CHEMISTRY ONLINE
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CHEMISTRY

INORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	AMINO ACIDS, PROTEIN & DNA
PAPER TYPE:	SOLUTION - 2
TOTAL QUESTIONS	10
TOTAL MARKS	45

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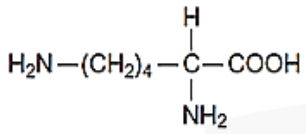
Amino Acids, Protein and DNA

1.

(a)



lysine

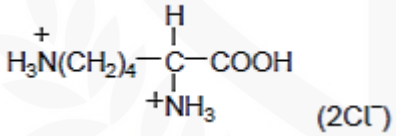
IUPAC name of lysine:

2,6-diaminohexanoic acid

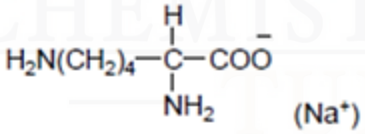
(1)

(b) Draw structures to show the product formed in each case when lysine reacts with

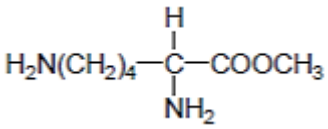
- An excess of aqueous HCl



- An excess of aqueous NaOH



- Methanol in the presence of a small amount of concentrated H_2SO_4



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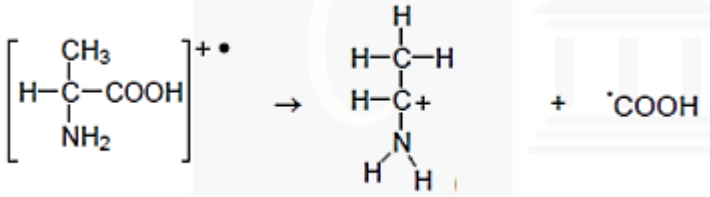
(3)

(c)

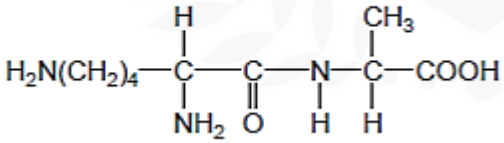
Equation for the fragmentation:



(2)

(d)

Following is a dipeptide formed from one molecule of lysine and one molecule of alanine.



(1)

2. C

(1)

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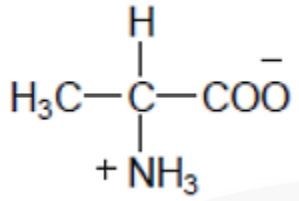
3.

(a)

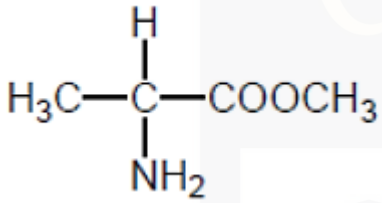
Zwitterion formed by alanine:



(1)

(b)

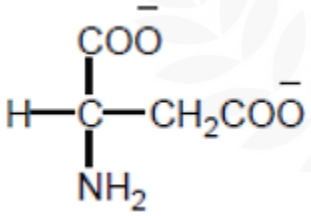
Structure of the compound:



(1)

(c)

Following is the structure of the specie formed by aspartic acid at high pH.



(1)

(d)

Following is the structure of a dipeptide formed by two aspartic acid molecules.

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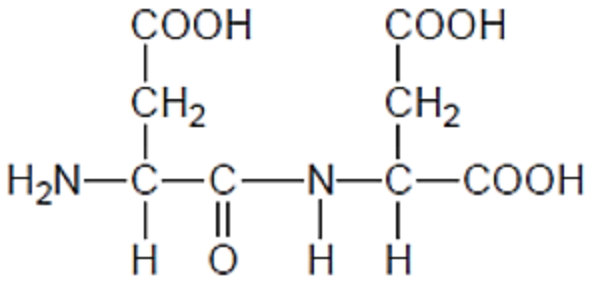


(1)

4.

(a)

IUPAC name of a monomer that forms polymer L:

3-methylpent-2-ene

(1)

(b)

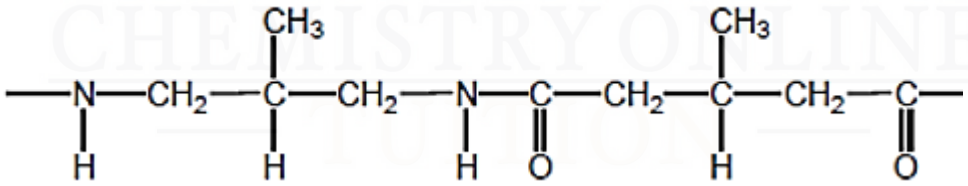
IUPAC name of the monomer that forms polymer M:

4-amino-3-methylbutanoic acid

(1)

(c)

Following is the section of a polymer made from a dicarboxylic acid and a diamine that is isomeric with the section of polymer M shown:



(1)

(d)

Polymer L is non-biodegradable because it lacks polar groups or bonds vulnerable to attack by water, acids, alkalis, or enzymes.

Additionally, its strong C-C bonds resist degradation by biological processes.

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(1)

5.

(a)

Balanced equation:

$Pt(NH_3)_2Cl_2 + H_2O \rightarrow [Pt(NH_3)_2Cl(H_2O)]^+ + Cl^-$

(2)

(b)

Type of bond:

The bond formed between the hydrogen atom from an ammonia ligand on complex ion Q and an atom in guanine is a hydrogen bond.

Atom in guanine:

In guanine, the atom that could form a bond to this hydrogen atom is the oxygen atom in the carbonyl group (C=O) or the nitrogen atom in the amino group (NH_2).

(2)

(c)

Type of bond:

The bond formed between guanine and platinum when a water molecule is displaced is a coordinate bond.

Atom in guanine:

In guanine, the atom that could bond to platinum in this way is the nitrogen atom in the nitrogenous base portion of guanine.

(2)

(d)

One risk of using cisplatin as an anticancer drug is its potential to attach to DNA in normal cells, causing damage or killing them, leading to side effects like hair loss.

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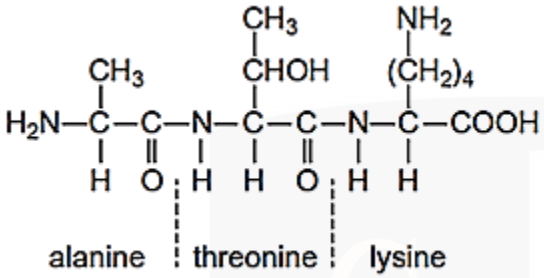
(2)

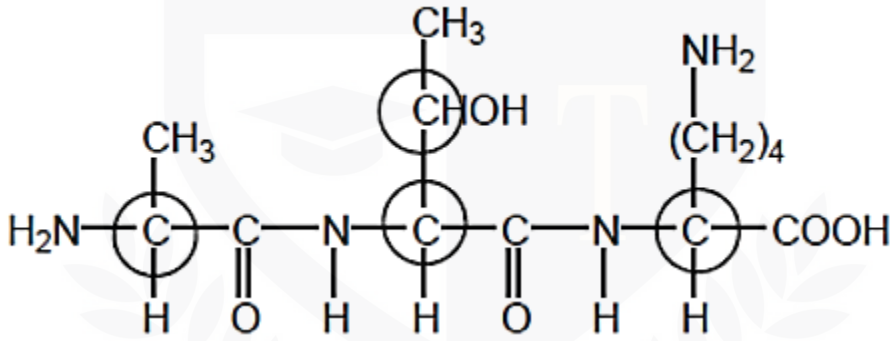
6.

The tripeptide:



(a)

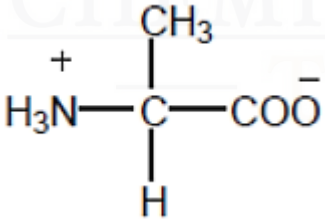
Circle around each of the asymmetric carbon atoms in the tripeptide:



(1)

(b)

Zwitterion of alanine.



(1)

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(c)

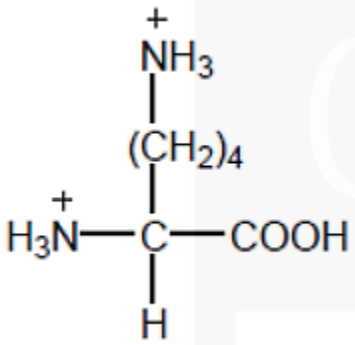
IUPAC name of threonine:

2-amino-3-hydroxybutanoic acid

(1)

(d)

Folloing is the species formed by lysine at low pH.



(1)

7.

(a)

Zwitterion:

A zwitterion is a neutral molecule that contains both positive and negative charged functional groups, making it electrically neutral overall.

(1)

(b)

In leucine, the amino group ($-NH_2$) and the carboxyl group ($-COOH$) are the functional groups involved in zwitterion formation.

Amino Group ($-NH_2$):

The amino group acts as a base, accepting a proton (H^+) from the carboxyl group.

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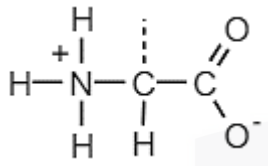
Carboxyl Group (-COOH):

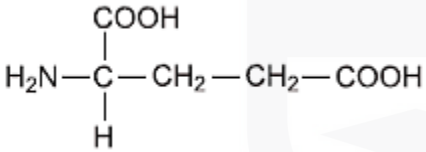
The carboxyl group acts as an acid, donating a proton (H^+) to the amino group.



(2)

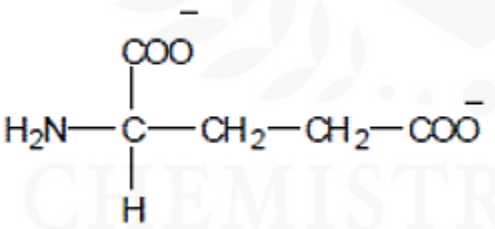
8.

Glutamic acid



(a)

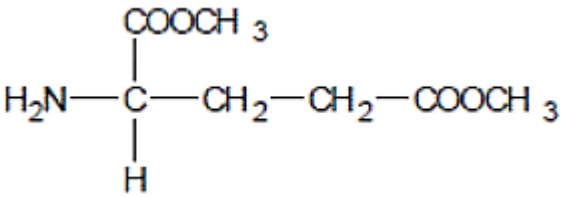
When glutamic acid reacts with an excess of sodium hydroxide



(1)

(b)

When glutamic acid reacts with an excess of methanol in the presence of concentrated sulfuric acid



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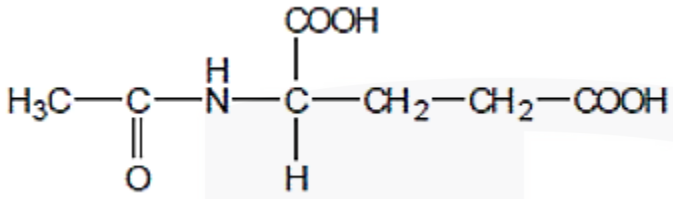
(1)

(c)

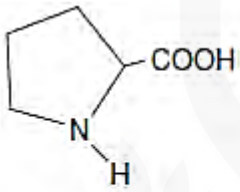
When glutamic acid reacts with ethanoyl chloride



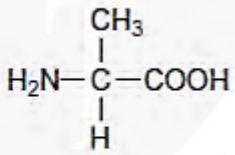
(1)

9.

(a)

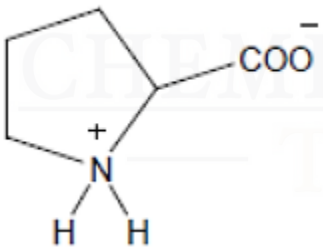


proline



alanine

Zwitterion of proline:



(1)

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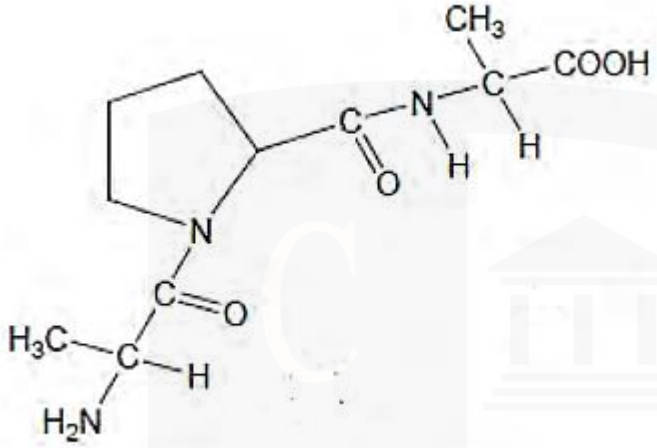
(b)

Following is the structure of the tripeptide formed when a proline molecule bonds to two alanine molecules, one on each side.



(2)

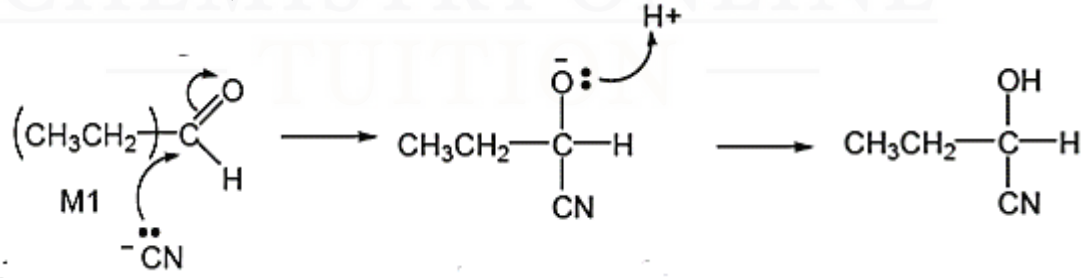
10.

(a)

Name:

nucleophilic addition

Mechanism for Step 1:



(5)

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(b)

IUPAC name of the product of Step 2:

2-bromobutanenitrile

(1)

(c)

Reagent:

Ammonia or NH_3

Condition:

Excess (ammonia)

Name of mechanism:

Nucleophilic substitution

(3)

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