



RQF LEVEL 3



FOPBK303

FOOD PROCESSING

**Basic
Knowledge in
Food Processing**

TRAINER'S MANUAL

October 2024



BASIC KNOWLEDGE IN FOOD PROCESSING



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COORDINATION TEAM

RWAMASIRABO Aimable

MARIA Bernadette M. Ramos

NTAHONTUYE Felix

Production Team

Authoring and Review

NTEZIMANA Onesphore

UWANYIRIGIRA Jeannette

Validation

UWAYEZU Elisabeth

NSANZIMANA Egide Pasteur

Conception, Adaptation and Editorial works

HATEGEKIMANA Olivier

GANZA Jean Francois Regis

HARELIMANA Wilson

NZABIRINDA Aimable

DUKUZIMANA Therese

NIYONKURU Sylvestre

Formatting, Graphics, Illustrations, and infographics

YEONWOO Choe

SUA Lim

SAEM Lee

SOYEON Kim

WONYEONG Jeong

MANIRAKORA Alexis

Financial and Technical support

KOICA through TQUM Project

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ACRONYMS

AGR: Agriculture

ASF: Animal source foods

BK: Basic Knowledge of food processing

Bp: Boiling point

CBC: Competence Based Curriculum

EDTA: Ethylene diamine tetra acetic acid

FAO: Food and Agriculture Organization

FOP: Food Processing

Fp: Freezing point

Ltd: Limited

MAP: Modified atmosphere packaging

Mp: Melting point

pH: Potential of Hydrogen

PPE: Personal Protective Equipment

RQF: Rwanda Qualification Framework

RTB: Rwanda TVET Board

TQUM: TVET Quality Management project

TVET: Technical and Vocational Education and Training

INTRODUCTION

This trainer's manual includes all the methodologies required to effectively deliver the module titled "**Basic Knowledge in Food Processing**". Trainees enrolled in this module will engage in practical activities designed to develop and enhance their competencies.

The development of this training manual followed the Competency-Based Training and Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

The trainer's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainer, you will begin by asking questions related to the activities to encourage critical thinking and guide trainees toward real-world applications in the labor market. The manual also outlines essential information such as learning hours, didactic materials, and suggested methodologies.

This manual outlines the procedures and methodologies for guiding trainees through various activities as detailed in their respective trainee manuals. The activities included in this training manual are designed to offer students opportunities for both individual and group work. Upon completing all activities, you will assist trainees in conducting a formative assessment known as the end learning outcome assessment. Ensure that students review the key reading and the points to remember section.

**MODULE CODE AND TITLE: FOPBK303-BASIC KNOWLEDGE
IN FOOD PROCESSING**

Learning Outcome 1: Apply basics of thermodynamic

Learning Outcome 2: Apply basics knowledge of food chemistry.

Learning Outcome 3: Describe micro-organisms in food.

Learning Outcome 1: Apply basics of thermodynamic



Indicative contents

1.1 Description of physical quantities

1.2 Identification uses of physical quantities

1.3 Description of Heat transfer mechanisms

1.4 Differentiation of the types of food

1.5 Description of the physical properties of different types of food

Key Competencies for Learning Outcome 1: Apply basics of thermodynamic

Knowledge	Skills	Attitudes
<ul style="list-style-type: none">• Description of the types of physical quantities• Identification of heat transfer modes• Description of food types and their physical properties	<ul style="list-style-type: none">• Measuring physical quantities	<ul style="list-style-type: none">• Be accurate• Be Confidence• Be Self-Efficacy• Be Precise and accuracy• Patience and Perseverance• Collaboration and Teamwork



Duration: 10 hrs



Learning outcome 1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Describe properly types of physical quantities and their uses.
2. Distinguish appropriately modes of heat transfer mechanisms.
3. Describe adequately the physical properties of the different types of food
4. Measure accurately physical quantities used in food processing



Resources

Equipment	Tools	Materials
<ul style="list-style-type: none"> ● Heat exchangers ● Pumps ● Engines and Turbines ● Refrigerator and air conditioners 	<ul style="list-style-type: none"> ● Tape measure, ● Balance, ● Thermometer, ● Chronometer, ● Graduated cylinder, ● Densimeter, ● Calorimeter, ● Moistmeter ● Monometers 	<ul style="list-style-type: none"> ● Sugar ● Milk ● Meat ● Fruits ● Wheat flour ● Water



Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail a classroom and workshop
- Avail materials, tools and equipment and make sure that they are in good working conditions
- Prepare teaching aids and didactic materials (manuals/guides, task sheets, photos, audio-visuals, protocols)

Ic

Indicative content 1.1&1.2: Description of physical quantities



Duration: 4hrs



Theoretical Activity 1.1.1: Description of physical quantities and their uses



Notes to the trainer:

- Trainer may use small groups for describing physical quantities used in food processing.
- Trainer may use drawings, pictures or videos as didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- i. Describe fundamentals and derived quantities.
- ii. Give 3 examples of fundamentals and derived quantities.
- iii. Give the symbols and units of fundamental and derived quantities
- iv. State the uses of physical quantities

Step 2: Asks trainees to write answers on papers/flip chart, blackboard or whiteboard

Step 3: Facilitate trainees to present their findings

Step 4: Provide expert view

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 1.1.1 in trainee manual



Points to Remember

- Physical quantities should always be accurate to meet standard in food processing.
- Follow manufacturer's instructions While adjusting food processing tools and Equipment.
- Use Fundamental quantities and physical quantities correctly.



Practical Activity 1.1.2: Measuring physical quantities



Notes to the trainer

- Trainer may use small group to demonstrate how physical quantities are measured in food processing
- Avail images and illustrations as didactic material
- Avail all required materials, tools and equipment for measuring physical quantities



Key steps:

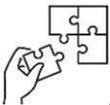
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go in the food processing workshop to measure physical quantities.
- Step 2:** Explain the task and provide clear work instruction (PPE, Time allocated)
- Step 3:** Demonstrate how you can measure physical quantities. While demonstrating, explain the procedure for measuring physical quantity.
- Step 4:** Asks trainees to measure physical quantities and monitor the procedure.
- Step 5:** Verify whether physical quantities are correctly measured and provide feedbacks where necessary.
- Step 6:** Ask trainees to read key reading 1.1.2 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 1.1.



Points to Remember

- While adjusting tools and equipment for standard food processing, it is strictly recommended to follow manufacturer's instructions
- When you are selecting tools and equipment for standard food processing, select tools and equipment that meet the selection criteria.
- Adjust the weighing balance regularly to ensure that it is providing accurate readings
- Adjust the thermometer regularly to ensure that it is providing accurate results
- Adjust the watch regularly to ensure that it is providing accurate time
- Use Fundamental quantities and physical quantities correctly.



Application of learning 1.1 & 1.2.

INEZA Company Ltd located near the school is designing new bakery products. Those new bakery products require precise measurements of various physical quantities, such as mass and volume of ingredients and adjustment of temperature and time for baking. Prepare a field trip in that company and ask trainees to measure those physical quantities.

Checklist

SN	Criteria	Indicators	Yes	No
1	Materials and tools are appropriately selected	1.1 Tools are selected		
		1.2 Materials are selected		
2	Physical quantities are properly measured	2.1 Mass and Volume of bakery products is measured		
		2.2 Temperature is adjusted		
		2.3 Time of baking is respected		
3	Field visit/trip is well done	3.1 company identification is well indicated		
		3.2 Objective of trip/visity is well achieved		



Indicative content 1.3: Description of Heat transfer mechanisms



Duration: 2hrs



Theoretical Activity 1.3.1: Description of Heat transfer mechanisms



Notes to the trainer:

- Trainer may use drawings, pictures or videos as didactic materials while describing heat transfer mechanisms applied in food processing is required.
- Trainer avail drawings, pictures or videos as didactic materials while describing heat transfer mechanisms applied in food processing is required.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- i. Define the term “heat”.
- ii. How is the temperature converted from one scale to another, such as Celsius, Kelvin, Fahrenheit and Reaumur?
- iii. Explain the heat transfer mechanisms

Step 2: Monitor discussions in groups and ask trainees to write the findings on papers, flip chart, Blackboard or white board.

Step 3: Asks trainees to discuss the provided answer and choose the correct ones.

Step 4: Provide the expert view and clarify ideas by using didactic materials

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 1.3.1 in trainee manual



Points to Remember

- Always adjust heating tools and equipment while you are working on conduction, convection, radiation.
- Main heat transfer mechanisms are: Conduction, convection, and Radiation.
- Remember to take PPE (Personal protective equipment) related to the task of workshop.



Indicative content 1.4: Differentiation of the types of food



Duration: 2hrs



Theoretical Activity 1.4.1: Differentiation of food types



Notes to the trainer:

- Trainer may use drawings, pictures or videos as didactic materials while differentiating food types is required.
- Trainer may avail some drawings, pictures or videos to be used as didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- i. Explain different types of food.
- ii. What is the role of different types of food?

Step 2: Monitor and ask trainees to write the findings

Step 3: Asks trainees to provide answer and choose the correct ones.

Step 4: Provide and clarify ideas by using didactic materials

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 1.3.1 in trainee manual



Points to Remember

- Always select types of food according to their categories.
- Types of food are: Cereals, Legumes, Vegetables, Fruits, roots and tubers.



Indicative content 1.5: Describe physical properties of different types of food



Duration: 2hrs



Theoretical Activity 1.5.1: Description of physical properties of different



Notes to the trainer:

- Trainer may use drawings, pictures or videos as didactic materials while describing physical properties of different types of food is required.
- Trainer may avail some drawings, pictures or videos to be used as didactic materials to describe physical properties of different types of food.



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- i. State the physical properties of types of food.
 - ii. Define each physical property of types of food.
- Step 2:** Monitor and ask trainees to write the findings.
- Step 3:** Asks trainees to provide answer and choose the correct ones.
- Step 4:** Provide and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns.
- Step 6:** Ask trainees to read the **key reading 1.5.1** in trainee manual



Points to Remember

- Always select accurate tools and equipment for measuring physical properties such as volume, density/specific gravity, moisture content.
- Physical properties of food types are; Density, Specific gravity, Colour, moisture, content, volatility, Freezing, Melting and Boiling Point, Hygroscopicity, taste, solubility.



Learning outcome 1 end assessment

Theoretical assessment

Q1. Choose the correct answer by encircling the corresponding letter

a) The following terms are examples of fundamental physical quantities except:

- i. Area
- ii. Volume
- iii. Density
- iv. Relative humidity
- v. Speed
- vi. Acceleration
- vii. Work
- viii. Power
- ix. Energy

Answer:

iv) Relative humidity

2. Circle the wrong term in the following terms refer to the change of state of matter between solid, liquid, and gas phases

- a) Freezing Point
- b) Melting Point
- c) Moisture content
- d) Boiling Point

Answer: C) Moisture content and e) Humidity

3. Match the Column B containing the modes of heat transfer with their corresponding meaning in Column C. Write the answer in the provided space (Column A)

Column A	Column B	Column C
1=.....	1. Conduction	A. Is the transfer of heat through a fluid by means of motion in the fluid?
2=.....	2. Convection	B. Is the transfer of heat through electromagnetic

		waves?
3=.....	3. Radiation	C. Is the transfer of heat from one substance to another that is in direct contact with it.
		D. Is a transfer of heat from liquid to gas
		E. Is energy transfer from one substance to another
		F. Is a transfer of heat from liquid, gas and solid?

Answer:

1=c

2=a

3=b

4. Fill in blank space the correct word among the following: **density, volatility, viscosity** pertaining physical properties of different types of food.

a) is a measure of a fluid's resistance to flow. It is a physical property that affects many food processes, such as mixing, pumping, and spreading.

b)is the tendency of a substance to evaporate or vaporize. It is a physical property that affects many food properties, such as flavor and aroma.

c) is a measure of how much mass is contained in a given volume. It is a physical property that affects many other properties.

Answer:

a) Viscosity is a measure of a fluid's resistance to flow. It is a physical property that affects many food processes, such as mixing, pumping, and spreading.

b) Volatility is the tendency of a substance to evaporate or vaporize. It is a physical property that affects many food properties, such as flavor and aroma.

c) Density is a measure of how much mass is contained in a given volume. It is a physical property that affects many other properties.

Practical assessment

Dairy farmer, committed to maintaining high-quality milk production, has contacted you, as food processing assistant technician. They are interested in collaborating to ensure their milk consistently meets the highest standards. During a recent milking, they observed some changes in the milk, including volume, temperature, and consistency (watery). Ask trainees to help Dairy farmer in measuring those physical quantities.

Checklist

SN	Criteria	Indicators	Yes	No
1	Materials and tools are appropriately selected	1.1 Tools are selected		
		1.2 Materials are selected		
2	Physical quantities are properly measured	2.1 Volume of milk is measured		
		2.2 Temperature of milk is measured		
		2.3 The density of milk is measured		

END



Further information to the trainer

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Learning Outcome 2: Apply basics knowledge of food chemistry



Indicative contents

2.1 Description of food components

2.2 Differentiation of solute and solvent

2.3 Identification of the types of solution

2.4 preparation of solution

2.5 Description of acid and base

2.6 Identification of food additives

Key Competencies for Learning Outcome 2: Apply basics knowledge of food chemistry

Knowledge	Skills	Attitudes
<ul style="list-style-type: none">• Description of different food components• Differentiation of the solute from the solvent• Identification of solutions based on their nature• Description of the properties of acids and bases• Identification of types of food additives• Application of formula related to solutions	<ul style="list-style-type: none">• Preparing solutions	<ul style="list-style-type: none">• Be Careful• Be Attentive• Be Accuracy• Be professional• Be precise• Patience• Perseverance

preparation		
 <p>Duration: 20 hrs</p>		
 <p>Learning outcome 2 objectives:</p> <p>By the end of the learning outcome, the trainees will be able to:</p> <ol style="list-style-type: none"> 1. Describe appropriately food components 2. Differentiate properly solute from solvent 3. Identify effectively the types of solution 4. Prepare properly the solution 5. Describe clearly acids and bases 6. Identify correctly food additives 		
 <p>Resources</p>		
Equipment	Tools	Materials
<ul style="list-style-type: none"> • Analytical balances • Spectrophotometes • Chromatographs • Dryers 	<ul style="list-style-type: none"> • Measuring cylinder, • Test tube, • Conical flask, • Baguette • Burette, • Pipette, • Wash bottle, • Ph-meter, and • Beaker • Calculator 	<ul style="list-style-type: none"> • Indicator (litmus, phenolphthalein, ...), • NaOH, • HCl, • H2SO4 • Distilled water • Buffer solution, and • Food additives



Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail a classroom and workshop
- Avail all materials and tools. Make sure that the tools are in good working conditions, and verify if materials are not expired.
- Prepare teaching aids and didactic materials (manuals/guides, task sheets, photos, audio-visuals, protocols).



Indicative content 2.1: Description of food components



Duration: 5hrs



Theoretical Activity 2.1.1: Description of different food components



Notes to the trainer:

- Trainer may use pictures or videos as didactic materials while describing different food components is required.
- Trainer avail pictures or videos as didactic materials while describing different food components is required.



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- i. Identify all food components with their sources.
 - ii. Explain the functions of food components.
 - iii. Classify food components.
 - iv. Monitor discussions in groups and ask trainees to write the findings on papers, flip chart, Blackboard or white board.
- Step 2:** Asks trainees to provide answer and choose the correct ones.
- Step 3:** Provide and clarify ideas by using didactic materials
- Step 4:** Address any questions or concerns.
- Step 5:** Ask trainees to read the key reading **2.1.1** in trainee manual



Points to Remember

- Always classify carbohydrates according to their categories.
- Carbohydrates are Monosaccharides, Disaccharides, Polysaccharides
- Select tools and equipment help you to separate monosaccharides, Disaccharides, Polysaccharides



Indicative content 2.2: Differentiation of solute and solvent



Duration: 3hrs



Theoretical Activity 2.2.1: Explaining the difference between the solute and solvent



Notes to the trainer:

- Trainer may use pictures or videos as didactic materials while differentiating the solute and the solvent is required.
- Trainer avail pictures or videos as didactic materials while differentiating the solute and the solvent is required



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- i. Define solute and solvent.
- ii. Differentiate solute from solvent.

Step 2: Monitor and ask trainees to write the findings on papers, flip chart, Blackboard or white board.

Step 3: Ask trainees to provide answer and choose the correct ones.

Step 4: Provide and clarify ideas by using didactic materials

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 2.2.1 in trainee manual



Points to Remember

- Always select tools and equipment for preparation of solutions
- Prepare tools and equipment for preparation of solution
- Solutions based on the physical state of the solute and solvent are: Solid solution, Liquid solution, Gaseous solution, Saturated solution, Unsaturated solution, Supersaturated solution.



Indicative content 2.3: Identification of the types of solution



Duration: 3 hrs



Theoretical Activity 2.3.1: Identification of the types of solution



Notes to the trainer:

- Trainer may use pictures or videos as didactic materials while classifying the solutions based on their nature is required.
- Trainer avail pictures or videos as didactic materials while classifying the solutions based on their nature is required



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- i. Define the term solution
 - ii. What are the characteristics of solution?
 - iii. Classify the solutions based on their nature
- Step 2:** Monitor and ask trainees to write the findings.
- Step 3:** Ask trainees to provide answer and choose the correct ones.
- Step 4:** Provide and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns.
- Step 6:** Ask trainees to read the key reading 2.3.1 in trainee manual



Points to Remember

- Always select tools and equipment for preparation of solutions
- Methods of preparing solutions are: dissolving (dissolution) and Diluting (dilution).
- Follow instructions while preparing solutions.



Indicative content 2.4: Preparation of solution



Duration: 3hrs



Practical Activity 2.4.1: Preparing solution



Notes to the trainer:

The trainer may demonstrate how to preparing solutions used in food testing; for the effective delivery; it is recommended to:

- Avail videos, images and illustrations as didactic material
- Avail all required materials and tools for solutions preparation.



Key steps:

While delivering this activity, pass through the following steps:

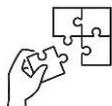
- Step 1:** Introduce the activity and ask trainees to do the task described below:
As a food processing assistant technician, you are asked to go in the food processing workshop and prepare solutions for food testing.
- Step 2:** Explain the task and provide clear work instruction (Task, PPE, Time allocated)
- Step 3:** Demonstrate how you can prepare solutions. While demonstrating, explain well the preparation procedures.
- Step 4:** Asks trainees to prepare solutions and monitor the procedures.
- Step 5:** Verify whether solutions are properly prepared and provide feedbacks where necessary.
- Step 6:** Ask trainees to read key reading 2.4.1 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 2.4.



Points to Remember

- Equipment used in food chemistry workshop should always be accurate.
- While adjusting tools and equipment used in food chemistry workshop, it is strictly recommended to follow instructions
- When you are selecting tools and equipment used in food chemistry workshop select tools and equipment that meet the selection criteria.

- Adjust the weighing balance regularly to ensure that it is providing accurate readings.
- Always respect procedures of preparation of solution correctly.
- Before starting respect rules and regulation of how prepare solutions and take personnel protective equipment



Application of learning 2.4

AKEZA Company Ltd is Food Company located near Burega School. The AKEZA Company Laboratory has a problem of preparation of irrelevant solution of 0.1 M acetic acid (CH₃COOH) for use in an experiment to study the effect of pH on the texture of bread. As an assistant technician in food processing, solve this problem by preparing relevant solution of 0.1 M CH₃COOH.

Checklist/Solution for application

SN	Criteria	Indicators	Yes	No
1	Materials and tools are appropriately selected	1.1 Tools are selected		
		1.2 Materials are selected		
2	Solution is appropriately prepared Physical quantities are properly measured	2.1 The volume of water is respected		
		2.2 The quantity of HCl is respected		
		2.3 The dilution is done		
		2.4 The concentration of diluted HCl is obtained		



Indicative content 2.5: Description of acid and base



Duration: 3hrs



Theoretical Activity 2.5.1: Description of acid and base



Notes to the trainer:

- Trainer use illustrations, pictures or videos as didactic materials while describing the physical properties of acid and base and their application is required.
- Trainer avail pictures or videos as didactic materials while describing the physical properties of acid and base and their application is required.



Key steps:

While delivering this content pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- Define the terms “acid and base” according to Arrhenius
- What are the physical properties of acid and base?
- Give the applications of acid and base

Step 2: Monitor and ask trainees to write the findings.

Step 3: Ask trainees to provide answers and choose the correct ones.

Step 4: Provide and clarify ideas by using didactic materials

Step 5: Address any questions or concerns.

Step 6: 6: Ask trainees to read the key reading 2.5.1 in trainee manual



Points to Remember

- Calibrate tools and equipment pertaining to acid and base.
- Physical properties of bases are: Bitter taste, Ability to change litmus paper color, Ability to conduct electricity, Slippery feel, Solubility in water, they react with acid to form salt and water.
- Always follow instructions of PH calibration.



Indicative content 2.6: Identification of food additives



Duration: 3 hrs



Theoretical Activity 2.6.1: Description of food additives

Notes to the trainer:



- Trainer use illustrations, pictures or videos as didactic materials while describing the types of food additives and their application is required.
- Trainer avail pictures or videos as didactic materials while describing the types of food additives and their application is required



Key steps:

While delivering this content pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- Define the term “food additive”.
- What are the types of food additives?
- Explain the application of food additives.

Step 2: Monitor and ask trainees to write the findings on papers, flip chart, Blackboard or white board.

Step 3: Ask trainees to provide answers and choose the correct ones.

Step 4: Provide and clarify ideas by using didactic materials

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the **key reading 2.6.1** in trainee manual



Points to Remember

- Equipment used in food chemistry workshop should always be accurate.
- While adjusting tools and equipment used in food chemistry workshop, it is strictly recommended to follow instructions
- When you are selecting tools and equipment used in workshop of food chemistry, select tools and equipment that meet the selection criteria.
- Adjust the weighing balance regularly to ensure that it is providing accurate readings
- Always respect procedures of solution preparation correctly.

- Before starting respect rules and regulation of how prepare solutions and take personnel protective equipment.
- Always classify food additives according to their general categories.
- Four general categories of food additives are nutritional additives, Processing agents, Preservatives and Sensory agents.



Learning outcome 2 end assessment

Written assessment

1. Answer by True or False for this statement

In a tea solution, the sugar is the solute and the water is the solvent.

Answer: True

2. The following are four general categories of food additives except:

- i) Nutritional additives
- ii) Processing agents
- iii) Carbohydrates
- iii) Sensory agents
- iv) Preservatives

Answer: Carbohydrates

3. Match the **Column B** containing the modes of heat transfer with their corresponding meaning in Column C. Write the answer in the provided space (**Column A**)

Column A	Column B	Column C
1.....	1. dissolution	A. involves adding more solvent to an existing solution to decrease the concentration of the solute
2.....	2. dilution	b. involves mixing a solid solute with a liquid solvent to form a homogeneous solution. The solute particles disperse evenly throughout the solvent, forming a new substance with uniform properties
3.....	3. Morality	C. defined as the number of moles of solute per liter of solution. D. The process of preparing a solution involves dissolving a known amount of solute in a solvent to form a homogeneous mixture.

Answer:

1=b

2=a

3=c

4. Fill in blank space the correct word between **preservatives, flavourings, emulsifiers** pertaining with Composition of food additives.

a) are substances that help to extend the shelf life of food by preventing the growth of bacteria and other spoilage-causing microorganisms.

b) These additives enhance the taste or aroma of food

c) are substances that help to stabilize mixtures of oil and water, preventing them from separating.

Answer:

Fill in blank space the correct word between preservatives, flavourings, emulsifiers pertaining with Composition of food additives.

a) **Preservatives** are substances that help to extend the shelf life of food by preventing the growth of bacteria and other spoilage-causing microorganisms.

b) **Flavourings** These additives enhance the taste or aroma of food

c) **Emulsifiers** are substances that help to stabilize mixtures of oil and water, preventing them from separating.

Practical assessment

In laboratory of food industry there is a problem in solution preparation because they use concentrated hydrochloric acid. The specialist tells the industry technicians to use diluted hydrochloric acid to avoid the problem caused by concentrated HCl. Ask learners to go in laboratory and prepare a diluted hydrochloric acid (HCl) solution of 0.1M from a concentrated solution of 12M HCl for an experiment.

Checklist/Solution for application

SN	Criteria	Indicators	Yes	No
1	Materials and tools are appropriately selected	1.1 Tools are selected		
		1.2 Materials are selected		
2	Solution is appropriately prepared Physical quantities are properly measured	2.1 The volume of water is respected		
		2.2 The quantity of HCl is respected		
		2.3 The dilution is done		
		2.4 The concentration of diluted HCl is well respected.		



Further information to the trainer

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END

Learning Outcome 3: Describe micro-organisms in food



Indicative contents

3.1 Classification of food microorganisms

3.2 Identification of factors influencing microbial growth in food

3.3 Differentiation of harmful and beneficial microorganisms in food

Key Competencies for Learning Outcome 3: Describe micro-organisms in food

Knowledge	Skills	Attitudes
<ul style="list-style-type: none">• Identification of food microorganisms' types• Identification of factors affecting microbial growth in food• Differentiation between harmful and beneficial microorganisms• Explaining the functions of beneficial microorganisms• Identification of the sources of food Microorganisms	<ul style="list-style-type: none">• None	<ul style="list-style-type: none">• Attentive• Curiosity• Respect• Understanding



Duration: 10hrs



Learning outcome 3 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Identify correctly types of food microorganisms
2. Identify properly factors influencing microbial growth in food
3. . Differentiate appropriately harmful and beneficial microorganisms
4. Explain clearly the functions of beneficial microorganisms
5. Identify correctly the sources of food microorganisms



Resources

Equipment	Tools	Materials
<ul style="list-style-type: none"> • Microscopes • Culturing equipment • Microscopy stains • Spectrophotometers • Mass spectrometry • Biochemical test kits 	<ul style="list-style-type: none"> • Scientific calculator 	<ul style="list-style-type: none"> • Culture media • Reagents and strains • Sterile swabs • Dilution tubes • Media and agar additives: nutrients supplements • Control materials: positive and negative



Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail a classroom
- Prepare teaching aids and didactic materials (manuals/guides, task sheets, photos, audio-visuals, ...)
- Note that this outcome will be delivered only through theoretical activities which will take place in classroom.



Indicative content 3.1: Classification of food microorganisms



Duration: 4hrs



Theoretical Activity 3.1.1: Characterization of food microorganisms



Notes to the trainer

- Trainer may use illustrations, pictures or videos as didactic materials while explaining the difference between harmful and beneficial microorganisms in food is required.
- Trainer avail pictures or videos as didactic materials while explaining the difference between harmful and beneficial microorganisms in food is required



Key steps:

While delivering this content pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- i. What do you understand by the term “food microorganisms”?
 - ii. Give the characteristics of food microorganisms
 - iii. Give the types of food microorganisms.
 - iv. What are the sources of food microorganisms?
- Step 2:** Monitor and ask trainees to write the findings.
- Step 3:** Ask trainees to provide answers and choose the correct ones.
- Step 4:** Provide and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns.
- Step 6:** Ask trainees to read the **key reading 3.1.1** in trainee manual



Points to Remember

- Microorganisms are classified in variety ways including morphological, Chemical, Genetic, Metabolic, and Cultural Classification.
- Select six main types of microorganisms that can found in food.
- Types of food microorganisms are : Bacteria, Viruses, Protozoa, Algae, Fungi, Archae.
- Select the common sources of food microorganisms found in food.
- Sources of food microorganisms are : Soil and water, Animals, Food handlers, Equipment and surfaces, Packaging, Insects and rodents,air.



Indicative content 3.2: Identification of factors affecting microbial growth in food



Duration: 3hrs



Theoretical Activity 3.2.1: Identification of factors influencing microbial growth in food



Notes to the trainer:

- Trainer may use illustrations, pictures or videos as didactic materials while identifying factors affecting microbial growth in food is required.
- Trainer avail pictures or videos as didactic materials while identifying factors affecting microbial growth in food is required



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following question:
i) Give the factors affecting microbial growth in food
- Step 2:** Monitor and ask trainees to write the findings/answers.
- Step 3:** Ask trainees to provide answer and choose the correct ones
- Step 4:** Provide and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns.
- Step 6:** Ask trainees to read the key reading 3.2.1 in trainee manual



Points to Remember

- Select accurate tools and equipment pertaining with physical factors affecting microbial growth in food.
- Physical factors always affecting microbial growth in food are: temperature, Moisture content, pH, Osmotic pressure, oxygen.
- Nutritional (biochemical) factors are: nature of food, Antimicrobial substances, Biological structure.



Indicative content 3.3: Differentiation of Harmful and beneficial microorganisms in food



Duration: 3hrs



Theoretical Activity 3.3.1: Differentiation of Harmful and beneficial microorganisms in food



Notes to the trainer:

- Trainer may use illustrations, pictures or videos as didactic materials while explaining the difference between harmful and beneficial microorganisms in food is required.
- Trainer avail pictures or videos as didactic materials while explaining the difference between harmful and beneficial microorganisms in food is required.



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following question:
- i) What do you understand by the terms “harmful and beneficial microorganisms”?
 - ii) What are the functions of beneficial microorganisms?
- Step 2:** Monitor and ask trainees to write the findings on papers, flip chart, Blackboard or white board
- Step 3:** Ask trainees to provide answer and choose the correct ones.
- Step 4:** Provide and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns.
- Step 6:** Ask trainees to read the key reading 3.3.1 in trainee manual



Points to Remember

- Always select microorganisms according to their behaviors either beneficial or harmful.
- Beneficial microorganisms are: Fungi, yeast, Bacteria such as Lactobacillus, Streptococcus thermophiles.
- Harmful microorganisms are: E. coli, Salmonella, Staphylococcus aureus, and Mycobacterium tuberculosis., viruses, parasites.



Learning outcome 3 end assessment

Written assessment

1. Which is not a source of food micro-organisms in the following words?

- a) Soil
- b) Water
- c) Animals
- d) Time
- e) Food handlers
- f) Equipment and surfaces
- g) Packaging
- h) Insects and rodents
- i) Air

Answer: d) time

2. Read the following statements and answer by **True** if it is Right otherwise **False**.

- a) Beneficial microorganisms can be used to improve the flavor, texture, and nutritional value of food.
- b) Beneficial microorganisms can be used to preserve food and prevent spoilage.
- c) Beneficial microorganisms can be used to produce antibiotics and other medicines.
- d) Beneficial microorganisms can be used to biodegrade pollutants and clean up the environment.
- e) Beneficial microorganisms can be used to produce biofuels.

Answer:

- a) **True**
- b) **True**
- c) **True**
- d) **True**
- e) **True**

3. The following terms below are Nutritional (biochemical) factors except:

- a) Nature of food
- b) Osmotic pressure
- c) Antimicrobial substances
- d) Biological structures

Answer: b) Osmotic pressure

4. Match the **Column B** containing the factors affecting microbial growth in food with their meanings in the **Column C**. Write the answer in the provided space (**Column A**).

Column A	Column B	Column C
1.....	1. Water activity (aw)	A. The presence of microorganisms that compete with harmful microorganisms for resources
2.....	2. pH	B. Factors that prevent microorganisms from reaching food, such as packaging.
3.....	3. Temperature	C. Substances that inhibit or kill microorganisms.
4.....	4. Oxygen	D. The length of time that food is stored at a temperature that allows microbial growth.
5.....	5. Nutrients	E. The presence or absence of oxygen.
6.....	6. Time	F. The availability of nutrients for microbial growth.
7.....	7. Antimicrobials	G. The acidity or alkalinity of food.
		H. The temperature at which food is stored or cooked
		I. The availability of water for microbial growth.

Answer: 1=I, 2=G, 3=H, 4=E, 5=F, 6=D, 7=C.



Further information to the trainer

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