ALL SAINTS' COLLEGE

Science Department

Year 12 2015

Topic Test 3: Organics

Answers

Name: _____

Teacher: _____

Instructions to Students:

1. 50 minutes permitted
2. Attempt all questions
3. Write in the spaces provided
4. Show all working when required
5. All answers to be in blue or black pen, diagrams in pencil.

Part A	Part B	TOTAL	Final Percentage
/15	/40	/ 55	

Section One: Multiple-choice (15 questions) **(15 marks)**

This section has **15** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided.

1. Which of the following molecules contains at least a single bond, a double bond and a triple bond?

   a) CH_2CHCCH

   b) $CH_2Cl(CH_2)_3CH_3$

   c) $CH_2CClCClCH_2$

   d) $CH_3CHBrCH_3$

2. Which one of the following names is incorrect?

   a) 1,2,3-trimethylcyclohexane.

   b) 2,3,3-trichlorohexane.

   c) 2,3,4-trichlorocyclohexene.

   d) 4,4,5-trimethylhexane.

3. Which of the following compounds has only one distinct form of the molecule which can be drawn?

   a) 3-chloropropene.

   b) Dichloropropanone.

   c) Butene

   d) 1,2-dichloropropene.

4. Which one of the following substances will exhibit geometrical (cis - trans) isomerism?

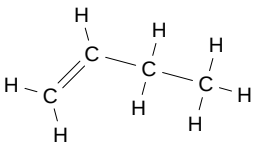
   a) $CH_3CCl=CCl_2$

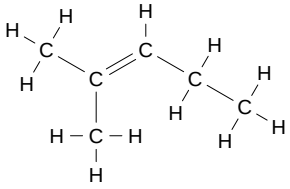
   b) $CH_3\text{-}(CH_2)_2\text{-}CH=CHCOOH$

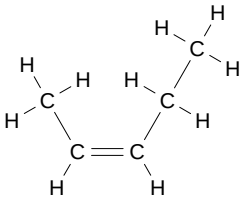
   c) $CH_2=CH\text{-}(CH_2)_4\text{-}CH_3$

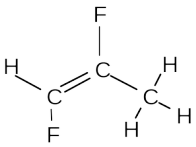
   d) $HOOC\text{-}(CH_2)_2\text{-}COOH$

5. Which of the following molecules is the trans form of a pair of geometric isomers?

a) 

b) 

c) 

d) 

6. Which of the following reactions are substitution reactions?

I	C_2H_2	+	HCl	→	CH_2CHCl			
II	CH_4	+	Cl_2	→	CH_3Cl	+	HCl	
III	CH_3CH_3	+	$2Br_2$	→	CH_2BrCH_2Br	+	2HBr	
IV	CH_4	+	O_2	→	CO_2	+	H_2O	

a) II and IV only.
b) II and III only.
c) I and IVonly.
d) I and II only.

7. One of the compounds formed when fluorine reacts with ethane is 1,2-difluoroethane. This type of reaction is called:

a) an addition reaction.

b) a hydrolysis reaction.

c) a combustion reaction.

d) a substitution reaction.

8. Which of the following has been filled in correctly?

		Representation of functional group	**Main intermolecular forces between molecules of the substance**	**Solubility**
a)	Carboxylic acid	RCOOH	dipole - dipole	soluble in water
b)	Amine	RNH_2	hydrogen bonding	soluble in water
c)	Aldehyde	RCHO	hydrogen bonding	soluble in water
d)	Alkene	R = R	dispersion forces	soluble in water

9. 2-pentanone can be prepared from which of the following lists of substances?

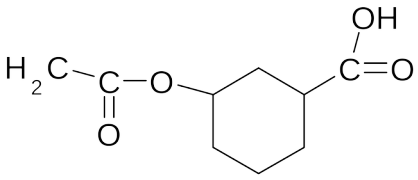
a) 2-pentanoic acid and 2-pentanol.

b) 2-pentanol and acidified potassium permanganate solution.

c) Pentanal and acidified potassium permanganate solution.

d) 2-pentene and pentanoic acid.

10. The figure below shows the structure of aspirin. The structure contains:



a) an acid and an ester

b) an acid and a ketone

c) an ester and a ketone

d) a ketone and an alcohol

11. Which of the following lists do not have the compounds arranged in order of decreasing boiling point?

a) Pentanal, 1-pentanol, 1-pentanoic acid.

b) Butanoic acid, butanone, butane.

c) Hexane, pentane, propane.

d) Diamond, ammonia, carbon dioxide.

12. Which of the following substances will react with $CH_3(CH_2)_2COOH$ to produce $CH_3(CH_2)_2COOCH_2CH_3$ and water?

a) $CH_3CH_2CH_3$

b) CH_3CHCH_2

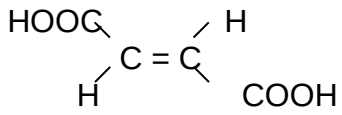
c) Acidified potassium permanganate solution

d) CH_3CH_2OH

13. Which of the following most correctly describes what happens in the manufacture of soaps?

	Main reaction classification	Reactants	By-product(s)
a)	Hydrolysis	triglyceride, water	glycerol
b)	Saponification	sodium hydroxide, fat	1,2,3-propanetriol
c)	Esterification	glycerol, fatty acids	water
d)	Sulfonation	sulfuric acid, alkyl benzene	water

14. Which of the following is an isomer of fumaric acid, whose structure is shown below?



a) $CH_3CH_2CH_2COOH$

b) $HO(CH_2)_3$ COOH

c) $HOOCCH_2CHOHCOOH$

d) $HOOC(CH)_2COOH$

15. The following represents the repeating sequence of a condensation polymer:

$-OCCH_2COO(CH_2)_2O-$

Which of the following represents the pairs of monomers which produced the above polymer?

a) CH_2OH and $HOOC(CH_2)_2COOH$

b) $HOOCCH_2COOH$ and $HO(CH_2)_2OH$

c) $HOCH_2OH$ and $HOOC(CH_2)OH$

d) $(HO)_2CCH(OH)_2$ and $(HOOC)_2CH_2(COOH)_2$

PART B: SHORT ANSWER QUESTIONS **(40 MARKS)**

1. The hydrocarbon but-1-ene (C_4H_8) is a member of the homologous series of alkenes.

   a) Provide the general formula of the alkenes: ……**CnH2n……** (1)

   b) But-1-ene has structural isomers.

      (i) State the meaning of the term *structural isomers*.

      Same molecular formular, but different structure.....

      ..... (2)

      (ii) Give the IUPAC names of two further isomers of C_4H_8.

      But-2-ene

      Cyclobutane

      2-methylpropene

      methylcycloproane

      ..... (2)

   c) Write an equation for the combustion of But-1-ene in an excess of air.

      C4H8 + 6 O2 --> 4 CO2 + 4 H2O..... (1)

2. Write IUPAC names for the following compounds.

Compounds	*Names*
$CH_3CH_2COOCH_3$	**Methylpropanoate**
$(CH_3)_3CH$	**Methylpropane**
$CH_3CH(CH_3)CH_2CH_2COCH_3$	**5-methylhexan-2-one**

(3)

3. From the following list of substances, chose two that fit the descriptions below.

H_3PO_4 **$Cr(NO_3)_3$** **HNO_3** **$CH_3CH_2CH_2COOH$**

$Cr(OH)_3$ **$K_2Cr_2O_7$** **C_2H_4** **Br_2**

C_3H_8 **CH_3CH_2OH** **H_2** **CH_4** **HOOCCOOH**

Description	Substance 1	Substance 2
Two green substances that are both soluble in water.	**$Cr(NO_3)_3$**	**Cl_2**
Two monoprotic acids.	**HNO_3**	**$CH_3CH_2CH_2COOH$**
Two substances that can react together to produce ethanoic acid	**CH_3CH_2OH or CH_3CHO**	**$K_2Cr_2O_7$**
Two substances that can be used as monomers in polymerization reactions	**C_2H_4**	**HOOCCOOH**
Two substances with the same empirical formula.	**$CH_3CH_2CH_2COOH$**	**CH_3CHO**

(5)

4. A student has been asked to prepare a sample of propyl ethanoate.

a) Name three substances necessary for the laboratory preparation of the above compound.

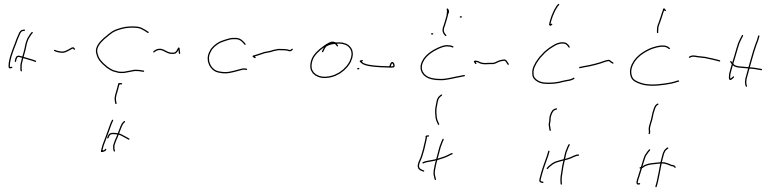
…propanol……

…ethanoic acid……

…concentrated sulfuric acid…… (3)

b) Draw the structure of propylethanoate: (1)

(1(

y 

c) Name two isomers of the above substance. (2)

Any two of:

Methyl butanoate, butyl methanoate, ethyl propanoate

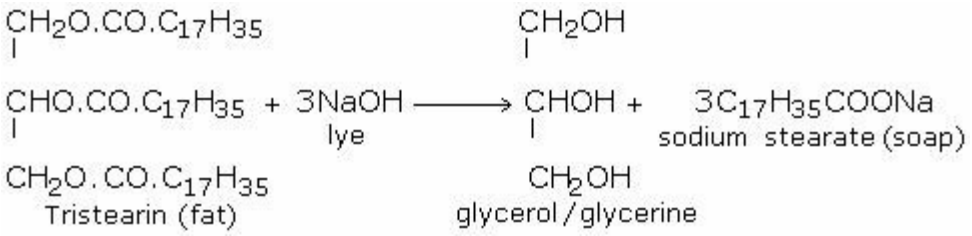
2-methylbutanoic acid, methylpropylmethanoate, pentanoic acid

d) Write an equation for the formation of propylethanoate: (1)

$CH_3COOH + CH_3(CH_2)_2OH$ -----H+ --> $CH_3COO(CH_2)_2CH_3 + H_2O$

5. The sodium salt of stearic acid is used as soap.

a) Write an equation for the production of the soap Sodium Stearate, $(CH_3(CH_2)_{16}COONa)$ from a triglyceride and sodium hydroxide.



1 mark for correct formula of reactants and products
Second mark if correctly balanced **(2)**

a) What are the terms used to describe the two portions of the soap molecule A (shaded) and B (unshaded) in regards to their interaction with water? (2)

$(CH_3(CH_2)_{16}COONa)$

A B

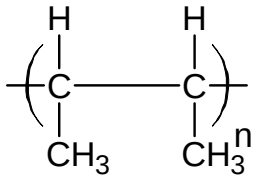
A: hydrophobic tail
…
B: hydrophilic head

b) What are the intermolecular forces between portion A and a grease stain and portion B and water? (2)

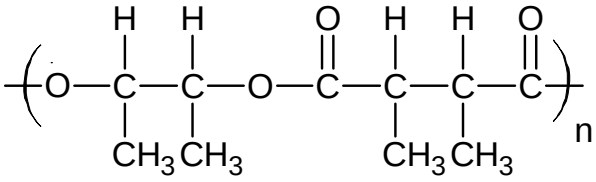
A: dispersion forces

B: ion dipole

6. The repeating units of two polymers, P and Q, are shown below.



P



Q

a) Draw the structure of the monomer used to form polymer **P**. Name the type of polymerisation involved.

Structure of monomer

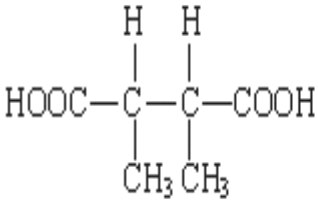
$CH_3CH=CHCH_3$

*Name of monomer: ……**but-2-ene…(cis/trans doesn't need to be mentioned as double bond broken)***

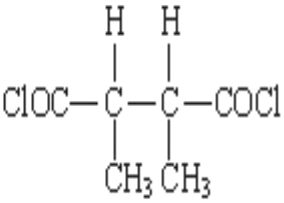
Type of polymerisation .....**addition**..... (3)

b) Draw the structures of two compounds which react together to form polymer Q. Name these two compounds and name the type of polymerisation involved.

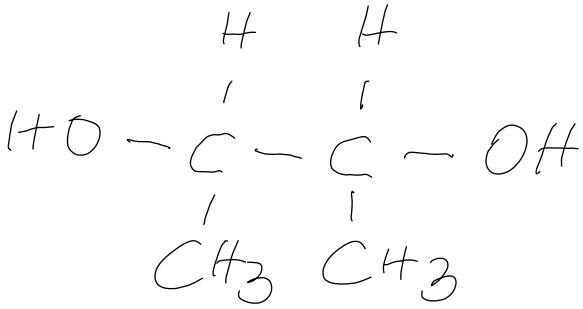
Structure of compound 1



allow

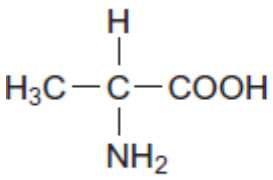


Structure of compound 2

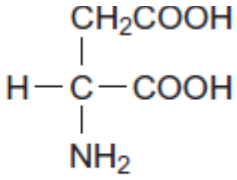


Type of polymerisation .....**condensation** ..... (3)

7. Alanine and aspartic acid are naturally occurring amino acids.

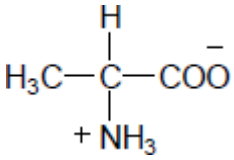


alanine



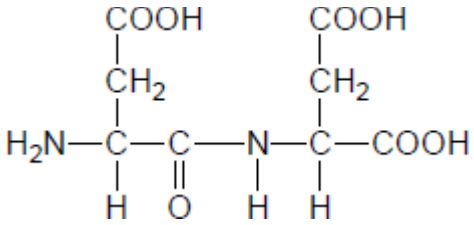
aspartic acid

a) Draw the structure of the zwitterion formed by alanine.



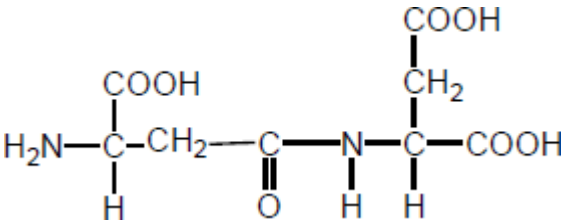
(1)

b) Draw the structure of a dipeptide formed by two aspartic acid molecules.



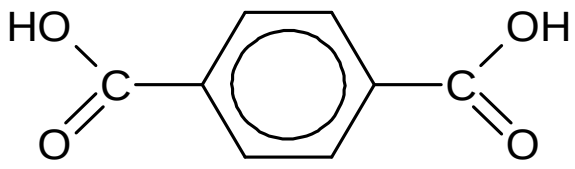
Allow zwitterion with any COO^-

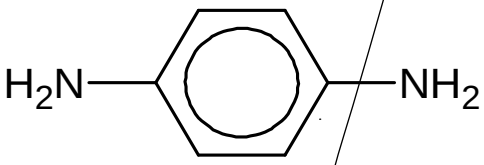
Allow use of "wrong" COOH



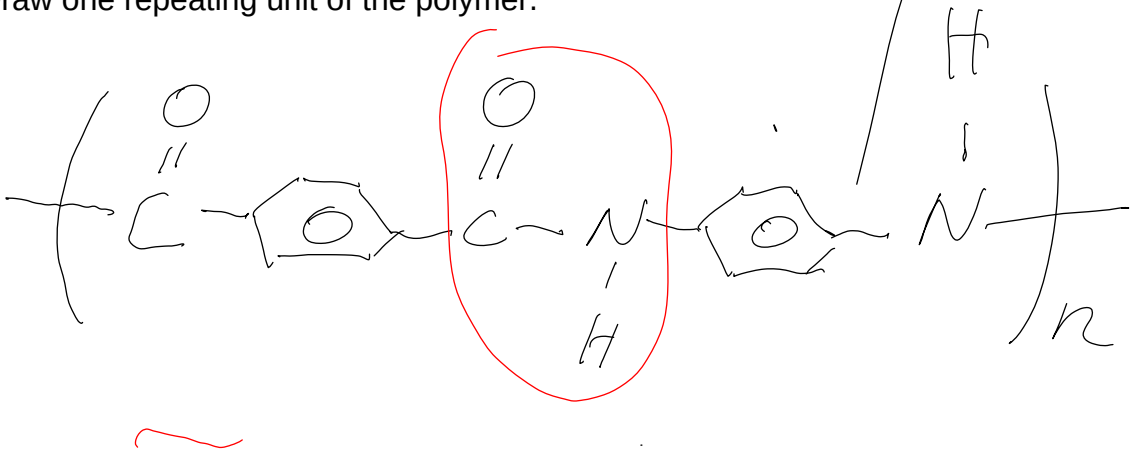
(1)

8. The polymer commonly known as Kevlar is used to make bullet proof vests and bicycle tyres. It can be made in a polymerization reaction between the two monomers shown below.





a) Draw one repeating unit of the polymer.



b) Indicate the amide linkage on your drawing. (2)

c) In terms of the intermolecular forces between the polymer chains, explain the strength of Kevlar fibres. Use a diagram in your answer.

Intermolecular force identified: H-bonding and dispersion forces between strands of Kevlar polymer chains (2)

Diagram clearly showing interaction between slightly positively charged hydrogen and a lone pair (1)

END OT TEST