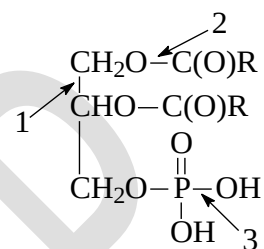


Unit V.

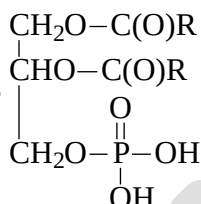
Online test (typical questions)

- State the number of double carbon-carbon bonds in the molecules of the following compounds:
 1) arachidonic acid 2) 1-palmitoyl-2,3-dilinolenoylglycerol
 3) trioleoylglycerol 4) tristearoylglycerol
- The molecule of 1-oleoyl-2-palmitoyl-stearoylglycerol contains the residues of:
 a) different fatty acids b) the same fatty acids c) glycerol d) sphingosine

- Identify the ester bond in the following molecule:



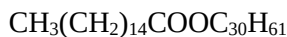
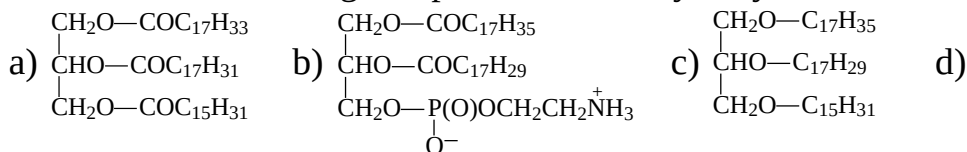
- The hydrolysis of



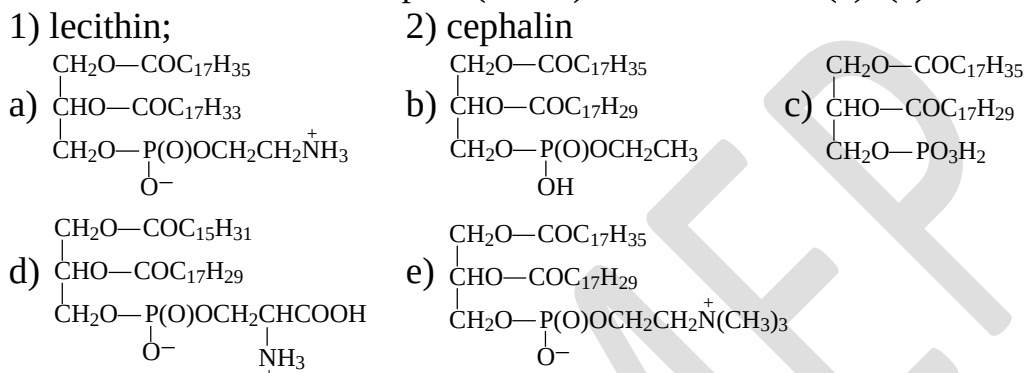
- aldehydes; b) carboxylic acids; c) glycerol; d) phosphoric acid.
- The hydrolysis of a lipid produced glycerol, 2-aminoethanol, palmitic, linoleic and phosphoric acids. State the type of the initial lipid:
 a) colaminecephaline; b) ceramide; c) cerebroside; d) glycerophospholipid.
 - Which compounds will decolourise bromine water?
 a) stearic acid b) palmitic acid c) oleodistearin d) arachidonic acid
 - Which statements are true?
 a) triacylglycerols derived from animal tissues are usually liquid compounds
 b) the molecule of a phosphatidylserine contains the residue of an amino acid
 c) soaps are sodium or potassium salts of fatty acids
 d) the hydrolysis of complex lipids produces only fatty acids and alcohols
 - Match the names of fatty acids (1–5) with their compositions (a–f):
 1) palmitic; 2) linoleic; 3) linolenic; 4) oleic; 5) arachidonic.
 a) 20:4 5,8,11,14; b) 18:1 9; c) 18:0; d) 18:2 9,12; e) 16:0; f) 18:3 9,12,15.
 - Match the types of acid (1–3) with their names (a–d):
 1) ω -3; 2) ω -6; 3) ω -9.
 a) palmitic; b) linoleic; c) linolenic; d) oleic.
 - Match the structural formulae (1 or 2) with the names of lipids (a–e):
 1) $\begin{array}{l} \text{CH}_2\text{O}-\text{C}(\text{O})\text{C}_{17}\text{H}_{33} \\ | \\ \text{CHO}-\text{C}(\text{O})\text{C}_{17}\text{H}_{31} \\ | \\ \text{CH}_2\text{O}-\text{C}(\text{O})\text{C}_{15}\text{H}_{31} \end{array}$ 2) $\begin{array}{l} \text{CH}_2\text{O}-\text{C}(\text{O})\text{C}_{17}\text{H}_{35} \\ | \\ \text{CHO}-\text{C}(\text{O})\text{C}_{17}\text{H}_{29} \\ | \\ \text{CH}_2\text{O}-\text{C}(\text{O})\text{C}_{15}\text{H}_{31} \end{array}$
 a) 2-linolenoyl-1-oleoyl-3-palmitoylglycerol
 b) 2-linolenoyl-3-palmitoyl-1-stearoylglycerol

- c) 2-linolenoyl-3-oleoyl-1-stearoylglycerol
 d) 2-linoleoyl-1-oleoyl-3-palmitoylglycerol
 e) 1-linolenoyl-2-linoleoyl-3-palmitoylglycerol

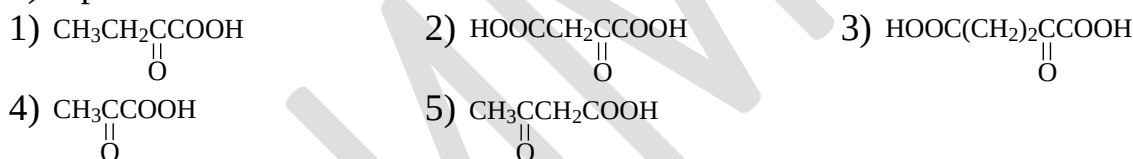
11. Which of the following compounds can be hydrolysed under basic conditions?



12. Match the class name of lipids (1 or 2) with structures (a)–(e):



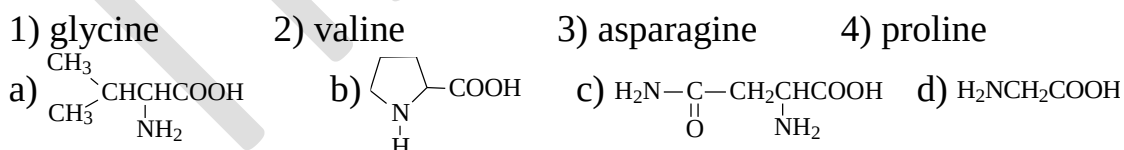
13. Which acid is the product of the transamination reaction for: a) alanine; b) aspartic acid?



14. Select all correct statements about the structure and properties of a peptide bond:

- 1) the hybridisation state of C, O and N atoms is sp^2 ;
 2) the peptide bond can be hydrolyzed by both acids and bases;
 3) the C=O bonds in peptides are longer than those in amino acids;
 4) the peptide fragment is a three-centre p, π -conjugated system;
 5) the peptide fragment is planar.

15. Match the names of amino acids with their formulae:



16. For glycine $pI = 6.0$. In which forms does it exist at $pH = 4.3$?

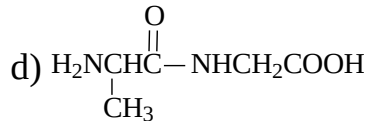
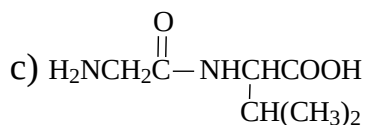
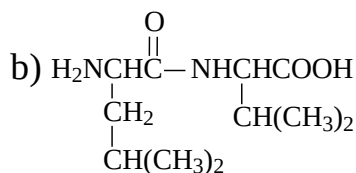
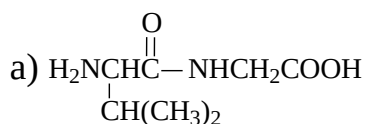
- a) cationic and dipolar forms b) anionic and dipolar forms
 c) cationic and anionic forms d) dipolar form only

17. Choose the pH range for a buffer system of glycine ($pK_{a1} = 2.34$, $pK_{a2} = 9.60$) consisting of the cationic and dipolar forms:

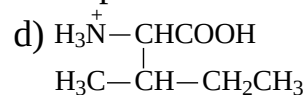
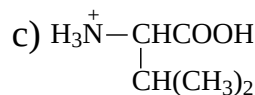
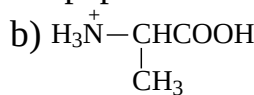
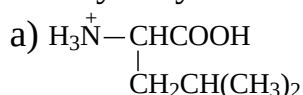
- a) 1.34–3.34 b) 2.34–4.34 c) 7.60–9.60 d) 2.34–9.60

18. Match the names of peptides with their formulae:

- 1) glycylvaline; 2) alanylglycyl; 3) valylglycyl; 4) leucylvaline.



19. The hydrolysis of the dipeptide Leu-Val under acidic conditions produces:



20. Which of the following is the product of decarboxylation for leucine?

a) *tert*-butylamine

b) isopentylamine

c) 3-methylpentanoic acid

d) 2-methylbutanoic acid

21. Which of the following is the product of oxidative deamination for alanine?

a) lactic acid

b) pyruvic acid

c) malic acid

d) ethylamine

22. The reaction of isoleucine with 2-propanol in the presence of hydrogen chloride taken in excess gives:

a) isoleucine isopropyl ester hydrochloride

b) isoleucine isopropyl ester

c) isopropyl ester of 2-aminohexanoic acid

d) isoleucine hydrochloride

23. If the isoelectric point of a protein is less than 7, it consists of:

a) approximately equal numbers of acidic and basic amino acid residues

b) mainly acidic amino acid residues

c) mainly basic amino acid residues;

d) mainly aromatic amino acid residues

24. In a protein the covalent bonds can be formed between the side chains of:

a) Trp and Met

b) Met and Met

c) Cys and Cys

d) Tyr and Cys

25. Arrange the dipeptides in increasing order of the pI:

a) Asp-Glu

b) Met-Asp

c) Ser-Thr

d) Arg-Ala

26. For the following peptides A (Phe-His-Thr-Gly) and B (Ser-Asp-Glu-Thr) choose the correct statement(s)

a) $pI(B) < pI(A)$

b) peptide A is more soluble in water than peptide B

c) $pI(B) > pI(A)$

d) $pI(A) > 7$

27. Assuming that all ionogenic groups in the side chains are charged, write down the value and the sign of charge of the predominant form of Arg-Pro-Lys-Ser-Thr at pH=7

28. Acid-base properties of proteins are mainly determined by:

a) -COOH and -NH₂ groups

b) -SO₃H and -NH₂ groups

c) -COOH and -OH groups

d) -SO₃H and -SH groups

29. Choose the correct and incorrect statements

a) The secondary structure of a protein is stabilized by hydrogen bonds between amino acid side chains.

- b) Nucleoproteins, hemoproteins and lipoproteins are complex proteins
- c) Protein charge decreases with decreasing pH
- d) The most common types of secondary structures are α -helix and β -pleated structure

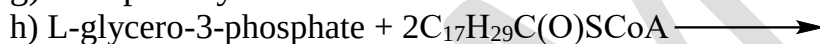
30. Choose the correct and incorrect statements

- a) Enzymes that contain a coenzyme part are complex proteins
- b) The secondary structure of a protein is stabilized **only** by hydrogen bonds between amino acid side chains
- c) Hair α -keratin is classified as a fibrillar protein
- d) All proteins have several polypeptide chains in a molecule

Paper test (typical questions)

I. ($8 \times 1 = 6$ points, 2 points – names of the products)

a) Complete the following equations:



b) Write systematic and/or class names for the products.

II (5 points)

a) Hydrolysis of a lipid produces glycerol, palmitoleic, stearic and linolenic acids. What group of lipids does this compound belong to? Draw the formula of this lipid and the double bond configuration for linolenic acid.

b) Draw the reaction of hydrolysis for this lipid in acidic medium. Indicate and name the bonds that break during the hydrolysis.

III. (5 points)

a) Draw the structural formula for the tripeptide Gln-Lys-Ala. Indicate peptide bonds, C-terminal and N-terminal. Estimate the pH value of the isoelectric point ($\text{pI} > 7$, $\text{pI} < 7$, $\text{pI} \approx 7$) for this peptide. Explain your answer.

b) Write the hydrolysis reaction for this peptide in KOH solution.