FAQs

1) Functional properties of food proteins.

Ans: Functionality of food proteins are defined as those physical and chemical properties which affect the behavior of proteins in food systems during processing, storage, preparation and consumption". The functional properties of proteins include emulsification, foaming, film forming, gelatinization, fat & flavor binding, thickening and adhesivenature.

2) Factors affecting functional properties of food proteins.

Ans: Proteins are the macromolecules which play a fundamental role not only in sustaining life, but also impartthe structural basis for various functional properties of foods.The physical and chemical properties that govern protein functionality include size, shape, amino acid composition and sequence, net charge and distribution of charges,hydrophobicity/hydrophilicity ratio, secondary, tertiary, and quaternary structures, molecular flexibility/rigidity and ability to interact/react with other components.

3) Role of proteins in sensory attributes of food.

Ans: Sensory attributes such as texture, flavor, color, and appearance are the net effect of complex interactions among various minor and major components of the food.Proteins generally have a great influence on the sensory attributes of foods. For example:

- The sensory properties of bakery products are related to the viscoelastic and dough-forming properties of wheat gluten.
- The textural and succulence characteristics of meat products are largely dependent on muscle proteins (actin, myosin, and several water-soluble meat proteins).
- The textural and curd-forming properties of dairy products are due to the unique colloidal structure of casein micelles; and
- The structure of cakes and the whipping properties of dessert products depend on the properties of egg-white proteins.

4) Explain briefly the various functional properties of proteins along with their functional role in foods.

Function	**Mechanism**	**Food**	**Protein type**
Solubility	Hydrophilicity	beverages	Whey proteins
Viscosity	Water binding , hydrodynamic size and shape	Soups, gravies, and salad dressings, desserts	Gelatin
Water binding	Hydrogen bonding, ionic Hydration	Meat sausages, cakes, and breads	Muscle proteins, egg Proteins
Gelation	Water entrapment and	Meats, gels, cakes,	Muscle proteins, egg

	immobilization, network formation	bakeries, cheese	and milk proteins
Emulsification	Adsorption and film formation at interfaces	Sausages, soup, cakes, dressing s	Muscle proteins, egg proteins, milk proteins
Foaming	Interfacial adsorption and film Formation	Whipped toppings, ice cream, cakes, desserts	Egg proteins, milk Proteins
Fat and flavor binding	Hydrophobic bonding, Entrapment	Low-fat bakery products, doughnuts	Milk proteins, egg proteins, cereal proteins

5) Write a note on solubility of proteins.

Ans: Proteins are soluble only in strong polar solvents such as water, glycerol, formamide, dimethylformamide or formic acid. In less polar solvent such as ethanol, proteins are rarely soluble (e.g,prolamines). Protein solubility is variable and is influenced by the number of polar and apolar groups and their arrangement along the molecule. The major interactions that influence the solubility characteristics of proteins are hydrophobic and ionic in nature. Hydrophobic interactions promote protein-protein interactions and result in decreased solubility, whereas ionic interactions promote protein-water interactions and result in increased solubility.

6) Give the classification of proteins based on the solubility.

Ans:Proteins are classified into four classes depending on their solubilty, they are as follows:

1) ***Albumins***are those that are soluble in water at pH 6.6(e.g., serum albumin, ovalbumin, and α-lactalbumin)
2) ***Globulins***are those that are soluble in dilute salt solutions at pH 7.0(e.g., glycinin, phaseolin, and β-lactoglobulin)
3) ***Glutelins***are those that are soluble only in acid (pH 2) and alkaline (pH 12)solutions (e.g., wheat glutelins) and
*4)****Prolamines***are those soluble in 70% ethanol (e.g., zein and gliadins).

7) Give short notes on protein hydration.

Ans: Water is an essential constituent of foods. Water molecules bind to several groups in proteins. These include charged groups, backbone peptide groups, amide groups, and nonpolar residues.Many functional properties of proteins, such as dispersibility, wettability, swelling, solubility, thickening/viscosity, water-holding capacity, gelation, coagulation, emulsification, and foaming depend on water-protein interactions.The hydration capacity of a protein is related to its amino acid composition - greater the number of charged residues, greater is the hydration capacity. Several environmental factors, such as pH, ionic strength, type of salts, temperature,

and protein conformation, influence the water binding capacity of proteins. Proteins exhibit the least hydration at their isoelectric pH, where enhanced protein-protein interactions result in minimal interaction with water.

8) Application of emulsification of proteins in food industries.

Ans: The emulsifying properties of food proteins are evaluated by several methods such as size distribution of oil droplets formed, emulsifying activity, emulsion capacity, and emulsion stability. Several natural and processed foods, such as milk, egg yolk, coconut milk, soy milk, butter, margarine, mayonnaise, spreads, salad dressings, frozen desserts, frankfurter, sausage, and cakes, are emulsion-type products where proteins play an important role as an emulsifier. In natural milk, the fat globules are stabilized by a membrane composed of lipoproteins. When milk is homogenized, the lipoprotein membrane is replaced by a protein film comprised of casein micelles and whey proteins. Homogenized milk is more stable against creaming than is natural milk because the casein micelle-whey protein film is stronger than the natural lipoprotein membrane.

9) Protein denaturation.

Ans: Denaturation is a phenomenon that involves transformation of a well-defined, folded structure of a protein, formed under physiological conditions, to an unfolded state under non-physiological conditions. Many biologically active proteins lose their activity upon denaturation. In the case of food proteins, denaturation usually causes insolublization and loss of some functional properties.The native structure of a protein is the net result of various attractive and repulsive interactions emanating from various intra molecular forces as well as interaction of various protein groups with surrounding solvent water.Partially denatured proteins are more digestible and have better foaming and emulsifying properties than native proteins. Thermal denaturation is also a prerequisite for heat-induced gelation of food proteins.

10) Explain the amphoteric behavior of proteins.

Ans: Proteins are amphoteric polyelectrolytes, i.e. they possess both acidic and basic properties. The acid-basic properties of amino acids are primary due to occurrence of α-amino and α-carboxyl groups (i.e. acid-base pairs) in them. The ability of a chemical to behave both as an acid or base is called amphoterism& the substance is called amphoteric substance. These substances act as acids in presence of base & vice versa. The amphoterism of proteins is due to the acid-base groups of side-chain radicals of protein-constituting amino acids.

11) Sedimentation of proteins.

Ans: Sedimentation is the tendency for particles in suspension to settle out of the fluid in which they are entrapped and come to rest against a barrier. This is due to their motion through the fluid in response to the forces acting on them. These forces can be due to gravity, centrifugal acceleration, or electromagnetism. Protein mixtures are subjected to a series of separations, each based on a different

property to yield a pure protein. Sedimentation of proteins is carried out to separate them or purify them. Several thousand proteins have been purified in active form on the basis of *solubility, size, charge,*& *specific binding affinity*. A variety of separation techniques are used to purify proteins which include salting out, dialysis, gel filtration chromatography, ion exchange chromatography, affinity chromatography, high pressure liquid chromatography, gel electrophoresis, etc.

12) Define foaming properties with respect to proteins.

Ans: The foaming property of a protein refers to its ability to form a thin tenacious film at gas-liquid interfaces so that large quantities of gas bubbles can be incorporated and stabilized. Foaming properties of proteins are evaluated by***foaming capacity & foaming stability.*** Foaming capacity or foam ability of proteins refers to the amount of interfacial area that can be created by the protein. It can be expressed in several ways, such as or *foaming power* (or foam expansion) or*overrun* (or steady-state foam value).

$$FP = \frac{\text{volume of gas incorporated}}{\text{volume of liquid}} \times 100$$

13) Write a note on the functional role of foaming properties of proteins.

Ans: Foams are dispersions of gases in liquids. Proteins stabilize by forming flexible, cohesive films around the gas bubbles. Protein-stabilized foams are formed by bubbling, whipping, or shaking a protein solution. In several processed foods, proteins function as foam forming and foam-stabilizing components, for example in baked goods, sweets, desserts, whipped cream, ice cream, cakes, meringue, bread, soufflés, mousses, and marshmallow. The uniquetextural properties and mouth feel of these products stem from the dispersed tiny air bubbles.

14) What are the factors that affect the formation of stabilized proteins?

Ans: The properties of protein-stabilized emulsions are affected by several factors. These include intrinsic factors & extrinsic factors.

Intrinsic factors: These include pH, ionic strength, temperature, presence of low-molecular-weight surfactants, sugars, oil-phase volume, type of protein, and the melting point of the oil used.

Extrinsic factors: These include type of equipment, rate of energy input, and rate of shear.

15) Give a short note on flavor binding properties of proteins.

Ans: Proteins themselves are odorless. However, they can bind flavor compounds, and thus affect the sensory properties of foods. Proteins can hold together a combination of ingredients.

When heated, proteins coagulate so that the product is unbroken (ex: cakes, burgers). The flavor-binding property of proteins also has desirable aspects, because they can be used as flavor carriers or flavor modifiers in fabricated foods. This is particularly useful in meat analogues containing plant proteins, where successful simulation of a meat-like flavor is essential for consumer acceptance. In order for a protein to function as a good flavor carrier, it should bind flavors tightly, retain them during processing, and release them during mastication of food in the mouth. However, proteins do not bind all flavor compounds with equal affinity. This leads to uneven and disproportionate retention of some flavors and undesirable losses during processing.