Fruit and vegetable Processing-Level-II

Based on May 2019, Version 2 Occupational standards

Module Title: Handling By- product Manufacturing Processes

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LG #82	LO #1- Identify finish by-product requirement

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying manufactured product
- Identifying micronutrient or additive requirements
- Identifying hazards and risks

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Identify product manufactured
- Identify micronutrient or additive requirements
- Identify hazards and risks

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Identifying manufactured product

1.1. Identify manufactured product from production schedule, customer order or Standard Operating Procedure (SOP).

Manufacturing, a branch of industry, is the application of tools and processes for the transformation of raw materials into finished products. However, manufacturing is the production of products for use or sale using labor and machines, tools, chemical or biological processing or formulation and is the essence of secondary industry. Finished Product defined as the medicinal product that has undergone all stages of production, including packaging in its final container. The specifications for release of the finished product must comply with the FDA regulations. Manufactured Product means an item that through processing becomes chemically and physically stable and remains so during its intended use. Examples of manufactured products include wallboard, ceiling tile, plywood, lumber, office furniture, containers, and bricks juice, fruit and vegetable beverage, jam, jell,…etc.

Scheduling is the process of arranging, controlling and optimizing work and workloads in a production process or manufacturing process. Scheduling used to allocate plant and machinery resources, plan human resources, plan production processes and purchase materials. The production schedule is a project plan of how the production budget will be spent over a given timescale, for every phase of a business project. A Standard Operating Procedure (SOP) is a set of written instructions that document a routine or repetitive activity followed by an organization to manufacturing fruit and vegetable products. The development and use of SOPs are an integral part of a successful quality system as it provides individuals with the information to perform a job properly, and facilitates consistency in the quality and integrity of a product or end-result. It minimizes opportunities for miscommunication and can address safety concerns.

A product is a tangible item that put on the market for acquisition, attention, or consumption, while a service is an intangible item, which arises from the output of one or more individuals. In fact, a majority of products carry with them an element of service.

Although it seems like the main distinction between the two concepts is founded on their tangibility that is not always the case. In most cases, services are intangible, but products are not always tangible.

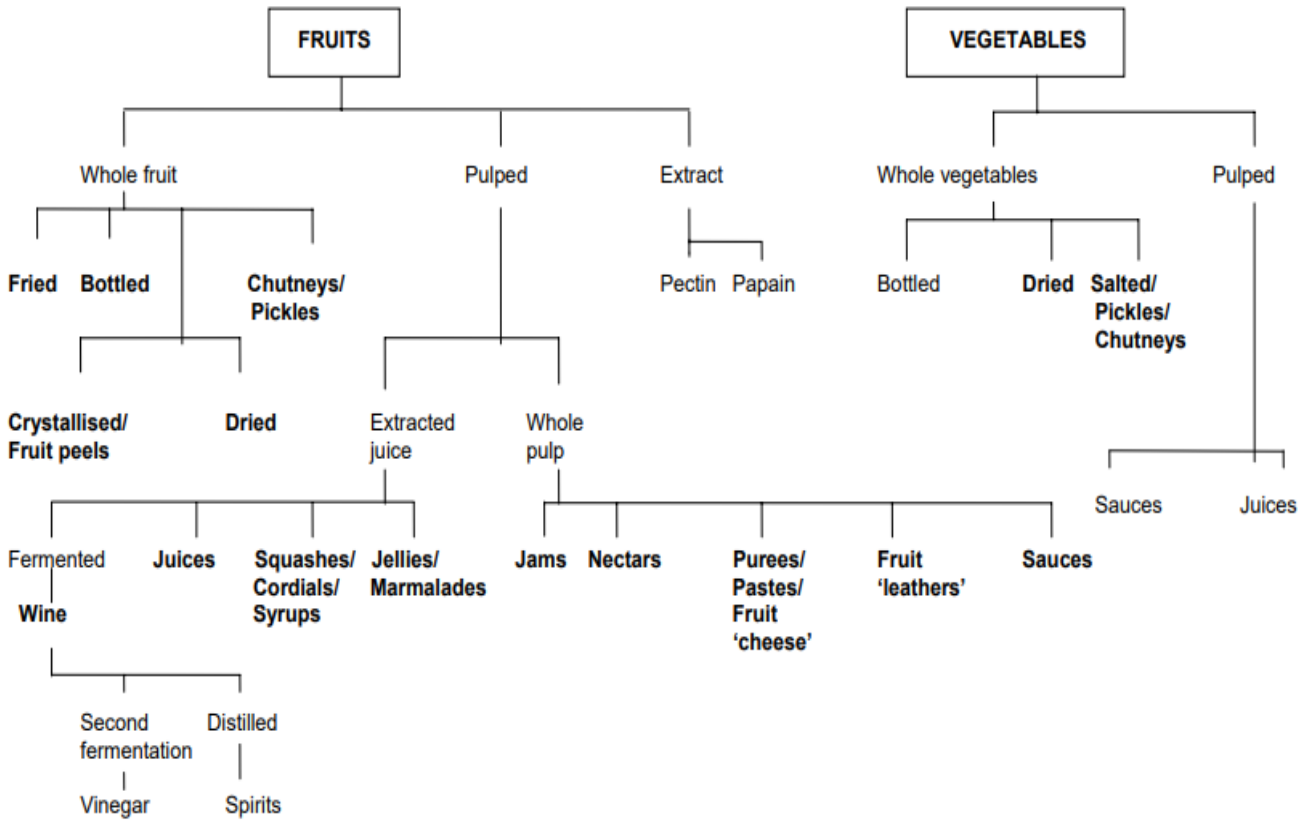

Figure 1.1Fruit and vegetable products

Based on their requirement amount of fruit and vegetable product:

- High demand include:

✓ Dried fruit (pineapple and banana for export)
✓ Fruit wines (especially pineapple)
✓ Fried snacks (banana or potato chips)
✓ Juices (pineapple and passion fruit)
✓ Squashes and cordials
✓ Tomato sauce.

- Low demand include:

✓ Jams, jellies and marmalades
✓ Bottled fruits
✓ Chutneys and pickles
✓ Purees and pastes

On the other hands, the term "**by-product**" suggests that plant food wastes might be usable and have their own market. These by-products might reach around 60% of

harvested plants. While, byproduct is a common outcome in the majority of production processes. It is in a lesser quantity and is of lower overall value as compared to the main product. One of the important by products of commercial value is pulps of fruit and damaged vegetable, produced mainly from underutilized. Shark fins. The commercial value of the fins depends on their color, size, variety and quality.

The **waste utilization of fruit processing industries** has become one of the main challengeable aspects in the world due to the generation of large quantities of by-products including:

- ✓ Peels,
- ✓ Seeds and
- ✓ Unused flesh in different steps of processing chain.

However, these plant by-products are rich in valuable compounds that can be use in various industries as:

Novel,
Low-cost,
Economical and natural sources of dietary fiber,
Antioxidants,
Pectin,
Enzymes,
Organic acids,
Food additives and
Essential oils etc, through different methods of extraction, purification and fermentations.

During the processing of fruits and vegetables, large quantities of solid and liquid wastes are produced. The waste obtained from fruits and processing industry is extremely diverse due to the use of wide variety of fruits and vegetables, the broad range of processes and the multiplicity of the product. Finished Product is defined as the medicinal product that has undergone all stages of production, including packaging in its final container. The most recent Food Balance Sheets indicate that fruits and vegetables presented the highest values of food losses along the food chain compared to the rest of the commodity groups: cereals, roots and tubers, oilseeds and pulses, meat, fish and seafood, and dairy products.

For example

- The pineapple (*Ananas comosus*) is one of the most important fruits in the world and is the leading edible member of the family *Bromeliaceae*. This fruit juice is the third most preferred worldwide after orange and apple juices. Pineapple by-products are:
  - ✓ Residual pulp,
  - ✓ Peels,
  - ✓ Stem and
  - ✓ Leaves

Processing residuals ranges between 45 to 65%, an indication of serious organic-side streams disposal challenges, which causes environmental pollution if not successfully utilized. **Peel** is the major bio-waste generated during pineapple processing. Sugars are present in large quantities in pineapple peel that can be used as nutrients in fermentation processes. The peel can be used as a potential substrate for methane, ethanol and hydrogen generation. The second major bio-waste is the core and can be used for the production of pineapple juice concentrates, alcoholic, non-alcoholic beverages or vinegar.

- Apples processing generates **skin, stems, and residual flesh**, which are considered as a potential value added food ingredient. Apple pomace is the main by-product of apple cider and juice processing industries and accounts for about 25% of the original fruit mass at 85% (wet basis) moisture content. It is considered a rich source of dietary fiber, especially pectin, with a content in the range of 10-15% (w/w dry basis), depending on the source.

Self-check 1	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer (5 point)

1. Define the following terms:
   Product,
   Manufacturing,
   Production schedule and
   SOP
2. List common types of fruit and vegetable products:----------
   ----

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 5 points Unsatisfactory - below 5 points

Information Sheet 2- Identifying micronutrient or additive requirements

2.1. Identify micronutrient or additive

Micronutrients are one of the major groups of nutrients your body needs. They include vitamins and minerals. Vitamins are necessary for energy production, immune function, blood clotting and other functions. Meanwhile, minerals play an important role in growth, bone health, fluid balance and several other processes. Micronutrients are essential elements required by organisms in varying quantities throughout life to orchestrate a range of physiological functions to maintain health. Micronutrient requirements for animals also include vitamins, which are organic compounds required in microgram or milligram amounts. There are lists of permitted food colours, emulsifies, stabilisers, preservatives and other additives that can be added to foods. Any chemical that is not on these lists cannot be used. There are also maximum levels set for each additive in specific foods and lists of foods that are able to contain specified preservatives. Contaminants, including poisonous metals such as arsenic and lead, have maximum permitted levels in specified foods. Many people enjoy making bread, cakes, wine, beer and ice cream at home. However, most of today's food bought from shops and supermarkets and has to stay in top condition over a much longer period than home-cooked food. That is why food additives have become a necessity of all types of food products and food industry.

Right from the aroma of the beverage, the texture of the food and its visual appeal, have to be enriched to make it acceptable. Additives also improve the nutritional value of some foods and can make them more appealing by improving their taste, texture, consistency or color. Because many chemical additives are banned by food legislation and by customers, the need for natural alternatives has increased. That is why more and more additives are produced by fermentation or will be produced in future. According to the Food and Drug Administration (FDA), a food additive in its broadest sense is any substance added to food. Legally, the term refers to "any substance the intended use of which results or may reasonably be expected to result directly or indirectly in its becoming a component or otherwise affecting the characteristics of any food." (FDA). Additives are useful in controlling such factors as:

- ✓ Decomposition and deterioration,
- ✓ Nutritional losses,
- ✓ Loss of functional properties and
- ✓ Aesthetic value, but may not be used to disguise poor quality.

Vitamins and **minerals** are a special category of food ingredients. They are essential for nutrition but their use apart from food often is surrounded with controversy. Their use in foods has been increasing, as they have been associated with the prevention and/or treatment of at least four of the leading causes of death in the United States. Existing additives, as well as new ones, are utilized in new product development. A food additive in its broadest sense is **any substance added to food**.

Legally, additives are classified as:

- ✓ **Direct:-** If they are intentionally or purposely added to foods, these direct additives must be named on food labels
- ✓ **Indirect: -** If indirect, they are incidentally added to food in very small amounts during some phase of production, processing, storage, packaging, or transportation.

General categories of food additives include preservatives, nutritional additives, sensory agents, and processing agents as noted below. When new food products are developed, new or existing food additives may be utilized. Additives perform a variety of useful functions in foods that are often taken for granted. Since most people no longer live on farms, additives help keep food wholesome and appealing while in route to markets sometimes thousands of miles away from where it is grown or manufactured.

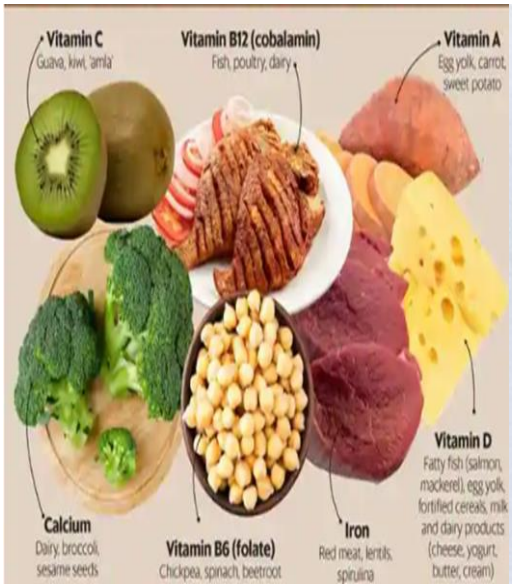


Fig 2.1. Different types of food micro nutrient/additives

Micronutrients are essential elements required by the body for functioning. They are essential, just like macronutrients, but needed in much smaller amounts. Despite the amount needed, they are crucial for proper development, growth, enzyme production and much more. **Food fortification** or **enrichment** is the process of adding micronutrients (essential trace elements and vitamins) to food. It can be carried out by food manufacturers or by governments as a public health policy, which aims to reduce the number of people with dietary deficiencies within a population. The predominant diet within a region can lack particular nutrients due to the local soil or from inherent deficiencies within the staple foods; addition of micronutrients to staples and condiments can prevent large-scale deficiency diseases in these cases.

2.2. Categories of additives

Food additives divided into several groups, although there is some overlap because some additives exert more than one effect. For example, salt is both a preservative as well as a flavor. Additives also improve the nutritional value of certain foods and can make them more appealing by improving their taste, texture, consistency or color.

Acidulents: - Acidulants confer sour or acid taste. Common acidulents include vinegar, citric acid, tartaric acid, malic acid, formic acid, and lactic acid.

Acidity regulators: - Acidity regulators are used for controlling the pH of foods for stability or to affect activity of enzymes.

Anticaking agents: - Anticaking agents keep powders such as milk powder from caking or sticking.

Antifoaming and foaming agents: - Antifoaming agents reduce or prevent foaming in foods. Foaming agents do the reverse.

Antioxidants: - These are used to protect fat from becoming rancid and fruit containing food from discoloration. Vitamins (such as A, D, E and B,) that are sensitive to degradation can also be protected by the action of antioxidants. Antioxidants such as vitamin C are preservatives by inhibiting the degradation of food by oxygen.

Bulking agents: - Bulking agents such as starch are additives that increase the bulk of a food without affecting its taste.

Food coloring: - Colorings are added to food to replace colors lost during preparation or to make food look more attractive.

Fortifying agents: - Vitamins, minerals, and dietary supplements to increase the nutritional value

Color retention agents: - In contrast to colorings, color retention agents are used to preserve a food's existing color.

Emulsifiers: - Stabilizing and thickening agents, including anti-caking agents: This is an extensive group with several different compounds intended to be used in order to affect the consistency of foods. Some compounds in this group of additives have caused concern among consumers, for example the anti-caking agent sodium ferrocyanid (E 535) in salt

Flavors: - Flavors are additives that give food a particular taste or smell, and may be derived from natural ingredients or created artificially.

Flavor enhancers: - Flavor enhancers enhance a food's existing flavors. A popular example is monosodium glutamate. Some flavor enhancers have their own flavors that are independent of the food.

Flour treatment agents

Flour treatment agents are added to flour to improve its color or its use in baking.

Glazing agents: - Glazing agents provide a shiny appearance or protective coating to foods.

Humectants: - Humectants prevent foods from drying out.

Tracer gas: - Tracer gas allow for package integrity testing preventing foods from being exposed to atmosphere, thus guaranteeing shelf life.

Preservatives: - Preservatives prevent or inhibit spoilage of food due to fungi, bacteria and other microorganisms.

Stabilizers emulsions:- Stabilizers, thickeners and gelling agents, like agar or pectin (used in jam for example) give foods a firmer texture. While they are not true emulsifiers, they help to stabilize

Sweeteners: - There are two main groups of sweeteners, the natural and the synthetic (artificial) sweeteners. The natural sweeteners contain energy and can be further subdivided in one group of general sugars such as glucose, sucrose and fructose, and another group of sugar alcohols, such as sorbitol and xylitol. The second group contains the synthetic sweeteners without energy, such as aspartame, ace- sulphame K, saccharin and cyclamate. This group of artificial sweeteners has caused a lot of debate regarding safety. Sweeteners are added to foods for flavoring. Sweeteners other than sugar are added to keep the food energy (calories) low, or because they have beneficial effects regarding diabetes mellitus, tooth decay, or diarrhea.

Thickeners: - Thickening agents are substances which, when added to the mixture, increase its viscosity without substantially modifying its other properties.

Generally, food additives are clearly defined in the codex general standard for food additives as: “any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in:

Manufacture, Treatment,
Processing, Packing,
Preparation, Packaging,

Transport or holding of such food results, or may be reasonably expected to result (directly or indirectly), in it or its byproducts becoming a component of or otherwise affecting the characteristics of such foods.

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions (5 pts each)

1. What is micro nutrient/additives:----------
   ----
2. List the categories of additives:----------

You can ask you teacher for the copy of the correct answers.

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Information Sheet 3- Identifying hazards and risks

3.1. Identifying hazards and risks

There are many definitions for hazard but the most common definition when talking about workplace health and safety is “A hazard is any source of potential damage, harm or adverse health effects on something or someone.” A **hazard** is something that can cause harm, e.g. electricity, chemicals, working up a ladder, noise, a keyboard, a bully at work, stress, etc. A **risk** is the chance, high or low, that any hazard will actually cause somebody harm. As identification of hazards is the first step in Risk Management, it implies that hazards, which are not identified, would not go through the rigour of the Risk Management process, leading to the non-identification of preventive measures for implementation and communication to prevent harm in the workplace. The range of hazards and risks associated with micronutrients and additives use includes:

- ✓ Cross-contamination of micronutrients and additives for different feeds and recipes.
- ✓ Wrong formula and other errors especially failure to read formula correctly
- ✓ Incorrect volume/measurement/proportion

Food contaminants typically include environmental contaminants, food processing contaminants, unapproved adulterants and food additives, and migrants from packaging materials. Environmental contaminants either are impurities that are introduced by human or occurring naturally in water, air or soil. Food processing contaminants include those undesirable compounds, which are formed in the food during baking, roasting, canning, heating, fermentation, or hydrolysis. Contamination of the food products such as **meat, vegetables,** and **fruits** is possible via the introduction of the parasite in the sewage, irrigation water, feces, soil, human handling or improper process of the infected meat. Food producing animals can itself transfer the parasites, as they are themselves infected.

Hazard identification and elimination and risk assessment and control" uses the following terms:

- ✓ Harm – physical injury or damage to health.
- ✓ Hazard – a potential source of harm to a worker.

A hazard is the potential for harm or an adverse effect (for example, to people as health effects, to organizations as property or equipment losses, or to the environment). Hazard identification is part of the process used to evaluate if any particular situation, item, thing, etc. may have the potential to cause harm. The term often used to describe the full process is risk assessment:

- ✓ Identify hazards and risk factors that have the potential to cause harm (hazard identification).
- ✓ Analyze and evaluate the risk associated with that hazard (risk analysis, and risk evaluation).
- ✓ Determine appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control).

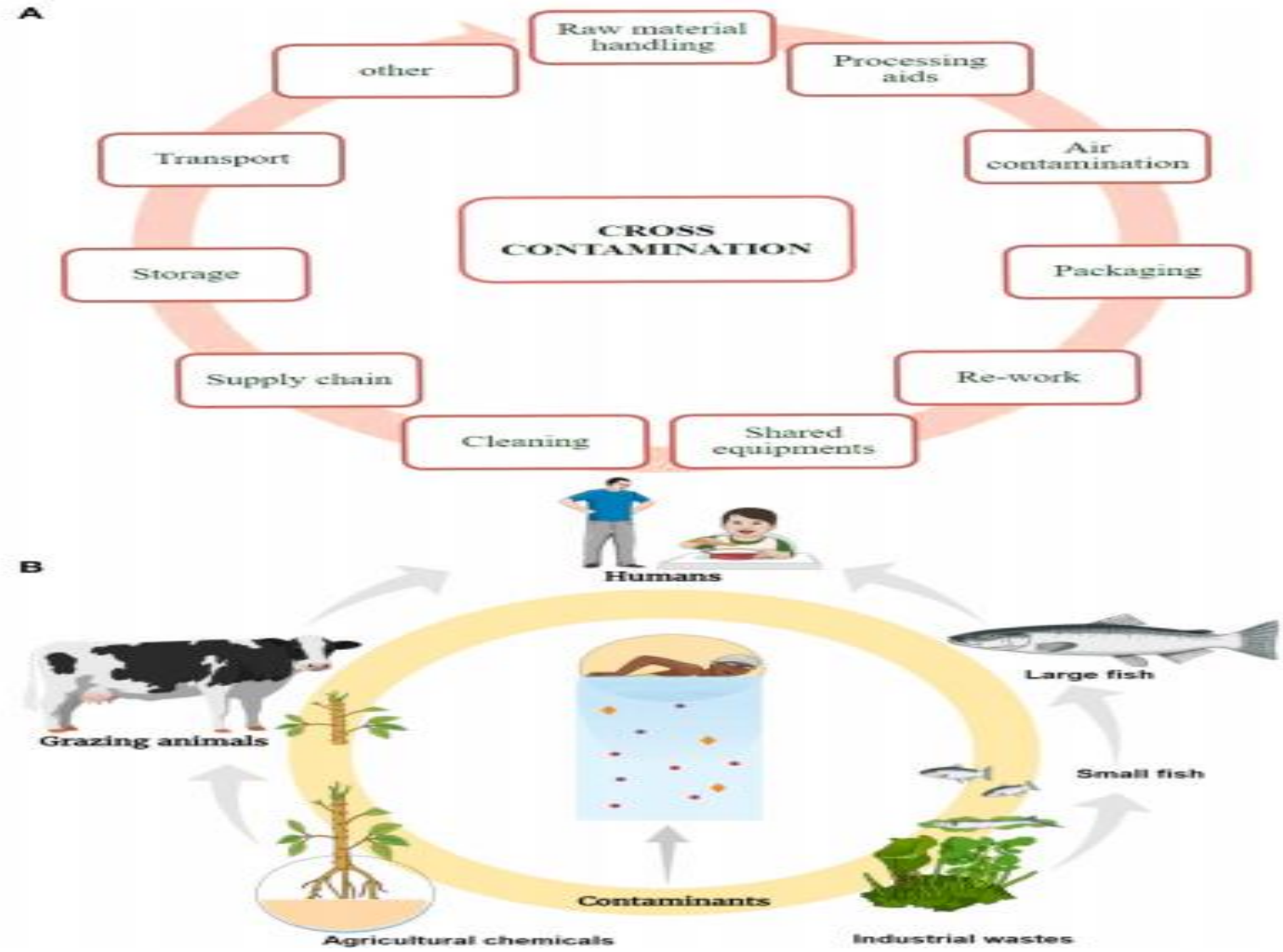

Figure3.1. Food contamination. (A) Contamination in the food production and processing. (B) Contamination due to environmental influences.

Hazards and risks

The range of hazards and risks associated with micronutrients and additives use includes:

- ✓ cross-contamination of micronutrients and additives for different feeds and recipes
- ✓ Wrong formula and other errors especially failure to read formula correctly
- ✓ Incorrect volume/measurement/proportion

Steps of identifying hazard identification and risk assessment:

- ✓ Preparation
- ✓ Hazard Identification
- ✓ Risk Assessment
- ✓ Plan Control Measures
- ✓ Record Keeping
- ✓ Implementation and Review

Self-Check – 3	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions (6 pts each)

1. Write down the term often used to describe the full process is risk assessment;----------
   ----

   ----
2. What is hazards identification;----------

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

LG #83	LO #2-Obtain correct micronutrient or other additive

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying micronutrient or additive storage location
- Obtaining micronutrient or additive
- Reading micronutrient or additive label

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Identify storage location micronutrient or additive
- Obtain micronutrient or additive
- Read micronutrient or additive label

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Identifying micronutrient or additive storage location

1.1. Micronutrient or additive storage location

Micronutrients and additives may range from common proprietary products to specific micronutrients and additives prescribed by veterinarians or covered by legislative requirements. Food additives are substances added to food to preserve flavor or enhance its taste, appearance, or other qualities. Some additives have been used for centuries; for example, preserving food by pickling (with vinegar), salting, as with bacon, preserving sweets or using sulfur dioxide as with wines. Products should be stored off the floor in a cool, dark storeroom that has good ventilation and protection against insects and rodents. QA systems should also monitor the time that they remain in storage. Records should show which materials are transferred into and out of the storeroom and when they are used or sold. A First In/First out (FIFO) system of stock control should be used. It should apply to raw materials, other ingredients and finished products. Processors should also monitor and control distribution to retailers and storage/display in retail outlets. There are five methods of storing vegetables and fruit product and by-products:

- ✓ Drying,
- ✓ Canning,
- ✓ Curing and salting,
- ✓ Freezing and common storage.

Which method is chosen depends upon the type of produce, the quality desired and the facilities available for storage. Nutritional recommendations emphasize fruit and vegetable consumption. A general rule for vegetables is that cool-season crops should be stored at cooler temperatures (32 to 35°F), and warm-season crops should be stored at warmer temperatures (45 to 55°F).

Most fruits and vegetables will resist disease as long as the skin is intact.

- Before storage, carefully inspect produce for cuts, bruises and signs of decay.
- Maintaining the correct moisture level is also important.

Successful Storage Begins in the Garden;

- ✓ Harvest early in the day, but after dew is gone
- ✓ Gently remove soil
- ✓ Sort produce
- ✓ Wash, if necessary, and dry

Maximizing Storage Life:

- ✓ Maintain moisture but not too much!
- ✓ Remove diseased produce
- ✓ Store at ideal temperature avoid temperature extremes
- ✓ Cold moist 32F-40F 95 humidity (apples, broccoli, spinach)
- ✓ Cold dry 32F-40F 65 humidity(onions, garlic)
- ✓ Cool and dry 50F-60F 60 humidity (winter squash, pumpkins)

Storage Compatibility

- ✓ Beware of strong odors don't store cut onions near apples or potatoes
- ✓ Ethylene-producing fruits can damage other produce don't store apples near lettuce, asparagus, beans
- ✓ Humidity and temperature requirements can vary

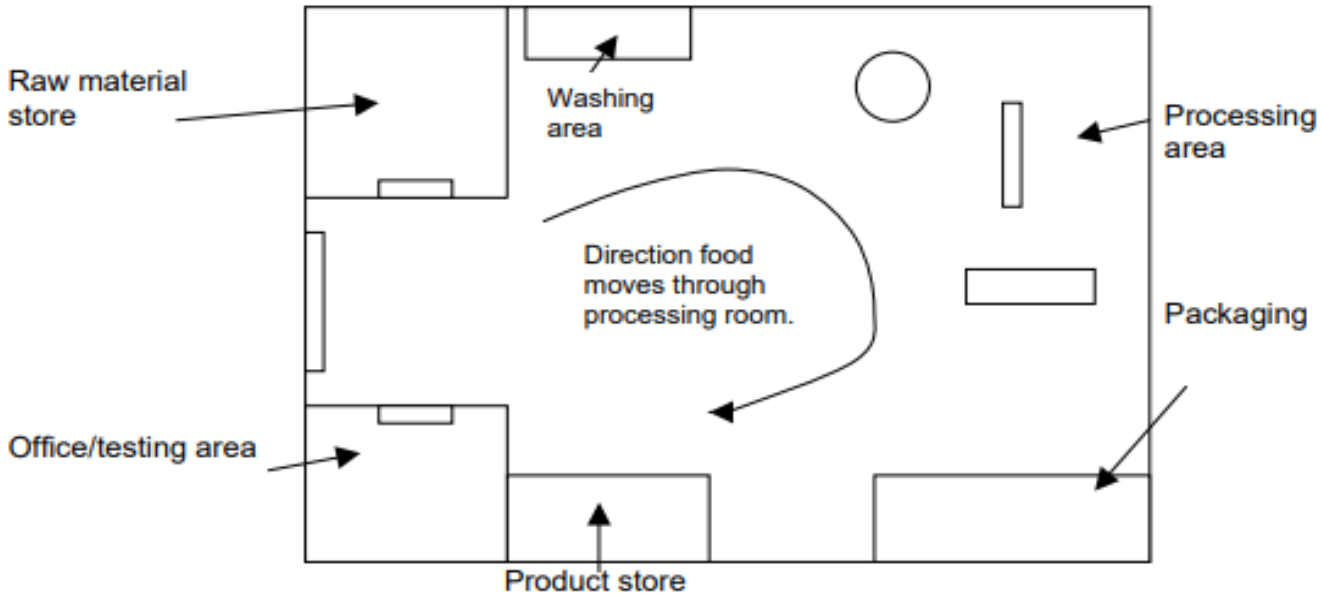

Fig 1.1. General guideline for storing product/by product of fruit/vegetable

Storeroom doors should not have gaps beneath them and should be kept closed to prevent insects and rodents from getting in and destroying stocks of product, ingredients or packaging materials. Processing room doors should be kept closed unless they are fitted with thin metal chains, or strips of plastic or cloth hung from door lintels. These keep out insects and birds, but allow easy access for staff. Alternatively, mesh door screens can be fitted.

Self-Check – 1	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. List the ways of storing fruit and vegetable product and by-products:----------
   ---

   ---
2. Explain the use of good storage area of micronutrient/additives:----------
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Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 2- Obtaining micronutrient or additive

2.1. Obtain micronutrient or additive

Micronutrients are defined as substances in foods that are essential for human health and are required in small amounts. They include all of the known **vitamins** and essential trace **minerals**. Micronutrient malnutrition affects a third to a half of the global population. It causes untold human suffering and levies huge costs on society in terms of unrealized human potential and lost economic productivity. Vitamins are necessary for energy production, immune function, blood clotting and other functions. Meanwhile, minerals play an important role in growth, bone health, fluid balance and several other processes. Many people enjoy making bread, cakes, wine, beer and ice cream at home. However, most of today's food is bought from shops and supermarkets and has to stay in top condition over a much longer period than home-cooked food.

That is why food additives have become a necessity of all types of food products and food industry. Right from the aroma of the beverage, the texture of the food and its visual appeal, have to be enriched to make it acceptable. Additives also improve the nutritional value of some foods and can make them more appealing by improving their taste, texture, consistency or color. Because many chemical additives are banned by food legislation and by customers, the need for natural alternatives has increased. That is why more and more additives are produced by fermentation or will be produced in future. Many industrially processed foods contain additives that are in fact natural or nature-identical micronutrients. Their purpose is to improve the consistency of the food and to give it certain characteristics. Micronutrients play a central role in metabolism and in the maintenance of tissue function, but effects in preventing or treating disease, which is not due to micronutrient, deficiency cannot be expected from increasing the intake.

Micronutrients or additives

Micronutrients and additives may range from common proprietary products to specific micronutrients and additives prescribed by veterinarians or covered by legislative

requirements. Food additives are substances added to food to preserve flavor or enhance its taste, appearance, or other qualities. Some additives have been used for centuries:

- ✓ preserving food by pickling (with vinegar),
- ✓ salting, as with bacon,
- ✓ Preserving sweets or using sulfur dioxide as with wines.

Additives are selected based on their primary function in the finished food product. Micronutrients are usually used as antioxidants:

- ✓ To prevent oxidative processes that impair food quality and
- ✓ Coloring agents to compensate for color lost during processing.

Food additives have an essential role in the current industry and consumption habits, as they not only make food products more appealing, but they increase their stability and inherent safety. Overall, food additives may be defined as compounds/extracts that are added to a food product in order to accomplish a specific technological goal but are not ingested as a food product themselves. According to the European Food Safety Agency (EFSA), an additive must not pose a safety concern for the consumers health (when ingested) while fulfilling a specific technological need that cannot be satisfied through other reasonable means. Examples of these needs are the enhancement of the sensory quality, the fulfillment of specific dietary needs, or the ease of production, packaging, transport, and/or storage of food products.

Overall, in the EU, the use of additives (non-enzymatic) is regulated by European Commission (EC) No 1333/2008 with the additives, the list of allowed additives, and subsequent limitations always dependent on the appearance of new evidence regarding their safety. In this legislation, the different groups are defined along with rules on how an additive must be referred to in a product (e.g., the information must be present in the label with the compounds referred to either by their name or their E-number and by the function they play in the final product). Moreover, food additives must follow specific purity criteria that are described in three different directives:

- ✓ Directive 2008/60/EC for sweeteners;
- ✓ Directive 2008/128/EC for colors; and

- ✓ Directive 2008/84/EC for other additives.

After the inclusion of the list of approved additives and food carriers (and the conditions associated with their use) into Regulation (EC) No 1333/2008, a revision of the purity criteria of food additives was undertaken, resulting in a new regulation, Regulation (EU) No 231/2012,that repealed the previous directives for sweeteners, colors, and other additives. Generally, term food additive means any substance the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food (including any substance intended for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding food; and including any source of radiation intended for any such use).

- **Foods that are rich in micronutrients include**:

  - ✓ Dark leafy greens
  - ✓ Any fruit or vegetable
  - ✓ Raw nuts & seeds
  - ✓ Animal protein that is void of GMOs, antibiotics, or hormones
  - ✓ Whole free range eggs
  - ✓ Herbs & Spices such as: Oregano, Thyme, Rosemary, Turmeric, Sea Salt, Clove, Ginger, Cinnamon

- **Important Supplements might include**:

  - ✓ Omega 3 Fatty Acids
  - ✓ Vitamin D
  - ✓ Probiotic
  - ✓ Vitamin B Complex

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions (5 pts)

1. Explain the purpose of micronutrient/additives:----------

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 points

Information Sheet 3- Reading micronutrient or additive label

3.1 Read micronutrient or additive label

The Nutrition facts panel is part of the label on a food package. It is where you look to find out the amounts of carbohydrates, calories, fat, protein, vitamins, and minerals in the food. This information can help you know whether a food fits well with your meal plan.

Read labels on food to identify:

- ✓ target and non-target species
- ✓ dose /addition level
- ✓ withholding period
- ✓ expiry dates
- ✓ storage and handling requirements
- ✓ manufacturer's name
- ✓ product and active ingredient name

Fig 3.1 Reading label of micro-nutrients/additives

General standard for labelling of pre-packed foods' that describes the information that must be included on a label, but there are also **detailed laws concerning the following aspects**:

- ✓ Specific names that must be given to different types of ingredients,
- ✓ Ingredients that are exempt from the law,

- ✓ The use of words such as best before and sell by,
- ✓ The declaration of alcohol content on spirit drinks,
- ✓ Locations of the name of the food,
- ✓ The sell-by date and the net weight (they must all be in the same field of vision when a customer looks at the label),
- ✓ The visibility of information and the ability of customers to understand it (including the relative print sizes of different information),
- ✓ Claims and misleading descriptions,
- ✓ Especially about health-giving or tonic properties,
- ✓ Nutritional advantages,
- ✓ Diabetic or other medicinal claims,
- ✓ Specifications of the way in which certain words such as flavour, fresh, vitamin etc.

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions (8 pts)

1. list the information should be written on labeling micronutrients:----------
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You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 4 points Unsatisfactory - below 4 points

LG #84	LO #3- Add micronutrient or additive to product

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Matching micronutrient or additive to product
- Determining appropriate volume or proportion of micronutrient
- Undertaking pre-mixing
- Adding micronutrient or additive to product
- Following contamination quality and sequencing procedures
- Taking stock feed samples
- Conducting work

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, **upon completion of this learning guide, you will be able to**:

- Match micronutrient or additive to product
- Determine appropriate volume or proportion of micronutrient
- Undertake pre-mixing
- Add micronutrient or additive to product
- Follow contamination quality and sequencing procedures
- Take stock feed samples
- Conduct work

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Matching micronutrient or additive to product

1.1. Match micronutrient or additive to product

In food processing, it adding appropriate amount of micronutrients and additive are important, unless it causes problems on human health. Food fortification or enrichment is the process of adding micronutrients (essential trace elements and vitamins) to food. It can be carried out by food manufacturers or by governments as a public health policy, which aims to reduce the number of people with dietary deficiencies within a population. The predominant diet within a region can lack particular nutrients due to the local soil or from inherent deficiencies within the staple foods; addition of micronutrients to staples and condiments can prevent large-scale deficiency diseases in these cases.

Utilization of those by-products as a valuable source of natural food additives appears to be a good alternative toward mitigation of environmental problems and for further exploitation of food additives or supplements having high nutritional value and economically attractive. Fruits and vegetables may be incorporated in different raw or cooked, fresh or processed forms: canned, pickled, dried, frozen, candied, and in sauces, purees or preserves. Juices are good sources of phytochemicals and vitamins and can contribute to the overall fruit and vegetable intake. However, they contain less fiber than unprocessed commodities and may contribute extra calories if sugar is added. Care must be taken regarding added salt in processed vegetable products, since they may contribute up to one-third of the total dietary sodium intake.

Fortification is the practice of deliberately increasing the content of an essential micronutrient, i.e. vitamins and minerals (including trace elements) in a food, to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health. Natural products provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. Fruit and vegetable peels are thrown into the environment as agro waste which can be utilized as a source of anti-microbes. However, there is currently no major exploitation of these sources, due to the poor understanding of their nutritional and economic value, adding that there is a great opportunity for agribusiness in the area.

A food ***additive*** in its *broadest sense* is any substance added to food. *Legally*, additives are classified as ***direct*** or ***indirect***. If they are intentionally or purposely added to foods, these direct additives must be named on food labels. If *indirect*, they are incidentally added to food in very small amounts during some phase of production, processing, storage, packaging, or transportation. In addition, pineapple, taro, papaya, and mango are typically appreciated for their flesh but processing of these crops involves separation and removal of the skin and seed byproducts.

Use of additives:

- ✓ Maintain product consistency
- ✓ Improve or maintain nutritional value
- ✓ Maintain palatability and wholesomeness
- ✓ Provide leavening or control acidity/alkalinity
- ✓ Enhance flavor or impart desired color.

1.2. Composition and functional compounds of fruit and vegetable by products

- **Chemical composition**

The amount of pollution load and characteristics of the waste depend on the food being processed. Chemical composition of the wastes from fruits and vegetables show that it is a rich source of various nutrients. Some of these fruit and vegetable wastes are a rich source of vital constituents like carbohydrates, proteins, fats, minerals, fibers etc.

- **Occurrence of functional compounds**

The most common bioactive compounds present in fruits and vegetables are vitamins C, E, carotenoids, phenolic compounds and dietary fiber.

- **Potential of fruit by-products as a source of food additives**

Fruit production, trade and consumption have increased significantly on the domestic and international markets due to their attractive sensory properties and a growing recognition of its nutritional and therapeutic value. Likewise, tropical crops such as pineapple, taro, papaya, and mango are typically valued for their fruit. Processing of these crops typically involves separating the valuable fruit part from byproducts such as skin and seeds. Fruit by products have a potential role in food industry; where one of the majors can be as food additives (antioxidants, antimicrobials, colorants, flavorings, and thickener agents). Vitamin C, a natural

compound obtained from several plant tissues is the best example of the potential use in the food industry.

- **Potential of vegetables by-products as a source of food additives**

The amount of vegetable residues generated after harvesting the edible portion of most crops can account for a large proportion depending on the plant. Traditionally, agro-industrial waste has been used as a feed or as a fertilizer. However, vegetable by-products are an important resource as a raw material for potential use in food additives or dietary supplements and as a source of extractable polysaccharides for industrial exploitation.

Self-Check – 1	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer

1. List the use of additives (8 pts):----------

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating - 4 points Unsatisfactory - below 4 points

Information Sheet 2- Determining appropriate volume or proportion of micronutrient

2. Determine appropriate volume of micronutrient

New additives and new process production of existing additives are evaluated by the Joint FAO/WHO Expert Committee on Food Additives (JECFA), which normally meets twice a year. It is an international expert scientific committee that is administered jointly by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO). Micronutrients are one of the major groups of nutrients your body needs. They include vitamins and minerals. Vitamins are necessary for energy production, immune function, blood clotting and other functions. Meanwhile, minerals play an important role in growth, bone health, fluid balance and several other processes. The dietary requirement for a micronutrient is defined as an intake level that meets specified criteria for adequacy, thereby minimizing risk of nutrient deficit or excess. These criteria cover a gradient of biological effects related to a range of nutrient intakes, which, at the extremes, include the intake required to prevent death associated with nutrient deficit or excess.

Micronutrients are vitamins, minerals, and trace elements that are critical to energy metabolism, cellular growth and differentiation, organ function, and immune function. Vitamins such as thiamine, riboflavin, niacin, biotin, pantothenic acid, and folate (B vitamins), as well as vitamin K, can be synthesized by the microbiota. Under the food additives amendment, two groups of ingredients were exempted from the regulation process.

GROUP I – Prior sanctioned substances are substances that FDA or USDA had determined safe for use in food prior to the amendment. Examples are sodium nitrite and potassium nitrite used to preserve luncheon meats.

GROUP II - GRAS (generally recognized as safe) ingredients are those that are generally recognized by experts as safe, based on their history of extensive use in food before 1958 or based on published scientific evidence. Among the several hundred GRAS substances, one finds salt, sugar, spices, vitamins and monosodium glutamate (MSG). Manufacturers may also request that FDA review the industry's determination of GRAS Status. The Food and Drug Administration (FDA) maintains a list of over 3000 ingredients in its data base "Everything

Added to Food in the United States" available General categories of food additives include preservatives, nutritional additives, sensory agents, and processing agents as noted below. When new food products are developed, new or existing food additives may be utilized.

Table 2.1.Amount of required additives per food

No	Type of food/product	Name of addiives	Max Permitted Level/Amount added
1	Citrus fruit	Oxidised polyethylene Propylene glycol	250 mg/kg 30000 mg/kg
2	Dried fruits and vegetables	Sorbic acid and sodium, potassium and calcium sorbates	1000 mg/kg
3	Commercially sterile fruits and vegetables in hermetically sealed containers	Acesulphame potassium Cyclamates Saccharin	500 mg/kg 1350 mg/kg 110 mg/kg
4	Fruit and vegetable spreads including jams, chutneys and related products	Acesulphame potassium	3000 mg/kg
		Cyclamates	1000 mg/kg
		Saccharin	1500 mg/kg
		Alitame	300 mg/kg
5	fruit and vegetable preparations for manufacturing purposes	Sulphur dioxide and sodium and potassium sulphites	1000 mg/kg

Generally, micronutrients /additives may range from common proprietary products to specific micronutrients and additives prescribed by veterinarians or covered by legislative requirements.

Self-Check – 2	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Explain two groups of ingredients were exempted from the regulation process under the food additives amendment (5 pts):----------
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You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 point

Information Sheet 3- Undertaking pre-mixing

3.1. Introduction

Raw materials and premixes were analyzed for their chemical composition. Premixes were incorporated to unleavened flat bread at 6 and 12% levels and evaluated for nutritional and sensory quality. Results indicated that premixes were rich sources of protein, iron, calcium, total and β-carotene, dietary fiber and bioactive components. They are used for a variety of reasons: to maintain freshness during storage or transportation, to add nutrients or increase the nutritional level, to have a more appealing appearance or taste, or to make processing easier. Food additives are mostly synthetic chemicals but many are natural. Additives like vitamins, enzymes, or amino acids as well as premixes play a key role in ensuring optimum feed for livestock. Only additives that are approved for animal nutrition in accordance with Regulation (EC) No. 1831/2003 may be used.

With the advent of food processing, food additives play an important role in providing a safe food supply as well as meeting the consumers' need. Food additive means any substance, either natural or synthetic, intentionally added to food for a technological purpose in the processing, packaging, transport or storage of such food.

1. The technological functions of food additive include but not limited to the following:

- ✓ Enhancing the safety and quality by the inhibition of microbial growth;
- ✓ Extending the shelf-life by protection against any oxidative deterioration;
- ✓ Enhancing the flavour and odour;
- ✓ Stabilizing or retaining the colour; and
- ✓ Improving the texture and consistency of a food, etc.

2. Food additive is not normally consumed as a food by itself and not normally used as a typical ingredient of the food. The term does not include contaminants or substances

added to food for maintaining or improving nutritional qualities as well as seasonings such as salts, herbs and spices.

3. There are many types of food additives and the commonly used ones include:
   a. Preservatives,
   b. Antioxidants,
   c. Sweeteners,
   d. Colouring matters,
   e. Flavour enhancers,
   f. Thickeners,
   g. Emulsifiers, etc

Safety and Public Health Significance

1. The toxicity of food additives is generally low. The major food safety concern of food additives is in fact due to their chronic exposure at levels above the safety reference.

2. The Joint Food Agriculture Organization / World Health Organization Expert Committee on Food Additives (JECFA) is the international food safety authority responsible for collecting and evaluating scientific data on food additives and allocate a safety reference (i.e. acceptable daily intake (ADI)) to the food additives evaluated. JECFA also makes recommendations on safe levels of use.

3. The ADI of a chemical is the estimate of the amount of a substance in food or drinking water, expressed on a body-weight basis that can be ingested daily over a lifetime without appreciable health risk. A dietary intake above the ADI does not automatically mean that health is at risk. Transient excursion above the ADI would have no health consequences provided that the average intake over long period is not exceeded as the emphasis of ADI is a lifetime exposure.

4. A small proportion of the population may be intolerant to some food additives and may have acute effects, e.g., small amount of sulphur dioxide may cause bronchoconstriction and asthmatic reaction people with allergic conditions.

Self-Check – 3	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the correct answer (6 pts)

1. From the following, which is/are the types of food additives and the commonly used

   A. Preservatives,
   B. Antioxidants,
   C. Sweeteners,
   D. Colouring matters,
   E. All

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 3 points Unsatisfactory - below 3 point

Information Sheet 4- Adding micronutrient or additive to product

4.1. Add micronutrient or additive to product

Food fortification has been defined as the addition of one or more essential nutrients to a food, whether it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups. Other terminology exists for the addition of nutrients to foods. Restoration means the addition to a food of essential nutrients, which are lost during the course of Good Manufacturing Process (GMP), or during normal storage and handling procedures, in amounts, which will result in the presence in the food of the levels of the nutrients present in the edible portion of the food before processing, storage or handling. Enrichment has been used interchangeably with fortification, but elsewhere it has been defined as the restoration of vitamins and minerals lost during processing.

The concentrations of phenolics and other phytochemicals present in the peels, pulp/pomace and seeds of many fruits and vegetables namely citrus, apples, peaches, pears, banana, pomegranate, berries, mangoes, onions, potatoes, tomatoes and sugar beet are generally substantially higher than in their respective edible tissues, suggesting these wastes and residues to be the potential sources for isolating bioactive compounds. The antioxidants (polyphenolic and other phytochemicals) and other bioactive compounds from these sources exhibit anti-cancer, anti-microbial (pathogens), anti-oxidative and immune-modulatory effects. In addition, they reduce incidence of cardiovascular diseases and capillary fragility, inhibit platelet aggregation and prevent thrombosis, oxidative stress, osteoporosis and diabetes in vertebrates.

Specifically, the phenolics and flavonoids present in apple, date pit, rambutan (Nephelium lappaceum) peel, tomato peel extracts strongly inhibit tumour-cell proliferation. Penta-O-galloyl-glucoside (PGG) present in mango seed kernel extract and mango peel is used in pharmaceutical industries, as it possesses anti-tumor, antioxidant, ant cardiovascular and hepato-protective effects. The terpenoid and flavonoids in banana foliage exhibit anthelmintic properties. Pomace of apple, pear, orange, peach, blackcurrant, cherry, artichoke, asparagus, onion, raspberry, tomato and carrot, durian seeds (gelling and thickening agents), mango peels, date pits, cauliflower trimmings, empty

pea pods and okara are used as dietary fibre supplements and as a functional ingredient in processed food products due to the presence of pectins and carotenoids and bound antioxidants.

Some of the fruit and vegetable wastes are excellent source of bio pigments; examples being betalains in beet root pulp and carotenoid in carrot pulp. Tomato seeds, banana peel, rambutan and mango seed kernel, passion fruit seed, black currant, date pits are good sources of edible oil rich in polyunsaturated fatty acids. Many fruit and vegetable wastes are used as a substrate for the production of organic acids (citric, lactic and ferulic acids), single cell protein, essential oils, exogenous enzymes, bio-ethanol/methanol, bio-pesticides, bio-sorbants, biodegradable plastic, bio-fertilizers, bio-preservatives and edible mushrooms. Some have potential to decrease the emission of enteric methane.

Additives are used in foods for five main reasons:

• To maintain product consistency. Emulsifiers give to products a consistent texture and prevent them from separating. Stabilizers and thickeners give smooth uniform texture. Anticaking agents help substances such as salt to flow freely.

• To improve or maintain nutritional value. Vitamins and minerals are added to many common foods such as milk, flour, cereal and margarine to make up for those likely to be lacking in a person's diet or lost in processing.

• To maintain palatability and wholesomeness. Preservatives retard product spoilage caused by mold, air, bacteria, fungi or yeast. Bacterial contamination can cause foodborne illness, including life-threatening botulism.

Antioxidants are preservatives that prevent fats and oils in baked goods and other foods from becoming rancid or developing an off-flavor. They also prevent cut fresh fruits such as apples from turning brown when exposed to air.

• To provide leavening or control acidity/alkalinity. Leavening agents that release acids when heated can react with baking soda to help cakes, biscuits and other baked goods to rise during baking. Other additives help modify the acidity and alkalinity of foods for proper flavor, taste and color.

• To enhance flavor or impart desired color. Many spices, natural and synthetic flavors enhance the taste of foods. Colors, likewise, enhance the appearance of certain foods to meet consumer expectations.

Self-Check – 4	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer (5pts)

1. List explain each of the use of adding additive into food:----------

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You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 point

Information Sheet 5- Following contamination quality and sequencing procedures

5.1 Follow contamination quality and sequencing procedures

Quality assurance refers to a systematic process taken throughout manufacturing to prevent and detect product deficiencies and product safety hazards. The category of contamination usually consists of the unplanned and unsuitable presence in either gross or minute quantities of one active substance in the presence of another. It is often limited to the presence of one active ingredient in the presence of another bulk or formulated active material. Cross-contamination usually occurs when common equipment or systems are used for the manufacturing and handling of different active substances. Improper cleaning procedures may contribute to this effect. Often the absence of contaminants or cross-contaminants is assured by either testing, proof of process compliance or conformance to strict good Manufacturing practices and is indicated to the customer via the certificate of analysis or through a continuing guarantee. Care must be maintained in all production operations to minimize and/or eliminate the risks of contamination and cross contamination. Adherence to directives regarding Good Manufacturing Practices and Proof of Performance for Existing Processes provides a high degree of certainty that production processes will meet this requirement.

During industrial processing of fruits, large quantities of wastes are generated. This has become a serious problem as they exert an influence on environment and need to be managed and/or utilized. Further exploitation of the fruit processing by-products as sources of functional ingredients and possible applications has become a promising field and global requirement due to the increase in the concern towards the environment. Natural functional compounds from fruit processing wastes can be used to replace synthetic additives adding multifunctional concepts by combining health benefits to technological use. Novel scientific and alternative technologies should be used to extract the optimum levels of bioactive compounds as well as other compounds of economic importance from the fruit wastes.

A quality assurance system is specific to a manufacturer's operations and addresses product safety matters. The following elements of a quality system are selected for special emphasis due to their significant effect on product integrity and safety:

- ✓ Inspection and Testing

- ✓ Statistical Methods and non-Conforming Material

Self-Check – 5	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer (5pts)

1. Explain the quality assurance system:----------

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 point

Information Sheet 6- Taking stock feed samples

6.1. Take stock feed samples

Ingredient quality is the foundation on which an animal ration is built. Correct sampling and sample evaluation enables the processor to make inferences about the quality of incoming grain, protein sources, micro-nutrients, and finished feed.Stockfeed includes feed commercially produced and branded by enterprises as well as customer provided formulations. Animal-source foods are good sources of the micronutrients that are often lacking in staple foods such as cereals and tubers. Meats are excellent sources of iron, zinc, and several B vitamins including vitamin B-12. Milk is rich in vitamin B-12, vitamin A, riboflavin, and folate but is very low in iron. Indeed, animal products are the only natural source of vitamin B-12. Low intakes of animal-source foods explain the high prevalence of vitamin B-12 deficiency in many developing countries.

- **The common stockfeed include:**
  - ✓ Pellets
  - ✓ Liquids
  - ✓ Mashes
  - ✓ Blocks
- **Sampling Systems**

Common sampling schemes used in the stock feed and grain industry include simple random sampling, stratified random sampling, and systematic sampling.

A **simple random sampling** from a population of N sampling units gives equal probability to all units.

A **stratified random sample** is obtained by separating the population elements into non-overlapping groups, called strata. Then, a simple random sample is collected from each stratum. This typically is how shiploads are sampled each hold represents a stratum and multiple samples are collected randomly within each hold.

Forage samples should contain several pounds of material.

The sampling scheme, procedure, and sample preparation will vary depending on whether the material is a dry forage, silage, pasture, green chopped forage, or forage in the field.

- Collect dry forage from at least 20 different locations using a core sampler. If a core sampler is not available, hand (grab) sampling can be used. Try to avoid leaf loss when using this procedure.

- Collecting silage samples from trench silos should be performed by removing a column 6 inches deep by 12 inches wide on the open face. Mix the silage and place a number of random handfuls in a plastic bag. Pack the sample tightly and seal the bag to exclude air.

Self-Check – 6	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer (5pts)

1. List the common types of stock feed:----------

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 point

7.1. Add micronutrient to product

Food fortification has been defined as the addition of one or more essential nutrients to a food, whether it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups. Other terminology exists for the addition of nutrients to foods. Restoration means the addition to a food of essential nutrients, which are lost during the course of Good Manufacturing Process (GMP), or during normal storage and handling procedures, in amounts, which will result in the presence in the food of the levels of the nutrients present in the edible portion of the food before processing, storage or handling. Enrichment has been used interchangeably with fortification, but elsewhere it has been defined as the restoration of vitamins and minerals lost during processing.

Principles for Using Food Additives

- The food additives being used should present no risk to the health of the consumer at the levels of use.
- The use of food additives is justified only when such use has an advantage, does not present a hazard to health of and does not deceive the consumer, as well as serves one or more of the following technological functions and needs, and only where these objectives cannot be achieved by other means which are economically and technologically practicable –
  a. To preserve the nutritional quality of the food;
  b. To provide necessary constituents for foods manufactured for groups of consumers having special dietary needs;
  c. To enhance the keeping quality or stability of a food or to improve its organoleptic properties;
  d. To provide aids in the processing, packaging, transport or storage of food, provided that the additive is not used to disguise the effects of the use of faulty raw materials or of undesirable (including unhygienic) practices of techniques during the course of any of these activities.
- All food additives shall be used under conditions of good manufacturing practice (GMP) which include the following:

a. The quantity of the additive added to food shall be limited to the lowest possible level necessary to accomplish its desired effect;

b. The quantity of the additive that becomes a component of food as a result of its use in the manufacturing, processing or packaging of a food and which is not intended to accomplish any physical, or other technical effect in the food itself, is reduced to the extent reasonably possible; and

c. The additive is prepared and handled in the same way as a food ingredient.

Self-Check – 7	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer (5pts)

1. What is food fortification:----------

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 point

LG #85	LO #4- Record use of micronutrient or additive

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Recording type and amount of micronutrient or additive used
- Generating and adding target species to product

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, **upon completion of this learning guide, you will be able to**:

- Record type and amount of micronutrient or additive used
- Generate and add target species to product

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Recording type and amount of micronutrient or additive used

1.1. Uses of additive

The use of food additives originated in ancient times. Far back in time people understood that some foods contained natural chemical compounds that could be used in food storage, although the structure and mechanisms of action of the sub- stances were unknown. For example, the naturally occurring chemical substance benzoic acid is present in several berries and fruits, such as lingon berries, and acts as a preservative and protects against yeast, bacteria and fungi. Additives perform a variety of useful functions in foods that are often taken for granted. Since most people no longer live on farms, additives help keep food wholesome and appealing while en route to markets sometimes thousands of miles away from where it is grown or manufactured.

Additives also improve the nutritional value of certain foods and can make them more appealing by improving their taste, texture, consistency or color. Some additives could be eliminated if we were willing to grow our own food, harvest and grind it, spend many hours cooking and canning, or accept increased risks of food spoilage. But most people today have come to rely on the many technological, aesthetic and convenience benefits that additives provide in food." Food manufacturers attempt to increase the shelf life of their products by controlling and preventing deterioration; therefore, additives may be used to preserve or combat microbial or enzymatic deterioration. All living tissue resists microorganism attack to some degree, and additives assist in microbial (pathogens and non-pathogens) protection.

The use of additives at the point of manufacture or processing cannot stop all foodborne illness though and cannot guarantee food safety for the population at large. For example, mishandling of food at restaurants and homes contributes a larger portion of foodborne illness than handling at food processing plants. A second use of food additives is that they may be included in food to maintain or improve nutritional value. They enrich, fortify, or restore what is lost in processing. Additives may add nutrients and correct deficiencies, such as when iodine was used to treat goiter or when the minerals calcium and iron are added to food. Antioxidants such as lemon juice, vitamins A and C are added to control the damaging effect of exposure to oxygen, or vitamin D is added to fortify milk. Many grain

products are enriched or fortified with thiamin to prevent the disease beriberi, niacin to control the devastating pellagra, and more recently, with folate to prevent the reoccurrence of neural tube defect. Nutritional fortification is of tremendous benefit to many people.

One of the above additives, in fact the very first food additive in the United States, was iodine. Its function was nutritional: to treat and prevent goiter, common in the Great Lakes and Pacific Northwest regions of the United States. It is shown then that additives play a role in food protection and nutrition fortification. Other roles of additives are as flavor and color sensory agents. These agents may be added to food so that it is made more appealing. As well, additives may be included in processing, for example, to maintain product consistency, to emulsify, stabilize, or thicken a food.

Table 1.1. Types of additives and their function

No	Type of Additives	Uses/Function
1	Sweeteners	Increase the sweetness (can be added or table-top)
2	Colors	Add or restore color
3	Preservatives	Prolong shelf-life by inhibiting microbial deterioration or the growth of pathogens
4	Antioxidants	Prolong shelf-life by inhibiting oxidative deterioration (e.g., color changes or rancidity)
5	Acids	Increase the acidity and/or impart a sour taste
6	Acidity	regulators Alter/control the pH of a foodstuff
7	Anti-caking agents	Reduce particle agglomeration
8	Anti-foaming agents	Prevent/reduce foam formation
9	Bulking agents	Increase the volume of a foodstuff without significantly increasing its energetic value
10	Emulsifiers	Ease the formation/maintenance of an homogenous mixture of two immiscible phases

11	Emulsifying salts	Convert cheese proteins into a dispersed form contributing to an homogenous distribution of other components (e.g., fat)
12	Firming agents	Either keep fruit and vegetables firm/crisp or produce/strengthen gels
13	Flavor enhancers	Enhance taste/odor
14	Foaming agents	Ease the dispersion of a gaseous phase in a liquid/solid
15	Gelling agents	Form a gel and improve texture
16	Stabilizers	Maintain the physico-chemical state of a foodstuff
17	Raising agents	Release gas therefore increasing the volume or a dough or batter
18	Sequestrants	Complex metallic ions
19	Thickeners	Increase the viscosity
20	Flour treatment agents	Improve the baking quality of flours/dough's (non-emulsifiers)

Self-Check – 1	Written test

Name…… ID…… Date…

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer (5 pts)

1. List the additives and their function;----------

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 points

Information Sheet 2- Generating and adding target species to product

2.1. Add target species to product

Food additives are substances added to food to preserve flavor or enhance its taste, appearance, or other qualities. Some additives have been used for centuries; for example, preserving food by pickling (with vinegar), salting, as with bacon, preserving sweets or using sulfur dioxide as with wines. With the advent of processed foods in the second half of the twentieth century, many more additives have been introduced, of both natural and artificial origin. Food additives also include substances that may be introduced to food indirectly (called "indirect additives") in the manufacturing process, through packaging, or during storage or transport.

The term micronutrients is used to describe vitamins and minerals in general. Macronutrients, on the other hand, include proteins, fats and carbohydrates. Vitamins are organic compounds made by plants and animals, which can be broken down by heat, acid or air. On the other hand, minerals are inorganic, exist in soil or water and cannot be broken down. The micronutrient content of each food is different, so it is best to eat a variety of foods to get enough vitamins and minerals. An adequate intake of all micronutrients is necessary for optimal health, as each vitamin and mineral has a specific role in your body. Vitamins and minerals are vital for growth, immune function, brain development and many other important functions. Depending on their function, certain micronutrients also play a role in preventing and fighting disease. Generally, target species may include:

- ✓ Land and marine animals raised commercially for meat,
- ✓ Skin products and
- ✓ Milk

Table2:1. Function of Micronutrients

No	Micronutrients	Function
1	Vitamin A	Necessary for proper vision and organ function
2	Vitamin D	Promotes proper immune function and assists in calcium absorption and bone growth
3	Vitamin E	Assists immune function and acts as an antioxidant that protects cells from damage.
4	Vitamin K	Required for blood clotting and proper bone development
5	Vitamin B1 (thiamine)	Helps convert nutrients into energy.
6	Vitamin B2 (riboflavin)	Necessary for energy production, cell function and fat metabolism.
7	Vitamin B3 (niacin)	Drives the production of energy from food.
8	Vitamin B5 (pantothenic	Necessary for fatty acid synthesis acid)
9	Vitamin B6 (pyridoxine)	Helps your body release sugar from stored carbohydrates for energy and create red blood cells.
10	Vitamin B7 (biotin)	Plays a role in the metabolism of fatty acids, amino acids and glucose.
11	Vitamin B9 (folate)	Important for proper cell division.
12	Vitamin B12(cobalamin)	Necessary for red blood cell formation and proper nervous system and brain function.
13	Vitamin C (ascorbic acid)	Required for the creation of neurotransmitters and collagen, the main protein in your skin.

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions (5 pts)

1. List the target species: ----------

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 points

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