $\text{CH}_3\text{CH}_2\text{COOH}$
- $\text{CH}_3\text{CHOHCH}_3$
- $\text{CH}_3\text{CHBrCH}_2\text{OH}$
- $\text{CH}_3\text{CHOHCH}_2\text{Br}$

Question 2

The structural formula of an ester is shown below



Which ONE of the following pairs of compounds can be used to prepare the above ester?

- Propanoic acid and butan-1-ol
- Propanoic acid and butan-2-ol
- Butanoic acid and propan-1-ol
- Butanoic acid and propan-2-ol

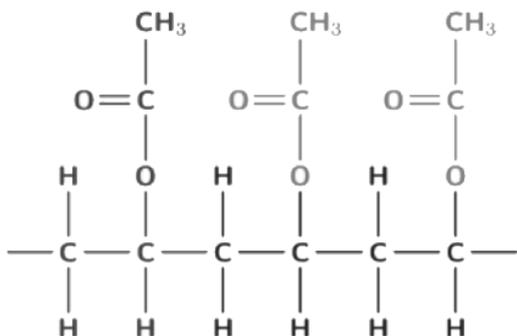




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Question 3

The small section of the structural formula of the polymer, polyvinyl acetate (PVC), is shown below



The molecular formula of the monomer used to produce this polymer is

- A $\text{C}_4\text{H}_6\text{O}_2$
- B $\text{C}_4\text{H}_8\text{O}_2$
- C $\text{C}_5\text{H}_8\text{O}_2$
- D $\text{CH}_3\text{CO}_2\text{CHCH}_2$

Question 4

An example of an unsaturated hydrocarbon is

- A. C_2HCl_5
- B. C_3H_6
- C. C_2H_6
- D. $\text{C}_2\text{H}_5\text{OH}$

Question 5

Which one of the following compounds is an isomer of Propanoic acid ($\text{C}_3\text{H}_6\text{O}_2$)

- A. Ethyl ethanoate
- B. Methyl ethanoate
- C. Propan-1,2,3-triol
- D. 3-methylpropan-1-ol





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Exam Questions

Question 1

(Adapted from DoE Exemplar Paper 2 – 2014)

The letters A to G in the table below represent seven organic compounds.

A		B	
C		D	
E	Butane	F	
G	Ethyl propanoate		

- 1.1 Write down the:
- 1.1.1 Name of the homologous series to which compound F belongs (1)
 - 1.1.2 Name of the functional group of compound D (1)
 - 1.1.3 Letter that represents a primary alcohol (1)
 - 1.1.4 IUPAC name of compound A (2)
 - 1.1.5 Structural formula of the monomer of compound B (2)
 - 1.1.6 Balanced equation, using molecular formulae, for the combustion of compound E in excess oxygen (3)
- 1.2 Briefly explain why compounds C and D are classified as POSITIONAL ISOMERS. (2)
- 1.3 Compound G is prepared using an alcohol as one of the reactants. Write down the balanced equation for the reaction using structural formulae for all the organic reagents. (7)

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Question 2

(Adapted from DoE Exemplar Paper 2 – 2014)

The table below shows the results obtained from experiments to determine the boiling point of some alkanes and alcohols of comparable molecular masses.

Compound	Relative molecular mass	Boiling point (°C)
CH ₃ CH ₃	30	-89
CH ₃ OH	32	65
CH ₃ CH ₂ CH ₃	44	-42
CH ₃ CH ₂ OH	46	78
CH ₃ CH ₂ CH ₂ CH ₃	58	0
CH ₃ CH ₂ CH ₂ OH	60	97
CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	72	36
CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ OH	74	117

- 2.1 Define the term boiling point. (2)
- 2.2 Consider the boiling points of the four alkanes in the above table.
- 2.2.1 Describe the trend in their boiling points. (1)
- 2.2.2 Fully explain the trend in QUESTION 2.2.1. (3)
- 2.3 The boiling point of each alcohol is much higher than that of the alkane of comparable relative molecular mass. Explain this observation by referring to the type and strength of the intermolecular forces in alkanes and alcohols. (2)
- 2.4 Pentane has a boiling point of 36°C. 2-methylbutane and 2,2-dimethylpropane are structural isomers of pentane. Samples of these three isomers are placed in containers at a temperature where they are all liquids.
- 2.4.1 Predict the trend in boiling points for these organic compounds (2)
- 2.4.2 Which of these organic compounds are you most likely to smell first, if the lids of the containers were opened at the same time? (2)
- 2.4.3 Explain the trend in boiling point and your prediction about smell. (4)

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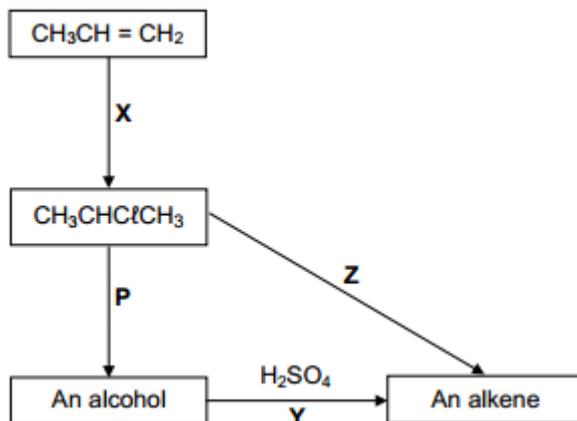


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Question 3

(Adapted from DoE Exemplar Paper 1 – 2014)

The flow diagram below shows the preparation of different organic compounds using $\text{CH}_3\text{CH} = \text{CH}_2$ as starting material. X, Y, Z and P represent different organic reactions.



- 3.1 To which homologous series does $\text{CH}_3\text{CH} = \text{CH}_2$ belong? (1)
- 3.2 Write down the:
- 3.2.1 Type of reaction of which X is an example (1)
- 3.2.2 Structural formula and IUPAC name of the alcohol produced during reaction P (3)
- 3.2.3 Type of reaction of which Y is an example (1)
- 3.2.4 Function of the acid in reaction Y (1)
- 3.3 For reaction Z, write down:
- 3.3.1 The NAME of the inorganic reagent needed (1)
- 3.3.2 TWO reaction conditions needed (2)
- 3.3.3 A balanced equation for the production of the alkene, using structural formulae (5)
- [15]

