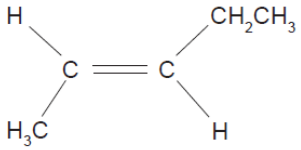
MULTIPLE CHOICE

2012 EXAM

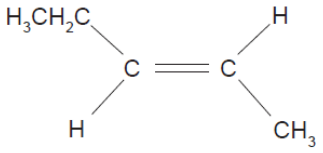
21. Which one of the following is a substitution reaction?

(a) $CH_3CH_2CH_2CH_2Br + Br_2 \rightarrow CH_3CH_2CH_2CHBr_2 + HBr$
(b) $CH_3CH_2CHCH_2 + Br_2 \rightarrow CH_3CH_2CHBrCH_2Br$
(c) $CH_3CH_2CH_2COOH + CH_3OH \rightarrow CH_3CH_2CH_2COOCH_3 + H_2O$
(d) $CH_3CH_2CHCH_2 + H_2 \rightarrow CH_3CH_2CH_2CH_3$

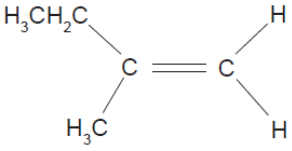
Examine the structures for compounds (i), (ii), (iii) and (iv) below to answer Questions 22 to 24.



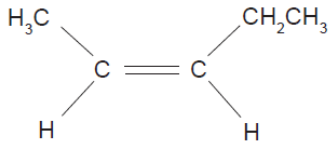
(i)



(ii)



(iii)



(iv)

22. Which of these compounds are geometric isomers?

(a) (i) and (ii)
(b) (i), (ii) and (iii)
(c) (i) and (iv)
(d) (iii) and (iv)

23. How many moles of oxygen will be consumed in the complete combustion of 1 mole of compound (i)?

(a) 1 mol
(b) 3.5 mol
(c) 5 mol
(d) 7.5 mol

24. Which one of the following is the product from the reaction of bromine with Compound (iii)?

(a) $CH_3CH_2CBr(CH_3)CH_2Br$
(b) $CH_3CH_2BrCH(CH_3)CH_3$
(c) $CH_3CH_2BrCH(CH_3)CH_2Br$
(d) $CH_3CH_2CH(CH_3)CH_2Br$

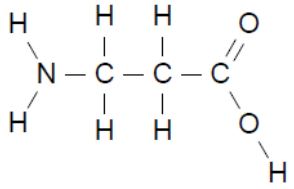
25. Which one of the following will react with acidified potassium dichromate to give a ketone?

(a) $CH_3CH_2CH_2OH$
(b) CH_3CH_2CHO
(c) $CH_3CH(OH)CH_3$
(d) $(CH_3)_3COH$

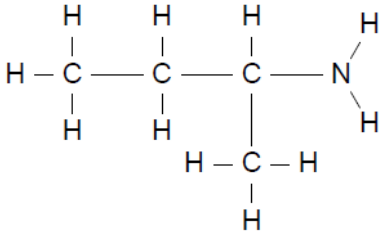
2010 EXAM

22. Which one of the following compounds is an α-amino acid?

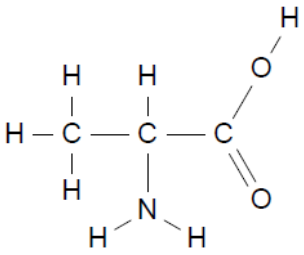
(a)



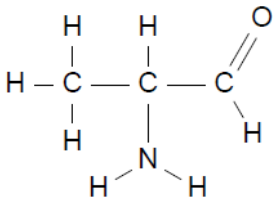
(b)



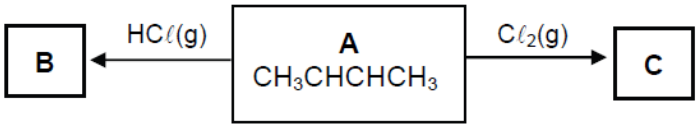
(c)



(d)



Use the information below to answer questions 23 and 24.



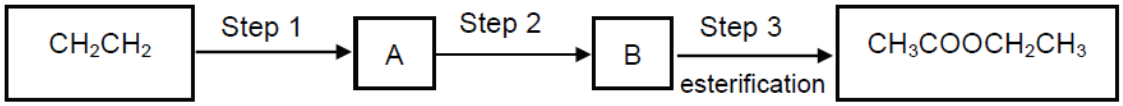
23. Which one of the following is the formula for the product B from the reaction of A with hydrogen chloride?

(a) $CH_3CHCHCH_2C\ell$
(b) $CH_3CHC\ell CHC\ell CH_3$
(c) $CH_3CH_2CHC\ell CH_3$
(d) $CH_3CH_2CH_2CH_2C\ell$

24. Which one of the following is the formula for the product C from reaction of A with chlorine?

(a) $CH_3CHCHCH_2C\ell$
(b) $CH_3CHC\ell CHC\ell CH_3$
(c) $CH_3CH_2CHC\ell CH_3$
(d) $CH_2C\ell CHCHCH_2C\ell$

25. Ethene (CH_2CH_2) can be used to manufacture ethyl ethanoate, $CH_3COOCH_2CH_3$, in three steps, as indicated below:



2007 exam

2. Which one of the following will show hydrogen bonding between neighbouring molecules?

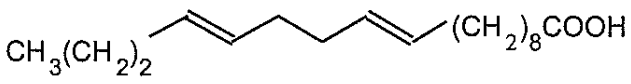
   (a) Ethane

   (b) Ethanol

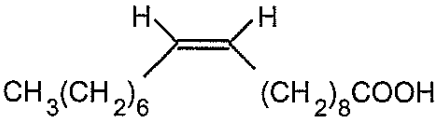
   (c) Ethene

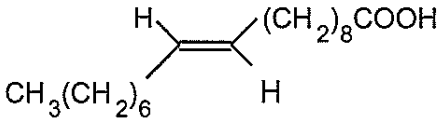
   (d) Ethanal

13. Fatty acids are important in our diet and can be saturated or unsaturated. The unsaturated fatty acids can have *cis* or *trans* forms. Which one of the following representations of various fatty acids **best** shows the structure of a *cis* type unsaturated fatty acid?

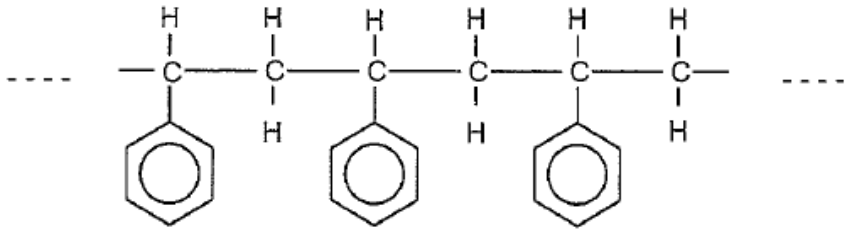
   (a) 

   (b) $CH_3(CH_2)_5CH=CH(CH_2)_6COOH$

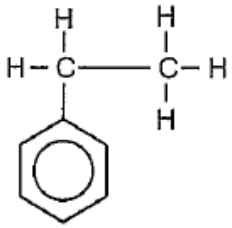
   (c) 

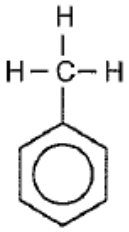
   (d) 

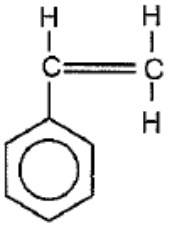
14. Below is a section of the structure of an addition polymer:

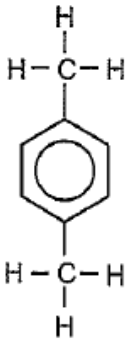


Which one of the following compounds could polymerise to form this chain?

(a) 

(b) 

(c) 

(d) 

15. How many primary alcohols have the molecular formula C_4H_9OH?

(a) 1

(b) 2

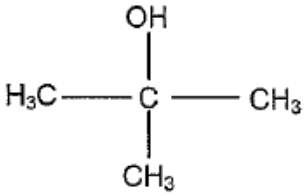
(c) 3

(d) 4

16. Which one of the following will react readily with acidified dichromate ($Cr_2O_7^{2-}$) solutio

(a) CH_3COCH_3

(b) CH_3CH_2CHO

(c) 

(d) $CH_3CH_2CH_3$

1999 EXAM

20. Which of the following will most readily cause a warm solution containing both potassium dichromate and sulfuric acid to change colour?

(a) CH_3CH_2OH

(b) CH_3COOH

(c) $CH_3COCH_2CH_3$

(d) $(CH_3)_3OH$

23. For complete oxidation to carbon dioxide and water, 1 mole of an organic compound requires 3 moles of oxygen gas. Which one of the following could the compound be?

(a) acetic acid (ethanoic acid)

(b) ethanal

(c) ethane

(d) ethanol

24. Which one of the following gases readily decolourises bromine water?

(a) carbon dioxide

(b) ethane

(c) ethene

(d) hydrogen chloride

25. Which one of the following structures will exhibit geometrical (*cis-trans*) isomerism?

(a) $CH_3CBr{=}CC\ell_2$

(b) $CH_2{=}CH{-}CH_2{-}CH{=}CH_2$

(c) $CH_2{=}C(CH_3)_2$

(d) $C_6H_5CH{=}CHCOOH$

26. How many esters are there with the molecular formula $C_4H_8O_2$?

(a) 1

(b) 2

(c) 3

(d) 4

27. Which of the following statements about ethene, C_2H_4, are correct?

I It undergoes substitution reactions rather than addition reactions.

II It can form a polymer.

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

28. A small amount of an alcohol RCH_2OH is shaken with an excess of a warm solution containing both sodium dichromate and sulfuric acid until reaction ceases. Which functional group is present in the product?

(a) –CO–C–

(b) –CO–H

(c) –CO–O–H

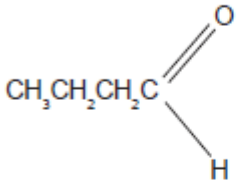
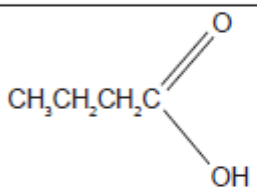
(d) –CO–O–C

SHORT ANSWER

2012 EXAM

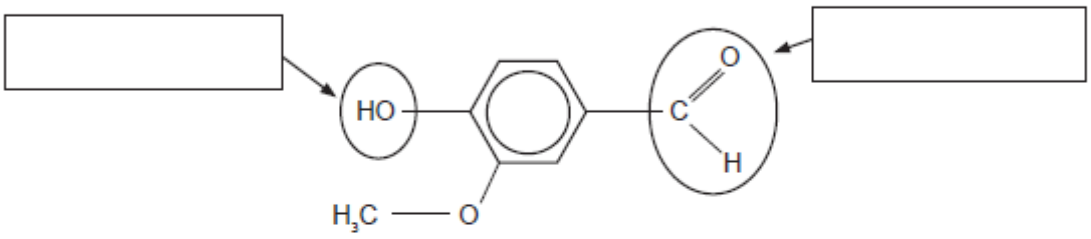
Question 27 **(4 marks)**

Examine the data in the table below. Use your knowledge of intermolecular forces to explain the differences in boiling points of the three compounds listed in the table.

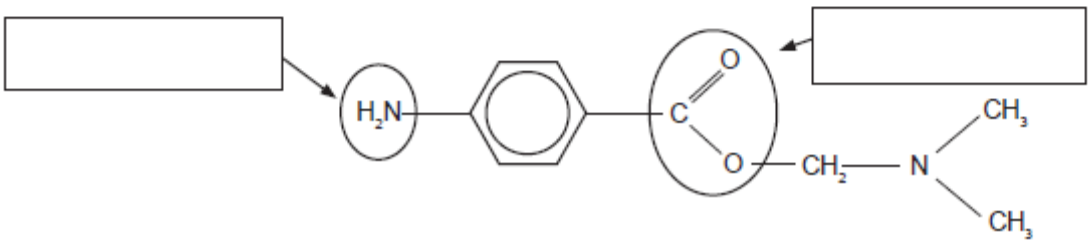
Compound	Structure	Molar mass ($g\ mol^{-1}$)	Boiling point (°C)
Butan-1-ol	$CH_3CH_2CH_2CH_2OH$	74.24	118
Butanal		72.22	75
Butanoic acid		88.22	163

Question 31 **(4 marks)**

Examine the two compounds below. Compound 1 is the naturally occurring flavouring agent vanillin. Compound 2 is the local anaesthetic procaine. Name the functional groups circled in these two compounds.



Compound 1: Vanillin



Compound 2: Procaine

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Question 30 **(6 marks)**

Consider the following reactions and complete the tables that follow.

(a) An excess of 2-butanol is oxidised by acidified $Na_2Cr_2O_7$. (3 marks)

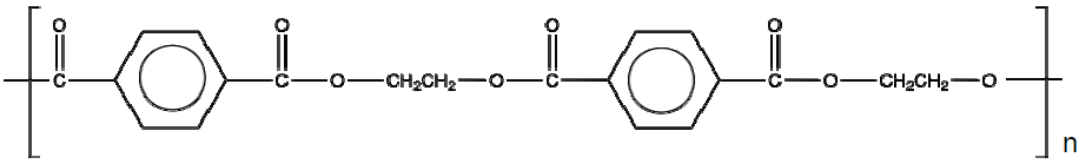
Observations	
Structural formula of organic product Show all atoms	
Name of organic product	

(b) Butanoic acid reacts with methanol in the presence of H_2SO_4. (3 marks)

Observations	
Structural formula of organic product Show all atoms	
Name of organic product	

Question 31 **(3 marks)**

Condensation polymers form from two monomers, each with functional groups at their terminal carbon atoms (that is, the monomers are difunctional). Examine the polyester structure below.



(a) Circle **all** the ester linkages (functional groups that link the monomers) represented in the above structure. (1 mark)

(b) Identify the two monomer compounds (A and B) used in the production of this polymer and draw their molecular structures. (2 marks)

Monomer A

Monomer B

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2007 EXAM

LONG ANSWER

2012 EXAM

Question 10 **(6 marks)**

Draw the structure and give the IUPAC name of the organic compounds that match the following descriptions.

Show all atoms in the structure

(a) A primary amine containing 9 hydrogen atoms.

Structure	Name
	_____

(b) The product of the oxidation of 2-pentanol

Structure	Name
	_____

(c) A compound X has the molecular formula C_5H_8. When X is warmed with excess hydrogen in the presence of powdered nickel, it forms a compound with the molecular formula C_5H_{10}.

Give the structure and name of compound X.

Structure	Name
	_____

2008 EXAM

Question 5 **(9 marks)**

Describe a chemical test that can be used to distinguish between each substance in the following pairs of substances. Describe fully the chemical test and the observations expected for each substance.

Substances	Chemical Test	Expected observations
Cyclohexane (C_6H_{12}) and cyclohexene (C_6H_{10})		C_6H_{12}
		C_6H_{10}
1 mol L^{-1} sulfuric acid solution (H_2SO_4) and 1 mol L^{-1} hydrochloric acid solution ($HC\ell$)		H_2SO_4
		$HC\ell$
Propanone (CH_3COCH_3) and propanal (CH_3CH_2CHO)		CH_3COCH_3
		CH_3CH_2CHO

1999 EXAM

(0.0026 atm = 0.263kPa)

1. An unknown organic compound 'A' melts sharply at 53°C and is therefore assumed to be pure. At 1.00 atm 'A' decomposes above 100°C before it boils. Its empirical formula is determined to be CH_2O.

(a) When 0.0033 g of 'A' is vaporised on a steam bath at 100°C and 0.0026 atm it occupies 460 mL. Calculate the molecular weight of 'A'. Show your working.

[5 marks]

(b) It is difficult to measure gas volumes accurately at such high temperatures and very low pressures. Nevertheless the inaccurate value you calculate for a molecular weight still enables you to establish the molecular formula. What is the molecular formula for 'A'?

[2 marks]

(c) When 'A' is dissolved in water the solution is quite acidic. Therefore 'A' must be a carboxylic acid. When the solution is titrated with sodium hydroxide solution the titration curve of this solution shows that 'A' is a monoprotic acid. When 1 mole of 'A' is treated with excess sodium, 1 mole of H_2 is produced. Besides the carboxylic acid, what other functional group is present in 'A'?

[1 mark]

(d) Draw one of the two possible structural formulae for 'A'.

[1 mark]