UNIT 4 Sample test

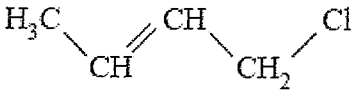
CARBON CHEMISTRY

NAME:_____ **TIME ALLOWED: 55 MINUTES**

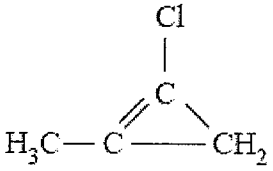
Goal Mark: /39
Actual Mark: /39

Part A: Multiple Choice Questions. (10 marks)

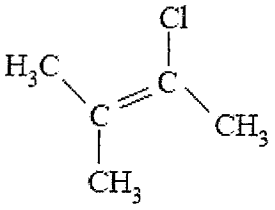
Q1. Which of the following formulae represent a pair of isomers?



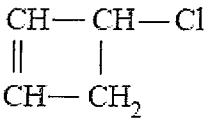
(I)



(II)



(III)



(IV)

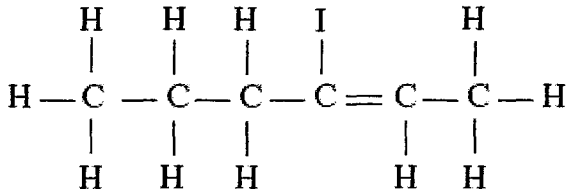
A. (I) and (II).
B. (I) and (III)
C. (I) and (IV)
D. (II) and (IV)

Q2. When hot acidic potassium permanganate is used to oxidise an alkene, a colour change occurs.

What colour change would be observed?

A. Colourless to purple
B. Orange to brown
C. Brown to colourless
D. Purple to colourless

Q3. What is the IUPAC name for the compound whose structure is given below?

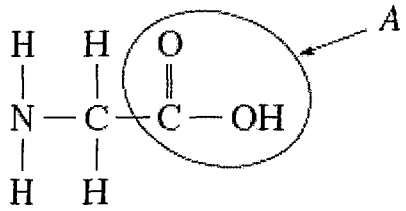


A. 4-iodo-4-hexene
B. 3-iodo-2-hexene
C. 4-iodo-5-hexene
D. 2-iodo-2-hexene

Q4. Which of the following pairs of substances are **NOT** isomers?

A. 2-pentanone and 3-methylbutanal
B. butanoic acid and 1,2-cyclobutanediol
C. 3-methylhexane and 2,2,3-trimethylbutane
D. methylcyclopentane and hexane

Q5. The structure of glycine is shown.



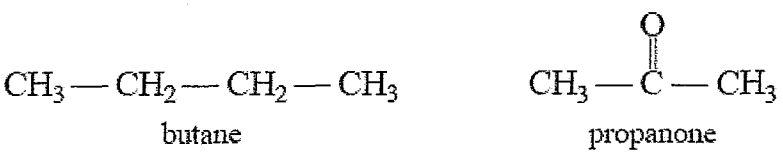
The functional group *A* is

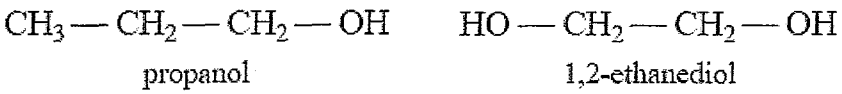
A. hydroxyl group
B. ester group
C. carboxylic acid group
D. amine group

Q6. Which of the following is a common use for ethyl pentanoate?

A. Flavouring
B. Fuel
C. Indicator
D. Solvent

Q7. The four substances below have similar molar masses.



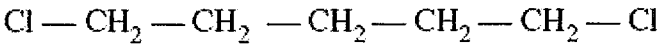


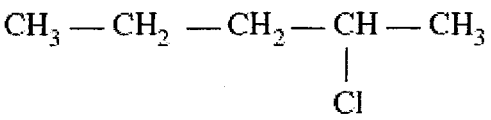
The substance with the highest boiling point is

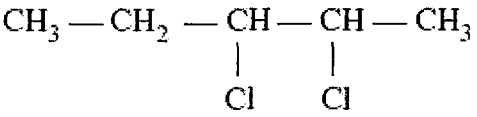
A. butane
B. propanol
C. propanone
D. 1,2-ethanediol

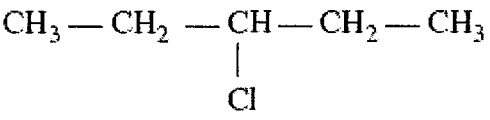
Q8. Chlorine gas is added to 2-pentene in the dark.

What is the major organic product?

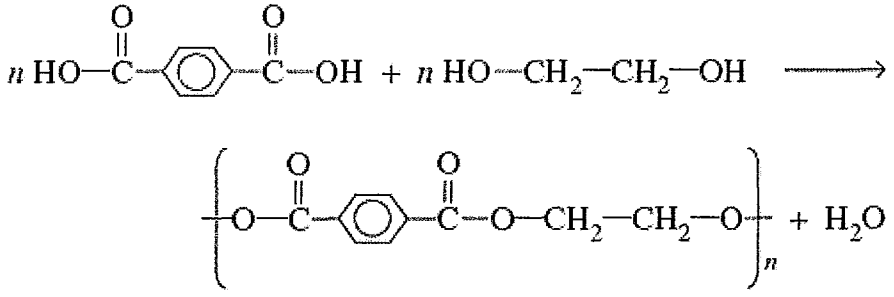
(A) 

(B) 

(C) 

(D) 

Q9. The type of polymerisation shown in the following reaction is



A. Addition
B. Condensation
C. Esterification
D. Hydrolysis

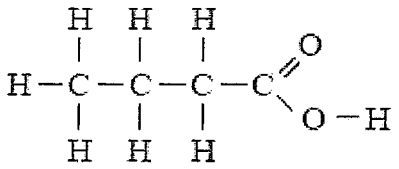
Q10. A student was given the task of identifying a liquid organic compound that contains only carbon, hydrogen and oxygen. The following tests were carried out

Test 1: Some brown $Br_{2(aq)}$ was added to a sample of the compound.
A reaction occurred and a colourless product formed.

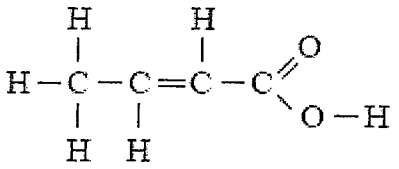
Test 2: Some $Na_2CO_{3(s)}$ was added to a sample of the compound.
A reaction occurred and a colourless gas was evolved.

Based on the above test results, the compound could be

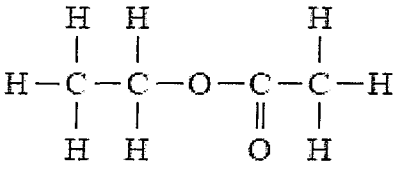
A.



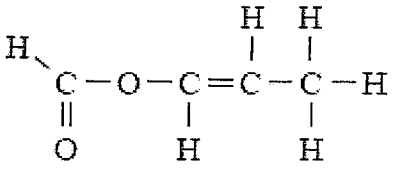
B.



C.



D.



END OF PART A

PART B: SHORT ANSWER QUESTIONS (15 marks)

Q11. An investigation to compare the reactivity of an alkene with its corresponding alkane was carried out.

A. State the name of the alkene. _____

B. Outline a procedure to compare the reactivity of this alkene with its corresponding alkane.

_____

_____

_____

_____

_____

_____

(1 marks)

C. Describe the results obtained from this first-hand investigation and include relevant chemical equations.

_____

_____

_____

_____

_____

(4 marks)

relevant chemical equations

_____

_____

Q12. Punicic acid, $C_{17}H_{29}COOH$, is the main alkanoic (carboxylic) acid found in pomegranate seeds. It is an unsaturated straight chain compound.

A. Deduce (work out) the number of carbon to carbon double bonds in punicic acid.

_____

_____

_____ (1 mark)

B. A triglyceride can be made from punicic acid and glycerol (propan-1,2,3-triol)

Draw the structure of this triglyceride. You should represent the hydrocarbon chains in punicic acid as $C_{17}H_{29}$.

(1 mark)

Name the **two** types of functional groups in the triglyceride in B above.

_____ & _____ (2 marks)

C. Explain why this triglyceride is soluble in non-polar solvents such as hexane.

_____

_____

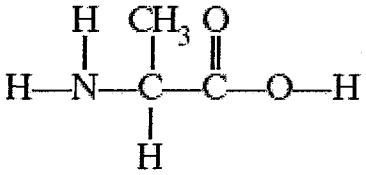
_____

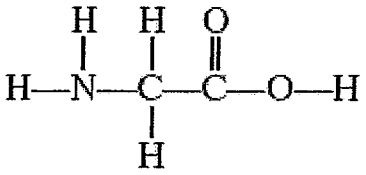
_____

(2 marks)

Q13. To what class of compounds do these molecules belong?_____

(1 mark)





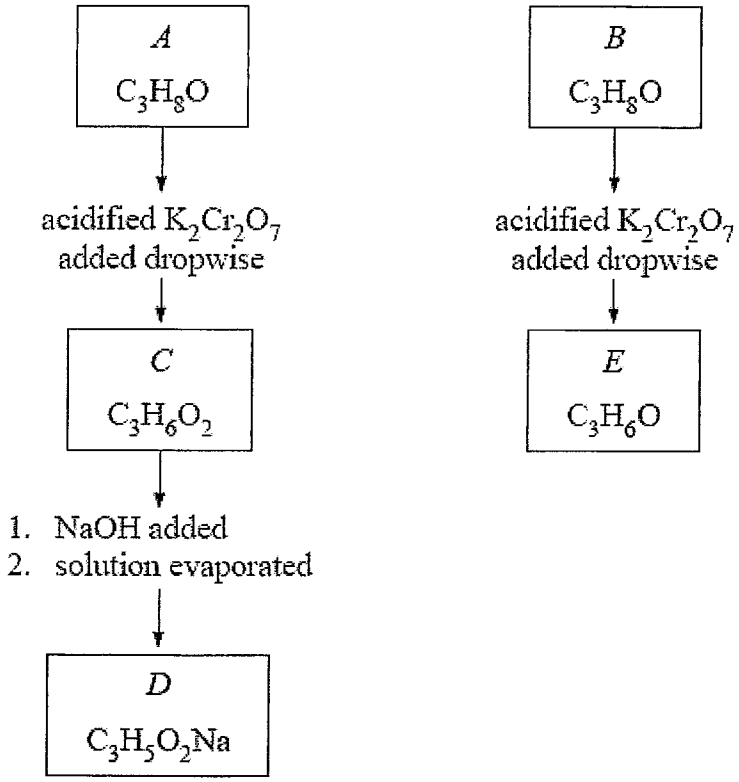
Using the two compounds above describe the formation of a peptide bond with a chemical equation.

(1 mark)

Clearly indicate the peptide bond by circling it (1 mark)

PART C: EXTENDED ANSWER SECTION (15 marks)

Q14. Two different compounds *A* and *B* are isomers with the molecular formula C_3H_8O.
A and *B* undergo a series of reactions as shown below.



A. Draw the structural formula for *C* and *E* (2 marks)

C	*E*

B. How is compound *A* different from compound *B*? (2 marks)

C. Describe the colour change seen in going from *A* to *C*.

(1 mark)

D. Draw the structural formula and give the name for the compound produced if *B* and *C* react in the presence of a small amount of concentrated sulfuric acid.

(1 mark)

Name:

(1 mark)

Q15. Thiophene is a liquid compound of the elements C, H and S.

A sample of thiophene weighing 7.96 g was burned in oxygen, giving 16.65 g CO_2.

Another sample was subjected to a series of reactions that transformed all of the sulphur in the compound to barium sulfate. If 4.31 g of thiophene gave 11.96 g of barium sulfate, what is the empirical formula of thiophene?

(6 marks)

Thiophene's molecular mass is 84 amu. What is its molecular formula?

(1 mark)

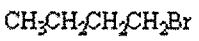
Given that thiophene is a ring or cyclic compound, draw a possible structural formula.

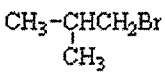
(1 mark)

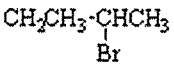
END OF TEST

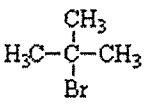
Structural Isomers Practice ANSWERS

C_4H_9Br

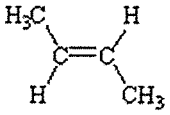


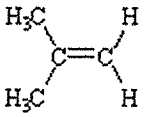


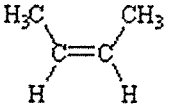


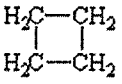


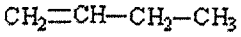
C_4H_8

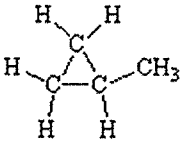




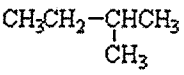


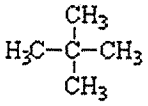






C_5H_{12}





UNIT 4 Sample test

CARBON CHEMISTRY

NAME:_____ **TIME ALLOWED: 55 MINUTES**

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Part A: Multiple Choice Questions. (10 marks)

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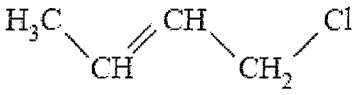
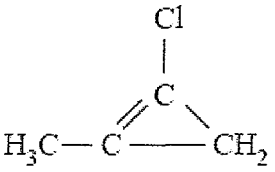
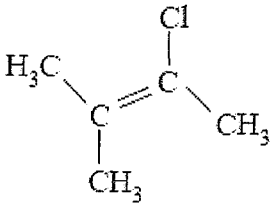


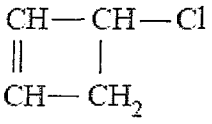
(I)



(II)



(III)



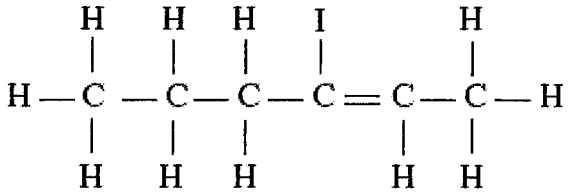
(IV)

A. (I) and (II).
B. (I) and (III)
C. (I) and (IV)
#D. (II) and (IV)

Q2. When hot acidic potassium permanganate is used to oxidise an alkene, a colour change occurs.

What colour change would be observed?
A. Colourless to purple
B. Orange to brown
C. Brown to colourless
#D. Purple to colourless

Q3. What is the IUPAC name for the compound whose structure is given below?



A. 4-iodo-4-hexene
#B. 3-iodo-2-hexene
C. 4-iodo-5-hexene
D. 2-iodo-2-hexene

Q4. Which of the following pairs of substances are **NOT** isomers?

A. 2-pentanone and 3-methylbutanal
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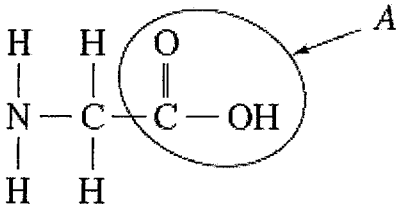
C. 3-methylhexane and 2,2,3-trimethylbutane
#D. methylcyclopentane and hexane

Q5. The structure of glycine is shown.



The functional group *A* is

A. hydroxyl group
B. ester group
#C. carboxylic acid group
D. amine group

Q6. Which of the following is a common use for ethyl pentanoate?

#A. Flavouring
B. Fuel
C. Indicator
D. Solvent

PART B: SHORT ANSWER QUESTIONS (15 marks)

Q11. An investigation to compare the reactivity of an alkene with its corresponding alkane.

A. State the name of the alkene. Any suitable alkene

B. Outline a procedure to compare the reactivity of this alkene with its corresponding alkane.

Bromine water added [1]
Iodine water added [1]
Acidified oxidising agent added [1]

(1 mark)

C. Describe the results obtained from this first-hand investigation and include relevant chemical equations.

Bromine water added [1] both layers went immediately colourless for the alkene [1]
Alkene organic solvent turned red [1]

Iodine water added [1] both layers went immediately colourless for the alkene [1]
Acidified oxidising agent added [1] colour of the oxidising agent changed [1] (must state colour change [1]

(4 marks)

relevant chemical equations

correct chemical eqn.

Q12. Punicic acid, $C_{17}H_{29}COOH$, is the main alkanoic (carboxylic) acid found in pomegranate seeds. It is an unsaturated straight chain compound.

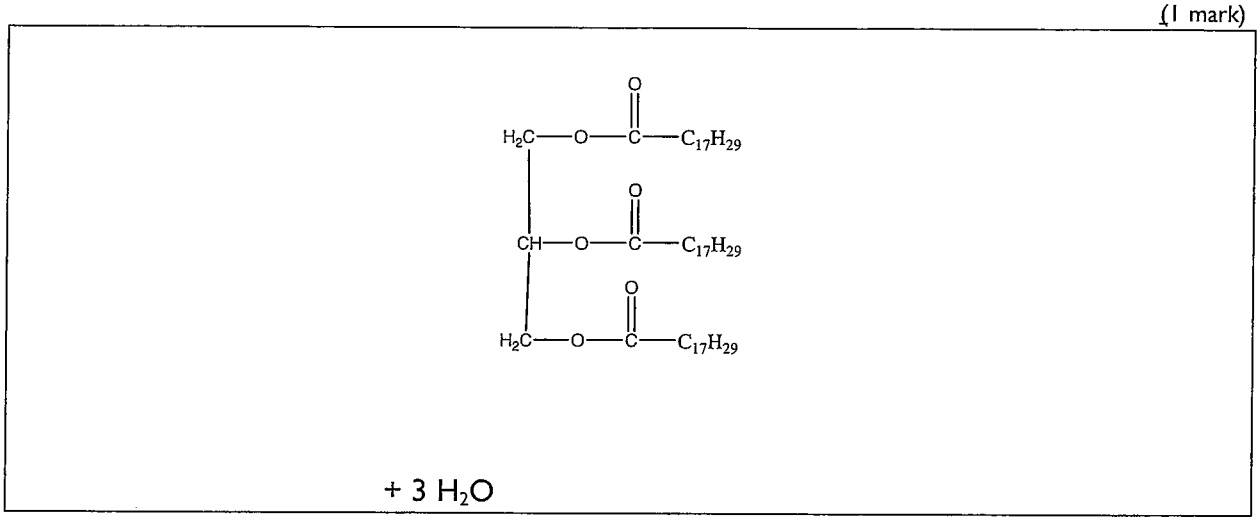
A. Deduce (work out) the number of carbon to carbon double bonds in punicic acid.

18 carbons. – 1 carbon = 17 (+1 bond) x2 hydrogens + 1 hydrogen to make it saturated = 35 hydrogens. Therefore **3 double bonds** due to 6 too many hydrogen atoms. (1 mark)

B. A triglyceride can be made from punicic acid and glycerol (propan-1,2,3-triol)

Draw the structure of this triglyceride. You should represent the hydrocarbon chains in punicic acid as $C_{17}H_{29}$.

(1 mark)



Name the **two** types of functional groups in the triglyceride in B above.

ESTER & ALKENE (2 marks)

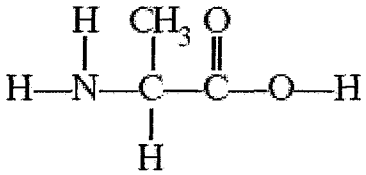
C. Explain why this triglyceride is soluble in non-polar solvents such as hexane.

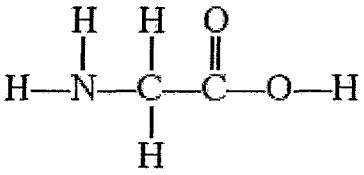
Dispersion forces of the non-polar [1] long hydrocarbon chain [1] allow it to interact with the alkane solvent

(2 marks)

Q13. To what class of compounds do these molecules belong? Amino Acids

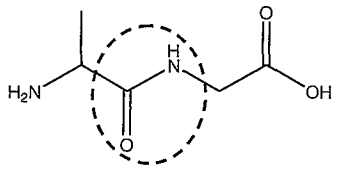
(1 mark)





Using the two compounds above describe the formation of a peptide bond with a chemical equation.

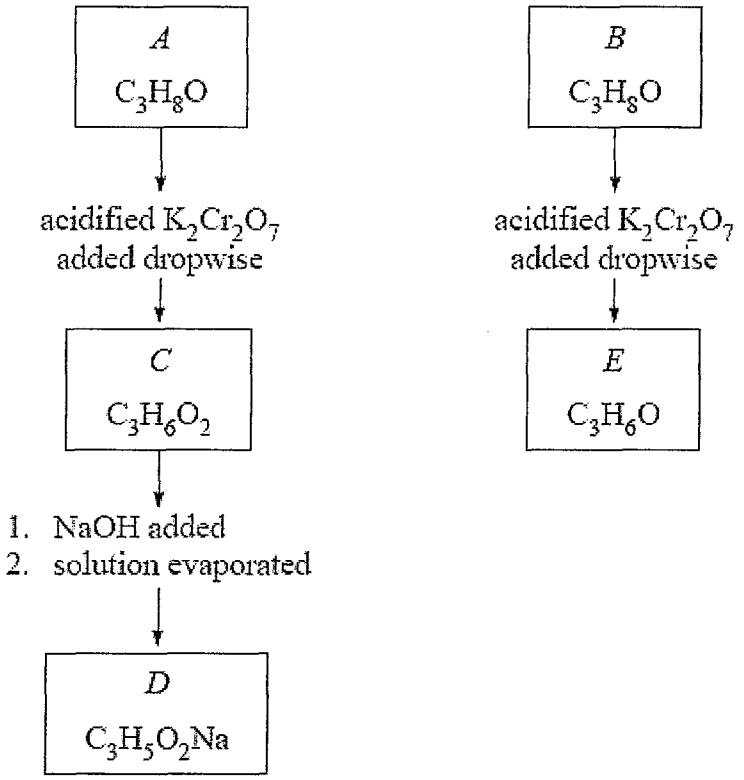
(1 mark)



Clearly indicate the peptide bond by circling it indicated above (1 mark)

PART C: EXTENDED ANSWER SECTION (15 marks)

Q14. Two different compounds *A* and *B* are isomers with the molecular formula C_3H_8O.
A and *B* undergo a series of reactions as shown below.



A. Draw the structural formula for *C* and *E* (2 marks)

C	*E*
Propanoic Acid CH_3CH_2COOH	Propanamyde CH_3CH_2CHO

B. How is compound *A* different from compound *B*? (2 marks)

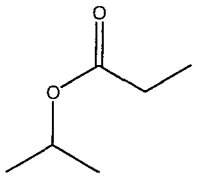
C is acidic [1]
E does not have as large a molar mass [1] ie. Has one less oxygen.

C. Describe the colour change seen in going from *A* to *C*.

Orange Dichromate will turn Deep Green after making Cr^{3+}

(1 mark)

D. Draw the structural formula and give the name for the compound produced if *B* and *C* react in the presence of a small amount of concentrated sulfuric acid.



(1 mark)

Name: Propan2-ol + Propanoic acid → Isopropyl propanoate

(1 mark)

Q15. Thiophene is a liquid compound of the elements C, H and S.

A sample of thiophene weighing 7.96 g was burned in oxygen, giving 16.65 g CO_2.

Another sample was subjected to a series of reactions that transformed all of the sulphur in the compound to barium sulfate. If 4.31 g of thiophene gave 11.96 g of barium sulfate, what is the empirical formula of thiophene?

n(C) = 16.65 / 44.01 = 0.3783 moles
m(C) = 12.01 x 0.3783 = 4.54 g
%(C) = 4.54 / 7.96 x 100 = 57.04 %
n(S) = 11.96 / [137.32 + 32.07 + (4x16)] = 11.96 / 233.39 = 0.051244 moles
m(S) = 0.051244 x 32.07 = 1.6434 g
%(S) = 1.6434 / 4.31 x 100 = 38.13 %
%(H) = 100 – (57.04+38.13) = 4.83%

In 100g....

	C	H	S
%	57.04	4.83	38.13
A_r	12.01	1.008	32.07
n	4.75	4.79	1.18
(/smallest) Ratio	4	4	1

(6 marks)

Thiophene's molecular mass is 84 amu. What is its molecular formula?

Ans: C_4H_4S (1 mark)

Given that thiophene is a ring or cyclic compound, draw a possible structural formula.

Any suitable isomer, count no bonds on C(4) and S(2).

(1 mark)

END OF TEST