

# Exploration of microworld (ages 11-12)

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## Summary

The module offers IBSE activities about exploring the microworld. Three topics are presented.

Microorganisms are explored through their metabolic activities (decay of paper, production of CO<sub>2</sub> by rising dough, fermentation), nutrients and conditions needed for their vital activities are also determined. Work with variables is tested in activities preventing microorganisms from growing (conservation of food). Students compare methods used to measure the amount of CO<sub>2</sub> produced.

## Target concepts

- ▶ microorganisms
- ▶ sanitary properties of soil
- ▶ metabolism
- ▶ fermentation factors
- ▶ conservation of food

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<b>Topic 2</b> <b>Problem</b> <i>Characteristics of a procedure.</i>	<b>Cultivation of microorganisms</b> How can we identify microorganisms? Cultivation and identification of microorganisms on simple soils.
<b>Topic 3</b> <b>Problem 1</b> <i>Characteristics of a procedure.</i> <b>Problem 2</b> <i>Characteristics of a procedure.</i> <b>Problem 3</b> <i>Characteristics of a procedure.</i>	<b>Control of metabolic activity of microorganisms</b> Identification of fermentation factors. Identification and control of variables during fermentation. What gas and what volume of it is produced by yeast? Set of gasometer. Measuring the CO <sub>2</sub> produced. How can we stop the growth of microorganisms? Testing of different ways to slow down biochemical activity of microorganisms.

# 1. Sanitary property of soil

## Goal

Identification of factors causing paper decay

## WHAT HAPPENS TO THE PAPER?

**Problem:** A piece of paper has been thrown out in a park. What happens to it after several days? What causes it? Can you prevent it?

**Task 1:** Prepare an observation (outside or in the classroom). Observe the paper for 1 week. Describe the changes observed.

**Material:** A jar, soil, a thin piece of paper.

**Procedure:** Fill  $\frac{1}{3}$  of a jar with soil.

With clean hands, place the paper on the soil. If you do your observation in a classroom, imitate conditions affecting paper in a park.

Observe once a day and take notes of what you see (Observation sheet 1).

**Observation:** Before the observation, make a prediction of what will happen to the paper (write it down or draw it).

	Prediction	Observation
What does the piece of paper look like after 1 week?		

**Observation sheet 1:** What does the paper look like?

Day 3	Day 4	Day 5	Day 6	Day 7

What factors caused what you observed?

How do you know?



**Task 2:** How can you prevent the changes observed in task 1? Remove / change one factor which you think caused the changes. Prepare an experiment and observe during 1 week. Write down what you observed (Observation sheet 2).

**Material:** Write down what you need.

**Procedure:** Write down how you proceed with the experiment.

Which factor did you change / remove?	What do you predict will happen or will not happen to the paper?	Was your prediction correct?

### Conclusion:

Basing yourself on your experiment, can you confirm what caused the observed changes of the paper?

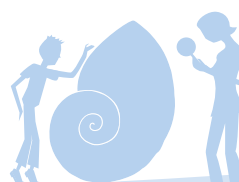
If you cannot explain observed changes on the basis of your own experiment, can you explain them on the basis of experiments made by your classmates?

What factor did you change / remove?

Why was it important to change / remove only one factor in your experiment?

**Observation sheet 2:** Factor changed / removed .....

Day 3	Day 4	Day 5	Day 6	Day 7




## 2. Cultivation of microorganisms

### Goal

Cultivation of micro-organisms on simple soils

Photo - documentation



**Problem**      **How can we identify microorganisms?**

*Explain what you observe. Was your expectation correct? What do microorganisms need in order to grow and multiply? Can you come up with a different soil where you could grow microorganisms?*

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## WHERE ARE MICRO-ORGANISMS?

**Problem:** Where are micro-organisms? Have you ever seen them? Can we see them? What do they need in order to live?

**Background:** Micro-organisms are very small structures invisible to the naked eye. Because they are so small we can see only big groups of micro-organisms which consist of thousands or even millions of organisms. We call those groups colonies.

A field studying them, microbiology, uses so-called cultivating medium. It contains nutrients so that micro-organisms can grow and multiply on it.

**Task:** Suggest a cultivating medium which enables micro-organisms to grow. Discuss your suggestion with the teacher. Prepare a cultivating medium according to the steps below.

**Material:** Jar with a lid (Petri dish), table cooker, pot, jelly.



Suggested composition (nutrients) of a cultivating medium to grow micro-organisms

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Preparation of a cultivating medium to grow micro-organisms:

- ▶ Boil suggested nutrients for a cultivating medium and mash them in a small amount of water.
- ▶ Add jelly.
- ▶ Pour into clean jar (or Petri dish) jelly with nutrients (cultivating medium). Close immediately. Let it cool off.
- ▶ For a very short moment, place various objects, where you expect micro-organisms to be present, on a cold jelly (cultivating medium). You can also open a jar with a cold jelly for 5 minutes in an environment where you expect micro-organisms to be present.
- ▶ Mark each jar so that you can identify what you placed on the jelly (or what the cultivating medium was exposed to) and what the composition of the cultivating medium is.
- ▶ Jars (Petri dishes) are closed and put in a place with conditions that you think are appropriate for growing micro-organisms.
- ▶ Observe during 7 days. Record your observations.

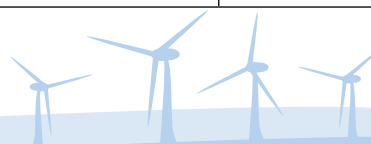
Observation:

Describe the conditions where you placed jars with a cultivating medium (place, heat, light...)

What did you place on a cultivating medium or what did you expose it to?

Observation of a cultivating medium

Day 3	Day 4	Day 5	Day 6	Day 7



**Conclusion:**

Compare the appearance of a cultivating medium surface and the surface of an object that was placed on it (or an environment to which the medium was exposed to). How can you explain your observations (presence or absence of colonies on surfaces)?

What is needed for micro-organisms to grow and multiply?

Where in your environment are micro-organisms present?

Suggest a different composition of a cultivating medium and explain your choice.



## 3. Control of metabolic microorganisms

### Goal

Identification of factors and conditions of fermentation.

## WHEN DOES YEAST START WORKING?

**Problem:** When does yeast start being active? What does it need?

**Background:** Yeasts consist of one cell organisms called candida. They are actually fungi. It is often sold pressed with flour. 1 g of yeast contains approximately 7, 5 billion candida cells.

**Task:** Suggest ingredients and conditions which are needed to activate yeast. Carry out your suggestion.

Suggested ingredients	Suggested conditions

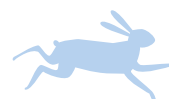
**Material:** yeast

Material needed to carry out your experiment

**Procedure:**

Ingredients	Conditions	Activity
Yeast* +		
Yeast* +		
Yeast* +		

\* The same amount of yeast in each setting.



**Conclusion:**

When do you observe a change? What caused it?

Describe observed change.

When do not you observe any change?

Justify ingredients and conditions used in your experiment.

In a discussion with your classmates summarize what is needed to activate yeast.

## TESTING DIFFERENT WAYS TO SLOW DOWN THE GROWTH OF MICROORGANISMS

**Goal**

Eliminating factors supporting the growth of micro-organisms leading to the spoiling of food

## HOW TO KEEP FOOD FRESH FOR A LONGER TIME?

**Problem:** Why does food get spoiled? Can it be prevented or can we keep food fresh for a longer time?

**Background:** Micro-organisms live and multiply in certain conditions. Their life cycle depends on these conditions. Insufficient, inappropriate conditions damage or kill them. How can you use that knowledge? What conditions prevent micro-organisms from growing and multiplying?

**Task:** Suggest different ways to slow down (or to stop) the spoiling process of food.

Food		Suggested way	Principle (Why do you think it slows down the spoiling process)
A			
B			
C			
D			
E			
F			





### Material:

Suggested food	Suggested material

### Procedure:

Describe the procedure and carry it out.

Leave a piece of each food sample unprocessed. It is called control (What do you need it for?).

**Observation:** Observe for several days and record it.

Food	.....(A)	..... (B)	..... (C)	..... (D)	..... (E)
Number of days					
Brief description of the procedure					
1					
2					
3					
4					
5					
6					
7					

### Conclusion:

How can you explain the slowing down of the spoiling process of food A?

How can you explain the slowing down of the spoiling process of food B?

How can you explain the slowing down of the spoiling process of food C?

How can you explain the slowing down of the spoiling process of food D?

How can you explain the slowing down of the spoiling process of food E?

Are there any other ways to slow down the spoiling process?

What is a control sample needed for?

