FAQ'S:

Q.1. Why are eggs considered as a nutrient dense food?

Ans. A hen's egg is a specialized structure containing sufficient nutrients for the development of the embryo into a young chick. Eggs have an excellent nutritive value. They contain 12-14% proteins, which are well balanced with respect to all the essential amino acids. The lipids of egg constitute 10-12% and they are composed of a high percentage of unsaturated fatty acids. Minerals are present to the extent of 1%. Eggs are also excellent source of vitamins like vitamin A, vitamin D, with the exception of vitamin C. The yolk of an egg contains about 250mg cholesterol, a fact which makes it necessary for some people on special diets to restrict their intake of eggs. Thus, with its rich protein, lipid, mineral and vitamin content and good storage qualities, eggs are more useful as food than even milk.

Q.2. What are the various structures present in the egg?

Ans.The avian egg is a complex and highly differentiated reproductive cell. An egg consists of shell, membrane, white or albumen, and yolk, and its structure can be seen with the naked eye or a lens. These are discussed as under.

(i). Shell. The egg is surrounded by a 0.2– 0.4 mm thick calcareous and porous shell. It contributes about 11% weight of the whole egg. It is composed of 94% calcium carbonate, 1% calcium phosphate, 1% magnesium carbonate and 4% organic matrix mainly protein.

(ii). Egg membranes. The inside of the shell is lined with two closely adhering membranes (48 and 22 µm, respectively). These are made up of an interwoven network of protein polysaccharide fibers. One of the membranes is attached to the shell while the other is not and moves with the egg contents during separation. The air cell is formed at the broader end of the shell as the egg membranes separate from

each other due to shrinking of egg contents.

(iii). Albumen (Egg White). Albumen is an aqueous solution (10%) of different proteins. Besides proteins other components are present in low amounts. It consists of four concentric layers.

Thick chalaziferous layer (3% of white).

Inner thin layer of albumen (17% of white).

Thick layer of albumen (57% of white).

Outer thin layer of albumen (23% of white)..

(iv). Yolk. The yolk consists of alternate layers of dark- and light-colored material arranged concentrically. The colour of yolk varies depending on the feeding schedule and pigments in the feed of hen. The center of yolk is latebra. Germinal disc or blastoderm is present on the surface of yolk on the lateba neck. The yolk is enclosed by a semipermeable membrane known as vitelline membrane. It is about 0.025 mm thick and is colorless.

Q.3. What is the composition of an egg?

Ans. An average hen egg weighs about 57 g, which includes the weight of the white, yolk and shell. Each component differs in composition, as shown in table below.

Component	%	Water	Protein	Fat	Ash
Whole egg	100	65.5	11.8	11.0	11.7
Egg white	58	88.0	11.0	0.2	0.8
Egg yolk	31	48.0	17.5	32.5	2.0
Shell	11	3.3		95.1	

Q.4. Write a short note on shell of an egg?

Ans. The egg is surrounded by a 0.2– 0.4 mm thick calcareous and porous shell. It contributes about 11% weight of the whole egg. It is composed of 94% calcium carbonate, 1% calcium phosphate, 1% magnesium carbonate and 4% organic matrix mainly protein. It is composed of four layers namely cuticle, spongy layer, mammillary layer and outer shell membrane. Cuticle or bloom is a thin (10 μm) outermost layer consisting mainly of mucilaginous protein layer. The cuticle blocks the pores and protects the egg against outside contamination entering the egg. Mammillary layer is the innermost layer of shell adjusant to outer shell membrane. It is composed of numerous roughly conical knobs or mammille, which are oval to circular in cross section. The mammille are arranged in such a way that it creates spaces/ or pores within the shell. There are numerous small apertures in the outer surface of the shell, leading to the pore canals, which penetrate to the inner surface. The concentration of pores is usually higher on the broader end where air cell is located than at the pointed end of the shell. The pores allow the oxygen necessary for respiration to diffuse in, and carbon dioxide and other waste gases to diffuse out through the shell during incubation.

Q.5. Write a note on ovalbumin as the main albumin protein?

Ans. Ovalbumin is the main albumen protein. It is a glycophosphoprotein with 3.2% carbohydrates and 0–2 moles of serine-bound phosphoric acid per mole of protein. Ovalbumin consists of a peptide chain with 385 amino acid residues. It has a molecular weight Mr = 42,699 and contains four thiol and one disulfide group. Ovalbumin is relatively readily denatured, for example, by shaking or whipping its aqueous solution. This is an interphase denaturation which occurs through unfolding and aggregation of protein molecules.

Q.6. Give a brief description about antimicrobial defence of egg.

Ans. Egg has natural antimicrobial defence against microorganisms

which helps in its preservation. Some of the defences are.

(i) Lysozyme consists of a peptide chain with 129 amino acid residues and four disulfide bonds.This protein is an N-acetylmuramidase enzyme that hydrolyzes the cell walls (murein) of Gram-positive bacteria.

(ii). This protein like ovomucoid is a proteinase inhibitor. It inhibits the activities of trypsin, chymotrypsin and some proteinases of microbial origin and acts as a defence against microbial invasion.

(iii) Avidin is a basic glycoprotein and is a tetramer consisting of four identical subunits, each of which binds one mole of biotin. the avidin□biotin complex is stable upto 100 °C. This makes biotin unavailable for microbial growth.

Q.7. Why is there need to preserve the quality of eggs?

Ans. This protein is an N-acetylmuramidase enzyme that hydrolyzes the cell walls (murein) of Gram-positive bacteria. Since a freshly laid egg is assumed to have maximum quality. As soon as the egg is laid, the deteriorative changes start taking place which pose a danger to the sensory attributes. These changes are.

Egg white (Albumin) becomes less viscous and spreads rapidly.

The size of air cell increases.

Water passes from the white to the yolk thus increasing the volume and water content of yolk resulting in breaking of vitelline and producing off odors.

Loss of water which results in the decrease in the weight of egg, increase in air cell and thus decrease in specific gravity of egg.

Loss of carbon dioxide.

Changes in pH 7.6-9.7 in egg white i.e., increase in pH

Microbial contamination may occur most commonly by Salmonella spp.

Q.8. Discuss thermo-stabilization as a method of preservation of egg quality?

Ans. It is a different treatment which involves immersion of eggs in hot water or oil for a sufficient time to kill the embryo in the fertile eggs & to stabilize the thick albumin in a way that a thin layer of albumin is made to coagulate in egg thereby blocking pores and acting as a barrier for loss of carbon dioxide and water. Different time temperature combinations suggested are.

- 60 º C or 10 minutes in still water
- 60 º C for 14 minutes in oil.
- 56.7 º C or sixteen minutes in oil

Q.9. What do you understand by Lime method of preservation?

Ans. Lime method is widely used in Asia, America and Europe. It involves the use of calcium carbonate solution. A litre of boiling water is added to 1kg of quick lime and allowed to cool. Then 5 litres of water are added to it. The solution is then strained through a fine cloth when the mixture settles down. Eggs are then dipped in clear fluid overnight or up to 14-16 hours and then dried at room temperature and stored for 3-4 weeks. The lime being alkaline prevents the growth of microorganisms such eggs have prolonged storage time

Q.10. How mineral oils protect the quality of an egg?

Ans. Oil coating or spray oiling has become very popular for short term storage Coating with oil forms a thin layer which seals the

pores of the shell. It ultimately results in the reduction of rate of Carbon dioxide and moisture loss. The oil used must be odorless, colorless and free of fluorescent materials which confirm to food grade. Light mineral oil or ground nut oil can be used where as for oil spray the eggs are arranged in filler flats with their broad end up. The temperature of oil should be in the range of 15-30 º C. In such a treatment, it is essential that the treatment is applied to egg shell & in a few hours of production because the rate of carbon dioxide and evaporation of water is very high during first few hours and weight loss is also very significant. After this egg may be frozen and stored (70-85 RH).

Q.11. Name the various proteins present in albumen?

Ans. A number of different proteins are present in albumen. They are.

Ovalbumin, Conalbumin/Ovatransferrin, Ovamucoid. Lysozyme/ G1 Ovaglobulin, G2 Ovaglobulin, G3 Ovaglobulin, Ovamucin, Flavoprotein, Ovaglycoprotein, Ovamacroglobin, Ovainhibitor, Avidin and Cystatin.

Q. 12. Write short note on drying of egg.

Ans. Eggs are broken, shell and membranes are separated and liquid eggs are preserved by drying the egg contents i.e., egg white and yolk. This reduces the bulk of eggs and helps in easy transportation and storage. Liquid eggs may become contaminated with pathogenic and spoilage microorganisms that may multiply under improper holding conditions and may survive in uncooked and partially cooked foods. Therefore, egg products are pasteurised under conditions that destroy Salmonella besides reducing spoil-

age microorganisms. Liquid whole eggs have been pasteurized at 60-61 °C for 3.5 min without affecting the functionality of eggs. After pasteurisation de-sugaring is performed to remove traces of glucose (0.5%) to prevent browining due to mallards reaction. Glucose can be removed by three methods, controlled bacterial fermentation using cultures of Steptococcus, yeast fermentation using Saccharomyces, and enzyme fermentation using glucose oxidase and catalase. Most commercial powders are spray dried, although whites are also dried in trays or as a film on a continuous belt. The core of spray drying technique is spraying a feed material in a liquid state into a hot drying medium (temperature ranging from 100 to 300°C) in which liquid (often water) is evaporated. The final product of a spray drying process is a dried form of powders, granules or agglomerates, depending upon the physical and chemical properties of the feed, the dryer design and operation. Evaporation of water from the droplets is facilitated by heat and vapor transfer through/from the droplets. It is believed that the wet-bulb temperature of the droplets is in the range of 30- 50°C and total duration of drying is only a few seconds.

Q.13. Write briefly about egg pickling.

Ans. Egg pickling is an old-time technique for preserving hard-cooked eggs in a vinegar-brine solution. They are making a comeback due to the increased use of pickled condiments in restaurants and interest in easy home-pickling. Note that pickled eggs should never be stored at room temperature. Botulism has been found in home-canned pickled eggs stored at room temperature. Make sure all of your equipment and hands are thoroughly cleansed and the pickling jars are sterilized. Pickled eggs should be stored in the refrigerator. It is not recommended that pickled eggs be canned. Pickled eggs can be made with a variety of seasonings and vinegars for different flavor profiles.

The smaller the egg, the quicker the pickling solution will flavor the egg. The USDA states pickled eggs be kept in the refrigerator a maximum of seven days.

Q.14. Discuss Reinhard method of egg preservation.

Ans. The Reinhard method is said to cause such a chemical changes in the surface of the egg shell that it is closed up perfectly air tight and an admittance of air is entirely excluded, even in case of long continued storage. The eggs are for a short time exposed to the direct action of sulphuric acid, whereby the surface of the egg shell, which consists chiefly of lime carbonate, is transformed into lime sulphate. The dense texture of the surface thus produced forms a complete protection against the access of the outside air, which admits of storing eggs for a very long time, without the contents of the egg suffering any disadvantageous changes regarding taste and odor. The only disadvantage of this method is that sulphuric acid is a dangerous poison that might, on occasion, penetrate the shell.

Q.15. Discuss older preservation methods of eggs.

Ans. Before the invention of refrigerator/freezers, farmers devised some simple means of preserving their excess eggs. Some farmers relied solely on the use of salt to keep their eggs from rotting. After gathering their eggs, they packed them in a large barrel or crock with plenty of salt and stored them in a cellar or spring house to keep them cool. The majority, however, found some way to clog up the pores of the egg shells so that moisture would not escape and air could not enter. Eggs were rubbed with grease, zinc, or boric ointment, or submerged in a solution of lime, salt, cream of tartar,

and water. Probably the most popular way to seal egg shells was to water-glass them. By this method a chemical, sodium silicate, was mixed with water and poured in a crock which was filled with eggs that were about twelve hours old. The sodium silicate would clog the pores in the shells and make them airtight. Some people, even today, use waterglassing as a means of preserving eggs, but this storage method has its drawbacks. Eggs preserved this way are not good for boiling because their shells become very soft in the waterglass solution. The whites will not become stiff and form peaks, no matter how long they are beaten. There is also a very good possibility that by consuming eggs stored in water glass you would be consuming some of the undesirable chemical, sodium silicate. If you keep roosters with your hens, (which you'll do if you want to maintain a natural, happy environment for your hens and produce wholesome eggs for your family), waterglassing may not be a successful means of preservation for you. The life factor in fertilized eggs makes these eggs deteriorate more quickly than sterile, unfertilized eggs, and water glassing may not be enough of a preventative against spoilage. The way that water glass preservation works is simple and straightforward. The water glass blocks and fills the pores of the eggshell thereby preventing bacteria from entering inside the egg and moisture from leaving the egg.