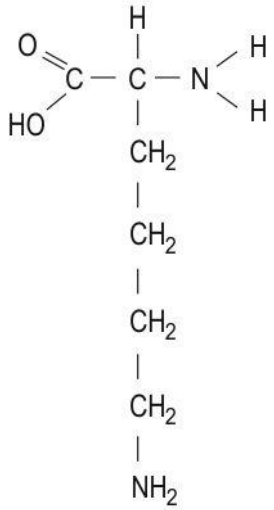
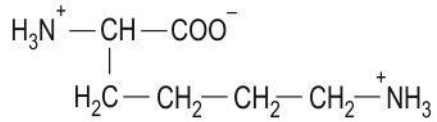
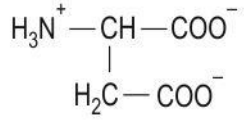
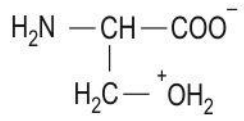
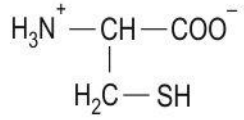
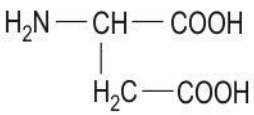
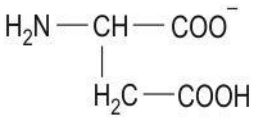
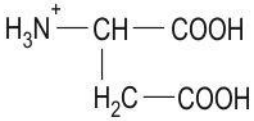
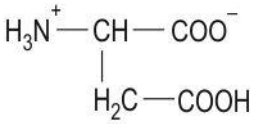
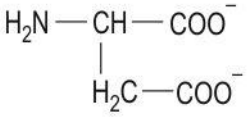
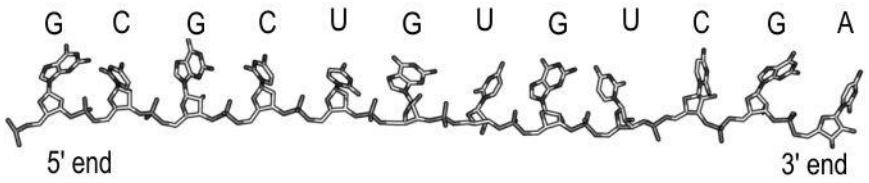
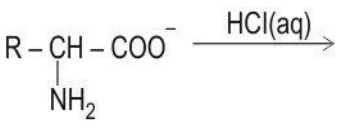
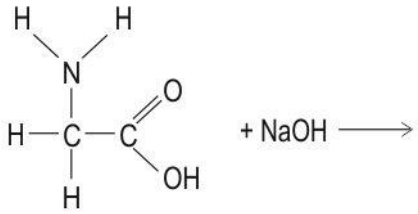
BIOMOLECULES

Q.No	Question	Marks
	Multiple Choice Question	
Q.203	Shown below is the chain structure of an unknown compound A.  Which of the following statements is true for compound A? A. Compound A is neutral. B. Compound A is basic in nature. C. Compound A is acidic in nature. D. Compound A is ammonium salt.	1
Q.204	Assertion (A): Vitamins A and K reduce excess body fat in humans. Reason (R): Vitamins A and K are fat soluble. Which of the following is correct? A. Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A). B. Both Assertion (A) and Reason (R) are the true but Reason (R) is not a correct explanation of Assertion (A). C. Assertion (A) is true and Reason (R) is false. D. Assertion (A) is false and Reason (R) is true.	1
Q.205	Assertion (A): Sucrose and Fructose can not give positive Tollen's test Reason (R): Sucrose and Fructose do not contain an aldehyde group.	1

	Which of the following is correct? A. Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A). B. Both Assertion (A) and Reason (R) are the true but Reason (R) is not a correct explanation of Assertion (A). C. Assertion (A) is false and Reason (R) is true. D. Assertion (A) is true and Reason (R) is false.	
Q.206	Which of the following statements is/are correct? (i) Amongst Lysine, Histidine and Serine, Lysine is the most basic in nature. (ii) All non-essential amino acids are basic in nature. (iii) Adding acids such as lemon juice into meat protein does not denature the primary structure yet tenderize meat. A. i only B. iii only C. i and iii only D. all- i, ii, and iii	1
Q.207	Given below are two statements labeled as Assertion (A) and Reason (R). Assertion (A): All amino acids are solid at 20°C. Reason (R): Amino acids can form zwitter ions. The ionic nature of the zwitter ions gives amino acids relatively strong intermolecular forces of attraction. Select the most appropriate answer from the options given below: A. Both A and R are true and R is the correct explanation of A. B. Both A and R are true but R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1
Q.208	Which is the structure of a zwitter ion of an amino acid?	1

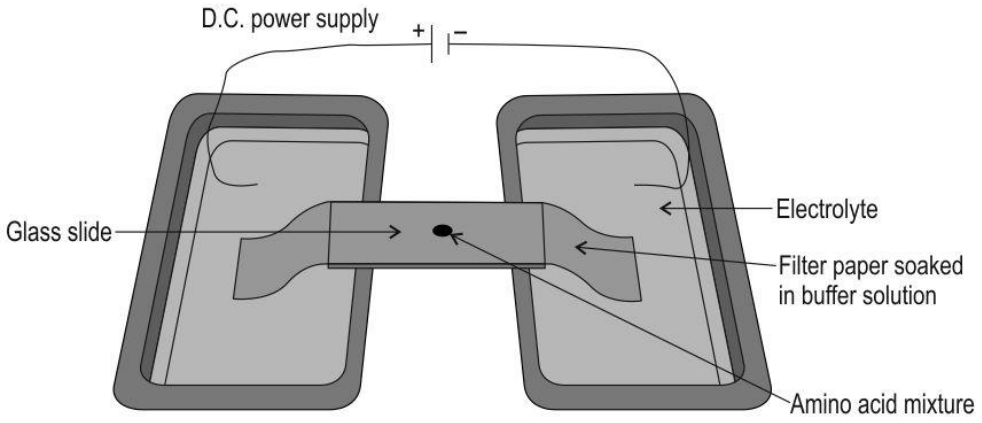
	A  **B**  **C**  **D**  A. A B. B C. C D. D	
Q.209	The structure of aspartic acid is shown in the image below.  Which of the following structures is the form of aspartic acid in solution at pH 12? **A**  **B**  **C**  **D**  A. A B. B	1

	C. C D. D	
Q.210	Which of the following statements is/are correct proteins or enzymes when they are subjected to physical changes as specified? (i) The sequence of amino acids in the peptide changes in a protein when the pH of its environment is changed. (ii) Most enzymes stop working above about 50°C. (iii) Albumen, a globular protein found in egg whites, sets into an insoluble white solid when the egg white is heated. A. iii only B. i and ii only C. ii and iii only D. all- i, ii, iii	1
Q.211	The following image shows the structure of DNA, with the letters indicating the bases present.  Which structure of DNA is represented above? A. Primary B. Secondary C. Tertiary D. Quarternary	1
Free Response Questions/Subjective Questions		
Q.212	Complete the following reactions. (i)  (ii)	2

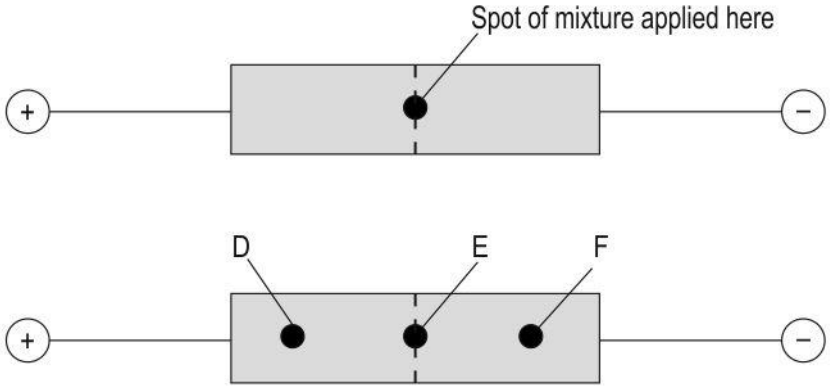


Q.213 Electrophoresis is used for DNA fingerprinting in forensic science. 3

The diagram below shows an electrophoresis apparatus used to separate different amino acids.



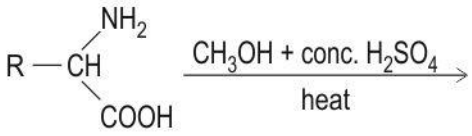
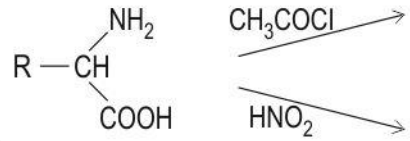
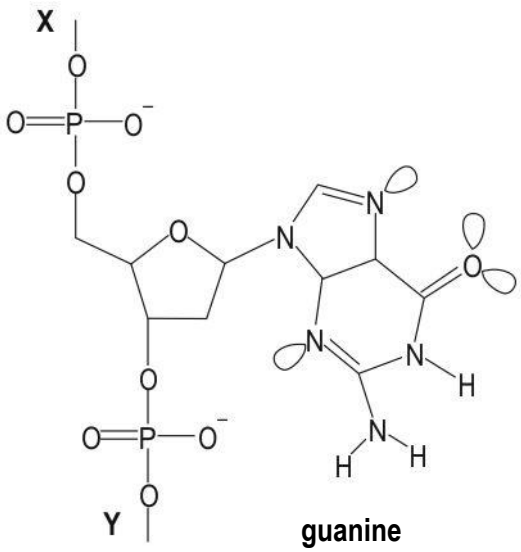
The mixture of the amino acids* consisted of glycine, lysine and glutamic acid at pH 7 (at which the amino acids are neither acidic nor alkaline). When an electric field is applied to this mixture and left for a certain period of time, the mixture separates as shown below.

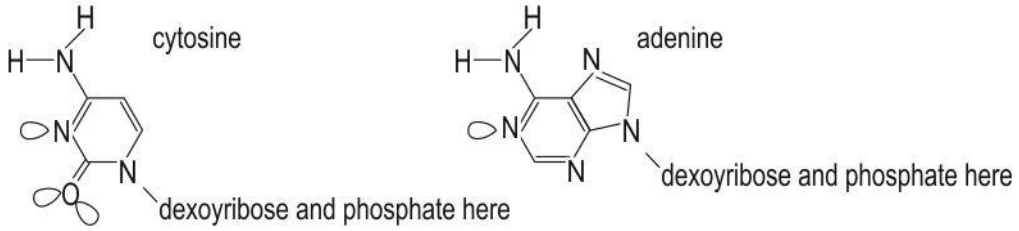
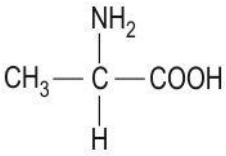
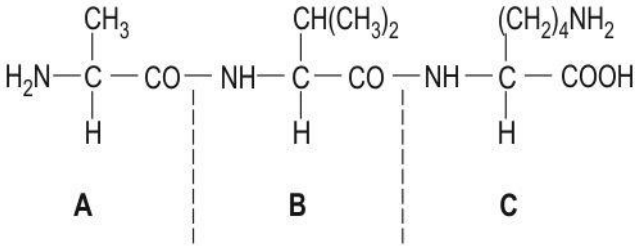
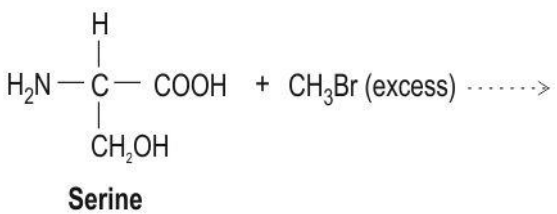


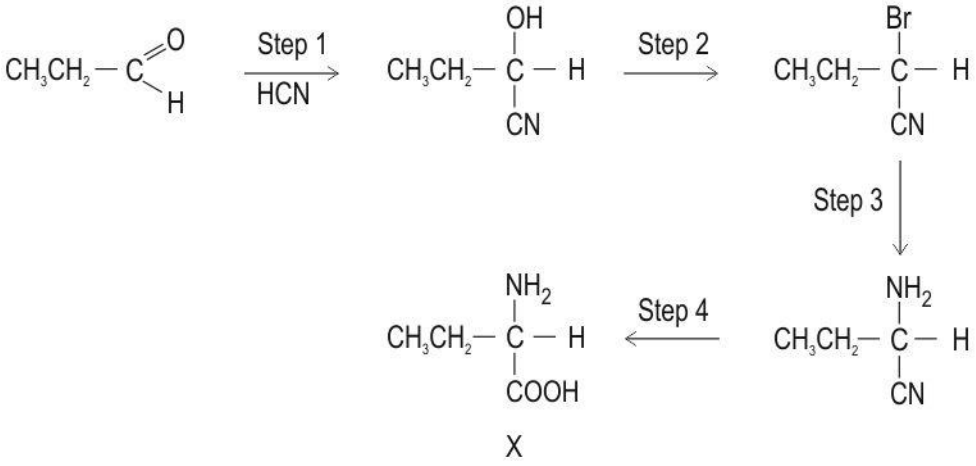
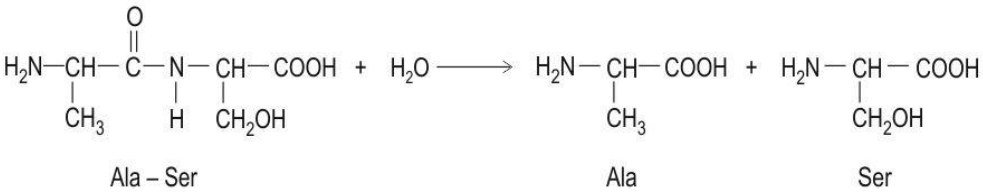
Identify the amino acids that would be found in spots labelled D, E and F. Give a reason to support your answer.

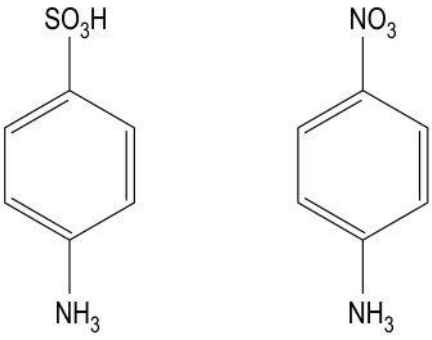
[Molecular formulae:

Glycine: H_2N- CH_2 - COOH

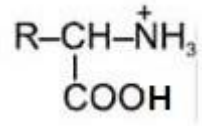
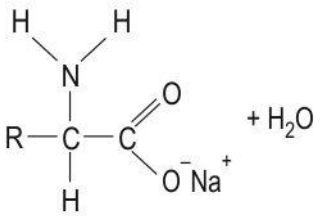
	Lysine: H_2N-$(CH_2)_4$ - $CH(NH_2)$ - COOH *Glutamic acid: HOOC-CH_2-CH_2 - $CH(NH_2)$ - COOH]*	
Q.214	The amino acid alanine, $CH_3CH(NH_2)COOH$, reacts with glycine, $H_2NCH_2CO_2H$. Show how this produces two dipeptides with different structures.	2
Q.215	How many possible sequences of tripeptides can be formed from the three amino acids Gly, Ala, and Ser, if each tripeptides contains all three amino acids? Also write down the name of all sequences of these tripeptides.	4
Q.216	Amino acids can act as buffers, stabilising the pH of a solution if excess acid or alkali is added. Show this with the help of reactions of acids with a acid (H^+) and a base (OH^-).	2
Q.217	Due to the formation of zwitter ions by amino acids, they show many of the typical reactions of amines and carboxylic acids like esterification, and acylation reactions. Based on this, complete the following reactions:  (i)  (ii)	3
Q.218	The image below shows a small part of single strand of DNA. The DNA continues bond at X and Y.  	4

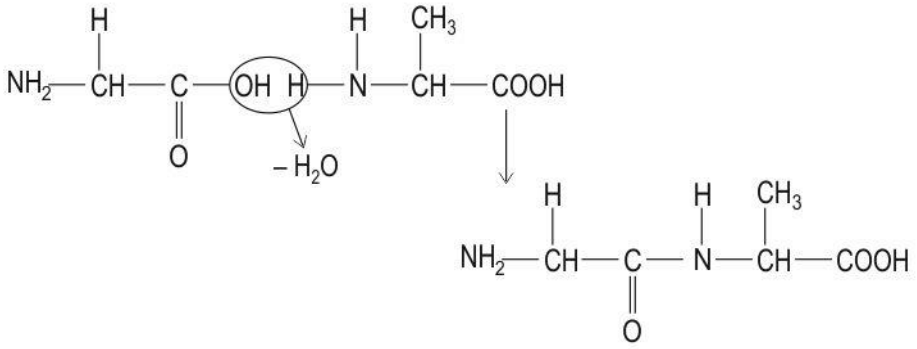
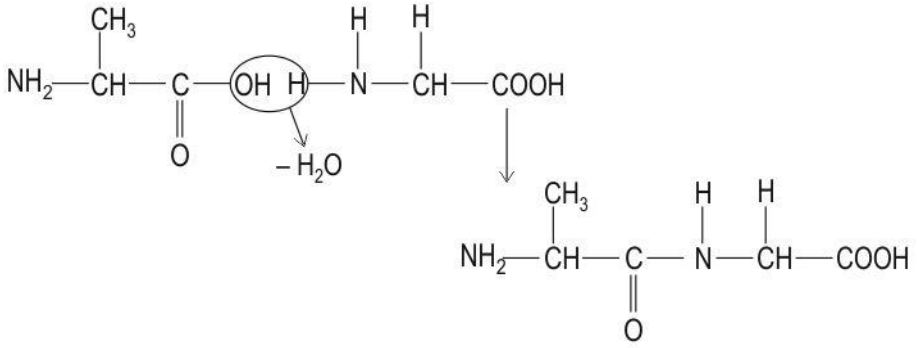
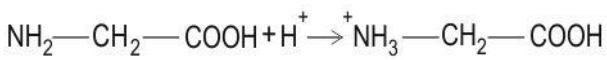
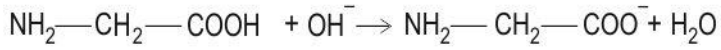
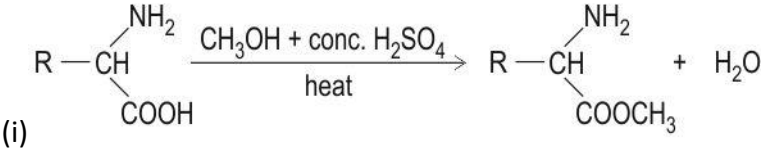
	The image below shows two other bases, cytosin and adenine which are also found in a DNA.  (i) Which of these two bases pairs with the guanine in first image when two seperate strands of DNA form a double helix? (ii) Explain how the base that you have selected in i, forms a base pair with guanine.	
Q.219	The structure of the amino acid alanine is shown below.  Draw the structure of the organic products formed when alanine reacts with: (i) CH_3OH in the presence of small amount of conc. H_2SO_4 (ii) Na_2CO_3	2
Q.220	Shown below is the tripeptide formed by three amino acids A, B, C.  (i) Is it possible to get the original amino acids from this structure? If yes, how? (ii) What will be the structure of the amino acid B in the aqueous solution?	2
Q.221	(i) Draw the structure of product, P in the below reaction.  Serine (ii) Draw the dipeptide formed by two molecules of serine.	2

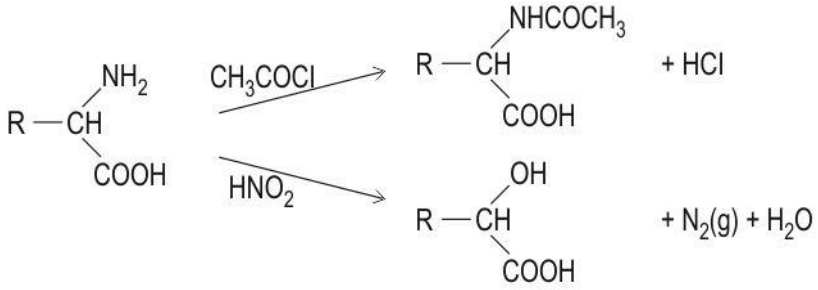
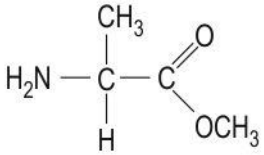
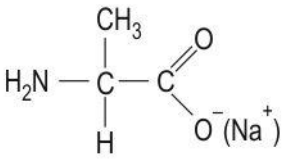
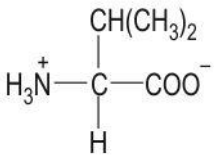
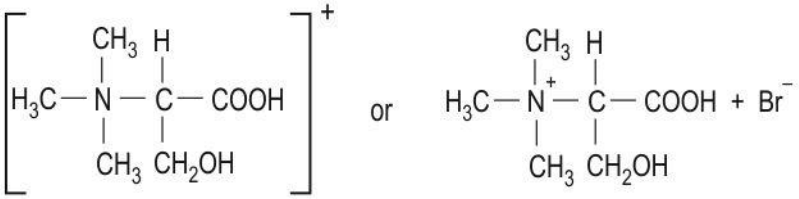
Q.222	The image shows the steps to synthesize an unknown amino acid X.  (i)Name the reagent used in step 3. What is the necessary condition for this reaction to take place? Name the mechanism. (ii) At room temperature, the amino acid X exists as a solid. Draw the structure of the solid amino acid. (iii) With reference to your answer to part (ii), explain why the melting point of the amino acid X is higher than the melting point of $CH_3CH_2CH(OH)COOH$	4
Q.223	Peptides can be hydrolysed into individual amino acids, for example:  (i) How many water molecules would be required to hydrolyse a peptide made from 'n' amino acid molecules? (ii) Write down the hydrolysis equation for Ala-Ser-Gly. ** Note the formula for Gly (Glycine) is $H_2N\text{-}CH_2\text{-}COOH$*	2
Q.224	Mr. Chatterjee was having pain in his joints. The shape of one his canines and some of his toes got deformed a bit. He visited the doctor. Along with the medications he was asked to take ample amounts of milk, and eggs. He was also asked to take cod liver oil capsules. The doctor asked Mr. Chatterjee to expose himself to sufficient sunlight every day. (a) What is the most probable disease that Mr. Chatterjee is suffering from?	4

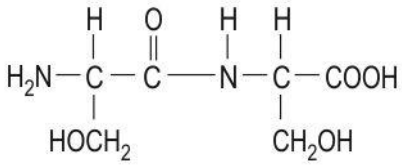
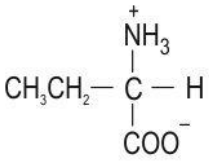
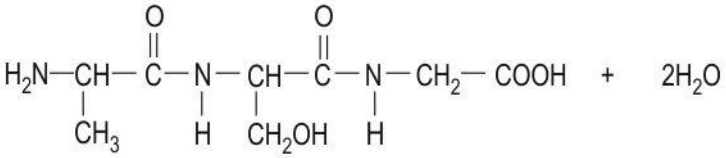
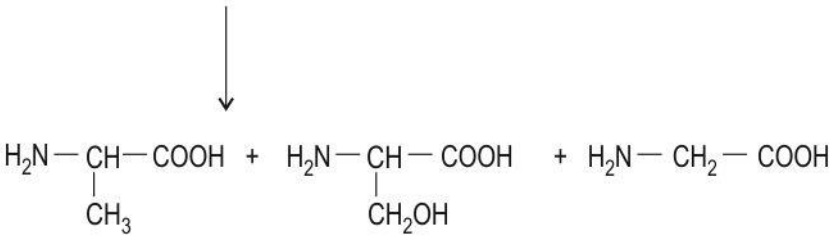
	(b) Mr. Chatterjee found one morning the milk had curdled. What could be a probable reason for his observation? Explain the observation. (c) How can exposure to sunlight help in improving the health condition of Mr. Chatterjee?	
Q.225	(a) Amongst the following amino acids, which is the most basic in nature? Why? **Amino acid** / **Side chain** Glycine / H Lysine / $H_2N-(CH_2)_4$ Serine / $HO - CH_2$ (b) How do acids such as lemon juice tenderise the meat while using it in a marinade?	3
Q.226	A zwitter ion is a dipolar ion in aqueous solution.  p-amino benzenesulphonic acid p-nitroanilic Of p-aminobenzene sulphonic acid and p-nitroaniline, which will give rise to a zwitter ion in aqueous solution? Explain why.	2

Answer Key and Marking Scheme

Q.No	Answers	Marks
Q.203	B. Compound A is basic in nature.	1
Q.204	D. Assertion (A) is false and Reason (R) is true.	1
Q.205	C. Assertion (A) is false and Reason (R) is true.	1
Q.206	B. iii only	1
Q.207	A. Both A and R are true and R is the correct explanation of A.	1
Q.208	D. D	1
Q.209	D. D	1
Q.210	C. ii and iii only	1
Q.211	A. Primary	1
Q.212	(i)  (ii) 	2
Q.213	- At pH 7, glutamic acid carries an extra negative charge and moves towards the positive electrode – it is responsible for spot D. - At pH 7, glycine carries one of each type of charge, so it is attracted equally to both electrodes and does not move – it is responsible for spot E. - At pH 7, lysine carries an extra positive charge, and hence moves towards the negative electrode – it is responsible for spot F.	3
Q.214	First way:	2

	 Second way: 	
Q.215	- Total number = 6 [1] - 6 sequences: Gly-Ala-Ser, Gly-Ser-Ala, Ala-Gly-Ser, Ala-Ser-Gly, Ser-Ala-Gly, Ser-Gly-Ala *(give 0.5 marks for each correct combination)*	4
Q.216	Reaction of amino acid with an acid:  Reaction of amino acid with a base: 	2
Q.217	(i) 	3

	 (ii)	
Q.218	(i) cytosin (ii) For hydrogen bonding to happen, cytosin's top N–H forms hydrogen bonds to lone pair on O of guanine [1] - The lone pair of electrons on N bonds to H–N of guanine [1] -A lone pair of electrons on O bonds to lower H–N of guanine [1] *[give marks if they show it by diagram instead of text]*	4
Q.219	 (i)  (ii)	2
Q.220	(i) yes, through hydrolysis reaction *don't give marks for hydration*  (ii)	2
Q.221	 (i)	2

	(ii) 	
Q.222	(i) - Reagent: ammonia or NH_3 [0.5] - Conditions: excess (ammonia) [0.5] *[ignore concentrated]* - Name of mechanism: Nucleophilic substitution [1] (ii)  (iii) Due to presence of ionic bonding in X	4
Q.223	(i) n-1 [1]   (ii)	2
Q.224	(a) Mr. Chatterjee is suffering from osteomalacia. *[Give 1 mark for the correct answer.]* (b) If the pH of milk is increased it curdles. The change in pH leads to breaking of the hydrogen bond and salt bridges in the protein molecules of milk. Thus the proteins in milk get denatured and the milk curdles. *[Give 1 mark for each correct answer. Students may write the answer in their own words.]*	4

	(c) Vitamin D helps in treating osteomalacia. It can be produced below the skin by irradiation of sterols with the UV rays present in sunlight. Thus, exposure to sunlight helps in improving the health condition *[Give 1 mark for each correct structure. Students may write the answer in their own words.]*	
Q.225	(a) Lysine - It has one more amine group which makes it basic. (b) Acidic ingredients in the marinade, like lemon juice, will tenderise meat by denaturing or unwinding the long protein in the meat by breaking apart the amino acids.	3
Q.226	- Out of p-aminobenzene sulphonic acid and p-nitroaniline, it is p-aminobenzene sulphonic acid which will give rise to a zwitter ion in aqueous solution. [1] - In aqueous solution the lone pair of electrons on the N-atom in amino group accepts a proton from sulphonic group and zwitter ion is formed. [1]	2