Technological University of the Philippines – Taguig
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VISION: The Technological University of the Philippines shall be a premiere state university with recognized excellence in engineering and technology education at par with the leading universities in the ASEAN region.

I. Objectives:

At the end of the period the students should be able to:

1.Describe what fermentation is in simple terms.
2.Identify the ingredients used in alcoholic fermentation.
3.Explain why fermentation is important in food processing.

II. Subject Matter:

Performing Alcoholic Fermentation of Fruits and Vegetables
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III. Materials:

1. Laptop
2. Projector
3. PowerPoint Presentation

IV. Procedure:

TEACHER'S ACTIVITY	STUDENT'S ACTIVITY
A. Preparation Good morning/afternoon Class! Please lead the prayer, [Student]. - Thank you Student Teacher will check for the attendance Class , please pick up all the scattered pieces of paper under your chair and please arrange your chairs also.	Good morning/afternoon Sir! Student will lead the prayer Student will listen on the attendance Student will do as instructed

B. Motivation

Let's play! The game is called "Fresh or Changed?"
I will show you pictures of food, and you just think quietly is it fresh, or has it changed over time? For every right answer I have a prize for you.

C. Lesson Proper	
Before we proceed, can anyone guess what was the theme of the game?	They we're about fermentation
That's correct, it's fermentation	
Now let's address what is fermentation?	Fermentation is a natural process where tiny living things called microorganisms help turn sugars in food into something new. Sometimes they make food sour, bubbly, or even longer lasting.
What are the Fermenting ingredients?	Fermenting Ingredients:
First one is sugar.	1. Sugar – is a soluble carbohydrate converted to alcohol or acid through fermentation. Simple sugars or monosaccharides are made up of one molecule of sugar.
I'll give example of simple sugars.	The 3 simple sugars are: 1. Glucose – found in the human bloodstream, sap of plants, fruits. 2. Fructose- found in fruits and vegetables 3. Galactose – found in dairy products
Second one is yeast.	2. Yeast or Saccharomyces cerevisiae is a species of fungus that converts sugar into ethanol during alcoholic fermentation.
Third one is vinegar.	3. Vinegar is both product of fermentation and an ingredient of fermented products. The mother vinegar, which can be found floating on the surface of unpasteurized vinegar, provides good bacteria that follow alcohol to ferment into acetic acid. Vinegar has antiseptic properties which kill microbes preventing spoilage. Vinegar tenderizes the meat and gives extra flavor to pickles.
Fourth one is Salt.	4. Salt or sodium chloride (NACI) reduces water activity and enhances the flavor. It also affects the texture of the product.
Last one is spices.	5. Spices are used to mask color and odor or fermented and pickled products.

Now let’s talk about Alcoholic Fermentation	Alcoholic Fermentation is the breakdown of sugar into alcohol and carbon dioxide due to the addition of yeast. This type of fermentation occurs under anaerobic conditions. The final product of alcoholic fermentation is ethanol. The process of alcoholic fermentation is best explained by wine processing.
So, when yeast and sugar mix, the sugar (glucose) breaks down and turns into ethanol and carbon dioxide. That’s why fermented drinks can get bubbly that’s the gas!	This is yeast to 2 carbon dioxide and 2 ethanol $C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$
Introducing Wine	Wine is a drink made from fruits like grapes or rice that have been left to change over time. When you crush the fruit and add yeast, the sugar in the fruit turns into a little alcohol and bubbles.
The four stages of Wine processing First one is Extraction.	Wine processing consists of four stages: 1.Extraction There are 2 methods of Extraction: applying pressure and water extraction. 1. Applying Pressure – freshly and juicy fruits like grapes, pineapple, and tomatoes are pounded and pressed. 2. Water Extraction – Water is added in proportion to the fruit. The mixture is brought to a boil and then strained. The solid particles are removed and the juice is extracted. Fleshly and dry fruits like banana, bignay, duhat, and guava are extracted through this method.
Second is Fermentation.	2.Fermentation At this stage, yeast is added to the extract. Yeast reproduces exponentially and digests the sugars, converting them to ethanol and carbon dioxide. A good indicator of this process is the formation of froth and bubbles on the surface of the liquid. The process takes about 1-4 weeks depending on the amount of sugar in the juice extract and the minimum number of yeast cells required to start a viable, active fermentation. At least one tablespoon of active yeast is required to start alcoholic fermentation. The ideal temperature for alcoholic fermentation is 28-30oC.

Third one is Ageing.	3.Ageing When fermentation is completed, the wine is siphoned into sterilized containers while the sediments at the bottom of the fermentation vat are discarded. The wine is then stored in oak barrels and left to age for one to two years. This gives the wine its distinct aroma and color. The longer the aging, the higher the price. The wine will continue to age when bottled. So, if you cannot age your wine in oak barrels, you can proceed to the last step- Clarification.
Last one is Clarification	4.Clarifying wine is done before bottling. This is to ensure that the wine appears clear without floating particles nor colloidal suspension. Cloudy wine does not command a good price. There are various ways to clarify wine: 1. Sedimentation and Decantation – leave the mixture undisturbed in order for the sediment to settle at the bottom, and then transfer or siphon the liquid above the sediment into a different container. 2. Filtration – use a filter paper or medium to separate the impurities from the liquid 3. Mondavl/s Method – Heat wine in a double boiler at 60 oC. Add beaten egg whites. The egg whites will bond with the sediments. Stir and maintain temperature for 30 minutes. Cool and filter the wine.
Alright class let’s now proceed to determining alcohol content	When making fermented drinks like wine, we can measure how much alcohol was made. This is called the alcohol content. To do this, we use two readings: 1. Before fermentation (how much sugar is in the juice) 2. After fermentation (how much sugar is left) We subtract the second from the first to see how much sugar was used by the yeast. Then we use this formula: 👉 Alcohol by Weight (ABW) = (Initial – Final) × 105 👉 Alcohol by Volume (ABV) = ABW × 1.25

Now that we are done with wine making let us procced to vinegar making	Vinegar-Making Vinegar is also referred to as “spoiled wine”. To make vinegar, sugar must first be converted to ethanol in the process of alcoholic fermentation. The vinegar bacteria, Acetobacter Aceti, or the mother vinegar is then added to the mixture to convert ethanol into acetic acid
Let’s discuss about the two stages of vinegar making	Vinegar contains 4-8% of acetic acid. It has a distinctive sour taste and pungent smell. Its keeping quality is due to the antiseptic properties of the acetic acid. Vinegar making consists of 2 stages:
First one is Alcoholic Fermentation	1. Alcoholic Fermentation Yeast is added to a juice extract. For vinegar, sugar cane and coconut are usually extracted. Yeast converts the sugars into carbon dioxide and ethanol under anaerobic conditions.
Second is Acetic Acid Fermentation	2. Acetic Acid Fermentation At this stage, a live culture of acetic acid bacteria (Acetobacter aceti) – also referred to as mother vinegar/ vinegar starter – combines with the ethanol. At 5 to 13% alcohol content, acetic acid fermentation will begin. The acetic acid bacteria will convert ethanol into acetic acid and water in the presence of oxygen. The optimum temperature is between 20 and 30 oC at a pH level of 5 to 6. $C_2H_5OH + O_2 \rightarrow CH_3COOH + H_2O$
Now let’s talk about Titratable Acidity	Titratable Acidity It is a test to measure the amount of acid in a solution (such as citric acid, acetic acid, lactic acid, etc.). It expresses as grams/ Liter (g/L). Deriving titratable acidity helps to describe the impact of acid on flavor while acidity (pH) only measures the strength of the acid.
Let’s move to the last part which is Lactic Acid Fermentation	Lactic acid fermentation happens when some tiny organisms (called bacteria) break down sugars in food without using oxygen. This process changes the food and gives it a sour taste, but it also helps preserve it making it last longer and stay safe to eat.

And these are examples of the products of fermentation	Products of Fermentation: Alcoholic Fermentation 1. Strawberry Wine 2. Rice Wine Acetic Acid Fermentation 1. Coconut, Water, Vinegar Lactic Acid Fermentation 1. Kimchi 2. Burong Isda 3. Patis (Fish Sauce) 4. Yogurt
D. Generalization "What do all types of fermentation have in common?"	"They all make food change using microorganisms."
E. Application "I will divide you into four groups. Each group will answer one question. Later, you will share your group's answer with the class."	□ Group 1: Your younger sibling asks, "Why does yogurt taste sour and last longer than milk?" 👉 Write a paragraph to explain how lactic acid fermentation makes yogurt different from milk and why that's useful. □ Group 2: You left grape juice in a bottle for a few days and noticed bubbles and a strong smell. 👉 Write a paragraph explaining what alcoholic fermentation is and what caused those changes in the juice. 🟤 Group 3: Your neighbor says vinegar is just spoiled wine. Is that true? 👉 Write a paragraph explaining how acetic acid fermentation turns alcohol into vinegar, and why it's important. 🟤 Group 4: Imagine your family wants to make fermented food to sell. 👉 Choose one type of fermentation and write a paragraph explaining how it works and why it's good for business or health.
V. Evaluation	
Answer the true or false questions on a ¼ sheet of paper	

VI. Assignment / Agreement

For your assignment, write a short paragraph (5–7 sentences) in a piece of bond paper. In your own words, explain what fermentation is and how it helps in making food. Then, search or ask at home and name two vegetables that are commonly pickled. Talk to someone in your house a parent, guardian, or older sibling and ask if they have ever tried or made pickled vegetables. Write what they said in your paragraph. This will help us prepare for our next lesson: Performing Pickling of Vegetables.

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