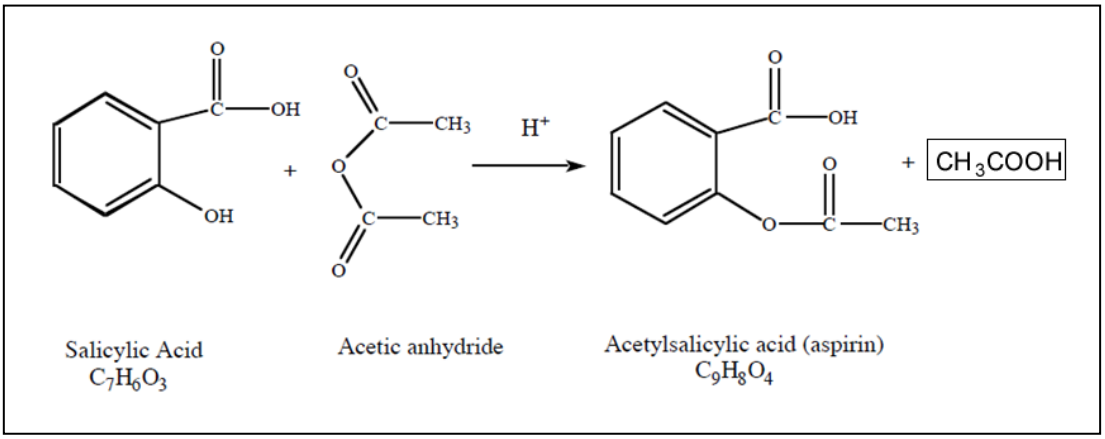
Friday Worksheet **Name: …….**

Analytical chemistry and organic 8

1) Aspirin can be made by reacting salicylic acid with acetic acid in the presence of an acid catalyst. The reaction between the phenol group (a hydroxyl group bonded directly to an aromatic reaction) and the acetic acid, however, is slow and has a relatively low yield. When acetic anhydride is used, in place of acetic acid, the reaction is much faster and has a higher yield.



a) Calculate the percentage yield for the above reaction if the amount of salicylic acid used was 2.34 g and 0.387 g of ethanoic acid was formed .
Molar mass of salicylic acid is 138.12 g/mol, aspirin 180.16 g/mol
Step 1 calculate the amount in mol of salicylic acid
=> 2.34 / 138.12 = 0.0169
Step 2 calculate the amount of aspirin, in grams, that theoretically could form
=> 0.0169 X 180.16 = 3.052 g
Step 3 calculate the amount of ethanoic acid that formed and hence the mol of aspirin that formed
=> 0.387 / 60.0 = 0.00645
Step 3 calculate the mass of aspirin that formed
=> 0.00645 X 180.16 = 1.16 g
Step 4 calculate percentage yield
=> (1.16 / 3.052) X 100 = 38.1 %

b) Using semistructural formulae give two equations that show glycine acting as a buffer.

$H_3N^+\text{-}CH_2\text{-}COO^-_{(aq)} + H_3O^+_{(aq)} \Rightarrow H_3N^+\text{-}CH_2\text{-}COOH_{(aq)} + H_2O_{(l)}$
This equilibrium mops up H_3O^+ ions.

$H_3N^+\text{-}CH_2\text{-}COO^-_{(aq)} + OH^-_{(aq)} \Rightarrow H_2N\text{-}CH_2\text{-}COO^-_{(aq)} + H_2O_{(l)}$
This equilibrium mops up OH^- ions.

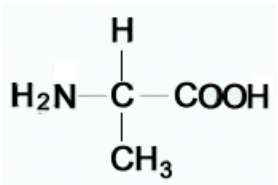
c) Give the systematic name for alanine
2-aminopropanoic Acid

d) The isoelectric point of the amino acid shown on the right is 6.1. Give the semistructural formula of the molecule at a pH:

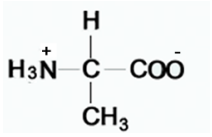
i. 6.1

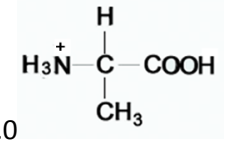
ii. 3.0

iii. 10

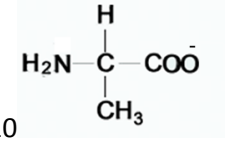


6.1





3.0



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e) A peptide chain is made up of two glycine molecules.

i. What is the molar mass of the peptide in g/mol.

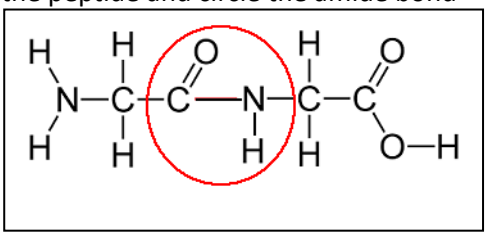
Molar mass of glycine is 75.1 g/mol

Two glycine molecules will have a combined molar mass of 150.2 g/mol.

The molar mass of the peptide must take into account the mass of the water molecule that is given off.

Hence the molar mass of the peptide is 150.2 – 18.0 = 132.2 g/mol

ii. Draw the peptide and circle the amide bond



2) Palmitoleic acid has the following formula $C_{16}H_{30}O_2$.

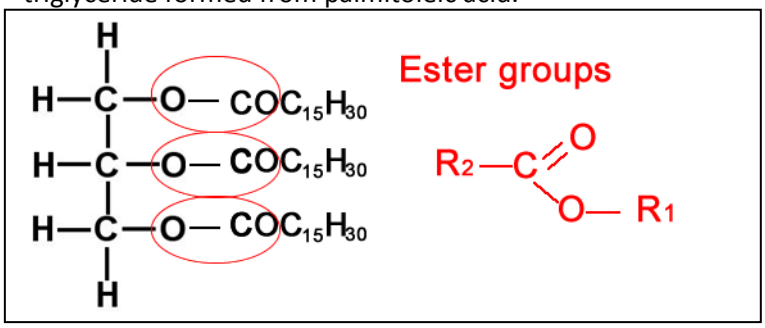
a) Is this a saturated or unsaturated fatty acid? Give a reason

This is an unsaturated fatty acid. It contains one double bond.

A saturated fatty acid has the formula $C_nH_{2n+2}COO$

A saturated fatty acid with one double bond has two hydrogen atoms less. For every double bond the fatty acid has two less hydrogen atoms than it would have if it was saturated. Palmitoleic acid would have 32 hydrogen atoms if it was saturated but it has only 30. It must, therefore, have one double bond.

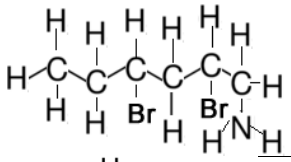
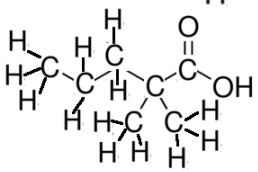
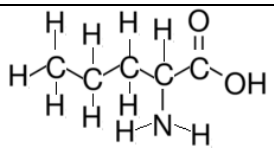
b) Glycerol is pictured below, complete the semistructural formula of the triglyceride formed from palmitoleic acid.



c) Circle and name the functional groups present in the triglyceride

d) What type of reaction forms the triglyceride.
Condensation

3) Complete the table below

Name	Structural formula	Semi-structural formula
2,4-dibromohexanamine		$CH_3CH_2CHBrCH_2CHBrCH_2NH_2$
2,2-dimethylpentanoic acid		$CH_3CH_2CH_2C(CH_3)_2COOH$
2-aminopentanoic acid		$HOOCCH(NH_2)CH_2CH_2CH_3$