A2 LEVEL CHEMISTRY

4.1.4 AMINES

4.2.1 AMINO ACIDS AND CHIRALITY

4.2.2. POLYESTERS AND POLYAMIDES

4.2.3 SYNTHESIS

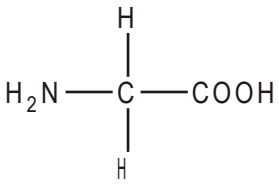
TEST

Answer all questions

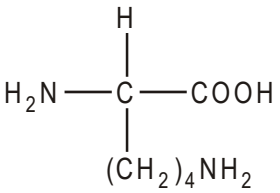
Max 43 marks

Name ……..
Mark ……../43 ……....% Grade ……

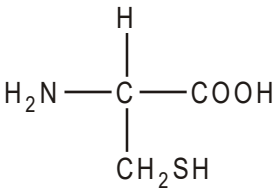
1. The four amino acids shown below are found in proteins and enzymes.



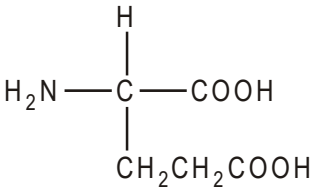
glycine



lysine



cysteine



glutamic acid

Write down the structural formula for a dipeptide formed from one molecule of glycine and one of lysine.

[Total 2 marks]

2. Leucine (2-amino-4-methylpentanoic acid) is a naturally occurring α-amino acid that is often used in protein supplements.

Leucine has a structural formula of $(CH_3)_2CHCH_2CH(NH_2)COOH$.

(a) (i) State the general formula of an α-amino acid.

.....

[1]

(ii) Draw a displayed formula of leucine.

[1]

(b) Leucine can exist as a zwitterion.

(i) State what is meant by the term *zwitterion*.

.....

.....

[1]

(ii) Explain with the aid of a diagram how the zwitterion is formed from the functional groups in leucine.

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[2]

(c) Leucine can be obtained from a source of protein such as meat.

(i) State suitable reagents and conditions to break down a protein into amino acids.

.....

.....

[2]

(ii) State the type of reaction occurring.

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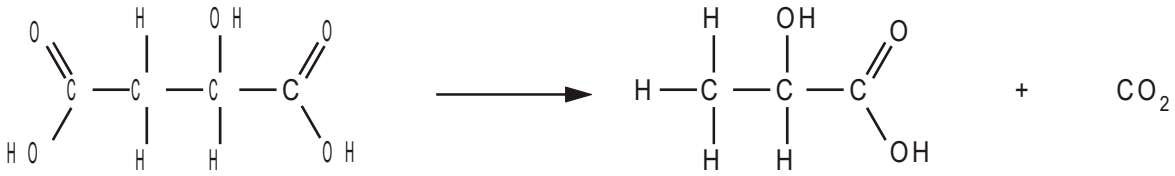
[1]

[Total 8 marks]

3. One of the final stages in winemaking involves the fermentation of malic acid to lactic acid.

An equation for the reaction is shown below.



malic acid **lactic acid**

Both acids contain a chiral centre.

(i) Identify the chiral centre on the structure of **malic acid** above using an asterisk *.

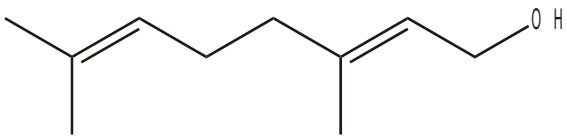
[1]

(ii) Draw a diagram to show the 3-D arrangement of groups around the chiral centre in malic acid.

[1]

[Total 2 marks]

4. Geraniol, $C_9H_{15}CH_2OH$, is a naturally occurring compound that contributes to the smell of roses. The skeletal formula of geraniol is shown below.



geraniol

(a) Name the two different functional groups in geraniol.

..... and .....

[1]

(b) Geraniol has stereoisomers due to one of the double bonds in the molecule.

(i) What is meant the term *stereoisomer*?

.....

.....

.....

[1]

(ii) Name the type of stereoisomerism shown by geraniol.

.....

[1]

(iii) State how this type of stereoisomerism arises in organic molecules.

.....

.....

[1]

(iv) Explain why one of the double bonds in geraniol does **not** give rise to stereoisomerism.

.....

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.....

[1]

[Total 5 marks]

5. Kevlar is a very tough polymer made from 1,4-diaminobenzene and benzene-1,4-dicarboxylic acid.

(i) State a use for Kevlar.

.....

[1]

(ii) Describe the polymerisation reaction that forms Kevlar. Include in your answer:

- an explanation of the type of polymerisation involved
- an equation for the reaction
- a repeat unit to show the structure of Kevlar.

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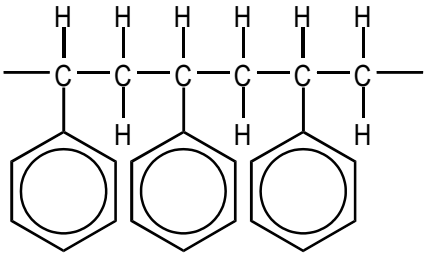
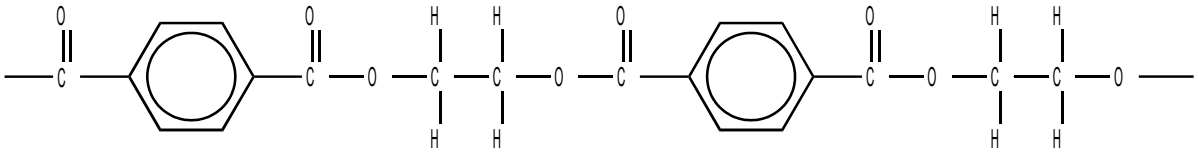
[5]

[Total 6 marks]

6. Short sections of the molecular structures of two polymers are shown below.



polymer C



polymer D

(a) (i) Circle, on the diagrams above, the simplest repeat unit in each polymer.

[2]

(ii) In the boxes below, draw the displayed formulae of the two monomers that could be used to prepare polymer **D**.

[2]

(b) Chemists have developed degradable polymers to reduce the quantity of plastic waste being disposed of in landfill sites. Polymer **D** is more likely to be a 'degradable polymer' than polymer **C**.

Suggest **two** reasons why.

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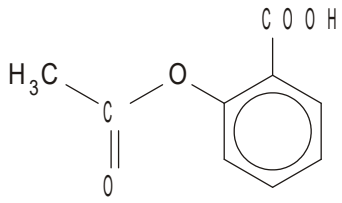
.....

.....

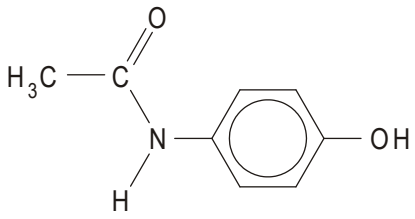
[2]

[Total 6 marks]

7. Aspirin and paracetamol are commonly available painkillers.



aspirin



paracetamol

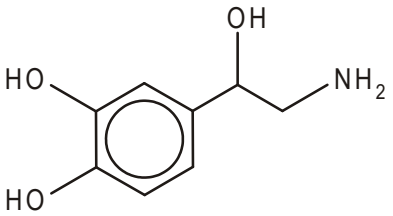
Name the functional groups in aspirin and in paracetamol.

aspirin .....

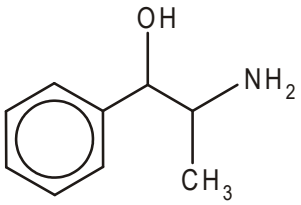
paracetamol .....

[Total 2 marks]

8. Noradrenaline is produced naturally by nerve cells in the brain. Compound **P** is a synthetic compound that has been widely used as an appetite suppressant. It is thought to be effective because it is similar to noradrenaline.



noradrenaline



compound P

(a) (i) Suggest a reagent that could be used in a test to distinguish compound **P** from noradrenaline.

.....

[1]

(ii) Draw a ring round the functional group responsible for the positive result in the test you have chosen.

[1]

(iii) State the expected observation for the positive result in the test you have chosen.

.....

[1]

(b) Both these compounds have stereoisomers due to the presence of chiral centres.

(i) Identify the chiral centres in each molecule by labelling them clearly with asterisks (*) on the structures above.

[2]

(ii) State the type of stereoisomerism caused by the presence of chiral centres.

.....

[1]

(iii) Using **noradrenaline** as an example, explain how a chiral centre gives rise to the stereoisomers. Illustrate your answer with a suitable diagram of the stereoisomers.

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[3]

(c) Explain why a pharmaceutical company may produce an appetite suppressant containing only one stereoisomer of compound **P**, rather than a mixture of the stereoisomers.

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[3]

[Total 12 marks]