Vision Empower & XRCVC

Teacher Instruction KIT

Respiration in Organisms

Syllabus: NCERT
Subject: Science
Grade: 7
Textbook Name: NCERT- Science Textbook for class VII
Chapter Number & Name: 10.Respiration in organisms

1. OVERVIEW

1.1 OBJECTIVES AND PREREQUISITES

Objective

- To learn that respiration is essential for the survival of living organisms..
- To understand the process of respiration.
- To comprehend how plants and animals breathe.

Prerequisite Concept

- Reaction of carbon dioxide with limewater -Grade 7, Chapter 6; Physical and Chemical Changes
- Breathing in earthworms and fish -Grade 6, Chapter 9 ; Soil
- Role of stomata -Grade 7, chapter 1; Nutrition in Plants
- Cells -the fundamental unit -Grade 7, chapter 1; Nutrition in Plants

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*Kindly Note: Activities marked with * are mandatory*

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4.1 EXERCISES & REINFORCEMENT

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2. LEARN

2.1 KEY POINTS

- Why do we respire?

- All organisms are made up of microscopic units called cells which perform many functions. They require a lot of energy.
- When organisms respire, energy is released from food.
- Oxygen and food reach the cell and the breakdown takes place to release energy. This is called cellular respiration.

Two types of respiration

	AEROBIC RESPIRATION	ANAEROBIC RESPIRATION
1.	Breakdown of food takes place in the presence of oxygen	Breakdown of food takes place in the absence of oxygen
2.	It leads to production of carbon dioxide, water and energy.	It leads to production of alcohol and carbon dioxide & lactic acid in certain cases
3.	It occurs in all organisms	It occurs in yeast cells, bacteria and human muscle cells

Aerobic respiration

$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6CO_2 + H_2O$ + energy

In the presence of oxygen

Glucose ----------→ Carbon dioxide + water + energy

Anaerobic respiration

$C_6H_{12}O_6 \rightarrow C_2H_5OH + 2\ CO_2$

In the absence of oxygen

Glucose ----------→ Ethanol + Carbon dioxide + energy

1) The organisms like yeast which can survive without oxygen are called **anaerobes**. **Yeast** is used to make wines and beer as they yield alcohol during respiration.

2) **Human muscle cells** also respire anaerobically during heavy exercise when there is a temporary deficiency of oxygen.

In the absence of oxygen

Glucose ----------→ lactic acid + carbon dioxide + energy

(in muscle cells)

The accumulation of lactic acid leads to **cramps** in the muscle.

- **Breathing --** Breathing involves inhalation and exhalation. During **inhalation** air rich in **oxygen** is taken into the body while during **exhalation**, air rich in **carbon dioxide** is given out.
- **Breathing rate** -The number of times a person breathes (one inhalation and one exhalation) in a minute.

-The average breathing rate of a human adult during resting is 15-18 per minute and around 25 during exercise.

-The breathing rate differs depending on the type of activities undertaken. We breathe faster when we require more energy

- **Mechanism of breathing** -

Path of air

Nostrils → Nasal cavity → Windpipe → Lungs

- **Lungs** are placed in the chest cavity surrounded by **ribs** and **diaphragm** (a Muscular sheet) forms the base at the chest cavity

During inhalation, the ribs move up and out, diaphragm moves down. The extra space helps the air to enter the lungs.

During exhalation, the ribs move down and inward and the diaphragm moves up. This reduces the size of the chest cavity and pushes the air out of the lungs.

Composition of inhaled and exhaled air

Gases	Inhaled air	Exhaled air
Oxygen	21%	16%
Carbon dioxide	0,04%	4.44%

Test for carbon dioxide in exhaled air_ A freshly prepared limewater turns milky when blown into it indicating the presence of carbon dioxide in exhaled air .

- **Breathing parts in some animals**

Cockroaches – tiny openings called spiracles

Insects -a network of air tubes called tracheae

Earthworm – moist and slimy skin

Frog - lungs on land and moist skin in water

Fish - gills (help to absorb the oxygen dissolved in water

- **Respiration in plants**

Plants also respire. Each part of the plant can take in oxygen and give out carbon dioxide independently.

In leaves, tiny pores called stomata help in the exchange of gases. The root hair takes in oxygen from the soil

2.2 LEARN MORE

None

3. ENGAGE

3.1 INTEREST GENERATION ACTIVITY

Interest generation activity

Activity 1: Can you guess?

Materials Required: None

Prerequisites: None

Activity Flow

Teacher can give some clues and ask the students to guess the system they are going to study

- You cannot survive without it.
- It helps to remove carbon dioxide from the body.
- Smoke blocks or hinders its working.
- When the human being runs or does physical activity it works harder.

Elicit the answer -respiratory system. No living organism can survive without respiration.
Tell them that they are going to study more about the respiratory system.
Ask them to sit with eyes closed for two minutes and observe their breathing.

3.2 CONCEPT INTRODUCTION ACTIVITIES

Why do we respire?

Activity 2: Cellular Respiration

Materials Required: None

Prerequisites: Cell -the fundamental unit

Activity Flow

- Ask the students, why do you need food?
- After their response, explain that the main reason we need to eat is to get energy. Food is our body's only supply of energy. However, this energy must be converted from the apple (or any other food we eat) into an energy source that our body can use. The process of getting energy from our food is called cellular respiration.
- Discuss with the students how the food you eat provides energy?
- Explain to them, when you need a quick boost of energy, you might reach for an apple or a candy bar. But cells do not "eat" apples or candy bars; these foods need to be broken down so that cells can use them. Through the process of cellular respiration, the energy in food is changed into energy that can be used by the body's cell.

Activity 3: Cellular Respiration- Kinesthetic activity

Materials Required: Tactile card with equation of aerobic and anaerobic processes and 2 metre rope

Prerequisites: Cell -the fundamental unit

Activity Flow

- After initial discussion of cellular respiration, tell the students that they will play the parts of the major players in cellular respiration.
- Have the students stand in an open area of the classroom as space will be necessary.
- Assign each student a role: carbon dioxide, oxygen, water, and food.
- Explain to the students that the rope represents the cell membrane.
- Ask the students what the function of cellular respiration is. They should remember that energy production from food is the function of cellular respiration. Prompt them if necessary.
- Ask them what is necessary to produce energy by cellular respiration? - Answer: oxygen and food.
- Ask the students what are the waste products? - Answer: Water and carbon dioxide
- Have the students that are "playing" the products (water and carbon dioxide) stand inside of the cell membrane as you begin the activity. (considering rope on the floor as a cell membrane)
- Once they understand that food and oxygen are the necessary reactants, have the other 2 students "play" the food and oxygen and enter the cell through the cell membrane (rope).
- After they have entered, ask them, what products are produced? - Answer: Water and carbon dioxide. Have the 2 students who were in the cell exit as you explain the reaction.
- As the reactants enter and the products exit, make a buzzing sound to represent the production of energy (or ask the students what sound should represent energy) as a result of the reaction of cellular respiration. Describe this sound as the sound representing energy.
- Have students write the formula in words first and then show them how it is written in the form of a chemical reaction.

Anaerobic respiration

Activity 4: Anaerobic respiration in muscle cells

Materials Required: Tactile cards with the reactants and products (words like glucose, lactic acid, oxygen etc)

Prerequisites: None

Activity Flow

- Ask the students whether they have experienced cramps or pain in the leg muscles after heavy exercise or climbing stairs etc.?
- Tell them that during exercise a lot of energy is required; hence muscles produce energy without oxygen.

- During this anaerobic process lactic acid is produced. Accumulation of lactic acid results in cramps.
- The process can be emphasised using the method in activity 2.
- Ask the students can the pain be cured? Explain that pouring hot water helps to reduce the pain because it helps in the circulation of blood and breakdown of lactic acid.
- Divide the students in groups and give them each a set of tactile cards. Ask them to form the correct word equation for aerobic reaction, anaerobic reaction in yeast cells and anaerobic reaction in muscle cells.
- Ask them to write these equations in their notebook.

Breathing

Activity 5: Holding your breath

Materials Required: None

Prerequisites: None

Activity Flow

NOTE: To be done under the supervision of the teacher only

- Ask the students to close their nostrils and mouth with their hand.
- What happens after some time? What did they feel?
- If possible, with the help of the teacher, find for how long they could be in that position.
- Lead the discussion to bring out the fact that breathing is a part of respiration and involves inhalation and exhalation. Explain the terms inhalation and exhalation.

Activity 6: Breathing rate

*Materials Required: s*top watch

Prerequisites: None

Activity Flow

- Ask the students to sit silently and observe their heart beat.
- Tell them to feel the inhalation and exhalation.
- Now ask them to count 20 heartbeats -one heart beat is equal to one inhalation and one exhalation.
- Try to record the number of heartbeats in one minute. That gives the breathing rate. An adult has an average breathing rate of 15-18 heart beats per minute at rest.
- Now ask the students to jump or jog for 1-2 minutes and record the heartbeat.
- Also ask them to repeat the measurement after taking rest. Let them compare their findings with two their friends

- Ask them when the heartbeats higher?
- During the discussion emphasise that one breathes faster when the body requires more energy. More oxygen is supplied to the body to speed up the breakdown of food to release energy. This explains why we feel hungry after a physical activity.

Activity 7: Variation in breathing rate during different activities
Materials Required: Tactile card showing pictures of common activities – walking, sleeping etc.
Prerequisites: None

Activity Flow
- Ask the students to identify the physical activities shown in the tactile card.
- Let the students find the activities in which the rate of breathing is fastest and slowest. Elicit the reasons for their answers.
- Let them now arrange the activities in the order of increasing breathing rate.
- Discuss why the breathing rate is less when one is drowsy and why one feels hungry after a physical activity.

Human respiratory system

Activity 8: Human respiratory system
Materials Required: model of respiratory system, tactile diagram showing the path of air
Prerequisites: None

Activity Flow
- Ask the students to feel the model of the respiratory system and explain the different organs involved – nostrils, nasal cavity, pharynx, trachea, lungs, ribs, diaphragm and their position.
- Now tell the students to show the position of these on their body.
- With the help of the tactile diagram, let the students follow the path of air from the nostrils to the lungs.

Size of chest cavity during breathing

Activity 9: Size of chest cavity during breathing
Materials Required: measuring tape or string
Prerequisites: None

Activity Flow
- Ask the students to keep their hand on the chest and take a deep breath. Repeat the same by placing the hand on the abdomen.

- Discuss the observation. Lead the discussion to emphasize the movement of ribs and the diaphragm taking place during inhalation and exhalation.
- The size of the chest cavity increases during inhalation and decreases during exhalation.
- Tell them that they are going to do an activity in pairs.
- Ask one student to take a deep breath. With hands over hands method the other student can measure the chest width. The length can be marked using a rubber band or a satin ribbon.
- Now repeat it after the student exhales. Mark the length using another rubber band / satin ribbon.
- The difference shows that the chest region expands during inhalation.
- The activity should be repeated by reversing the roles of the students.
- The exact measurements can also be taken by the help of a tactile measuring tape or the teacher.

Mechanism of breathing in human beings

Activity 10: Mechanism of breathing in human beings

Materials Required: Plastic bottle, Y shaped glass/plastic tube, balloons, thin rubber sheet, tactile diagram showing mechanism of breathing

Prerequisites: None

Activity Flow

- Cut the bottom of the bottle and attach 2 deflated balloons to the Y shaped tube or to the ends of two straws attached together.
- Ask the students to breathe in and out through the straws. With one end let them check the size of the balloons during the two processes.
- Fix it in the bottle through the lid. Tie the rubber sheet at the open base with the help of a rubber band.
- The set up has to be airtight. Tell the students that
  The balloons represent lungs
  The tube- trachea
  The rubber sheet- diaphragm.
- Tell the students to pull the rubber sheet and then push it up.
- When the rubber sheet is pulled down the balloons get inflated and when it is pushed up it gets deflated.
- With the help of a tactile diagram, help the students understand the mechanism of breathing – the lungs expand, the ribs move outward and the diaphragm moves down during inhalation. During exhalation the lungs contract, diaphragm moves upward and ribs inward.

What do we breathe out?

Activity 11: What do we breathe out?

Materials Required: Clean test tube /plastic bottle, freshly prepared lime water, straw
Prerequisites: Reaction of carbon dioxide with lime water.

Activity Flow

- Tell the students that freshly prepared lime water is a clear solution.
- Ask the students to blow into it. Tell them that the lime water has turned milky.
- Ask questions to help them recall the fact that lime water turns milky when carbon dioxide gas is passed through it. It is a test for identifying carbon dioxide.
- Lead the discussion to help the students understand that the exhaled air contains more of carbon dioxide gas.
- Also tell them the percentage of carbon dioxide and oxygen in inhaled and exhaled air.

Breathing in other animals

Activity 12: Respiratory parts in certain organisms

Materials Required:
1. Tactile diagrams showing respiratory system of cockroach, earthworm, frog.
2. Activity cards -1 set of 5 cards -tactile diagrams of organisms
1 set of 5 cards – respiratory part with 3 D effect

Prerequisites: Breathing in earthworm

Activity Flow

- Ask the students to name the respiratory organs of lion, cow, dog etc.
- Ask them, do all the organisms have lungs? How do frogs live on land and in water?
- With the help of tactile diagrams, explain the mechanism of breathing in cockroaches, earthworm.
- Divide the students into two groups. Provide students with the 2 sets of activity cards each.
- Ask the students to match the two sets of cards and the group to complete this activity first would be the winners.

Breathing under water

Activity 13: Breathing under water

Materials Required: 2 Plastic cups, paper towel, rubber band, chalk powder and water
Prerequisites: Gills in fish

Activity Flow

- Ask them how the aquatic animals like fish live in water.

- Help them recall that gills help the fish to breathe.
- Take a plastic cup with water and add chalk powder. Let the students feel the solution.
- Using a rubber band fix the paper towel over one empty plastic cup.
- Tell the children the paper towel represents the fish's gills, the water represents the ocean water, and the chalk powder represents the oxygen in the ocean.
- Pour the water and chalk powder mixture over the paper towel into the plastic cup.
- Ask the students to touch the filter paper. They will find the chalk powder on the filter paper. Filter paper removed the chalk powder (representing the oxygen).
- Explain that in the same way fish use their gills to filter the oxygen to breathe underwater

Respiration in plants

Activity 14: Do plants respire?

Materials Required: Tactile diagram showing roots and root hair.
Prerequisites: Role of stomata

Activity Flow

- Ask the students the role of stomata during photosynthesis. Ask the students do plants take in oxygen? Do they respire?
- Lead the discussion to explain that plants respire too as they are living things. Each part in the plant takes in oxygen and gives out carbon dioxide independently.
- With the help of the tactile diagram, explain that roots absorb oxygen from the soil through root hair.
- Ask the students what would happen if the potted plants are overwatered?

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

Start the discussion by asking questions

- Why do we sneeze? What happens when unwanted particles enter the nose during inhalation?
- Tell the students that sneezing helps to expel foreign particles entering with the inhaled air. Ask them the right practice to be followed while sneezing.
- Lead the discussion to make the students comprehend that smoking is injurious to health.
- Also, discuss the effects of air pollution –causing respiratory diseases.

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Reinforcement

Activity 15: Aerobic and anaerobic respiration

Materials Required: None

Prerequisites: aerobic and anaerobic respiration

Activity Flow

- Ask the students to list down the similarities and differences between aerobic and anaerobic respiration.
- Let them share with the class and also ask them to write the equation of each as well.

4.2 IMPORTANT GUIDELINES*

Exercise Reading

It is very important that the children practice their learnings as well as their reading. Hence have the children read out the newly learned concepts from their textbooks or other available resources.

Perform Textbook Activity

It is good practice to have the children perform the textbook activities. Your textbook activities might not be accessible hence go through this resource to learn how to make textbook content accessible

Provide Homework

To evaluate their understanding and to help the student revise and implement the new learnt concept ensure to provide them with homework. Students should perform one or two of the questions mentioned above or from the textbook exercises with the teacher in Class and the remaining may be given for homework. Also, ensure that the student knows their special skills linked to independently using their accessible books as it will be critical to doing homework independently

References:

https://www.perkinselearning.org/accessible-science/activities/cellular-respiration-kinesthetic-activity

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