BEE PRODUCT PROCESSING- LEVEL- II

Based on October 2019, Version 2 Occupational standards (OS)

Module Title: Identifying and receiving the type of raw material for processing

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LG #17	LO #1- Identify and Receive Bee Products

Instruction sheet

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

- Checking delivery services
- Determining tests for bee products
- Sampling and testing of bee products
- Procedures for rejected bee products
- Arranging workplace information
- Identifying honey for extracting and mead preparation

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:

- Check delivery services documentation
- Determine required tests for delivered bee products from standard operating procedures, supervisor instruction or other source
- Perform sampling and testing of bee products for the required parameters to determine if the delivery is within specifications
- Follow procedures for rejected bee products according to standard procedures
- Arrange workplace information according to the procedures
- Identify the type of honey for extracting and mead preparation

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).

6. If you earned a satisfactory evaluation proceed to “Operation sheets

7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,

8. If your performance is satisfactory proceed to the next learning guide,

If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Checking Delivery Services

1.1 Introduction

Bee products are all products collected from beehives. Honey, beeswax, pollen, jelly, propolis, bee venom and colony are the common known products. However this unit considers only the bee products of honey and beeswax. The quality of honey to received will consider the final expected products like extracted honey and bees wax, the fermented honey (mead) and by-products like *Biriz* and *Te'j* (traditional beverage in Ethiopia).

Receiving is the process of obtaining and accepting correct incoming materials to process. Identifying and receiving the type of crude honey and crude wax forbee product processing is applied where on-site or at the receiving area of processing center. The checking process includes documentation, weighing, and conduct of contamination and other initial checks like proper transportation and placement of bee products into storage. Delivery service like power, aeration, lighting, water should be check first before receiving bee products for processing.

1.2 Honey receiving section

- There shall be a raised platform for receiving the material and the sides and roof of the platform shall be sufficiently protected from extraneous contamination.
- The raw honey receiving section shall be sufficiently separated from processing area to prevent contamination
- Signboards directing the employees to wash and sanitize hands before entering and after each absence shall be installed
- Air curtains/fly killers shall be installed to prevent the entry of flies when the door is opened.

1.3 Conditioned Environment

It is best to have a honey house in which all the necessary conditions (cleanliness and dry air) can be created for the storage and processing of honey. All honey treatment must be done under dry air conditions. During transport and storage comb honey, even if it has been sealed, may absorb moisture from humid air. The time of exposure to humid air must be kept to a minimum. Inside the honey house, air conditioning, fans for ventilation or other means to reduce humidity in the air can be installed and applied. Warming the processing room will help reduce relative air humidity and also make the honey less viscous, which will simplify processing. Hygrometers and thermometers should be present in every room of the honey house. Arefractometer to monitor moisture content of the honey at different stages is also useful.

1.4 Heating, cooling, plumbing, power

Plumbing, electrical and ducting pipes should be laid out so that there are no areas where extraneous materials (i.e. dust and dirt) can accumulate. Structural members should be chosen to minimize or eliminate hard-to-clean areas. Round pipes rather than I beams are preferred. Ensure that plumbing is part of a monthly facility inspection routine to confirm that pipes do not leak, pool water or condensation, or function incorrectly; otherwise, maintenance is required.

1.5 Delivery Services to be check

1) Power

Power is the very important service for a lot of works. If the equipments are working with power should identify, check the availability and make it appropriate for the specific process. Electrical power or other is to different operations for making appropriate condition in receiving from transport to storage. Power is required for lighting, ventilation, cooling, weighing, sample testing and others. This is applicable the equipments used are required power.

2) Aeration

Since honey is melted under hot condition, aeration availability during handling, transporting and storage will be necessary to minimize the melting of bee products /specially honey/. Making available aeration in storage and transportation is must to maintain the quality of the product. The natural air will be circulated around the products. If it is not available in the place, there will be fix the air fun or other ventilating equipments where the transportation and storage.

3) Lighting

Lighting is usually brought in through high roof windows to avoid visual distractions for workers. Lux (symbol: lx) is the unit of illumination which is used to measure the intensity of light that hits or passes through a surface, as seen from the human eye. It measures luminous flux per unit area and is equal to one lumen per square meter. In an industrial environment, the spaces are deep thus artificial lights are the dominant source of light. The use of sky lights and jig saw roofs are adopted in the design to allow natural lights to reach deep spaces.

4) Water

Water is the major service used cleaning purpose in the delivery area. The water sources may be potable water, ground or other sources or recycled from industry but the quality should be checked by the authorized body.. Emphasis should be placed on the retention of storm water and on-site infiltration and ground water recharge using methods that closely emulate natural systems. Minimize the unnecessary and inefficient use of potable water on the site while maximizing the recycling and reuse of water, including harvested rainwater, storm water, and grey water.

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. What type of services to be check for delivery bee products? (4 points)
2. Discuss the requirement of honey receiving section?(4 points)
3. Discuss the conditioned environment for delivery bee products honey? (2 points)

Note: **Satisfactory rating - 10points** **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

   _____

2. _____

   _____

3. _____

   _____

Information Sheet 2- Determining tests for Bee Products

As mention under information sheet the bee products are honey and beeswax. After the delivery of honey and beeswax should be take tests of quality parameter. Such type of tests will determine the quality of final products. The quality of the products can scarcely be improved once they have been removed from the hive, but their quality can be diminished during harvesting, extraction, further processing and storage.

2.1 Bee Products

Honey

Honey is the natural sweet substance produced by honeybees from the nectar of blossoms or from the secretion of living parts of plants or excretions of plant sucking insects on the living parts of plants, which honeybees collect, transform and combine with specific substances of their own, in the honey comb to ripen and mature. This is the general definition of honey in the Codex Alimentarius (1989) in which all commercially required characteristics of the product are described

Table 1: Physical and chemical specifications of honey compositions.

No	Honey composition	Specifications
1.	Hydroxylmethylfurfural (HMF)	Not more than 60 mg/kg
2.	Total reducing suga	Not less than 60%
3.	Fructose	27–44.3%
4.	Glucose	22–40.7%
5.	Sucrose	Not more than 5%
6.	Fructose/Glucose ratio	Not less than 0.95%
7.	Heavy metals and other additives (arsenic, lead, mercury, pesticide, etc)	Absent or not exceed maximum levels allowed
8.	pH	3.24–6.1
9.	Pollen grains	Present

Source: Codex Alimentarius Commission (CAC, 2001)

Table 2: Constituent of Honey

No	Honey constituent	Average
1.	Moisture	17.2
2.	Fructose	38.2
3.	Glucose	31.3
4.	Sucrose	1.3
5.	Maltose	7.3
6.	Higher sugars	1.5
7.	Free acid as Gluconic	0.43
8.	Lactone as Glucolactone	0.14
9.	Total Acid as Gluconic	0.57
10.	Ash	0.169
11.	Nitrogene	0.041
12.	pH	3.91
13.	Diastase	20.8

Source: FAO Honey Processing Toolkit

The main composition of honey is carbohydrates or sugars, which represent 95% of honey dry weight. Honey is a complex mixture of concentrated sugar solution with main ingredients of fructose and glucose. The average ratio of fructose to glucose is 1.2:1.

Table 3: Composition of honey required by World Health Organization

No	Honey constituent	Range
1.	Moisture content	Not more than 21
2.	Fructose and Glucose	Not less than 65%
3.	Water soluble solids	Not more than 0.1%
4.	Sucrose	Not more than 5%
5.	Mineral content	Not more than 0.6%
6.	Acidity	Not more than 40 milli equivalents of acid per kilo
7.	Diastose activity	Not less than 8 on the Goethe Scale
8.	Hydroxymethylferfural	Not more than 40mg HMF per kilo

Beeswax

The wax obtained from the honey combs after the removal of honey and after being subjected to a preliminary treatment, such as melting, scumming, decantation and moulding called crude beeswax. The wax obtained after subjecting crude beeswax to further purification by melting (usually in hot water or steam) and finer called filtration refined beeswax.

The beeswax is secreted by the bees through four pairs of abdominal glands and manipulated for construction of the combs in the beehives. Under ideal conditions, the conversion rate of the sugar into wax is from 17:1 to 20:1 due to the biochemical complexity involving this process. An individual scale secreted by one gland each time weighs about 1.1 mg, then 910.000 scales are necessary to produce one kilogram of beeswax. Beeswax has a plastic consistency, white color to yellowish at the beginning of the honeycomb construction, and melts easily.

Table 4: Constituent of Beeswax

No	Beeswax constituent	Average
1.	Monoesters	35
2.	Hydrocarbons	14
3.	Free Acids	12
4.	Diesters	14
5.	Hydroxy polyesters	8
6.	Hydroxy monoesters	4
7.	Triesters	3
8.	Acid polyester	2
9.	Acid esters	1
10.	Unidentified	7

Source:- FAO Honey Processing Toolkit

2.2 Determining tests for Honey and Beeswax

Determining tests for Honey

Beekeepers do not really need to perform complicated tests to determine the quality of their honey, because they know whether the honey is fresh and raw and whether the moisture content is good or not. They can see this by looking at how syrupy it is, for

example. The beekeeper has also been present during production, harvesting, extraction and any other further processing and thus knows the products' production history. Simple measurement techniques are also available for use in the field. These are recommended, especially for larger producers and beekeepers' associations, because by measuring the result the beekeeper can improve the quality of his or her production methods. This will also allow him or her to market the products better.

Table 5:-Quality Indicators of Honey

No	Indicator/ composition	Parameter	Measurement/ reference
1.	Freshness	Small and taste	Olfactory
		HFM	Laboratory taste
		Glucose-Oxidize	H_2O_2 taste
		Diastase	Laboratory taste
2.	Moisture content	Density	Measuring gug-scale
		Refraction of light	Refractometer
3.	Fermentation	Alcohol	Foaming
		Acetic acid	Taste
		Fermentation	Microscope
4.	Enzyme	Diastase	Laboratory tests
		HFM	Laboratory tests
5.	Glucose / fructose	Differs per honey	Titration
			Polarization glass
6.	Pollen	Differs per honey	Microscope and pollen collection or pollen atlas
7.	No residue		Laboratory tests
8.	Electric conductivity	Differs per honey	Laboratory tests

Key: HFM=Hydroxymethylferfural
Source: Ethiopian Meat, Dairy and Industry Development Institute (EMDIDI), 2018

Note

HMF (Hydroxymethylfurfural) is a break-down of fructose (one of the main sugars in honey) that is formed slowly during storage but very quickly when honey is heated. Colour can also be an indicator of quality because honey becomes darker during storage and heating. The amount of HMF present in honey is used as a guide to the age of the honey and/or the amount of heating that has taken place. Some countries set an HMF limit for imported honey.

Table 6: Standards of honey based on EU, Codex and Ethiopia

No	Criteria	EU	Codex	Ethiopia
1.	Moisture content (%)	Not more than 21	Not more than 20	Not more than 20
2.	Water insoluble solids -Pressed honey, (%) -Extracted, (%)	0.5% Max 0.1% Max	0.5% Max 0.1% Max	 0.5% Max -
3.	Ash content, (%)	0.6 Max	-	-
4.	Sugar contents -Reducing sugars, (%) -Sucrose, %	 Not less than 65 Not more than 5	 Not less than 60 Not more than 5	 Not less than 65 Not more than 5
5.	Acidity, mill equivalent/kg	Not more than 40	Not more than 50	Not more than 40
6.	Diastase Number	Not less than 3	Not less than 8	Not less than 8
7.	HMF, mg/kg	Not more than 40	Not more than 40	Not more than 40

Key: HFM= Hydroxymethylferfural, EU= European Union, "-"= not identified
Source: Ethiopian Meat, Dairy and Industry Development Institute (EMDIDI), 2018

Honey will receive not only in raw or crude form from beekeepers which exists. There are different types of processed forms like crystallized, pasteurized honey, strained honey, ultra filtered honey and comb honey. In fact raw honey not does it mean only exists in the beehive but it is also as obtained by extraction, settling or i straining without adding heat (although some honey that has been "minimally processed" is often labeled as raw honey). Raw honey contains some pollen and may contain small particles of wax.

The testing parameters to be tested are similar but the quality indicator in visual and sample taking for test may different for different types of honey. Honey is hydroscopic, that is, it will absorb moisture from the atmosphere or damp surfaces that it comes into contact with. It is the moisture in honey that causes fermentation to begin. This can seriously affect the quality and longevity of your product. Laboratories and very large commercial operations may use a refractometer to determine the moisture content of honey. This is not practical for most beekeepers although some beekeepers do use them.

A simple way to test the density of honey and therefore estimate the moisture content of your honey is to place the honey in a jar, leaving a small amount of air and put the lid on it. Turn the jar upside down. The longer it takes for the bubble to raise to the 'top', the denser the honey and the lower the moisture content

Determining tests for Beeswax

Beeswax contains the following characteristics

1) **Specific gravity**

Beeswax has a low specific gravity compared with water therefore it floats in water. Any beeswax sample, which sinks in water, indicates that it has been contaminated or adulterated.

2) **Melting point**

Beeswax may exist in two forms; solid or liquid. Beeswax has higher melting point than paraffin wax and low melting point than other waxes of plant origin. The melting point of a wax was the temperature at which the wax changes from a solid to a liquid state. The beeswax was melted by warming it in water bath at a temperature just sufficient to melt it and the melting points were determined by the capillary tube method or the drop point method. The most popular and easy method is the capillary tube.

- Introduce the melted beeswax in a hollow capillary tube, until reaching a height of about specific length of capillary tube.
- Introduce it into a bath of water and continue warming slowly
- Take a reading of specific temperature in °C/min of at starting point of melting
- After that, check the temperature with a thermometer whose bulb had to be as close as possible to the beeswax column introduced in the capillary tube (the capillary tube, containing the beeswax).
- Compare your result with the standard
    - ✓ The melting point of beeswax is determined by measuring the temperature at which the first drop of liquid wax appears during heating. It should be between 61 and 66°C or preferably between 62 and 65°C

3) **Acid number**

Acid number is the number of milligrams of pure Potassium Hydroxide (KOH) required to neutralize completely the free fatty acids in one gram of wax. Thus an average sample of beeswax with an acid number of 20 needed 20mg of KOH per gm of wax to neutralize the acid content. Determination of acid number of beeswax can tell whether beeswax sample has been adulterated.

4) **Saponification value**

Saponification value is the number of milligrams of Potassium Hydroxide required to neutralize the acids resulting from the complete hydrolysis of 1gm of oil or fat. High Saponification value indicates adulteration with vegetable oils.

5) **Iodine value**

Iodine value is defined as the number of milligrams of iodine that will combine with 100gm of oil or fat to give the degree of unsaturation of the acids in the substance. Saturated fatty acids absorb no iodine, thus the iodine value is a measure of proportion of unsaturated fatty acids present in waxes. The higher the iodine number indicates adulteration.

Table 7: Beeswax Quality Specification

No	**Parameters**	**Minimum**	**Maximum**
1.	Melting point	62^0C	65^0C
2.	Acid Value	17.0	25.0
3.	Ester Value	72.0	79.0
4.	Ratio Number	3.3	4.2
5.	Saponification cloud point	65^0C	

Source: Ethiopian Meat, Dairy and Industry Development Institute (EMDIDI), 2018

Table 8: Summary results for beeswax test against standards of some countries

Country	Saponification cloud point	Melting point	Acid Value	Ester Value	Ratio Number
Ethiopia	57.9-65	61-63.85	18-32.7	66-4-98	2.8-4
British	-	62-65	17-23	70-80	3.5-4.1
U.S.A	62-65	62-65	18-24	72-79	3.3-4
France	-	62-66	16.8-22.4	72-80	-
Brazil	-	62-66	17-24	72-79	-

Key: "-"not identified

Source: Ethiopian Meat, Dairy and Industry Development Institute (EMDIDI), 2018

Besides physical and chemical specifications there are judging points for beeswax. These are:

1) Color: - Should be light and bright. However, beeswax has a plastic consistency, white color to yellowish at the beginning of the honeycomb construction, and melts easily.
2) Cleanses: - Beeswax should be free from dirty debris bad odors, propolis and honey. The impurities can be removed by heating and allowing standing for several times without disturbances.
3) Uniformity of appearance: should be free of bubbles and layers
4) Cracking and shrinkage: - should be free of cracking

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. What are quality indicators of honey? (8 points)
2. What are parameters to be tested for each quality indicators of honey? (8 points)
3. What are quality indicators of beeswax? (5 points)
4. What are parameters to be tested for each quality indicators of beeswax? (5 points)

Note: **Satisfactory rating –26 points** **Unsatisfactory - below 26 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

   _____

2. _____

   _____

3. _____

   _____

4. _____

   _____

Information Sheet 3- Sampling and testing of bee products

Sampling and testing of honey and beeswax is used to identify the quality. A procedure of sampling and testing is different from material to materials to be found the required parameters. However, the sampling and testing of bee products cover in this information sheet will be only honey. Sampling and testing of honey may follow procedures like:-

- proper sampling of honey
- honey colour and weight
- moisture
- presence of foreign materials

3.1 Sampling of Honey

Sampling is the act of selecting a certain portion, number of containers or product units from a particular lot of the beeswax and honey. Samples are normally sent to the laboratory for analytical purposes. The condition of the same arriving in the laboratory shall reflect conditions at the time of sampling. The results obtained from the laboratory will be the basis of removal of the product from the market, legal or administrative action to the producer, seller, distributor, exporter and consumer.

The sample to be analyzed should be representative of the honey lot. All honey samples should be prepared in the following way before analysis. For straining, use a stainless steel sieve, mesh diameter 0.5 mm. Liquid or crystallized honey free from extraneous matter.

- Homogenize the laboratory sample by stirring thoroughly (at least three minutes).
- Be careful that as little air as possible is stirred into the honey, especially if the sample is to be used for determination of hydroxymethylfurfural.
- If the honey is crystallized in a hard and compact mass, it can be previously softened by heating it in stove or thermostatic bath at no more than 40°C.

Liquid or crystallized honey containing extraneous matter

- Remove any coarse material, subsequently stir the honey at room temperature and pass through a 0.5 mm sieve.

- Gently press crystallized honey with a spatula through a 0.5 mm sieve. Comb honey. Uncap the comb.
- Drain the comb through a 0.5 mm sieve without heating in order to separate honey from the comb.

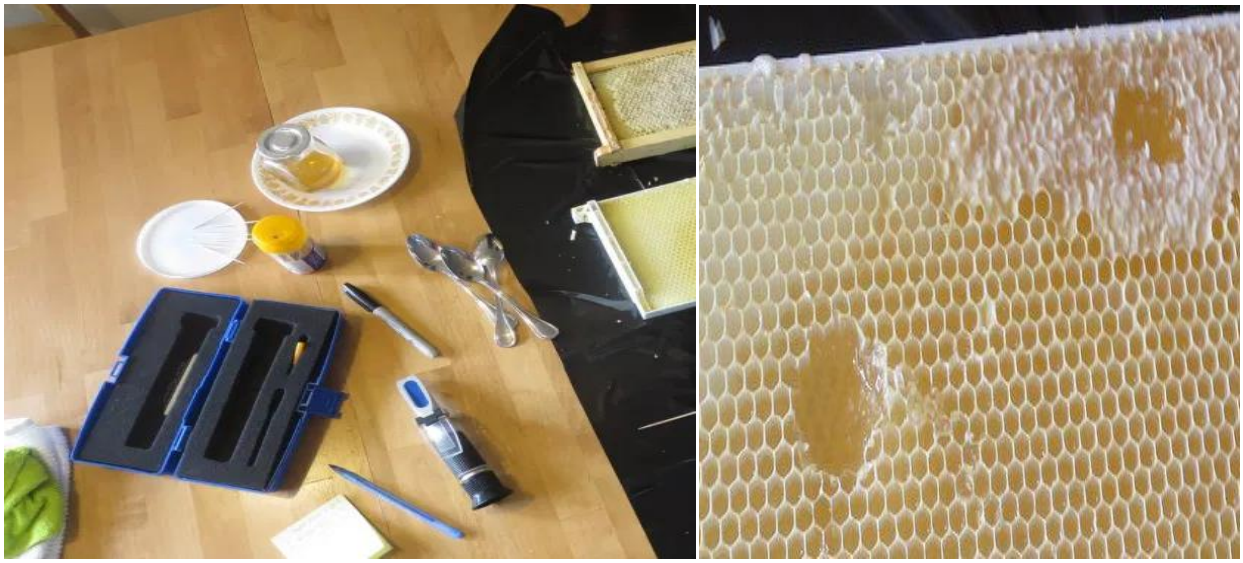

Figure 1: A refractometer, sampling spoons and toothpicks, clean-up cloths, markers to label, and honey

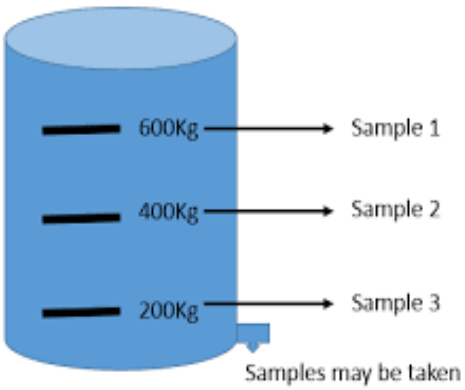

Figure 2: sampling from crude honey at receiving area

Figure 3: Samples of honey prepared to dispatch for test

3.2 Testing of Honey

Honey will be determined in laboratory using laboratory equipments or using simple methods depending on the level of industry and sampling purpose.

1. **Determination of Honey with Laboratory Test**

1) Determining color and weight of Honey

The color is one of the organoleptic or sensory characteristics of honey like smell, taste and viscosity. The color of honey can be measured by an instrument called a Pfund grader. On the world market, honey is traded based on color and some domestic honey packers pay beekeepers mainly on the honey color. The lighter the color, the more valuable it is to the beekeeper when sold to a honey packer. The lower the Pfund reading indicates the lighter the color. The different tastes, aromas and colors of honey are a result of the different flowers that the bees have collected nectar from. Color is also affected by the age of the combs old combs give darker honey than new combs.

Weight of the honey is one of the parameter of quality determination of honey. Honey is weighed than water which means honey weighs between 1.39 and 1.45 times the weight of water. The determination of weight intermes of volume and direct weighing of honey will be discussed in information sheet of #3 and #5 of LO#2 of this Learning Guide (LG#18).

2) Determining of Moisture content of Honey

Moisture content of honey is practically the most important quality parameter, since it affects storage life and processing characteristics. Even though moisture can be removed after extraction, only completely ripe honey should be harvested, i.e. combs with more than 75 % of the honey cells sealed. Moisture content of honey can be determined with Refractometer.

Full of blue color on the ruler of the refractometer is the before putting the sample of honey on plate. When you put the sample on the plate, the color the ruler looks like blue and white. The reading between blue and white will be the moisture content of sample (figure 4).

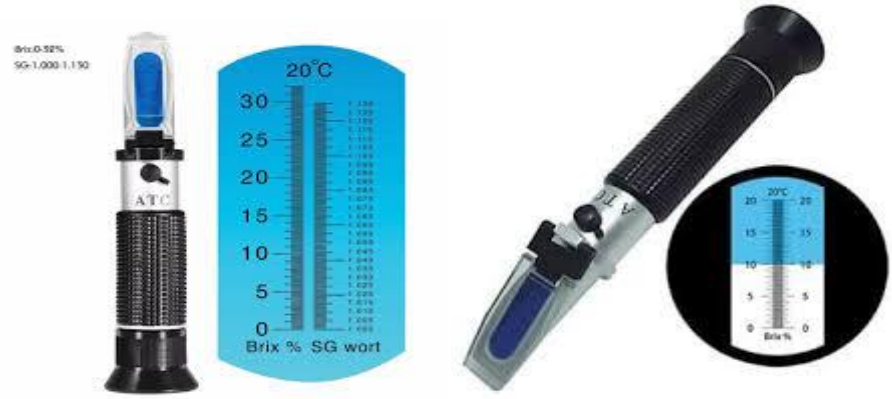

Figure 4: Refractometer

3) Determining of pH of Honey

The pH of honey may be determined by using digital pH meter (one type of pH measuring instrument). Ten grams of honey sample was dissolved in 75 ml of distilled water in 250 ml beaker. The solution was stirred and pH electrode was immersed Sodium Bisulphate solution 0.20 g /100 g (0.2 %) in the solution and pH was recorded.

Figure 5: Calibration of pH meter and measuring pH of sample

4) Preliminary tests for quality (testing of the presence of foreign materials or water content)

If a droplet of honey poured into cold water stays together without dissolving rapidly, it is most likely pure honey. This can be observed best against the light with a dark background. If the edges of the droplet or the thread start dissolving during pouring, the honey is likely to have been adulterated or has very high water content. In any case it should be kept separate from other honey until more precise tests can be carried out.

2. Simple Testing Methods of real Honey

There are a few methods to test real honey to see if it was mixed with water or other sugary syrups. None of these methods can tell if honey is organic or not, but they at least tell you if what you bought is only honey or some other substances like flour, starch, chalk, corn syrup, sugar etc.

1) It should not be very liquid

If you take the jar from the shelf and turn it upside down, it should form an air bubble the shape of a pear, which will go slowly up, to the bottom of the jar. If it goes quickly then it could have been mixed with different substances to increase fluidity and quantity. It can also mean that the honey is not matured.

2) It must crystallize

To be sure it's pure honey; the safest way is to buy it already crystallized. Otherwise, depending on the type of flower, honey should crystallize in several months. Some honeys take even longer, due to their high content of fructose.But to test this in a short time, place the honey in the fridge. If it doesn't crystallize, it's not pure.

3) It shouldn't dissolve quickly in water

Stir some honey into a glass of water. Pure honey won't dissolve, but rather form a lump and sink down to the bottom of the glass. Impure honey will easily dissolve in the water.

4) It should not perforate or be absorbed by the paper

Use a blotting paper, coffee filter or tissue paper. Put some honey on them. If it's impure honey the honey will be absorbed by the paper, if it's pure honey it will not. It means it doesn't have any water added.

5) Pure honey is a good skin regimen

Rub some honey between your index finger and thumb until it disintegrates, it will be absorbed into your skin if there's honey. Natural honey is not sticky. If what you rub is sticky, it has sugar or artificial sweetener in it.

6) Honey burns

Take some matchsticks and stick them with their tips in honey. Wipe off the exceeding honey and strike to light them. If they do, then the honey is good. Fake honey will not light because of the moisture.

Figure 6: Testing honey burns

7) Goes clockwise when poured /viscosity/

Pour half a cup of honey slowly into another cup. Honey will spin clockwise as you pour it. This is a result of the asymmetrical structure of honey molecules that give it a right hand bia.

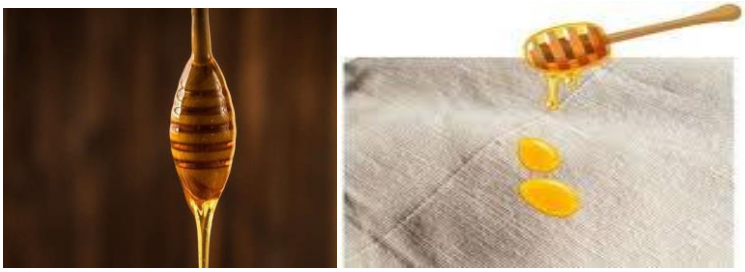

Figure 7: Testing honey viscosity

8) It hardens bread

Spread it on a slice of bread. Natural honey will harden the bread in minutes. Adulterated and artificial honey will wet the bread because of the water content.

9) Ants don't disturb natural honey

Put some honey on a plate outside the house, near some ants, and wait. If many ants come, then honey is not pure. If no ants or 2 or 3 that died, the honey is pure. Honey bees instinctively build hives on trees and between rocks. They add an additive to the honey in order to protect it from pests, such as ants.

Figure 8: Testing that ants don't disturb natural honey

10) Pure honey doesn't stain clothes

If you spilled real honey on your T-shirt, after washing there will be no stain.

11) Natural honey caramelizes quickly

Add 2 to 3 tablespoons to a microwave-proof bowl. Apply heat on high power until hot. Natural honey will caramelize quickly and never become foamy. Adulterated and artificial honey will become bubbly and difficult to caramelize. Once again this is because of the water.

12) Long lasting burning sensation if hot

Put 2 spoons of honey in a little jar and then place it in a hot water bath. Heat it to 30-60^{0}C and taste it. If it is real honey, you will have a strong sensation in the throat, which will not disappear after 15 minutes.

13) Mature honey wounds on as a tape

Take some honey with a spoon and quickly turn around its axis. Mature honey with normal humidity should wound on a spoon as a tape. Liquid honey, containing a lot of water, will flow.

14) Test the addition of starch

Dissolve one part honey in one part water and add 1 drop of standard iodine. If the color of the solution does not change (doesn't turn blue), then starch syrup is not mixed up. It is pure. It can also be done with ethanol. In an aqueous solution of honey (1:2) add 96% ethanol and stir. If the solution remains clear there is starch syrup added.

15) Test the addition of chalk

Take some honey, dilute it with distilled water and add a few drops of vinegar. The boiling of the mixture due to the release of carbon dioxide indicates the presence of chalk.If you mix honey and water and then add 2 or 3 drops of vinegar essence, this mixture should not become foamy. If it does, the honey used was adulterated.

16)Mix it with an egg yolk and beat with a fork

If the honey is pure, the yolk will look like it has been cooked.

17) Insert a hot stainless steel wire into it

Heat a stainless steel piece of wire (a needle can do it) and insert it into the honey. A good honey should stick to the wire and not flow back into the jar.

18)Freeze it

Unadulterated and unprocessed honey should not freeze. This is in fact the best method to preserve the best qualities of honey. Take your fresh jar of honey and place it in the freezer. It will harden, of course, but it will not crystallize nor will it be frozen. You can still take a teaspoon out of it and put it in your tea. It will also guarantee that what you have is real and fresh honey.

19) Mix 1 part honey and 8 parts water, shake well and check for bubbles

This is a method of testing real honey received from one of this site's visitors. This method is a way of testing honey which is become popular recently in some of the Asia countries. Mix honey with water in a portion of 1 to 8 in a clear bottle, shake it about 20-30 seconds. Real honey will form some fine bubbles on top layer and it will last for hours. Fake honey will not have fine bubbles and not lasting at all."

Figure 9: *Testing the bubble formation of honey when mixing and shaking with the proportion of honey water of 1:8*

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

1. Mention the procedures to be follow for sampling and testing of honey (4 points)
2. Define the sampling of honey (2 points)
3. How prepare the sample of honey to test? (4 points)
4. Discuss the determination of honey color, moisture content, and presence of foreign maters (5 points)
5. Mention the simple methods of honey testing (19 points)

Note: **Satisfactory rating –45 points** **Unsatisfactory - below 45 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

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4. _____

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5. _____

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Operation Sheet 1- Sampling and testing of Honey	
Operation Title: Sampling and testing of Honey using laboratory equipments	
Purpose	To acquire knowledge, skill and attitude by performing sampling and testing of honey in using laboratory equipments
Equipment, tools and materials	Supplies and equipment needed or useful for sampling and testing of honeyinclude: • Weighting balance, measuring cylinder, sampling spoons, tooth picks, clean up cloth, marker for to label, refractometer, pH meter, sample dishes and jar • Honey & distilled water
Conditions or situations for the operations	• Delivery services, equipment's and materials should be available • Appropriate working area for receiving, sampling and testing and storing.
Procedures	1. Wear the appropriate PPE 2. Confirm and make available delivery service 3. Make available all equipments and materials 4. Take proper sampling of honey based on sampling procedure 5. Test the moisture content, colour, pH, of the sample and presence of foreign materials 6. Record all parameters tested 7. Compare the result with the standard 8. Clean all equipments used and working area 9. Record and report to the appropriate personnel
Precautions	• Care should be taken while unloading, handling and sample taking • Using tools and equipment during receiving honey
Quality criteria	• The result of testes should be 17-20 of Moisture content, 3.24-6.1 of pH, and colour (lighter after heating) and accuracy of report

Operation Sheet 2- Sampling and testing of Honey	
Operation Title: Sampling and testing of Honey using simple testing method of real honey	
Purpose	To acquire the trainees with sampling and testing of honey using simple testing method of real honey
Equipment, tools and materials	Supplies and equipment needed or useful for sampling and testing of honeyinclude: • Thermometer, boiler, refrigerator, weighting balance, measuring cylinder, sampling spoons, table and teaspoon, tooth picks, clean up cloth, marker for to label, sample dishes or jar, string spoon, piece of cloth and paper, stick, matchstick, candle, 96% ethanol, standard syrup and iodine, Honey & distilled water
Conditions or situations for the operations	• Delivery services, equipment's and materials should be available • Appropriate working area for receiving, sampling and testing and storing.
Procedures	1. Wear the appropriate PPE 2. Identify all delivery service, equipments and materials 3. Take proper sampling of honey based on sampling procedure 4. Test the liquidity, crystallization, solubility, absorbable by paper or not, skin regimen, strain clothes or not, flammability, for bubble 5. Record all the result from test and compare with the standard 6. Clean all equipments used and working area 7. Record and report the appropriate personnel
Precautions	• Care should be taken while unloading, handling, sample taking and performing determination of parameters • Using tools and equipment during receiving honey
Quality criteria	• The result of testes should be crystallize, burn, flow slowly, make some type of bubbles and • The result of testes should not be very liquid, dissolve in water, quickly, absorb by paper, sticky, strain on clothes, colour change

LAP TEST	Performance Test

Name……. ID……..
Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 4 hour. The project is expected from each student to do it.

Project title: Sampling and testing of Honey

Task-1: performing sampling and testing of Honey using laboratory equipments

Task-2: performing sampling and testing of Honey using simple testing method of real honey

When testing the sample of honey, it may be out of the quality specification. At this time the honey may be rejected following the procedure of isolation of rejected honey or directing transport operator to remove honey off site or completion of appropriate documentation.

4.1 Honey test and regulations

Honey is not only consumed directly but is an important ingredient used in the food industry. Honey is regulated by the Food Safety and Standards Authority of National and International as food. Stringent regulations are in place to ensure the safety and authenticity of honey as it is important for both consumers and food processors. Food testing laboratories that test honey verify that the quality and purity as displayed on the label are indeed true. Honey is a high-value commercial product and the quality of honey is determined through sensorial (taste, texture) physical, chemical, and microbial food testing. Honey must be tested from testing laboratory that is accredited and notified by FSSAI so pesticides, antibiotics, chemical, and heavy metals residues all within the prescribed parameters as listed in standards.

4.2 Honey Adulteration

Honey can be adulterated with corn syrup, sugar syrup, invert sugar, flour, starch, glucose, dextrose or molasses. Once these substances are mixed into the honey it can no longer be considered pure because it becomes sub-standard. Honey is most often adulterated for financial gains as adulterated honey can be produced and offered for sale at lower rates to increase profit margins. In a food testing laboratory, it is possible to evaluate whether honey has been adulterated with these substances or even that sugar was fed to the bees.

4.3 Procedures for rejected bee products

Honey will be rejected after taking the required testing of quality parameters for extraction. Honey should be rejecting from extraction, if it is unfit for one of the quality parameters of extracting testing. Honey does not fulfill the standard should be rejected based the procedures of rejections of bee products, honey.

1. Follow sampling and testing procedure
2. Determine the required parameters
3. Record the result from the test
4. Compare the result with the standardmentioned at table 4 of this information sheet.
5. Make a decision to reject completely or to use for other purpose rather than extraction
6. Isolate the honey to reject
7. Avoid cross contamination
8. Perform cleaning and sanitation operation of working area and equipments
9. Reject using the appropriate transportation
10. Consider the environmental guide line
11. Report to the appropriate personnel

Note: procedure1 and 2 are performed in sampling and testing operation (information sheet #2 and #3 of this learning guide).

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: Short Answer Questions

1. Why rejected honey at receiving? (2 points)
2. Mention all procedure to be follow for defected honey rejection (8 points)

Note: **Satisfactory rating –10 points** **Unsatisfactory - below 10 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1. _____

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2. _____

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Information Sheet 5- Arranging workplace information

Arranging workplace information is used to organize the storage. The arrangement of the storage should be based on Standard Operating Procedures (SOPs); specifications and production schedules. This information should be related with the receiving area of processing industry. Information systems may be print or screen based.

A workplace is a location where someone works for his or her employer, a place of employment. The workplace information arrangement should be consider the standard of storage used for receiving honey for processing:

1) Requirements for workplace

The building and surrounding area shall be: such as can be kept reasonably free of objectionable odors, smoke, dust, or other contamination; of sufficient size for the purpose intended without crowding of equipment or personnel; be easily cleaned and sanitized be impervious, non-absorbent, and free from depressions, pits, cracks, and crevices that may harbor contaminants;

In areas experiencing high concentrations of air-borne pollutants, equipment shall be used to remove pollutants from the air blown across or through the product; and In the case of materials lining the walls, floors, and ceilings, be of a colour that does not disguise contaminants having regard to the lighting arrangements. The design of the floors shall permit easy cleaning and junctions between floors and walls shall be rounded and continuous

2) Requirements related to facilities and controls

- Separation of processes
- Handling area shall be completely separated from any part of the premises used as living quarters
- Water supply: the water used shall be of good quality complying with potable and shall comply with other resources (assured by the quality standard authority)

- **Plumbing and waste disposal:**
  - ✓ All plumbing and waste disposal lines (including sewer systems) shall be large enough to carry peak loads.
  - ✓ All lines shall be watertight and have adequate traps and vents.
  - ✓ Disposal of waste shall be effected in such a manner as not to permit contamination of potable water supplies.
  - ✓ The plumbing and the manner of waste disposal shall be approved by the official agency having jurisdiction.
- **Lighting and ventilation**
  - ✓ Lighting must be of a sufficient intensity and quality to enable satisfactory performance of all operations.
  - ✓ Light bulbs and fixtures suspended over food in any step of preparation shall be of the safety type or otherwise protected to prevent food contamination in the case of breakage.
  - ✓ Good ventilation is important to prevent both condensation (which may drip into the product) and mould growth in overhead structures which growth may fall into the food.

Requirements for equipment and utensils

- Materials: all food contact surfaces shall be smooth, free from pits, crevices and loose scale, nontoxic, unaffected by food products, and capable of withstanding repeated exposure to normal cleaning and non-absorbent unless the nature of a particular and otherwise acceptable process renders the use of a surface, such as wood, necessary.
- Sanitary design, construction and installation:
  - ✓ Equipment and utensils shall be so designed and constructed as shall prevent hygienic hazards and permit easy and thorough cleaning.
  - ✓ Stationary equipment shall be installed in such a manner as shall permit easy and thorough cleaning.
- Equipment and utensils:
  - ✓ All equipment that come into contact with edible honey must be designed, constructed, installed and operated in a manner that;
  - ✓ Ensure the effective performance of the intended task;

- ✓ Ensure effective cleaning;
- ✓ Facilitates good hygienic practices, including monitory; and
- ✓ Does not cause contamination of the product

- Equipment must be durable; resistant to chipping, flaking, delamination, abrasion; able to withstand exposure to heat, water and honey under normal operating; conditions; and corrosion resistant.
- **Hand-washing facilities**
  - ✓ Adequate and convenient facilities for employees to wash and dry their hands shall be provided wherever the process demands.
  - ✓ They shall be in full view of the processing floor.
  - ✓ The facilities shall be kept in a sanitary condition at all times.
  - ✓ The floors shall be smooth and free from cracks including open joints.
  - ✓ They shall have adequate drainage slopes to direct any water towards drainage channels.
  - ✓ There shall be no back flow from the drainage to the production areas.
- **Walls, doors and windows**

  Walls
  - ✓ All walls shall be impermeable, smooth, and easy to clean.
  - ✓ All finishes shall be properly applied and maintained. Painted surfaces shall not be allowed to deteriorate or flake.
  - ✓ Paint used shall be designed for food production areas.
  - ✓ Tiles if used shall be sound and in good repair. Loose or damaged tiles are unacceptable.

  Window and Doors
  - ✓ Mesh screens shall be put on all windows to avoid insects.
  - ✓ Glass shall not be used on the windows in the production areas, only shutter-proof materials are required
  - ✓ The doors opening from the production areas to the outside shall have self locking devices to ensure doors remain closed at all times.
  - ✓ Hanging strip doors shall cover the doors opening from the production to the outside, to avoid entry of dust or insects when the doors opened.
  - ✓ The doors shall be sealed at the bottom completely to avoid entry of insects to the production areas.

- **Ceilings and overhead structures**
  - ✓ The ceilings should have a smooth, impermeable surface kept in good repair.
  - ✓ They shall be regularly cleaned and the joints shall be sealed.
  - ✓ The number of overhead structures shall be minimized in production.
  - ✓ If required, they shall be of a circular cross-section to aid cleaning and shall be frequently inspected.

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: Short Answer Questions

1. Discuss the requirements for workplace location, size and design for honey receiving and processing (10 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

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Information Sheet 6- Identifying honey for extracting and mead preparation

Honey is harvested from traditional or modern hive. The honey from both sources will be extracted for mead production. The honey extraction process will be discussed under the Learning Guide (LG) “Performing honey pressing and Extracting Process” (LG#30, LO#2, information sheet #2).Honey identified for extraction and mead preparation is different. Honey for extraction identified at receiving area after testing for the required parameters. However honey identified mead preparation is after extracting process. The processing of extracting includes removing of foreign objects, separation of honey from honey comb and produces extracted crude wax and semi-processed honey.

Moreover, the extracted honey will also prepare for mead production. Mead is an alcoholic beverage made by fermenting a mixture of honey and water. Yeast and other ingredients are the products to make the fermentation process of mead. Honey from farm may be with the presence of foreign objects even if after quality analysis. Straining and filtering is the mechanism to separate the honey from unwanted materials. The figure below showed that the removal of the upper coverage from honey comb for extraction process which is called uncapping (figure 10). Uncapping is the first real step of honey processing. It consists of the removal of the thin wax layer that seals the honey cells.

Extraction of honey from honey extractor or presser may require to strain or filter for packing or mead preparation. The extracted honey may contain beeswax residue, bee fragments and other impurities. Mead is a fermented product of purified honey. Honey used to make mead or honey wine should be free from any foreign materials. The processing step of mead from honey will be discussed under Learning Guide (LG) “Performing Honey Fermentation Operation” (LG# 42-45).

The production process of honey mainly involves the different steps based on the level of production. Straining and filtration or purifications are carrying out before bottling or mead production.

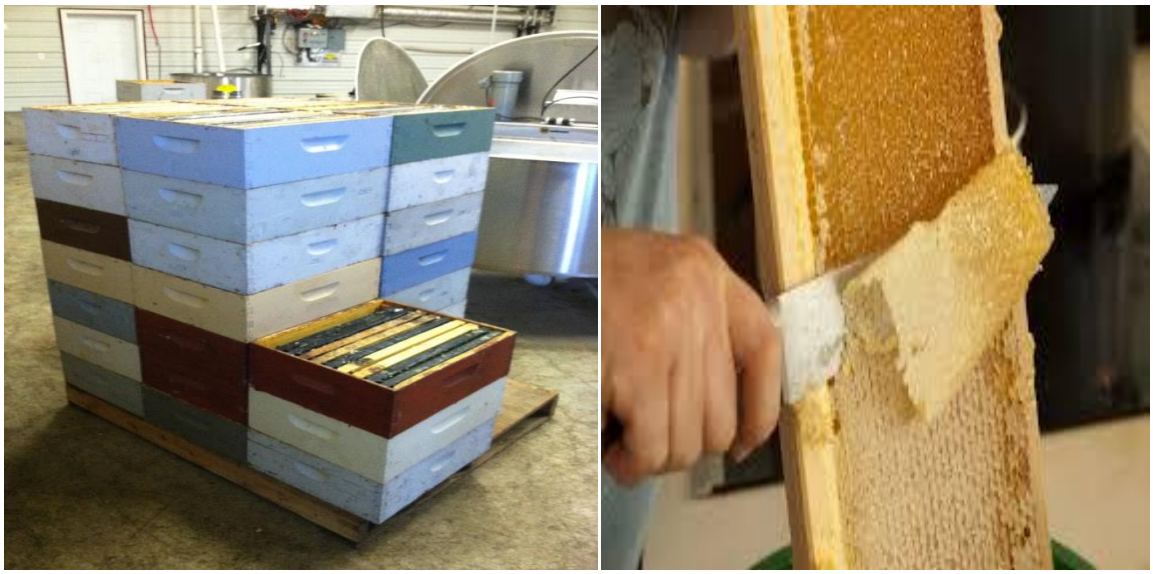

Figure 10: Identifying and uncapping for extraction

Straining

The straining operation to remove suspended solids (including large wax particles) is carried out either manually or by mechanical means. The method and the equipment used for straining depend on the size of the operation. In small-scale operations, straining is done using cloth or nylon bags, which are frequently cleaned to remove the suspended particles. In large-scale operations, the straining operation is combined with the pre-heating (up to 40°C) operation in a jacketed tank fitted with a stirrer.

Figure 11: Straining for mead preparation

Filtration

The strained honey is further processed using pressure filters. Typically a polypropylene micro filter of 80µm is used as a filter medium. The honey temperature is maintained between 50–55°C, which prevents the melting of the beeswax. Large-scale processors

subject honey to coarse filtration, centrifugal clarification, fine filtration, and blending prior to filling.

Honey after filtered may store in well-sealed jars or any other suitable containers which are food graded, acid resistant, non-reactive (stainless steel, plastic or glass) to the content and cannot cause the transfer of foreign odors to the honey. Honey for mead shall be store in new or used lacquered drum. However, it be packed in hygienically clean and plain.

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: Short Answer Questions

1. Mention the three processes included under Extraction process (3 points)
2. What are the difference between honey for extraction and mead preparation (2 points)
3. Discuss straining and filtering honey (5 points)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

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2. _____

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LG #18	LO #2- Weigh and screen accepted honey

Instruction sheet

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

- Unloading of honey from transport
- Screening of received honey
- Monitoring volume of honey
- Dust control procedures
- Weighing of honey

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**:

- Transport and routed honey is off loaded from to screens.
- Passed received honey through screens.
- Monitor volume of honey in the equipment.
- Follow dust control procedures are.
- Weigh honey

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).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Unloading of honey from transport

Transportation of honey Producers, processors, retailers, whole sellers and exporters of honey to be aware of honey transportation specifications and regulations of national and international requirement. Honey shall be carried so as to protect containers from mechanical damage and contamination. Transportation of honey shall be done during the night in order to avoid the heat of the sun that could adversely affect the quality of honey or if done during the day shall be done using refrigerated or insulated containers.

Honey can be transported by animals pack, airplane, road, rail, sea and conveyor from offsite to storage (honey stores). However, the requirements required to maintain the quality of the product.

Figure 12: transporting honey

1.1 Transporting Requirements

Transporting honey from apiary to the extracting room different requirements are considered to maintain the final products.

- The vehicle used in transporting the supers containing honeycombs to the extracting room should be prepared in the previous day, as subjected to a hygienic process.
- It is necessary that the vehicle did not recently transport any material that might have left some type of toxic residue, or otherwise has strong odor.
- Besides, the surface of the vehicle load area should be covered with nontoxic material, properly cleaned and free from impurities, in order to avoid the direct contact of the supers containing honeycombs with the floor.
- In case the vehicle has an open load compartment, the use of canvases that can cover the supers containing honeycombs is recommended; so avoiding the honey be contaminated by dust, earth and other contamination or by the residues from the combustion of the vehicle engine (mainly in cases of the diesel oil-moved motors).
- In addition, this procedure avoids the bees to plundering the honey.
- So, an appropriately dimensioned canvas can cover the floor of the vehicle and cover the upper surface of the supers, therefore efficiently involving the whole load.
- During the arrangement of the supers in the vehicle, it is recommended that this vehicle does not stay under the direct light of the sun, which may negatively affect the quality of the honey.
- For accommodation of the load, a hive cover placed on the lower canvas may be used. So performing as base for the piling of the supers, as well as a cover upon them that will impede the access of the bees during the formation of this supers pile.
- During their placement in the vehicle, the supers should be always covered by canvas until the total fulfillment of the load.
- So, the transportation process becomes more rapid and efficient, thus providing a safe and protected load.
- For a safe transportation, the supers should be well tied.
- Therefore avoiding their displacement in the case of abrupt braking, that could lead to the break of the honey combs; mainly if they are constituted of new wax.

- In those non-asphalted highways presenting irregularities, the vehicle should be slowly driven and with the maximum care.

1.2 Unloading of honey

Unloading of honey is the removal of the load /honey/ in to the ground for extracting or storage. There will not expected series problem for unloading small amount of honey. However a large industry will transport raw crude honey with large container/drum or honey comp with its frame. At this time should be used risks minimizing handling mechanism. A heavy container containing honey /drum, it may be metal or plastic may cause a risk to the person as well as to the product quality due to poor handling at unloading.

Rolling a drum on the bottom rim manually will cause a hazardous. Instead of this it shall be to mix the contents of a drum than rolling it on the floor.

Figure 13: Unloading honey from the transportation

Identify the Hazards:

- Drums too heavy for people to handle safely
- Flexible plastic drums that are difficult to grip
- Drums stored in tight spaces
- Slippery, cluttered or uneven floors
- Contents shifting in a partially full drum can make it difficult to control or even dangerous
- Dangerous drum contents

If the honey is transporting with frame in you should avoid the displacement in the case of abrupt braking that could lead to the break of the honey combs; mainly if they are constituted of new wax.

Figure 14: Handling drum after unloading

Recommendations for honey drum handling safety

Heavy drums should always be moved with proper drum handling equipment. Use a drum truck, forklift attachment, below-hook drum lifter or other equipment specifically designed for drum handling.

A full 55-gallon (210 litre) steel drum can weigh over 2,000 pounds (907kg), with typical weights of 400 to 800 Lb. (180 to 363 kg). When being moved, the contents of your drum may shift inside, making the drum difficult to control or even dangerous.

There are also special considerations when handling a plastic drum or a fiber drum. Conditions such as restricted spaces and slippery or uneven floors can entail greater risks.

Mishandling a heavy drum can cause serious injury, damage the drum, waste valuable contents or contaminate the environment. Common injuries include a strained back, crushed fingers or hands, and foot trauma. Incidents of dropped drums, or drums rolling out of control, can also cause spills and damage.

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. What are transportation methods for honey? (4 points)
2. Mention the Hazards related with mishandling the heavy drum (6 points)
3. Discuss the recommendations for honey drum handling safety (5 points)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

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2. _____

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3. _____

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Information Sheet 2- Screening of received honey

Screening is a sample test performed on a large volume of honey or honey in different containers. Such type of screening used to decide to accept or reject the honey for extracting. To be assured we should measure the quality parameters of honey and compare with the standard.

Screening should perform based on quality parameters of honey. All these are discussed at information sheet #1 in LO#1 of this Learning Guide. Screening after receiving honey based on the purpose. It may be for direct sell, or extract. Honey screening after receiving may include based on their color, odor or aroma and the source if there is honey from different sources.

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. Discuss what, why and how screen honey after receiving (5 points)

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

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

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Information Sheet 3- Monitoring volume of honey

Monitoring volume of honey is the systematic process of volume related to receiving, sample taking and testing, and identifying the honey for next processing. Honey is available in the market in the form of net weight not in volume. This can be confusing when it comes to honey containers, which are typically labeled and sold based on net weight ounces, sometimes called “honey weight.” So what is the difference between fluid ounces and net weight ounces? And how can you determine how much honey our honey jars will hold?

The monitoring volume of honey in the equipment includes:

- Meting and ensuring hygiene and sanitation standards
- All safety guards are in place
- Functions and performance based on specification

3.1 Fluid Ounces (FL. OZ) vs. Net Weight Ounces (NET WT. OZ)

- **Fluid ounce:** is a measure of volume or how much space something takes up.
- **A net weight ounce:** is a measure of mass or how heavy something is.

Usually liquids are measured in fluid ounces and dry goods are measured in net weight ounces. For water, the ratio of fluid ounces to net weight ounces is 1:1. In other words, one fluid ounce of water equals one net weight ounce. This is very handy when you are measuring water. But honey is heavier than water. So one fluid ounce of honey weighs more than one net weight ounce. Specifically, one fluid ounce of honey equals approximately 1.5 net weight ounces.

Honey weighs approximately 1.5 times the weight of water for any given volume. More precisely, honey weighs between 1.39 and 1.45 times the weight of water. This means that 1 litre of honey weighs approximately 1.42 Kilograms. There are certain situations where someone may need to calculate how much a particular volume of honey weighs, and cannot just weigh the honey itself. In order to do this and resolve the above situations, it helps to know how much honey weighs compared to water. While it varies

slightly due to the differing compositions of various kinds of honey, typically honey will weigh 1.42 times the equivalent volume of water.

To explain this, let us use the following example:

- If you took a 1 litre container and filled it with water, the net weight of the water would be 1 kilogram.
- If you were to take that same 1 litre container and fill it with honey, it would weigh 1.42 kilograms.

Armed with this knowledge we can tackle our honey/volume problems using the following formulas:

- To calculate the **volume of honey based upon its weight,** you take the weight of the honey and divide it by 1.42.

Example; you have 3kg of honey and would like to know how big the container needs to be.

3000/1.42 = 2112.7

- ✓ Therefore 3kg of honey divided by 1.42 would equal roughly 2110ml

Likewise, to calculate the **weight of honey based on its volume,** you multiply the volume of a container by a factor of 1.42

Example; you have a 250ml cup of honey and want to know how much this weighs.

250*1.42 = 355

- ✓ Therefore 250ml of honey equates to a weight of 355g

3.2 Monitoring volume of honey in the equipment

Equipments used to measure volume of honey

Honey extracting industry will receive and may sell also in the bulk using drum. After extracting, hone may also pack in drum (bulk volume) or in jar (small volume). The size of equipments used depends on the amount of honey received or dispatch but the type will be the same.

Figure 15: Bulk volume container (food graded metal, plastic and stainless steel)

Figure 16: container for Small volume (Jar)

Figure 17: Measuring Cup, Measuring jug and a typical graduated cylinder

Figure 18: Measuring spoon

Honey volume vs. weight conversions

The table below (Table 10) shows that honey volume vs. weight conversions.

Table 9: Honey Equivalent measurements

Cup	Gram	Tablespoons
1/8 cup of honey	42.5 grams	2 tbsp
1/4 cup of honey	85 grams	4 tbsp
1/3 cup of honey	113.3 grams	5.3 tbsp
3/8 cup of honey	127.5 grams	6 tbsp
1/2 cup of honey	170 grams	8 tbsp
5/8 cup of honey	212.5 grams	10 tbsp
2/3 cup of honey	226.7 grams	10.7 tbsp
3/4 cup of honey	255 grams	12 tbsp
7/8 cup of honey	297.5 grams	14 tbsp
1 cup of honey	340 grams	16 tbsp
2 cups of honey	680 grams	32 tbsp

Key: 1 teaspoon= 5 ml, 1 tablespoon= 15 ml, 1 cup=16 tablespoons, 1 tablespoon =3 teaspoons, 1 liter= 4 cups

Monitoring equipments include the cleaning and sanitation standards. The purpose will be considering the following standards:

- Ensure cleaning equipment should not be a source of contamination to bee products, ingredients, packaging and other material.
- Ensure cleaning equipment is:
  - ✓ used for cleaning purposes only;
  - ✓ stored in a hygienic manner when not in use; and
  - ✓ maintained in a good state of repair.

Guidance

Single use cleaning equipment is recommended where possible. Multiple-use cleaning equipment (e.g. re-useable cloths, brushes, squeegees etc.) should be cleaned and sanitized daily or at a frequency to minimize cross contamination between cleaning activities. Ensure equipment removed from a dry processing area for purposes of wet cleaning is dry prior to its return.

Handling equipments

- Try not to touch any part of a dish or plate which will come into contact with other contacts.
- Pick up cups and mugs by their handles, your fingers should be outside cups.
- Place teaspoons so they protrude from a dish.
- Pull out disposable cups from the base of a tube, this prevents your fingers from going inside the cup.
- Do not use plates which have become cracked or chipped.

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

1. Discuss the difference between Fluid Ounces vs. Net Weight Ounces (2 points)
2. How much weight of honey greater than weight of water? Why? (2 points)
3. What are equipments used as a container or measuring volume of honey? (5 points)
4. What is the purpose of monitoring equipments? (4 points)

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

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2. _____

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3. _____

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4. _____

   _____

Information Sheet 4- Dust control procedures

Dust can settle on and contaminate products before they are packaged. This is especially an issue when it comes to allergens, such as avoiding cross-contamination of flour on gluten-free products**.** Cross-contamination is a serious concern in the food processing industry. Facilities that produce both non-allergy-friendly and free-from foods face even more challenges. Food products can't be free-from unless the facility and processing equipment are as well including air in the facility, which can contain dust from airborne food particles.

Controlling Dust

Contamination control is the generic term for all activities aiming to control the existence, growth and proliferation of contamination in certain areas. Contamination control may refer to the atmosphere as well as to surfaces, to particulate matter as well as to microbes and to contamination prevention as well as to decontamination

The aim of all contamination control activities is to permanently ensure a sufficient level of cleanliness in controlled environments. This is accomplished by maintaining, reducing, or eradicating viable and non-viable contamination for either sanitary purposes or in order to maintain an efficient rate of production.Dust control is vital in any manufacturing industry. A well-built, fit-for-purpose dust control system will:

- Protect operators from harmful dust
- Prevent explosions
- Reduce housekeeping and minimize breakdowns
- Improve product quality by preventing cross contamination
- Protect the environment

The overall working area for honey extraction should be considering dust control (information sheet #1 of LO#1 in this learning guide). The standards of honey extracted areas to control dust consider that:

- Hanging strip doors shall cover the doors opening from the production to the outside, to avoid entry of dust or insects when the doors opened.

Figure 19: Hanging Strip Doors

- Do not collect samples in areas where dust or atmospheric conditions may cause contamination of the sample, unless such contamination may be considered a part of the sample.

Control points include

- Critical control points in a work process which must be monitored and controlled.
- Food safety, quality, and regulatory control points as well as inspection points.
- Monitoring may involve the use of production data such as performance control charts
- Process operation and monitoring functions may be manual or involve the use of a process control system

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: Short Answer Questions

1. What is the effect of dust in food and beverage industry? (2 points)
2. Discuss control dust in food and beverage industry (2 points)
3. What is the standard of honey extracting house to control dust (3 points)

Note: **Satisfactory rating - 7 points** **Unsatisfactory - below 7 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

   _____

2. _____

   _____

3. _____

   _____

Information Sheet 5- Weighing of honey

Honey is available in the market in the form of weight. Weighting in this unit cover weighing honey at receiving area. Weighing the raw material /honey/ used to compare the final of the intended product and by-product and used as one of the parameter to determine selling price. Depending on the industry size, there are different types of weighing balance used for honey.

Weighing Scale

A weighing scale is the device you will use to weigh honey, beeswax and other bee products. There are 3 types of weighing scales commonly used in most of countries:-

1) Platform Weighing Scale:-comprises of a platform and a scaled arm. Put the container with the bee product in question on the platform and adjust the scaled arm until it balances. The reading where it balances gives you the weight of the product in the container.

Figure 20: Platform weighing balance

2) Clock Face Weighing Scale:-Has a scaled clock face with a pointer, 2 hooks and re-setting nut. These weighing scales vary with maximum weighing capacity ranging from 25kgs to 200kgs.Re-set the pointer to 0' mark using a re-setting nut.Use upper hook for suspending the scale in a rope tied to a horizontal bar. Hang the container

with the product on to the lower hook. Take the reading from the scale where the pointer ends and record.

Figure 21: Clock face weighing balance

3) Clock face-with- weighing bowl-and-base weighing scale:-Has a scaled clock face with a pointer, a bowl, a base and re-setting nut. They vary with maximum weighing capacity ranging from 1 gram to 2kgs.Re-set the pointer to 0' mark using a re-setting nut. Put the container with the product on the bowl. Take the reading from the scale where the pointer ends and record. Used to weigh small quantities.

Figure 22: Weighing honey using Platform weighing balance

The net weight of honey will be determined using two simple methods:

First method

- weigh the empty container to be used (W_1)
- weigh the honey in the container (W_2)
- Calculate the net weight of honey by subtracting W_1 from W_2

Figure 23: Weighing empty container

Second Method

- Put the container on weighing scale/balance and make it zero by on tear button
- Weigh the honey in the container, the result is the net weight of honey

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: Short Answer Questions

1. What is the purpose of weighing honey? (2 points)
2. What type of weighing scale used to measure honey? (3 points)
3. Discuss the two type of methods used honey weighing (5 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

   _____

2. _____

   _____

3. _____

   _____

Operation Sheet 1- Weighing Honey	
Operation Title: Weighing Honey	
Purpose	To acquire the trainees with weighing accepted honey
Equipment, tools and materials	Supplies and equipment needed or useful for weighing accepted honey include: • Weighting scale both digital and analog, containers (it may be jar/ bucket), large spoon, calculator, thermometer
Conditions or situations for the operations	• Services, equipment's and materials should be available • Appropriate working area for weighing
Procedures	1. Wear the appropriate PPE 2. Identify all services, equipments and materials 3. Prepare equipments for weighing 4. Weigh the empty container (W_1) 5. Weigh honey in container (W_2) 6. Record the result and calculate the net weight of honey 7. Make a container zero 8. Add honey in to container and weigh 9. Take a reading and compare the reading net weight of the first method 10. Clean all equipments used and working area 11. Record and report to the appropriate personnel
Precautions	• Care should be taken while weighing from cross contamination of the product • Using equipment during weighing
Quality criteria	The expected result from weighing honey in both method should be • equal (net weight of honey)

LAP TEST	Performance Test

Name……. ID……..
Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1 hour. The project is expected from each student to do it.

Project title: Weighing Honey

Task-1: performing weighing accepted honey using both weighing methods

LG #19	LO #3- Store received honey

Instruction sheet

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

- Determining moisture content of honey
- Storing screened honey

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:

- Moisture content of honey is determined
- Screened honey is routed to containers

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).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Determining moisture content of honey

Honey having high moisture content is more likely to ferment. Under the EU standards a maximum of 21% has been set. Moisture content is one of the most commonly measured properties of food materials. Honey moisture is the quality criterion that determines the capability of honey to remain stable and to resist spoilage by yeast fermentation: the higher the moisture, the higher the probability that honey will ferment upon storage.

Moisture content of honey is practically the most important quality parameter, since it affects storage life and processing characteristics Even though moisture can be removed after extraction, only completely ripe honey should be harvested, i.e. combs with more than 75% of the honey cells sealed.

1.1 Effects Moisture Content on Honey

Harvesting of honey with high humidity, or subsequent addition of water to honey can result in honey fermentation and spoilage. Honey spoilage can be tested by a microscopicall yeast count, by measuring glycerol, butanediol or ethanol. Post-harvest reduction of moisture content can be achieved by leaving honey supers in warm rooms at 30 to 35^0C and circulating warm air through them.

Table 10: Moisture Content of Honey and its Effect

No	Moisture content Effects	<17%	18%	19%	20%	>21%
1.	Crystallization of high glucose honey	in beehive	right after harvesting	Within 3 months	Within 6 months	Only at the bottom
2.	Fermentation expected within	18 months	12 months	6 months	3 months	Right away
3.	Quality	Excellent	Good	Good	Inferior	Inferior
4.	Eligibility for export	Good	Good	Fair	Poor	Not eligible

In relatively cool climates the circulation of air heated to 35^0C can reduce moisture content in open honey cells by 1 to 3%. This is the easiest and cheapest of all post-harvest moisture controls. In tropical climates, the air temperature will have to be considerably higher (damaging to honey) or prior dehumidification of the air will be necessary. This requires a small, specially sealed room and a dehumidifier. Moisture content of honey can be determined with portable machine called Refractometer.

1.2 Determination of moisture, refractometric method

1. SCOPE
   - The standard describes a procedure to measure the water content of honey.
2. DEFINITION
   - The water content is that value determined from the refractive index of the honey by reference to a standard table.
3. PRINCIPLE
   - The method is based on the principle that refractive index increases with solids content. The table was constructed from a plot of the logarithm of the refractive index minus unity plotted against the water content as determined by vacuum drying, a technique which requires much greater manipulative skill.
4. EQUIPMENT
   - Flasks, 50 ml.
   - Water bath.
   - Abbé refractometer, that can be thermostated at 200^0C, regularly calibrated with distilled water or with another certified reference material. The refractive index for water (nD) at 20°C is 1.3330.

Figure 24: Abbé refractometer

5. PROCEDURE

- Sample preparation

  Carry out according to the section Sampling of INTRODUCTION AND GENERAL COMMENTS ON THE METHODS.

- Dissolution
  - ✓ Homogenize the prepared sample again and put in a flask.
  - ✓ Close the flask and place in a water bath at 50°C (±0.2) until all the sugar crystals are dissolved.
  - ✓ Cool the solution to room temperature and stir again.
    - ❖ Note: Ensure that the flask is air tight.
- Determination
  - ✓ Ensure that the prism of the refractometer is clean and dry.
  - ✓ Directly after homogenization, cover the surface of the prism evenly with the sample.
  - ✓ After 2 minutes (Abbe refractometer) read the refractive index.
  - ✓ Measure each honey twice and take the average value.
  - ✓ Read the corresponding moisture content from the table.
  - ✓ Carefully clean the prism after use.
    - ❖ Note: The method refers only to the use of the Abbé refractometer, not to digital instruments.

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. Discuss the moisture content of honey (2 points)
2. What are the effects of moisture content on honey and what should be the control? (5 points)
3. Mention the procedure of determining moisture refractometric method (5 points)

Note: **Satisfactory rating - 12 points** **Unsatisfactory - below 12 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

   _____

2. _____

   _____

3. _____

   _____

Information Sheet 2- Storing screened honey

At all points in the harvesting, extracting, transporting, consolidating storage and packing of honey care must be taken to avoid the risk of spoilage or contamination that will reduce honey quality. These risks can be easily identified with a little thought and it does not have to be made a difficult or complicated process. The official name for this process is Hazard Analysis Critical Control Points (HACCP).

2.1 Storage of honey

Producers, processors, retailers, whole sellers and exporters of honey should be aware of storage specifications and regulations of national and international requirements. Honey should be stored in clean glass jars, food grade drums, plastic airtight buckets or plastic coated metal containers immediately after extraction. Honey consolidators and packers should be aware of the potential value of special types and flavors of honey and endeavor to keep them separate. The methods used for extracting, processing and storing honey can profoundly affect its quality.

Figure 25: Storing screened honey

Honey must be stored in well-ventilated rooms, with temperature below 25 0C and relative humidity of less than 65% to maintain low HMF content. The floor of storage

should be clean, cemented and having pallet.Honey containers should not be left open in humid air and combs must be covered.

2.2 Honey Storage Guidelines

Honey should be stored in clean containers made of food grade materials which can include local natural materials. Metal containers (that are not stainless steel) or cheap, colored plastic buckets are not good for storage as the acidity of the honey can cause the coloring or other chemicals to leak from the containers into the honey.Honey must be stored in well-ventilated rooms, with temperature below 25^0C and relative humidity of less than 65% to maintain low HMF(hydroxymethylfurfural) content. The floor of storage should be clean, cemented and having pallet.

Honey's moisture content (about 17%), low pH and antibacterial properties make it one of the only ingredients that will most likely not go bad. Regardless, it is still very important to store honey properly to maintain its integrity. Best stored in a sealed container at room temperature, between 64-75˚F (18-24˚C)

- Cooler temperatures, between 35-60˚F, hasten honey's natural crystallization process
- Honey stored at temperatures above 85˚F for extended periods of time will darken in color and be subject to subtle flavor changes

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. What type of environment and containers used to store honey? (4 points)
2. Discuss the effects of storing environment and container on the quality of honey (6 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____

   _____

2. _____

   _____

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6. Berlin Packaging, 2019, Calculating Honey Weight ,Packaging Specialist.
7. Codex Alimentarius Commission, 1981. Revised Codex Standard for Honey Codex Stan 12-1981, Rev. 1 (1987), Rev. 2 (2001), Codex Standard, vol. 12, pp. 1–7.

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