I. FREQUENTLY ASKED QUESTIONS:

Q no. 1. What are the basic functions of food packaging?

Ans. Food packaging protects food from chemical, biological, and physical deterioration. The basic functions of packaging are more specifically stated as follows:

- 1. Containment: containing the product in its physical form and nature.
- 2. Protection: prevention of mechanical damage due to the hazards of distribution
- *3. Preservation*: prevention or inhibition of chemical changes, biochemical changes and microbiological spoilage
- 4. Information about the product: information about legal requirements, product ingredients, etc
- 5. Convenience: for the pack handlers and user(s) throughout the packaging chain
- 6. Presentation: material type, shape, size, colour, etc.
- 7. Brand communication: pack persona by the use of typography, symbols, illustrations, advertising and colour, thereby creating visual impact
- 8. Promotion (Selling): free extra product, new product, etc.
- 9. Economy: efficiency in distribution, production and storage
- 10. Environmental responsibility: in manufacture, use, reuse, or recycling and final disposal.

Q no. 2. What is the criterion for selection of a packaging material?

Ans. In order to select the packaging system that best fits the food to be packaged a detailed analysis of the product's characteristics needs to be performed. The nature of the product (fresh, dried, frozen, processed), its physical form and mechanical properties (size, weight, material consistency, fluid, powder), and compositional characteristics such as pH, fat content are all important to determine the most appropriate packaging system. Knowledge of the perishability of the food is also fundamental because shelf stable products do not require specific precautions for storage, while perishable foods (fruits/vegetables, ready-to-eat meat (RTE) products,

dairy products, etc.) need specific temperature requirements. Understanding the product quality requirements will help to determine the necessary barrier properties (gas, water vapor, light) required for effective protection. After taking into account all the product characteristics, the choice of the packaging material is also essential. The material should be suitable for consumer use but also convenient for transportation, since food packaging exists because of its basic functions – protection, containment, information, and utility of use.

Q no. 3. Explain different types of packaging systems

Ans. Packaging systems can be categorized into three main groups: primary packaging, secondary packaging, distribution or tertiary packaging.

1. Primary packaging

The first-level package that directly contacts the product is referred to as the "primary package." The examples include, a beverage can or a jar, a paper envelope for a tea bag is primary packages.

2. Secondary packaging

The secondary package contains two or more primary packages and protects the primary packages from damage during shipment and storage. The examples include shrink wrap and a plastic ring connector that bundles two or more cans together to enhance ease of handling.

3. Tertiary package

The tertiary package is the shipping container, which typically contains a number of the primary or secondary packages. It is also referred to as the "distribution package." Its main function is to protect the product during distribution and to provide for efficient handling.

Q no. 4. Describe polyethylene as a food packaging material.

Ans. Polyethylene or polymerized from ethylene, is the plastic most commonly used for food packaging. PE generally has flexibility, good moisture control, oil and chemical resistance, and good impact strength. It is of two types, high-density polyethylene (HDPE) and low-density polyethylene (LDPE). Low-density polyethylene is softer

and more flexible, and has lower tensile strength than HDPE. Since it has relatively weak intermolecular forces, LDPE has a low melting temperature, 105–115 °C, so it is a useful material for heat sealing. LDPE also has good impact and tear strength. Common applications for LDPE include stretch wraps, shrink wraps, and many types of bags and pouches. Like LDPE, HDPE also has good oil and grease resistance. It has better barrier properties than LDPE, since permeation occurs almost exclusively through amorphous areas of a polymer, and HDPE has less amorphous area and higher crystallinity than LDPE. The improved stiffness of HDPE makes it more suitable for rigid or semi-rigid packaging applications, such as bottles, tubs, and trays.

Q no. 5. Write a short note on processing of plastics.

Ans. Processing of plastics involves extrusion, thermoforming, and molding.

a) Extrusion: Most plastic forming processes begin with melting the plastic in an extruder. In the extruder, thermoplastics are mixed and softened, which enables shaping into some desired form

b) Thermoforming: In thermoforming, a plastic sheet heated to its optimum temperature is placed over a mold, and pressure is applied to stretch it into a designed shape.

c) Molding: Molding is the process of manufacturing by shaping liquid or pliable raw material using a rigid frame called a mold or matrix.

Q no. 6. Briefly explain the term molding of plastics?

Ans. Molding means to form (an object) out of malleable material. It is usually is of two types, injection molding and blow molding. In an injection molding operation, the molten plastic is injected into a mold with the desired shape, cooled, and ejected from the mold. It is widely used for making threaded closures (caps), tubs, and jars. Whereas, blow molding is a process where a parison is surrounded by a mold with the desired shape, and air is blown into the parison to force it to expand against the wall of the mold. The mold is then opened and the solidified product is ejected.

Q no. 7. What do you mean by waxed paper?

Ans. Waxed paper is produced by adding paraffin wax to one or both sides of the

paper during drying. Many base papers are suitable for waxing, including greaseproof and glassine. The major types are dry waxed, wet waxed, and wax laminated. Drywaxed paper is produced using a heated roller to allow the wax to soak into the paper. Wet-waxed paper is produced when the wax is cooled quickly after it is applied, so that the wax remains on the surface of the paper. Wax-laminated paper is bonded with a continuous film of wax which acts as an adhesive, so that it can provide both moisture barrier and a heat-sealable layer.

Q no. 8. What is a vegetable parchment?

Ans. Vegetable parchment is produced by adding concentrated sulfuric acid to the surface of the paper to swell and partially dissolve the cellulose fibers. It produces a grease resistant paper which maintains its strength well when it is wet. Vegetable parchment is odorless, tasteless, resists boiling temperature, and has a fiber-free surface. Labels and inserts on products with high oil or grease content are frequently made from parchment.

Q no. 9. Write about paperboards and their applications in packaging food.

Ans. Paperboard for food packaging generally includes white board, liner board, food board, carton board, chip board, and corrugated board.

a) White board: White board is made with a bleached pulp liner on one or both sides to improve appearance and printability, and the remaining part is filled with low-grade mechanical pulp. It is used for ice cream, chocolate, and frozen food cartons.

b) Liner board: Liner board is usually made from softwood kraft paper and is used for the solid faces of corrugated board.

c) Food board: Food board is used to produce cartons that are suitable for direct food contact. Food board can be used for all types of foods, particularly frozen and baked foods.

d) Carton board (boxboard): Carton board is used to make folding cartons and other types of boxes. To improve its appearance, it may be clay coated on one or both surfaces.

e) Chipboard: Chipboard is the lowest quality and lowest cost paperboard, made

from 100% recycled fiber, and is not used in direct contact with foods. Outer cartons for tea and breakfast cereals are some examples.

f) Corrugated board: Corrugated board has an outer and inner lining of kraft paper with a central corrugating (fluted) material. They are commonly used in shipping containers.

Q no. 10. Write about applications of metal foil in packaging of food.

Ans. Aluminum foil is the most commonly produced metal foil. It is manufactured by passing aluminum sheet between a series of rollers under pressure. Foil is widely used for wraps (9 μ m), bottle caps (50 μ m), and trays for ready-to-eat meals (50–100 μ m). Aluminum foil has excellent barrier properties against gases and water vapor. Thus, it is also used as the barrier material in laminated films for packages, such as those in retort pouches. Collapsible aluminum tubes can be used for the packaging of viscous products such as mustard, mayonnaise, and ketchup

Q no. 11. Explain forming of glass.

Ans. The glass making process begins with weighing out and mixing of the raw materials and introduction of the raw material to the glass melting furnace, which is maintained at approximately 1500 °C. Cullet, broken or recycled glass, is also an important ingredient in glass production. In the melting furnace, the solid materials are converted to liquid, homogenized, and refined (getting the bubbles out). At the end of the furnace, a lump of molten glass, called a "gob," is transferred to the glass forming process. For food packaging, glass can be formed using the blow and-blow process, or wide-mouth-press-and-blow process. In the blow-and blow process, compressed air blows the gob into the blank mold of the forming machine and creates the shape of the parison. Then, the completed parison is transferred into the blow mold where air blows the parison to form a final shape. In the wide-mouth-press-and-blow process, a metal plunger is used to form the gob into the parison shape, instead of using air blowing.

Q no. 12. Briefly state the properties of polyethylene terephthalate (PET).

Ans. The properties of polyethylene terephthalate are attractive as a food packaging material; it has very high mechanical strength, good chemical resistance, light weight, excellent clarity, and reasonably high barrier properties. It is also stable over a wide range of temperatures (-60 °C to 220 °C). PET can be used for "boil-in-the-bag" products, since it has resistance to higher temperatures than many other plastics.

Q no. 13. Briefly write about greaseproof and glassine paper.

Ans. Greaseproof is a dense, opaque, non-porous paper made from highly refined bleached kraft pulp. The prolonged beating during processing results in short fibers. Glassine derives its name from its glassy smooth surface. After the initial paper making process, it is further processed in the presence of steam. It does not have complete oil barrier but is still fairly resistant to oil. These papers are often used for packaging butter and other fatty foods.

Q no. 14. What do you mean by Epoxy-phenolic compounds?

Ans. Epoxy-phenolic compounds are lacquers used for all types of steel and cans. They are resistant to acids and have good heat resistance and flexibility. Such lacquering compounds are especially suitable for acidic products such as beer, soft drinks, meat, fish, fruits, vegetables.

Q no. 15. Describe latest trends in food packaging.

Ans. Latest trends in food packaging are listed below:

- 1. Numerous reports industry associations report the use of smart indicators.
- 2. Temperature recorders are used to monitor products shipped in a cold chain and to help validate the cold chain. Digital temperature data loggers measure and record the temperature history of food shipments. They can help determine the time of temperature extremes during shipment so corrective measures can be taken.
- r. Time temperature indicators integrate the time and temperature experienced by the indicator and adjacent foods. Some use chemical reactions that result in a color change while others use the migration of a dye through a filter media.

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- ٤. Biodegradable plastics including biodegradable films and coatings synthesized from organic materials and microbial polymers. Some package materials are edible. For example, pharmaceuticals are sometimes in capsules made of gelatin, starch, potato or other materials.
- 5. 2D barcodes used in autocoding are increasingly applied to food packaging to ensure products are correctly packaged and date coded.