Tentative exam questions on Food Biochemistry -2022

**Lecture 1: Chemical composition of the proteins. Properties of α- amino carboxylic acids.**

Outline general characteristics of amino acids. Write the common amino acid structure.

Classification of amino acids.

Stereochemistry of α – amino carboxylic acids.

Amino acid dissociation in water

Amphoteric properties of amino acids

What is isoelectric point of an amino acid

Buffering capacity of amino acids

Interaction with formaldehyde. Application. Write the reaction.

Interaction with ninhydrin. Application.

Interaction with alcohols. Write the reaction.

**Lecture 2: Protein structure: primary, secondary, tertiary and quaternary structure**

Describe the formation of a polypeptide chain.

Peptide bond formation. Write a reaction as an example.

Major characteristics of a peptide bond.

Disulfide bond formation. Characteristics.

Hydrogen bond formation

Ion bond formation. pH influence.

Hydrophobic interactions

Primary structure of proteins

Define protein secondary structure and its element.

Alpha-helix as an element of protein secondary structure

Beta (β) –pleated sheet as an element of protein secondary structure

β – turns as elements of protein secondary structure

Define protein tertiary structure. Describe participating bonds.

Major characteristics of globular proteins: give an example

Major characteristics of fibrous proteins: give an example

Compare globular and fibrous proteins

Define and characterize quaternary structure of proteins: give an example

**Lecture 3: Physical and chemical properties of proteins. Denaturation.**

Protein molecular size

Protein charge: influence of pH on protein charge

UV absorption of proteins

Influence of pH on protein solubility

Influence of salt on protein solubility

Influence of salt concentration on protein solubility

Define protein denaturation. Describe the denatured state of a protein molecule

Describe the role of heat as a denaturing agent

Hydrostatic pressure and UV radiation as denaturing agents

Explain the influence of acids and alkalis (pH) on proteins as denaturing agents

Explain the influence of organic solvents on proteins as denaturing agents

Explain the influence of the salts of heavy metals on proteins as denaturing agents

Explain the influence of chaotropic compounds on proteins as denaturing agents: give an example

Explain the influence of reducing agents on proteins as denaturing agents.

How can you explain increased digestibility of denatured proteins

Explain how protein solubility can be altered after denaturation

Define protein hydrolysis. Purpose (consequences) of the protein hydrolysis in food industry

Influence of alkaline conditions during food processing on protein reactivity: Lysinoalanine formation-give a reaction

Influence of alkaline conditions during food processing on protein reactivity: Lanthionine formation-give a reaction

Influence of alkaline conditions during food processing on protein reactivity: amino acid isomerization

**Lecture 4: Functional properties of proteins**

Define protein functional properties: give an example

Define water-holding ability; importance for food industry

Factors influencing water binding capacity of proteins: Protein type, concentration and denaturation

Influence of salt concentration on water binding capacity of food proteins.

Influence of pH on water binding capacity of food proteins.

Define gelation as a functional property of proteins

Thermally reversible and irreversible gels

Influence of pH on protein gel properties

What is emulsion? Define emulsification capacity and stability

Why can proteins serve as emulsifying agents? Any important protein features?

Utilization of proteins for foam stabilization

How are foams generated? Foam capacity and foam stability.

Protein modification to alter their functional properties: removal or replacement of positive charge of lysine; write reactions

Explain the role of protein hydrolysis in modification of protein functional properties.

Explain the utilization of peptidyl-glutaminase in modification of protein functional properties. Write a reaction.

**Lecture 5: Food proteins. Nutritive function of proteins. Quality evaluation.**

Explain the role of food proteins as food macro-components. Why do we need to consume proteins?

Amino acid composition as a determinant of protein quality: essential-, non-essential-, and conditionally essential amino acids

Complete proteins.

Incomplete proteins

Complementary proteins

What is amino acid score and how it is calculated

What is limiting amino acid; give an example

Drawbacks of amino acid score based approach for quality protein evaluation

What is protein digestibility? How can it be determined *in vivo*?

Outline indigenous anti-nutritional factors that influence protein digestibility.

Outline anti-nutritional factors formed during heat/alkaline processing of protein containing food that influence protein digestibility.

Protein efficiency ratio: definition and calculation

Describe a microorganism (including major characteristics) that can be used to assay bioavailable amino acids.

Describe the advantages of microbial assays for evaluation of food protein quality.

**Lecture 6: Plant proteins: proteins of cereals and legumes**

What are cereals: examples, importance?

Protein content and amino acid profile of cereal proteins

Major features of wheat albumin and globulin fractions

Characteristics and classification of wheat gliadins

Characteristics of wheat glutenins

What is gluten, how is gluten formed

Explain the role of HMW glutenin fraction in gluten formation and quality

Why is barley not appropriate for bread making?

General characteristics of leguminous proteins

Explain why phytic acid is considered an anti-nutrient compound in soybean seeds

Explain Kunitz type protease inhibitor activity and action

Explain Bowman-Birk type protease inhibitor activity and action

Who do soybean protease inhibitor activities influence protease digestibility: consequences

**Lecture 7: Proteins with animal origin: proteins of milk, meat and eggs.**

Describe milk protein composition/fractions

Casein structure: α-casein, β-casein, characteristics

Casein structure: κ-casein, characteristics

Describe the structure of casein micelle

Describe the application of HCl for casein micelle aggregation.

What is renin (chymosin)? Explain renin utilization for formation of casein curds

How is sodium caseinate produced?

Properties and application of sodium caseinate

General characteristics of whey proteins

Whey proteins: β-lactoglobulin

Whey proteins: α-lactalbumin

Digestibility of milk protein

Meat proteins: major characteristics of myosin and actin

Connective tissue proteins: major characteristics of collagen – amino acid composition, structure, nutritive value

Myoglobin-function, color alteration depending on Fe reductive/oxidative stage

Explain the application of nitrates and nitrites in cured meat product manufacturing

Major characteristics of ovalbumin, ovotransferrin and lysozyme

**Lecture 11: Biochemical alteration of food during postharvest and storage.**

Why are indigenous milk enzymes technologically significant?

Explain plasmin activity in milk and its significance

Explain lipase activity in raw milk and its importance for dairy industry. Lipolysis

Acid phosphomonoesterase and its technological significance

Lactoperoxidase activity and its bactericidal effect in milk

Proteolytic enzymes in meat: endoproteases and exopeptidases

Propose an approach to control of ethylene production in climacteric fruit during storage. Explain your choice.

Enzymes involved in cellulose/ starch/ pectin degradation of fruit and vegetables during storage

Polyphenol oxidase activity. Write a reaction

Control over polyphenol oxidase activity

**Lecture 12: Enzymes in food processing.**

Why are enzymes used in food processing? Advantages.

Possible non-desired effects of exogenously added enzymes in food processing

Sources for industrial production of enzymes for food industry

Advantages of microorganisms as a source for enzyme production

Use of glucose oxidase / proteases/ asparaginase in baked goods manufacturing

Enzymes in starch modification: liquefaction

Enzymes in starch modification: Saccharification

Production of maltose /glucose / fructose syrups

Enzymes in dairy products: Genetic technology for chymosin production

Application of lactase / lipases in dairy industry. Write reactions.

Use of lysozyme and nisin in dairy industry

Meat and seafood products manufacturing: use of proteases

Meat and seafood products manufacturing: use of transglutaminase, reaction, health implications