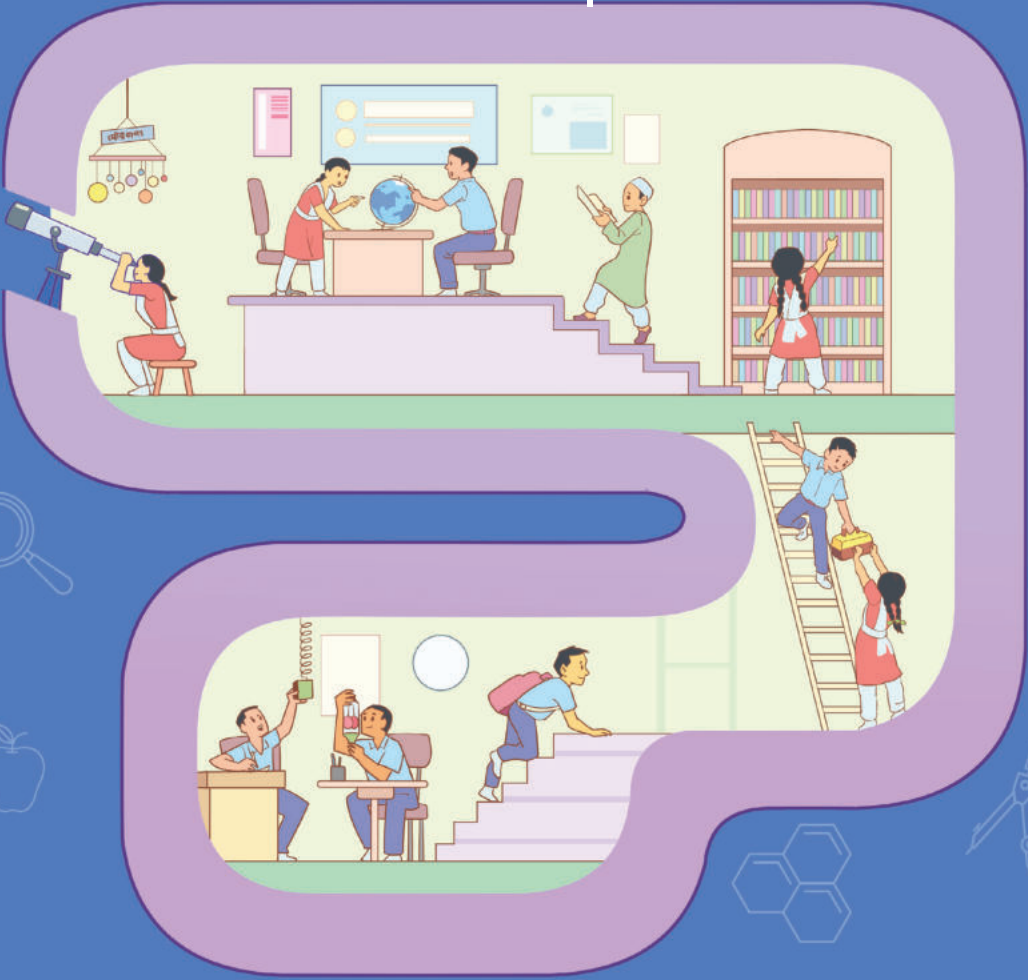


Science

Class Eight

Exercise
Book



NATIONAL CURRICULUM AND TEXTBOOK BOARD, BANGLADESH



বিজয় উল্লাস : ১৯৭১

১৯৪৭ সাল থেকেই পাকিস্তানি শাসকগোষ্ঠী দ্বারা পূর্ব পাকিস্তানের (বর্তমান বাংলাদেশ) জনগণ সর্বপ্রকার অত্যাচার, শোষণ, বৈষম্য ও নিপীড়নের শিকার হয়েছে। ১৯৭১ সালের ৭ই মার্চ বাংলাদেশের স্বাধীনতা সংগ্রামের অবিসংবাদিত নেতা বঙ্গবন্ধু শেখ মুজিবুর রহমান স্বাধীনতার ডাক দেন এবং ২৬শে মার্চ আনুষ্ঠানিকভাবে স্বাধীনতার ঘোষণা প্রদান করেন। ৯ মাসের মুক্তিযুদ্ধে অংশ নেয় নারী-পুরুষ, হিন্দু-মুসলিম, বৌদ্ধ-খ্রিষ্টান, শিশু-কিশোরসহ সর্বস্তরের জনগণ। পাকিস্তানি সেনাদের পাশবিক নির্যাতনের শিকার ২ লাখের অধিক মা-বোনের ত্যাগ এবং ৩০ লক্ষ বাঙালির প্রাণের বিনিময়ে সশস্ত্র সংগ্রামের মাধ্যমে ১৯৭১ সালে ১৬ই ডিসেম্বর মুক্তিবাহিনী ও ভারতীয় বাহিনীর যৌথ কমান্ডের কাছে পাকিস্তানি হানাদার বাহিনীর আত্মসমর্পণের মধ্য দিয়ে মুক্তিযুদ্ধে বিজয় অর্জন করে বাংলাদেশ। বিশ্ব ইতিহাসে বাংলাদেশের মুক্তিযুদ্ধ খুবই তাৎপর্যপূর্ণ ঘটনা। বাংলাদেশ তৃতীয় বিশ্বের প্রথম দেশ, যে দেশ সশস্ত্র মুক্তিযুদ্ধের মাধ্যমে স্বাধীনতা অর্জন করেছে।

Developed by the National Curriculum and Textbook Board as a textbook according to the National Curriculum 2022 for Class Eight from the academic year 2024

Science | Exercise Book

Class Eight (Experimental Version)

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PREFACE

In this ever-changing world, the concept of life and livelihood is changing every moment. This process of change has been accelerated due to the advancement of technology. There is no alternative to adapting to this fast changing world as technology is changing rapidly ever than before. In the era of fourth industrial revolution, the advancement of artificial intelligence has brought about drastic changes in our employment and lifestyles that will make the relationship among people more and more intimate. Various employment opportunities will be created in near future which we cannot even predict at this moment. We need to take preparation right now so that we can adapt ourselves to that coming future.

Although a huge economic development has taken place throughout the world, problems like climate change, air pollution, migrations and ethnic violence have become much more intense nowadays. The breakouts of pandemics like COVID 19 have crippled the normal lifestyle and economic growth of the world. Thus, different challenges as well as opportunities, have been added to our daily life.

Standing amid the array of challenges and potentials, sustainable and effective solutions are required to transform our large population into a resource. It entails global citizens with knowledge, skill, values, vision, positive attitude, sensitivity, adaptability, humanism and patriotism. Amidst all these, Bangladesh has graduated into a developing nation from the underdeveloped periphery and is continuously trying to achieve the desired goals in order to become a developed country by 2041. Education is one of the most crucial instruments to attain the goals. Hence, there is no alternative to the transformation of our education system. This transformation calls for developing an effective and updated curriculum.

Developing and updating the curriculum is a routine and important activity of National Curriculum and Textbook Board. The curriculum was last revised in 2012. Since then, more than a decade has elapsed. Therefore, there was a need for curriculum revision and development. With this view, various research and technical studies were conducted under NCTB from 2017 to 2019 to analyze the current state of education and identify the learning needs. Based on the researches and technical studies, a competency-based and seamless curriculum from K-12 has been developed to create a competent generation capable of surviving in the new world situation.

Under the framework of this competency based curriculum, the textbooks have been prepared for all streams (General, Madrasah and Vocational) of learners for Class Eight. The authentic experience-driven contents of this textbook were developed with a view to making learning comprehensible and enjoyable. This will connect the textbooks with various life related phenomenon and events that are constantly taking place around us. It is expected that, through this, learning will be much more insightful and lifelong.

In developing the textbooks, due importance has been given to all - irrespective of gender, ethnicity, religion and caste while the needs of the disadvantaged and special children are taken into special considerations.

I would like to thank all who have put their best efforts in writing, editing, revising, illustrating and publishing the textbook.






If any errors or inconsistencies in this experimental version are found or if there is any suggestions for further improvement of this textbook, you are requested to let us know.

Professor Md. Farhadul Islam






Chairman

National Curriculum and Textbook Board, Bangladesh

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To the student-

Dear students, you have been studying science in all the classes. How do you feel learning science? We are sure you enjoy doing scientific practical tasks more than reading. From now on, we will not only read science. Rather we will have some experiences that reflect the way scientists originally do their researches. Certainly you have got the Investigative study book which is directional or reference for you. Whenever you need throughout the year, you may consult this book. And the teacher is always there to help you.

This Book is Yours!!

This book is yours only; it is the book to jot down your tidbits of science, some sudden bright ideas and thoughts etc. All through the year, this book is going to help you like a friend!

Therefore, let us complete the introduction part right at the beginning, shall we? Write your name and ID in the blank space below—

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We should also strengthen our relationship a bit more, shouldn't we?

Write a few sentences informing the book more about you—

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Introduction

Many events continue to occur around us all the time. Certainly you have many questions about these, like why do these happen, how do they happen, etc. Some of you might have tried to seek answers to these on your own.

Now we altogether will seek answers to many such questions. This is your exercise book to make that work a little more organized. How to go through the various learning experiences step by step is given here in detail. While doing these tasks, you may need to know various types of information and theories of science; new questions may arise in your mind. The book 'Investigative Study' on Science will help you find the answers to all these questions. Moreover, these two books will directly help you in different stages of achieving learning experiences throughout the year.

Your learning experiences in class Eight are given beside.

Take a look at them-

-
- 1 In Search of Migratory Birds
 - 2 Sundial
 - 3 Green Friends
 - 4 Field Trip
 - 5 Our Laboratory
 - 6 Genealogy of the Living World
 - 7 Music Festival
 - 8 Environmental Protection
 - 9 Incredible Body Machine
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What kind of experience shall we have?

Title of Learning Experience	What we shall do
In Search of Migratory Birds	When we talk about world explorers, we usually think of a few well-known ones. But have you ever considered whether animals also explore the world? We've all heard about migratory birds, those amazing creatures that travel long distances, leaving their homes to find new ones in distant places during certain times of the year. In this learning experience, let's dive deeper into understanding these incredible migratory creatures.
Sundial	How did people measure time when the clock was not invented? The courses of the sun and the moon and stars in the sky were the only means of people. Now you know that the earth moves around the sun on its definite orbit and that's why we regularly observe the rising and setting of the sun. Is this course of the earth the same all year round? Is it possible to tell the time accurately using the light and shadow that we see depending on the position of the sun? Let's try it!
Green Friends	You have lots of friends at school or outside. Not all of them are humans. Many of us have cats or dogs, and they are also our four-legged friends. What if we make friendship with a tree? Many of you might wonder, how can a tree be our friend as it can't talk or show emotions? Don't trees really have feelings? Let's explore this further!
Field Trip	Isn't it more enjoyable to learn the complex topics of physics through hands-on activities, perhaps during a field trip? In this Learning Experience Session, you will design your own trip, measure its distance, and analyse various aspects of your travel, such as motion, speed, velocity, acceleration, and more.

What kind of experience shall we have?

Title of Learning Experience	What we shall do
Our Laboratory	<p>Have you seen how many things there are in the laboratories of scientists? How would it be, if you had your own such laboratory where you could experiment with different kinds of materials like real scientists? In this experience, let's explore how to turn your classroom into a laboratory! You must be thinking, so many things are required to set up a laboratory, and how to get so many things? In fact, we can choose the materials for our laboratory from the things that we use in our homes or in our daily needs. Let's get started!</p>
Genealogy of the Living World	<p>The living world includes the countless creatures living around us. It is a huge family spreading all over the world. How are these organisms interrelated, what are their similarities and differences, and where is the position of the human being in this big family? This learning experience is about finding answers to these questions. Come on, let's create the genealogy (family tree) of the living world!</p>
Music Festival	<p>Singing and humming brings so much joy! Imagine a beautiful day when you feel like singing aloud "What a wonderful world!" In this exercise section, through singing and playing with sound, you'll learn about the fascinating world of waves in physics. From cheering enthusiastically on the sports field to comprehending the creation and propagation of sounds, you'll dive into the fundamental concept of 'waves'.</p>

What kind of experience shall we have?

Title of Learning Experience	What we shall do
Environmental Protection	<p>The topic of environmental protection is not new for anyone. Earlier in various classes you have done a lot of work for environmental awareness. But have you ever thought about how your own daily activities on the environment? Let’s take a look back at ourselves in this learning experience. Our task this time is to explore if we are unknowingly harming the environment in our daily lives, and to find real solutions to it.</p>
Incredible Body Machine	<p>Our human body can be compared to a big machine just like the different parts of a machine do different jobs separately to make the machine accomplish entire work. Different systems of the human body keep our entire body system functioning and balanced through certain functions.</p> <p>In the previous class also, you have learned about different systems of the human body. Now in this class too, let's see how some other systems keep our physiological activities functioning through their interaction!</p>
Food Adulteration	<p>Food Adulteration is a social problem that all of us have faced in our daily lives. This problem is quite harmful to public health. Some unscrupulous people are adulterating the daily necessities including food for more profit. Through this, people are being affected by various complex diseases, and are even exposed to the risk of death. The presence of adulterants in essential food items has become a cause of danger for the general people. In the market, we can observe the presence of harmful chemical substances in various types of food, including vegetables, milk, fruits, and fish-meat. Adulterated food can cause of various diseases. This time our inquiry is about this important issue.</p>

In Search of Migratory Birds

When we talk about world explorers, we usually think of a few well-known ones. But have you ever considered whether animals also explore the world? We've all heard about migratory birds, those amazing creatures that travel long distances, leaving their homes to find new ones in distant places during certain times of the year. In this learning experience, let's dive deeper into understanding these incredible migratory creatures.





Sessions One and Two

- ✎ Have you noticed any birds in your neighborhood that are only around during certain seasons? Have you ever been curious about where they go for the rest of the year?
- ✎ Many of you might have already realized that we are talking about migratory birds (also known as guest birds). Can you name the migratory birds that visit your local area and specify the time of year when they are usually seen? Have a discussion with your classmates and record your findings below:

Area Name (Village/Town/Subdistrict/District) :

Name of Migratory Bird	When in the year are they seen?

- ✎ Now, take a look at the images of the birds next page. Are you able to identify any of these birds? Have you ever spotted them in your surroundings? Have a chat with your friends and see if anyone can recognize them.

In Search of Migratory Birds



Ruddy Shelduck



Black skimmer



Pitta brachyura



Wood Sandpiper









Red Crested Pochard



White Wagtail

Science

-  Now, discuss with your classmates and see if anyone can identify any of the birds.
-  Even if you haven't had the opportunity to observe migratory birds firsthand, you might have come across information about them in newspapers or magazines. When do they arrive? Where do they come from? Let's work together to find the answers to these questions.
-  Let's begin by following the teacher's instructions and forming groups. Our goal is to understand the route taken by migratory birds or their locations from where they migrated to our country. To achieve this, we need to learn how to specify the locations of different places on the Earth's surface. We can start learning that by making a model of the Earth.
-  I'm sure your school has a globe, right? The first task is to examine that and create a model of the Earth by yourselves. You can start making that by wrapping white paper around a ball or a spherical object.
-  Next, mark various regions on this handmade globe. You need to represent the continents on your globe in a way that helps us understand the migratory path of the guest birds. In order to do that, it's essential to learn how to indicate locations on the Earth's surface.
-  Pay close attention to the globe provided by the teacher. Have you noticed that there are both horizontal and vertical lines drawn encircling the globe? Can you take a guess about the purpose of these lines? Write down your thoughts below.

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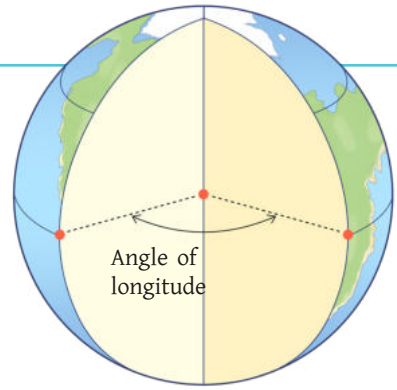
-  Explore the chapter on 'Geographical Coordinates, Local Time, and Regions' from your Investigative Study book. Engage in a group discussion about the section on 'Geographical Coordinates.'

- ✎ Next, proceed to the section in the same chapter that explains how to determine latitude. You could cut the model of Earth you made to understand the measurement of latitude, but it would no longer be useful then. Instead, pick a simple spherical object like a guava or an orange for this observation. Mark the guava with horizontal and vertical lines, imitating the concept of the globe. Then, carefully cut the guava from top to bottom through the center to measure the angle of latitude. (Please exercise extreme caution while using a knife or any sharp object to prevent accidents).
- ✎ On the flat surface of the guava (or the chosen object), draw essential latitude lines as described in the book, such as the Equator, the Tropic of Cancer, the Tropic of Capricorn, the Polar Circles, and other notable lines. Aim to replicate these lines on the Earth model you've constructed in a similar fashion.



Session Three

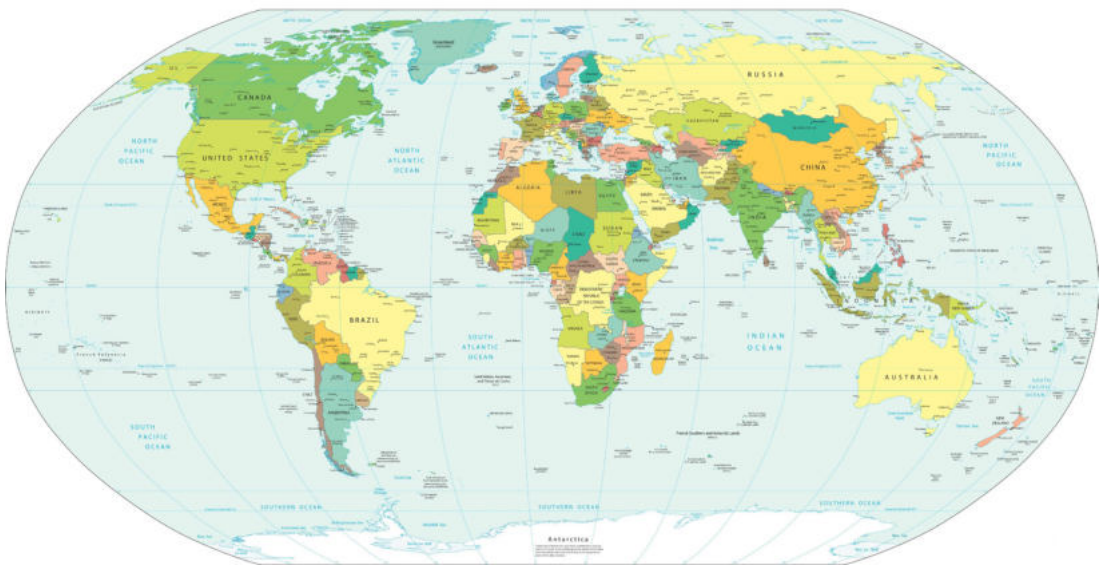
- ✎ Begin this session by revisiting the models you worked on during the previous day, and review the discussions you had earlier.
- ✎ Now, turn your attention to the 'Investigative Study' book. Study the importance and utilization of latitude, as well as the different geographical regions categorized based on latitude. Try to find the possible answers to the three questions presented in the book. Engage in discussions about these answers with your fellow classmates and your teacher.




- ✎ Next, take your Earth model to mark out key regions: the equatorial region, the temperate zone, and the polar region.
- ✎ Proceed to learn the method for determining longitude, and apply a similar approach as you did for measuring latitude, involving angle calculations.
- ✎ Have you grasped the method we use to determine the exact positions of different places on Earth using latitude and longitude? In

What is GPS?

Full name of GPS : Global Positioning System. Once upon a time, the geographical position of a place on the surface was determined with the help of latitude-longitude and measuring with maps, compasses, scales etc.. Now the location of any place in the world can be known very easily and accurately using GPS technology. Cars, ships, planes, laptops, and even ordinary smartphone models now have GPS receivers.



your science book, you'll find the specific location of Bangladesh marked on the world map through this method. If you observe the map closely and measure it, you may even be able to locate your school. You can make an approximate estimation of where you're currently standing on Earth's map based on precise latitude and longitude measurements. If your teacher has a smartphone, they can provide you with your current location coordinates. A smartphone equipped with GPS can determine latitude and longitude for any location.

 Can you use latitude and longitude to pinpoint the locations of the countries listed in the table below on the world map? Feel free to collaborate with other members of your group for assistance.

Name of the Country	Location on the Map (Latitude-Longitude)
Cambodia	
Uruguay	
Denmark	
Madagascar	
Japan	
Senegal	



- ✎ Now, we're going to engage in an interactive activity. One team from the class will choose a specific country, and the task of the other team will be to pinpoint the coordinates of that country using the world map. This will be an exciting way to practice the use of geographical coordinates!
- ✎ Have you noticed a thing? The size of different places we see on a globe is not exactly same as the size we see on a printed two-dimensional map. When trying to interpret a spherical surface as a two-dimensional surface this pitfall occurs. If you don't believe it, compare the size of the continent of Antarctica on a globe, and the size of the same continent on a printed map or any two-dimensional map!



Session Four

- ✎ As we begin this session, let's use the Earth model you've created to outline the continents on its surface. Match the lines of latitude and longitude on your model with those on the globe or a world map to accurately represent the continents.
- ✎ Now, let's ponder a fascinating question. When it's high noon in Bangladesh, it's midnight on the opposite side of the world. So, how do we figure out when the day starts in different places, what time it is elsewhere, and similar questions? Additionally, since each region begins its day at different times, how do we establish the date in a specific location?
- ✎ To address this, all countries have agreed upon a set of rules for determining time and date. Explore the sections on the 'International Date Line' and 'Determining Time and Date' in your Investigative Study book. Discuss this topic among yourselves, and if you encounter any challenges in understanding,

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don't hesitate to seek assistance from others.

- ✎ Look at your clock and note the current time. Next, based on the locations of the countries we discussed in the previous session, calculate what the current time might be in those countries. This exercise will help reinforce our understanding of time zones and international time differences.

Name of the Country	Current Time on the Clock
Bangladesh	
Cambodia	
Uruguay	
Denmark	
Madagascar	
Japan	
Senegal	



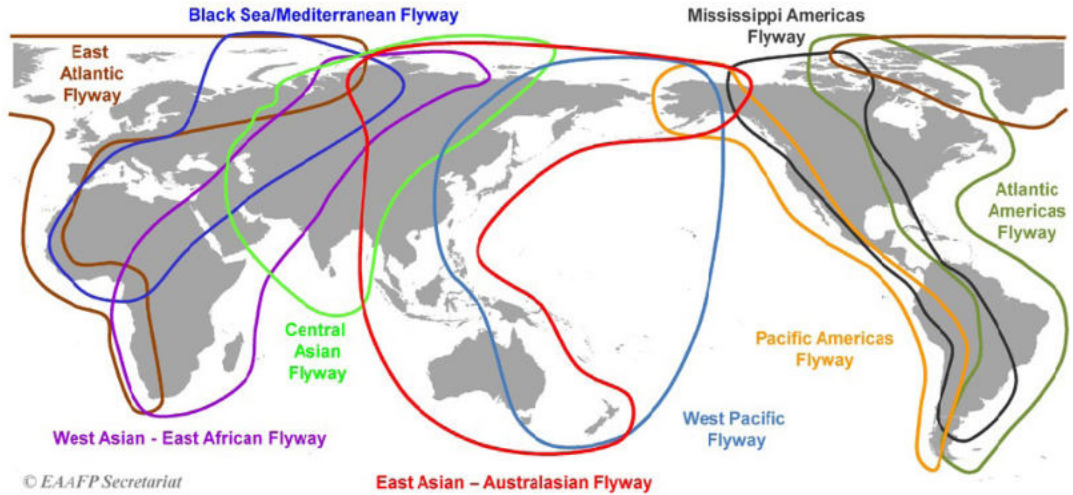
Session Five

- ✎ While we've been immersed in our exploration of the world map, let's not forget about our migratory feathered friends. Understanding the routes of migratory birds involves various methods. One particularly effective approach is attaching small devices to these birds that enable us to track their locations at any given time. This scientific technique has revealed remarkable insights about the journeys these birds undertake.
- ✎ Focus your attention on the primary migratory routes depicted on the map next page. Have you observed any routes that pass over or near Bangladesh? Write down the names of these routes below—

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- ✎ In the map above, carefully examine the migration routes or flyways that traverse over Bangladesh, and locate them either on the world map or by referencing the Earth model you've created. Can you imagine how extensive



and lengthy the paths are that these birds follow along each flyway?

- ✎ The East Asian-Australian Flyway alone accounts for the movement of approximately 500 million birds representing nearly 250 species! Record the countries over which this flyway passes, including Bangladesh—

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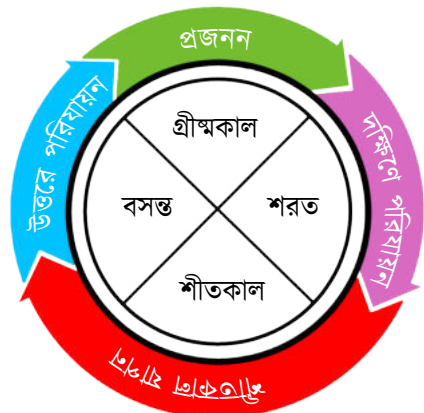
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- ✎ Across the globe, migratory birds follow distinct routes known as flyways. Although the flyways may vary, a common migration pattern emerges. In most cases, these birds begin their southward journey during autumn or late autumn. They often spend the cold months in southern regions. As spring arrives, they make their way



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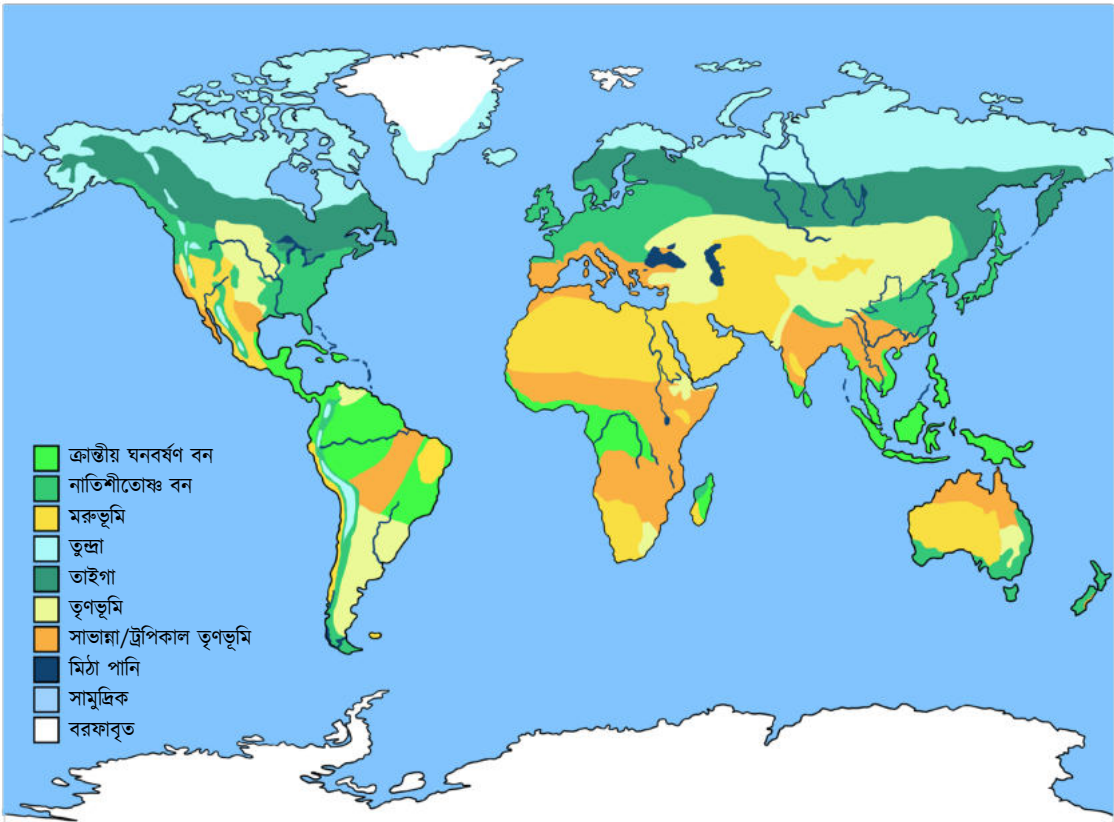
northward once more, using the summer months for building nests and breeding in northern areas. However, the migratory birds we observe in Bangladesh don't always arrive solely for winter. A considerable number of them reach Bangladesh a few months before winter and then continue their journey even further south during the winter season.

- ✎ What drives these birds to migrate? While the exact reason for migration isn't definitively established, it's believed to be linked to the search for abundant food or the need to escape extreme cold temperatures. Gaining an understanding of the varying terrains and climates across Earth's different regions can shed light on this phenomenon.
- ✎ Observe the map next page, which highlights diverse geographical regions on Earth. Essential characteristics of these regions are outlined in your Investigative Study book; refer to it for details. We'll delve deeper into this topic in the next session.



Session Six

- ✎ Examine the map in the previous session along with the migratory bird's flight paths. Look into which areas these birds migrate from and to, as well as the time of year they inhabit these different regions. Discuss this with your friends.
- ✎ Now the question arises: why does the Earth's topography and weather differ in various places throughout the year? There appears to be a connection with the transitions between day and night or the changing seasons, doesn't there?
- ✎ To find answers to this intriguing question, you can create a model of the Earth and observe how sunlight falls on different regions. Start by marking a few key geographical areas on the Earth's model with different colors, and try to estimate the latitude of these regions. Next, set up a light source (a flashlight or LED can be used) as a representation of the Sun, and observe how its light falls on the model of the Earth. For a better understanding of the path of the Earth's rotation around the Sun and the types of this rotation, refer to the section 'Sun, Earth, and Moon' in your Investigative Study book. Fill in the table below based on your observation—



Different types of geographical regions of the World

Various Geographical Regions	Direction of the Sun's Light at Different Times of the Year (Vertical/Oblique)				Day Length (Only Day/Day Length Longer than Night/Day Length Shorter than Night/Day and Night Length Nearly Equal/Night Only)			
	March 21	June 21	September 23	December 22	March 21	June 21	September 23	December 22
North Pole								
Tundra Region								

Science

Various Geographical Regions	Direction of the Sun's Light at Different Times of the Year (Vertical/Oblique)				Day Length (Only Day/Day Length Longer than Night/Day Length Shorter than Night/Day and Night Length Nearly Equal/Night Only)			
	March 21	June 21	September 23	December 22	March 21	June 21	September 23	December 22
Desert Region								
Evergreen Forest								
South Pole								

- ✎ Review the data on the chart with your group. Can you identify any correlations between the solar radiation patterns and the formation of distinct geographical regions?
- ✎ After the discussion, present the group's collective conclusion in the class. Listen to the opinions of other groups.
- ✎ Now, based on everyone's discussion, write the answers to the following question:
 - Even after the Earth's continuous rotation, how is the geographical diversity preserved in various regions?

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Sessions Seven and Eight

 In many instances, it's evident that migratory birds consistently follow the same paths each year, arriving at precise destinations in specific areas. This prompts the question: How do these migratory birds navigate these extensive routes with such accuracy?


 Before delving into the methods birds use to determine their paths, let's consider our own means of finding directions. The Sun is a significant guide for us in this regard. Additionally, we have a tool, the compass, which plays a helpful role in determining directions. Many of you are likely familiar with how a compass functions—with its needle always pointing north. People have been using compasses to find directions since many years. The first known use of the compass was in China, about two hundred years before the birth of Christ. Over the centuries, seafaring sailors have used compasses to determine the direction of their ships.



 Now, to comprehend how the compass helps in determining directions, we need to explore the properties of magnets.

 Take any magnet of any shape and observe how it interacts with various objects, noting which substances it attracts and which it does not. Record your observations in the table below.

Attracted to Magnets		Not Attracted to Magnets	
Name of the object	What it's made of	Name of the object	What it's made of

 Magnets are found naturally, and can also be made artificially. Can you make a magnet yourself? Let's try it!

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- This experiment requires a permanent magnet, and a piece of steel or a needle. Touch one end of a permanent magnet to one end of a piece of steel or needle and pull it to the other end. Then the permanent magnet must be lifted up and pulled back touching the same place, i.e. the friction must always be unidirectional. Continue this at least twenty times in the same direction using the same end of the magnet. Now take the steel or needle to an iron or nickel material, is attracting? Write your observations below.

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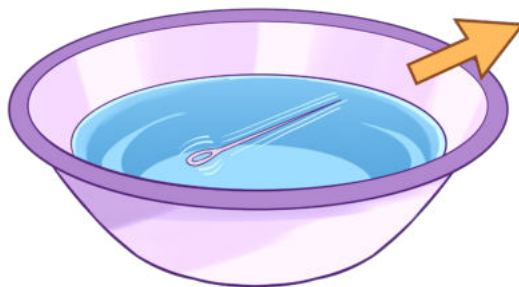
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- Now take a bowl of water and gently float the needle in that water very carefully. The needle will float because of the surface tension of water (You will know more about this properties of water in the next class). Attempting to drop it vertically will cause the needle to sink immediately. Another idea for floating the needle is to stick it in a small piece of paper and then float it.



- Now notice well, is the needle facing north-south direction? If you want to be sure, turn the bowl a little and see if the direction of the needle remains the same or not.

➤ Write your observations below.

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✎ If the above experiment are done correctly, you have now created a working compass.

✎ Why do magnets attract certain substances, and why do they face north-south? To understand these, carefully read the section on permanent magnets from the magnet chapter in the Investigative study book and discuss it with your classmates.

➤ Now think about it, since there is a relationship between charge and magnetism, is it possible to make a magnet with the help of electric current flow? Let's try it.

➤ Twist the plastic-covered electrical wire several times over a piece of drinking straw. Since the magnetic field is not high in just one twisted wire, it has to be twisted several times. Now place the twisted wire near a compass, generally the needle of the compass will initially face north. Now attached the two ends of the coil wire to the two ends of a battery. what you see? Is the compass turning towards the coil? Now turn the battery again and change the direction of the current, do you see any change in the direction of the compass? Write your observations in the below:

➤ What tools did you use?

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Science


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➡ What happened when you brought the compass closer?

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➡ What happened when you changed the direction of the battery?

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 Read and discuss with your classmates, the section on 'Electromagnetism' and 'Electromagnetic Induction' from the Investigative study book. Did you understand the reason of your observation?



Sessions Nine and Ten

- ✎ Now that we understand the workings and properties of magnets. Have you ever wondered why the two poles of a compass or any magnet consistently point in the north-south direction?
- ✎ You may have already guessed the answer, and it's quite fascinating. Our Earth itself behaves like a massive magnet. Therefore, when we use a compass, its north pole aligns with the Earth's south pole, and its south pole points towards Earth's north pole. To get clear understanding of this topic, read the section titled 'Magnetic Field of Earth' in your Investigative Study book. Share and discuss this topic with your classmates.
- ✎ Now, let's ponder another intriguing question: How do migratory birds navigate accurately over vast distances, even without relying on a compass? Apart from tracking the movement of the Sun or stars, a significant aid for them is the magnetic field. Quite surprising, isn't it? Recent research has revealed that migratory birds possess a tiny particle called 'magnetite' in their beaks, which exhibits magnetic properties! Additionally, they have small magnetic particles on their retinas, helping them perceive the Earth's magnetic field lines. Due to these extraordinary abilities, birds can precisely find their way to their intended destination.
- ✎ Migratory birds play a crucial role in our ecosystem, but they often face threats due to our lack of awareness. Your teacher will provide you with several newspaper articles discussing news related to migratory birds. Have you come across any incidents outside of these articles that are relevant? If so, please jot them down below.

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- ✎ You already know about natural ecosystems. Each component of the ecosystem has a role to play in maintaining the natural balance. Migratory birds are part of our nature, without them our natural balance would not be right. Taking into account the importance of migratory birds in maintaining the

Science

natural balance, the Wildlife Conservation and Safety Act of Bangladesh has mentioned their protection. According to this Act, killing, possessing, buying and selling, transporting, eating meat, hunting, trapping, etc. of migratory birds are punishable offences. The maximum penalty for which, the accused can be sentenced to 2 years imprisonment or a fine of 2 lakh taka or both.

- ✎ Engage in conversations with your classmates about this topic. After implementing your plan to support migratory birds, make sure to share your experiences with others. Together, we can make a positive impact on our environment!

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- ✎ Talk to your classmates. Don't forget to tell others about your experience after implementing the plan!

Retrospection

- 🗨️ What new information did you learn about migratory birds through this exercise?

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🗨️ Has your perspective on migratory birds shifted in any way following the completion of this activity?

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Sundial

How did people measure time when the clock was not invented? The courses of the sun and the moon and stars in the sky were the only means of people. Now you know that the earth moves around the sun on its definite orbit and that's why we regularly observe the rising and setting of the sun. Is this course of the earth the same all year round? Is it possible to tell the time accurately using the light and shadow that we see depending on the position of the sun? Let's try it!





Session One

- ✎ By hearing the title 'Sundial' you can understand that in this learning experience, you will be working to calculate the time using the sun. But what is the way to use the sun? How do we understand the Earth's orbit around the sun? Since the Earth




revolves around the sun all year round, you also need to make some observations throughout the year to understand the Earth's orbit. But in the beginning, before looking for the answer to this complex question, let's take a look at how sunlight reaches the earth.

- ✎ You can try it out for yourself by a simple observation. There must have been a flag stand in your school! You can observe how the shadow of this flag stand changes throughout the day (you can also observe the shadow of any long stick or pole instead of the flag stand). It can be difficult to accurately observe the shadow of the flag stand. In that case you can observe the shadow by placing a long stick, pole or baton vertically in one place. But for this observation it is necessary to keep the pole fixed in the same place throughout the day.
- ✎ Divide into groups of 5/6 with the help of the teacher. What is the change in the shadow of the flag stand every hour after school starts? Observe it and write it in Table 1.

Table 1


Names of group members:

Observation serial	Time (in a full hour)	Position of the flag stand's shadow	Length of the flag stand's shadow (foot)
1			
2			
3			
4			
5			
6			

 In the first class/science class, each of the groups by turns can gather data on the first-time change in the flag stand’s shadow. After each class ends, one person from the group will record the data on the change in the shadow in the table. In this way, data collection of only 5/6 observations will do. If the location of the flag stand is not in a convenient place, you can also use a stick or pole as shown in the picture to keep a record of its shadow. You can review this observation data in the next session.



Session Two

 Discuss the observation data from the previous session. How does the shadow of the flag stand or pole fall throughout the day? Did the shadow stay in the same place or did it move over time? Have you noticed any changes in the length of the shadow? Why is this happening? Discuss it in groups. Write your answer below based on the discussion.


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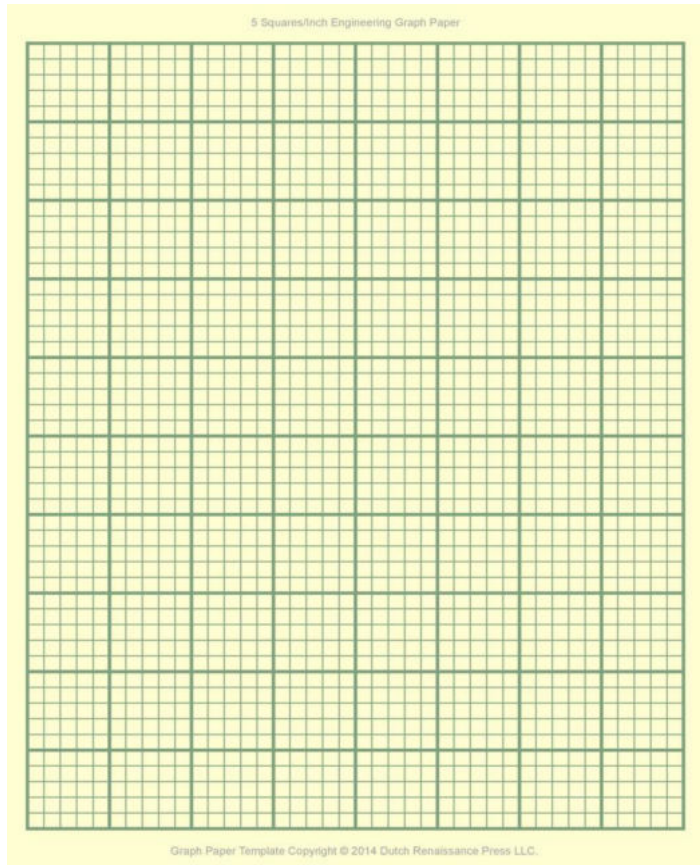
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Science

 Stick a round piece of paper as shown in the picture on top of a piece of hard cardboard or old carton. Now you can put a stick or even a pencil erect along its center. As the position of the shadow needs to be observed correctly to keep records of time, this sundial must be placed in a certain place in the sunlight. Better if you could start this observation exactly at 12 o'clock. Mark where the shadow of the pencil falls at 12 noon by writing 12. Now you have to write the time according to the position of the shadow after every hour.



-  Think whether it is possible to see the nighttime using a sundial.
-  Now let's discuss another matter. We have discussed the position of the shadow, but does the length of the shadow remain the same throughout the day?
-  Place the data of 5/6 observations of changes in the shadow of the flag stand or pole collected in the previous session on graph paper. Write the data on the corresponding graph paper in the exercise book with time (hours) on the X-axis and length of shadow (feet) on the Y-axis. Now, draw the line connecting the points obtained.
-  How does the shape of the graph look? What could be the reason for this difference in the length of shadow? Discuss it in groups and write your answers below.

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- ✎ Discuss the graph of your group and its explanation with the rest of the class. See what others have written.
- ✎ If necessary, check your logic by drawing the positions of the sun and the earth in the notebook.

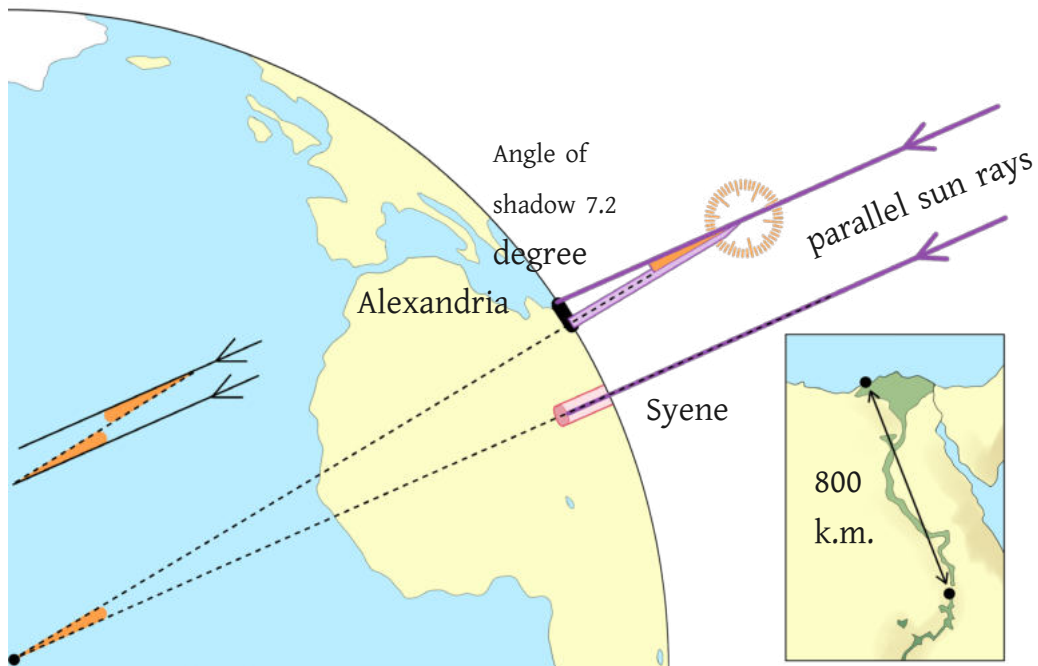
 **Sessions Three and Four**

- ✎ In the previous session, you have practically worked on shadows due to the positions of the sun and the earth. By making sundials, you have also learned how to measure time using shadows. People have made more amazing discoveries using this shadow. Let's know about one such incident today.

Story of the Measurement of Earth's Circumference by Eratosthenes

Eratosthenes was a Greek mathematician and the chief director of the famous Library of Alexandria. He read in a book that on 21 June the sun would remain at the midpoint of the sky at midday in the city of Syene and a pole stuck vertically would cast no shadow there. He noticed that the shadow was cast at exactly that time of day in Alexandria. The casting of the shadow in different ways in different places can mean only one thing - the earth is round! It may sound familiar now, but at that time in the 3rd century BC, few people would have believed it. Eratosthenes came up with a strange plan to prove his point. He appointed a man whose





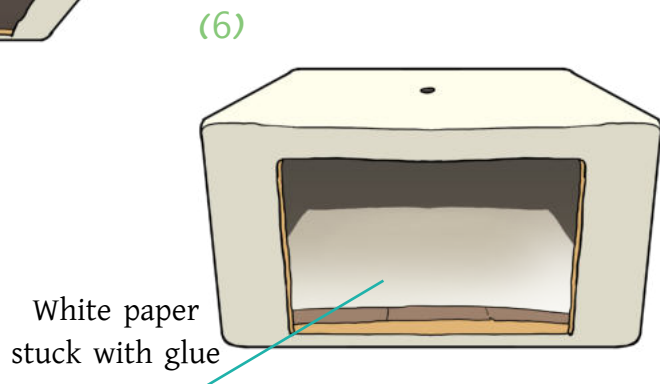
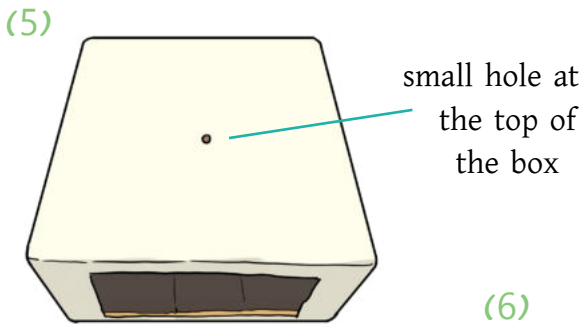
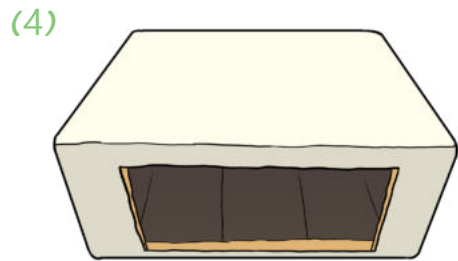
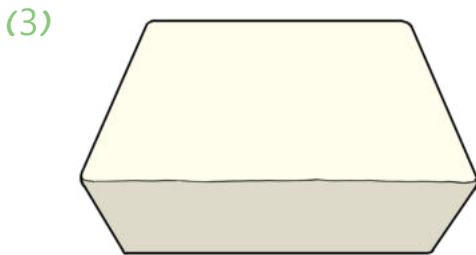
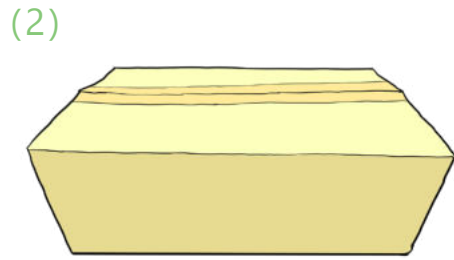
job was to walk straight from Alexandria to the city of Syene and measure the distance between the two cities.

Accordingly, his appointee started walking, and upon reaching the city of Syene, he measured that the distance between the two cities was 800 kilometers. Now on the next 21 June, he found out that the sun was really not casting a shadow in Syene city exactly at noon. That means the sun was shining exactly vertically. On the other hand, the angle of the shadow cast on Alexandria at the same time is 7.2 degrees. Now Eratosthenes calculated that if the earth is round, then the angular distance between these two cities at the center of the earth will also be 7.2 degrees, which is one 50th of 360 degrees. So if the distance between these two cities on the earth's surface is 800 km, the circumference of the whole earth will be 50 times!

In this way, he calculated the circumference of the earth as $800 \text{ km} \times 50 = 40,000 \text{ km}$.

Many, many years later, thanks to technology, when the circumference of the Earth was actually measured, it was found that Eratosthenes measured the circumference of the Earth almost accurately without any technology, using only the shadow of the sun! According to modern calculations, the circumference of the Earth is 40,075 km!

- ✎ You know the story of Erasthesin. He calculated the circumference of the Earth almost accurately from how the sunlight falls on two points on the Earth on the same day. Do you understand the way to determine the circumference? Discuss it in groups.
- ✎ Now think about it, does the sunlight fall in the same place throughout the year? Think for yourselves. However, it is difficult to answer this question from assumptions. It would be best if you examine by yourself how the sun shines throughout the year. For this, you can take a simple strategy.
- ✎ The best way to know exactly where the sun is shining is to allow the sunlight to enter through a point or small hole and to observe the position of the point of light at different times of the year.
- ✎ At first, you have to collect a box. You can use any small-size carton, or big-size empty tissue box/paper box for this task. Other than that you may need: an anti-cutter, a scale, nails, glue, etc.
- ✎ First wrap paper and glue around the paper box as shown in the sample picture next to it.
- ✎ Now poke a small hole in the top of the box with a nail or something sharp. Through this hole the sunlight will fall on the paper kept inside the box.
- ✎ Now cut one side of the box rectangularly with an anti-cutter and make a big gap. Through this blank space, you can easily see exactly where the sunlight is falling through the upper hole.
- ✎ Now put some glue on a white paper and paste it gently on the bottom of the box so that you can mark where the sunlight is falling. The paper should be removed after the year-long observation, so it is better to apply the glue very lightly.
- ✎ Now select a specific place in the school where these observations can be made at specific times throughout the year. That is to say, where the sun shines more or less throughout the year.
- ✎ Now select a certain time of the day when the sun falls on the place you have selected. Remember, the sunlight must fall through the hole in the box vertically onto the paper below so that you can keep notes of the observation. Fix a time around 12 noon as the sunlight falls fairly vertically at that time.
- ✎ Now your task is to keep the box in the same place at a certain time of the day and observe the exact point where the sunlight falls on the paper kept inside the box and mark the point with a pen or marker.
- ✎ As this observation should be done throughout the year, mark your selected



place well. If you want, you can mark where you will put the box with chalk or something else. Decide with the advice of the teacher.

- ✎ It's difficult to do this every day of the year, so fix a day of the week to do this observation. Do not forget to mark the position of the light spot on the paper placed inside the box after observation.
- ✎ Each of the groups in your class can complete one observation by turn on a given day of the week. But remember again, this observation has to be done with the box placed in the same spot, otherwise, the sun's rays cannot be compared to exactly where it fell the previous day.
- ✎ You can do the same observation at your home if you want.
- ✎ Leave the rest of this learning experience. Proceed with other learning experiences throughout the year. By the end of the year in November-December, the rest of this experience can be completed by seeing the results of your observations.



Session Five (November)

- ✎ You must have observed the position of the sun ray on the paper kept inside your box throughout the year. Before discussing this observation, let's know about a small matter.
- ✎ In class seven you have learned about the creation of the universe, how galaxies are formed, and the birth and death of stars. But do you know how our familiar moon, the closest object to Earth, was born?
- ✎ Read the 'Creation of the Moon' section of the 'Sun, Earth and Moon' chapter from the Investigative Study book. Discuss it in groups.
- ✎ You know about the most accepted theory about the creation of the moon. Now according to this theory, show the sequence of events of the formation of the moon in three stages in the following flowchart:

- ✎ Now, think about what happens as a result of the position of the sun, earth, and moon. You can immediately mention some incidents like these - such as the change of day and night, full moon-new moon and Chandrakola, change of seasons, lunar eclipse-solar eclipse, etc. But can you tell what causes these events?

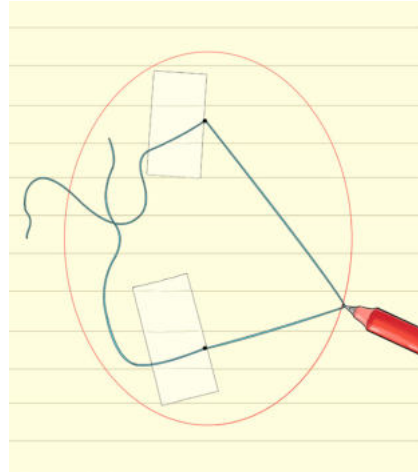
Science




- ✍ In the next sessions, let's take a look at these incidents one by one - how does this vast Earth-Sun-Moon system work, what incidents do we notice as a result of their position changing over time, and how does this system stay in balance?
- ✍ At first, it is better to make a model of the sun, the earth, and the moon. Then you can easily understand these various incidents by observing that model. You can choose anything round to make the earth and moon; it is best to use old, left-over materials. You can use any source of light instead of the sun. You can remember that earlier you made models of the sun and earth for the learning experience "In Search of Migratory Birds"? You can use the same material here if you want. And what else can be used to assemble the whole model, and show the axis of rotation? To show the different positions of the Earth and Moon in their orbits so that they can be rotated to different positions in their orbits, you can use a thin steel wire or something similar to make the orbit, which will be attached to a base below. Or you can do the same by hanging it from a wire frame above with a string. Also, think about what accessory you might need.
- ✍ Let's discuss a matter before we make the model. Neither the earth's orbit around the sun, nor the moon's orbit around the earth, is perfectly circular, but somewhat flattened or elliptical. You have learned this information from the Investigative Study book. But where is the center of this flat elliptical orbit? That is, if the Earth's orbit is elliptical, then where exactly is the sun located? If it is a circular path, you can easily say that the sun is at the center of the circle, but where will it be in the case of an elliptical orbit? You can understand this by doing the following small activity.
 - Loosely attach two ends of a piece of string to a piece of paper with a pin or scotch tape as shown in the picture on the side.
 - Pull the string as far as it will go by pulling it with a pen. Roll the string along the paper and mark along the border of the string. If you complete the whole range, you will see that an ellipse has been drawn on the paper. The two epicenters of this elliptic path are the

two points where the ends of the string are attached.

- Now think, if the two epicenters of the ellipse are close, what will be its size? If you move the two ends further apart, will the ellipse become flatter or more nearly round? Stick the two ends of the string at different distances and draw it.
- You can see that the closer the two ends of the string, i.e. the two epicenters, are, the more rounded the path drawn with your pen will be. If the ends of the string are brought to the same point to bring them closer together, the path will be perfectly circular.
- Since the Earth's orbit around the Sun is somewhat elliptical, the Sun's position in the Earth's orbit is not exactly at the center, but at one of the two epicenters of the elliptical orbit. That means, the distance from the Sun to the Earth is not always the same. The same applies to the Moon's orbit around the Earth. This is important to keep in mind when you make your model.




 Discuss with the rest of your group what materials can be used to make the model. Write the names of the materials below.

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 Discuss the reasoning behind the selection of materials with other groups and see what their plans are. Finalize the list with the advice of the teacher. You have to collect the materials before coming to the next session.



Session Six

 Your task in this session is to make models with your respective groups. You can also do this by using models from previous experiences (the learning experience of 'In Search of Migratory Birds'). But remember one thing, the size of various objects in space, including the Earth, is so large, and the distance between them is so great that it is impossible to understand their relative position or size in hand-made models. For example, the diameter of the Sun is about 109 times more than the Earth's diameter. Again, the diameter of the moon is only 27% of the diameter of the earth. That is, the diameter of the Sun is about 400 times greater than that of the Moon. On the other hand, the average distance between the Earth and the Sun (1,500 lakh km) is 400 times greater than the average distance between Earth and Moon (3.84 lakh km). Therefore, it is, in fact, impossible to make a model with their relative position and size. What we have to do is try to understand how things really happen by arranging the positions of the sun, earth, and moon as logically as possible in our own model.

 Once your group's model is done, look around at the models of the other groups. How do you know whether the position of the sun, earth, and moon is correct as shown in the model? It would be best to examine in this model the natural incidents we see occurring because of their location.

 At the end of the session, when the models are made, arrange all models in your classroom, will start observation from the next session.



Sessions Seven, Eight and Nine

- Now open the 'Sun, Earth and Moon' chapter of the Investigative Study book. This chapter explains the various incidents that occur due to the positions of the Earth, Sun, and Moon.
- Read in groups about penumbra and umbra, partial, total, and annular solar eclipses, effects and importance of solar eclipses, ways to observe solar eclipses, and necessary precautions, etc. Discuss these topics in class under the supervision of the teacher.
- Now change the position of the sun, earth, and moon in your model and try to observe these things. What incidents can you show in your model? Which ones can't be shown? Why? Discuss in groups and write your answers below.
 - Which incidents is not possible to observe in your model?

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- Why is it not possible to observe the above incidents in your model?

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Science

-  Can you observe umbra and penumbra in your model? Have you had any problems? Can you tell me why it is difficult to observe umbra during the day in the classroom?
-  Try a small experiment. Place your hand against the light, close to a wall or floor, and see that a dark shadow falls. If you slowly remove the hand from the wall or floor, you will see that the colour of the shadow will start to fade. This is because, as you move the hand away, light from different light sources around the hand is coming in, partially illuminating the shadow area. As a result, the shadow becomes lighter. During the day, the sun's light is reflected from different sources around us, so it is difficult to observe dark umbra due to the light coming from different directions. Rather, it is possible to observe umbra much better in a dark room against light coming from only one light source.
-  Similarly, read about different types of lunar eclipses, such as total and partial lunar eclipses, penumbral lunar eclipses, etc., and try to understand the topics with the help of your model. Discuss with everyone in your group, then join in the open discussion with the rest of the class, including the teacher.



Sessions Ten and Eleven

-  For almost a whole year, you have observed the position of the sun with the help of the device you made by yourselves. Now it's time to see where the sun was at different times of the year.
-  Carefully remove the paper stuck inside the cardboard box. First notice whether the sunlight fell at the same point throughout the year. If not, notice how it looks like if you connect all the points that you marked for the position of the sun.
-  Draw the shape in the blank space next page.



- ✎ Now compare it with the observations of the other groups. What kind of shape appears on the paper kept inside their devices?
- ✎ Does the shape that appears on the paper of your different groups look a bit like 8? The pattern in which the sun's position changes throughout the year is called an analemma. To learn more about this, read the analemma section from the 'Sun, Earth and Moon' chapter of the Investigative Study book in groups.
- ✎ After you finish reading, discuss whether you understand the reason for this change in position. Discuss with the rest of the class, and get help from the teacher.
- ✎ Now find out how the position of the earth and the sun was on different days of the year in your model. Can you notice the dates of the biggest day and the biggest night in our country? On which date are the day and the night equal? Try to figure out where the Sun was on or around this date by looking at the shape of the analemma. Now, try to understand by tilting the earth around the sun at a certain distance and a certain angle in your model. Try to understand their relative positions. But before that don't forget to mark the approximate location of our country in the earth model.

- ✎ Earlier you have learned about geographic coordinates. And you already know that the Tropic of Cancer has passed right over Bangladesh. Since the Earth is tilted exactly 23.5 degrees, the Sun's light falls exactly above the Tropic of Cancer at a certain time of the year, which is June 21st.
- ✎ Can you show in your model how the position of the earth and the sun is at this time?



Session Twelve

- ✎ You have already learned that the Earth's orbit is not perfectly circular, but somewhat flattened or elliptical. So, the distance from the Sun to the Earth is not always the same. You already know that we see the seasons change due to the Earth's tilt of 23.5 degrees. Now think, can the Earth's climate be affected because of the Earth's distance from the sun? Discuss it in groups and share your ideas.
- ✎ Now read the 'Change of Earth's orbit and axis' section from the same chapter of the Investigative Study book. Discuss your ideas in groups. Try to clarify ideas by discussing them with the rest of the class including the teacher. Now compare your previous ideas.
- ✎ In the light of what you learned in this learning experience, check your model carefully. Does the way you show the positions of the earth, sun, and moon seem logical? Is it possible to show the natural incidents you know about in this model (eg: different types of solar and lunar eclipses, umbra and penumbra, aphelion and perihelion, etc.)? Would any changes to the model explain these things more logically? Write your answer below.

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🗨️ Have you ever noticed where the solar panel is placed? Can you tell why the solar panel is always tilted in the same direction?

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Green Friends

You have lots of friends at school or outside. Not all of them are humans. Many of us have cats or dogs, and they are also our four-legged friends. What if we make friendship with a tree? Many of you might wonder, how can a tree be our friend as it can't talk or show emotions? Don't trees really have feelings? Let's explore this further!





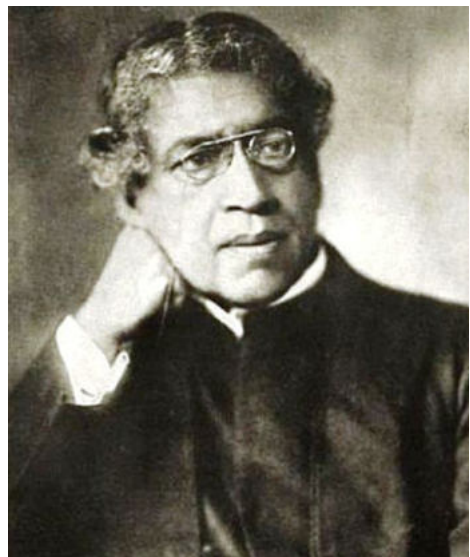
Session One

- ✍ When we talk about Bengali scientists, you probably know the name that comes first is Sir Jagdish Chandra Bose. For a long time, people have speculated that trees have a soul, they are living beings like us. But Jagadish Chandra Bose was the first to prove that plants have sensibility; they can respond to various stimuli.
- ✍ Now you might be wondering, what does this response from trees mean? How much "alive" are they? Can they truly be our friends?
- ✍ In this experience, you will have the opportunity to learn more deeply about trees. But before that, read an article written by none other than Jagdish Chandra Bose himself. Like many great scientists in the world, he not only devoted his life to research but also created a lot of literature for both adults and children.
- ✍ Take some time now and read the following text.

Words of Trees

Jagdish Chandra Bose

Do trees speak? Some may find this question strange. Do trees ever speak? Do only people speak out words? Again, is something that cannot be expressed is still not considered words? We have a child who cannot speak out all words clearly. It can only utter a few words which are so stuttering and mumbling that nobody can understand their meanings. But we can understand the meanings of all our child's words. Even, our child doesn't speak many



Science

words clearly; instead, it communicates a lot through gestures like eye movements, facial expressions, hand gestures, and head nods. We can understand that too, but others cannot. One day, a pigeon flies away from the neighbouring house and perches on our house. Sitting there, it starts calling out loudly in a high-pitched voice. It is our child's new acquaintance with a pigeon. The child begins imitating the pigeon's calls. If we ask the child how the pigeon calls, the child demonstrates it. Apart from this, the child constantly imitates the pigeon's calls in a subconscious mind while sitting and moving around. Learning this new skill, the child's joy knows no bounds.

One day, returning home, I see that the baby has a very high fever and is lying in the bed closing eyes with a headache. Usually, the baby plays and causes troubles in the house all day, but today it doesn't want to open the eyes at all. So, I sit by the bed and gently pat its head. The baby recognises me by the touch of my hand. But with a great difficulty, it manages to open eyes and looks at me for a while. Then the baby imitates the pigeon's call. I hear many things in that sound. I understand that the baby is saying, "Have you come to see the baby? The baby loves you very much." I understand many other things, which I also cannot express in words.

You may ask me, "How do you hear many things in the pigeon's call?" The answer is simple – because I love the baby. You know, a mother can understand what her son wants just by looking at his face. Sometimes, words are not needed. Only through love, you can see many good qualities, can hear many words.


In the past, when I used to go for walks alone in the fields or mountains, everything felt empty to me. But later, I learned to love trees, birds, and insects. It was then that I started to understand many of their words, which I couldn't understand before. I never knew that trees, though they can't talk, have a life too. They eat like us and grow every day. I did not know all this before, and now I understand it. Now we can notice that they also experience want and hardship. They need to remain busy all the time to make a living. Some of them commit theft and robbery when they are in distress. We can also see some good qualities in them, similar to those found in human beings. Trees are seen to help each other and they make friendship among themselves. Just like humans, the highest virtue of self-sacrifice can also be seen in trees. A mother saves her child's life by sacrificing her own life. A mother's love and sacrifice for her child is also commonly observed in plants. Tree life is only a shadow of human life. I


will tell you all these things step by step.

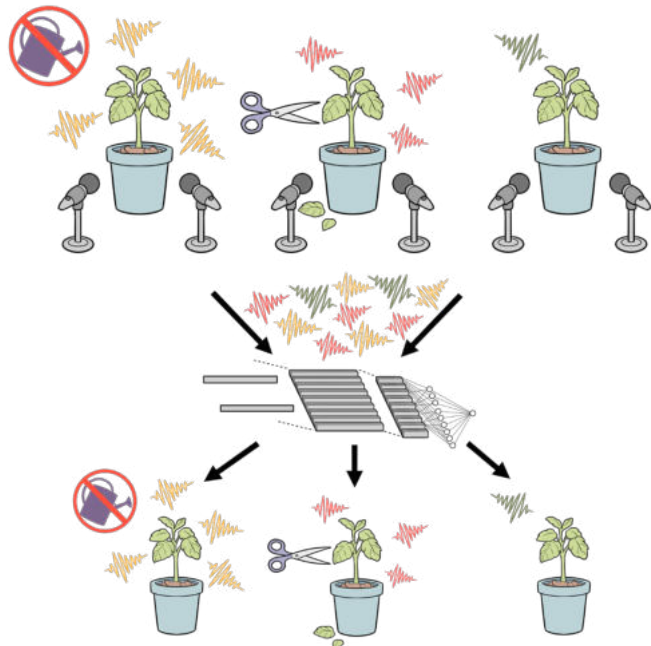
You have all seen dry branches of trees. Imagine you are sitting under a tree. The tree is full of thick green leaves; you are sitting in its shade. There's a dry branch lying on one side under the tree. It used to have many leaves, but now they have all dried up, and termites have infected the base of the branch. And after some days, there will be no trace of it. Now, let me ask you - what is the difference between this tree and the dead branch? The tree is growing and the dead branch is decaying. One has life, and the other has no life. Something that is alive gradually continues to grow. Another sign of living things is that they have movements that is they can move. The movement of trees is not observed suddenly. Have you ever noticed how the creeper twists and turns around the tree?

Living things show movements and they also grow. Only eggs do not show any signs of life. Life lies dormant in the egg. When eggs get warmth, chicks are born from them. Similarly, seeds are like plant eggs; the baby tree lies dormant inside the seed. When the seed gets water and warmth of the soil, baby trees grow from the seed.

(Abridged)

 Have you finished reading the text? How do you feel about it? Sit with the friend next to you and share your feelings with him/her. You can also ask your classmates how they felt about reading the text.

 Now, think about the various types of trees around you. Can you hear them? Jagadish Chandra Bose wrote that trees are similar to us. Love can bring them close to us. Even if you can't hear





them, you can still understand their thoughts.

- ✍ The problem is that looking through the eyes of science, there is no way to accept anything without evidence. Therefore, Jagdish Chandra Bose invented new instruments to record how plants respond to stimuli. However, with the technology available at that time, he couldn't prove whether trees actually "talk" or produce meaningful sounds.
- ✍ Now, let me share some exciting news with you. A very recent study has found that trees can really produce sounds. Not only that, after recording those sounds and analysing them, it was found that the sounds produced by trees when they are healthy, well that is when they are at a happy state are completely different from the sounds produced by them when they are in troubles, hungry, or thirsty. Notice that the next picture illustrates this in a simple way. When a tree doesn't get enough water or has its branches cut, it makes different sounds. However, when the same tree is healthy, the sounds it produces are completely different, as the analysis shows. What's even more surprising is that although these subtle sounds do not reach our ears, many small animals like mice can hear them.
- ✍ There is a sea of sounds around us, but sadly, we can never hear many of them.
- ✍ In this learning experience, let's try to observe trees in a closer way.
- ✍ All the students in the class, along with your teacher, in this learning experience, will choose a tree to make friendship with. You decide what kind

of tree that can be. Everyone will plant a sapling and spend time observing it closely, trying to understand and feel it better. You can plant the tree in the empty space in front of someone's house, or if you prefer, you can grow the tree in a tub on your balcony. Your teacher will also plant a tree and take care of it. The tree will be kept at the school, and you can also help the teacher in looking after it.

- ✎ Form small groups and talk about the tree you want to plant and how you can collect saplings of that tree. Share your ideas with others, including the teacher.
- ✎ Which tree have you decided to plant? Write the name of the tree below.

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- ✎ Before you join the next session, I want you to collect the saplings of your own trees!



Session Two

- ✎ Before joining this session, you must have been able to collect the seedlings of your own trees. Now it's time to grow these trees with care. You can get help from the person who takes care of the trees at your school. If your school doesn't have one, you can ask a person who works at a local nursery, or a parent or one from an upper class who has experience in this field. In class seven, you already had some experiences with tree care.
- ✎ Help in planting the teacher's tree, and through this, learn the basic idea of tree planting. Now, everyone should go home and plant your own trees. Seek help from an experienced gardener to learn how to take care of your new green friend.



Home Task

Write down your experience of planting trees back home today in the space below.

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Sessions Three and Four




-  Your green friend, the dear tree, will now grow a bit every day, just like how you've been growing little by little since your birth. You were once a child and have now reached adolescence, one day you will become an adult. But have you ever wondered how a small person or a tiny plant grows slowly? In class seven, you learned about the cells in the body, the structure of plant and animal cells, and their similarities and differences. Now it's time to see how these cells contribute to the growth of your body.

-  Open the chapter on Cell Division and Its Types from your Investigative Study book. Before learning about body growth, it's necessary to understand a bit more about cells. Form small groups of 5 or 6 people. Within your groups, read about the importance of cell division and cell structure. After reading it, with the guidance of the teacher, discuss your findings with the rest of the class and try to understand how chromosomes are arranged inside the cell's nucleus.

-  Now, let's learn about how cells divide to keep the process of growth and reproduction of organisms going. You will learn about three processes: amitosis, mitosis, and meiosis, one by one. First, learn about the process of amitosis.




-  Do your cells or your green friend's cells undergo amitosis cell division? Think

about it and discuss it in groups. Write down your answers with logics.

-  Now, let's learn about mitosis cell division. Mitosis is the primary process responsible for the growth of multicellular organisms. Read the entire process of mitosis cell division and discuss it in groups. Also, know the importance of mitosis cell division.
-  Now make models of the stages; it will make everyone's idea much clearer. Not everyone has to make models of all the stages in the entire process. Instead, each group should choose one stage by lottery, which you can explain to others by making its model. I want your groups to have your models ready before the next session!
-  Discuss in groups what you will use to make the model. Remember, the less environmentally harmful or costly materials you use, the better it will be. Instead, see if you can make the model using waste or previously used materials.




Session Five

-  In this session it's time to make the model. Decide first who will work on which part of the team. If everyone plays their role properly, the work will go faster. Materials must have been collected in advance? Use them to create the team model today.
-  Today, every group will show their own models of the different stages of mitosis cell division. Now a fun thing to do. How much have you presented your own model, what if you present the model made by another team?
-  Again, choose a stage by a lottery. Present a model made by a group that worked on this stage. Likewise, every group will present the model created by another group, except their own one. The other students will listen and ask questions during the presentations.







Session Six

-  How much did your tree grow in the last few days? Write down how much the plant grows each week in a separate diary. Also, write down what you did

Science

to take care of the tree.

-  You have learned about how you or your green friend grow through mitosis cell division. Have you ever wondered how this process of cell division continues in a controlled, orderly manner inside the small nucleus of the body's tiny cells? But what if this process goes out of control? What will happen because of that disorder? Discover more about this from your Investigative Study book.
-  You already know how our body grows. Now, imagine a time when you didn't have this body. There's another type of cell division called meiosis, that happens during the birth and reproduction of humans or other multicellular organisms. Let's learn about cell division.
-  Read about meiosis cell division in groups as you did before. Talk with your classmates about the whole process of meiosis cell division.
-  Can you tell the main difference between mitosis and meiosis cell division?

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Sessions Seven and Eight


-  How is your green friend doing? Let's learn a bit more about them i.e. plants. You might have observed your own planted tree carefully, right? Can you list the different organs of its body? Write them in the table next page.

Name of your plant	Different organs of the plant

 You already know plant cells. The cell is the functional unit of your body, and so is in the plant. Earlier, you learned about the steps scientists follow to understand the structure and function of the human body. These steps include:

Cell > Tissue > Organ > System

 Now, we need to continue the discussion in a step-by-step way to understand the structure and functions of the plant body. You already know plant cells. Similar to the human body, plants also have cells that come together to make tissues or organs for specific functions. Those tissues then form specific organs to perform those certain functions. Now, to know how many types of tissues there are and how they work read about the various types of tissues in plants from your Investigative Study book.

 Earlier, you have identified the different organs of a plant. Now, compare your list with the organs of a plant shown in your Investigative Study book. Is there any organ that you didn't find in your plant? If yes, write it down.

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Science

-  Now, think about the organs you've identified. If you already know the functions of various organs of the plant, now try to figure out which type of tissue each organ is made of.


Name of your plant	Different organs of the plant	Which types of tissues is it made up of



Sessions Nine and Ten

-  How much have your plants at your homes grown? How about the tree your teachers have in the classroom? To keep this tree healthy many processes are always going on in the body of this fresh tree that you see. Just like how your body needs to carry out various physiological functions such as breathing, eating, drinking, excreting, and disposing of wastes to stay well, plants also have to do similar things to stay healthy. How are these processes in the plants? You already know how they make food through respiration or photosynthesis. Now, let's learn about how the cells and tissues of plants perform their various physiological processes.
-  Learn about the physiological processes of plants such as diffusion and transpiration from the Investigative Study book. Read about the transport system of plants and discuss it in groups. Throughout this entire discussion, you have come to know about a few new processes,

- Diffusion
- Transpiration
- Osmosis

 Can you say which of these processes helps plants in producing and absorbing food, in respiration? Discuss them in groups and write your answers below.

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Session Eleven



-  We talked a lot about plants. Are you keeping an eye on your planted tree to see whether it is good? It must have grown quite a bit, right?
-  You and your classmates planted different kinds of trees, but what types are they? Write down the names of the trees that you and your group members planted.

Names of group members	What trees are planted?

Science



-  Now, consider which of these trees are more alike. Which trees look somewhat similar to each other? Or which trees have more similar types of flowers, fruits, or leaves? Discuss them in groups and identify them.
-  You have analyzed the characteristics of plants based on their similarities and differences; botanists have also discussed and analyzed the similarities and differences of plants in different ways. Based on this research, they have classified the entire flora in different ways.
-  Read the section about the Classification of Plants from the "Classification of Organism" chapter in your Investigative Study book. Discuss it in groups. Which class does your teacher's plant belong to? Everyone in the class should discuss and decide on it.
-  Now, your task is to identify which class the friend tree of each of your groups belongs to. Compare the characteristics of different classes and decide. Discuss it in groups and note it down in the table below. (There's an example of the name of a plant and its classification below for reference.)

Names of group members	What trees are planted?	Belong to which class
Example	Bean plant	Flowering plants > Angiosperms > Dicotyledonous plants

-  We discussed it a lot. All of you have learned a lot about your green friends. In the next session, you can plan a fair together. At the fair, you can tell others about your own plants. You can decide how you want to tell others about your green friend. You can talk about the things like how your tree is growing, how you look after it, if it has flowers or fruits, any stories or experiences you have with the tree, even funny ones. If you have a small plant in a pot, you can bring it with you. If that's not possible, you can draw a picture of it. You get to choose how you want to talk about your plant on that day.
-  Jagdish Chandra Bose once said, if you love, you can understand the mind of plants. Do you understand your green friend now?



Session Twelve

-  During today's fair, give everyone a chance to know about your green friend, the tree you've taken care of. Also, try to learn about the trees of others.
-  At the end of this entire learning experience, what are the similarities between trees and people you have found? Write it below.

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Retrospection

🗨️ What do you do for regular maintenance of your friend tree?

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🗨️ What is your new understanding while growing this tree?

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🗨️ Do you have a special memory of your green friend that you want to remember?

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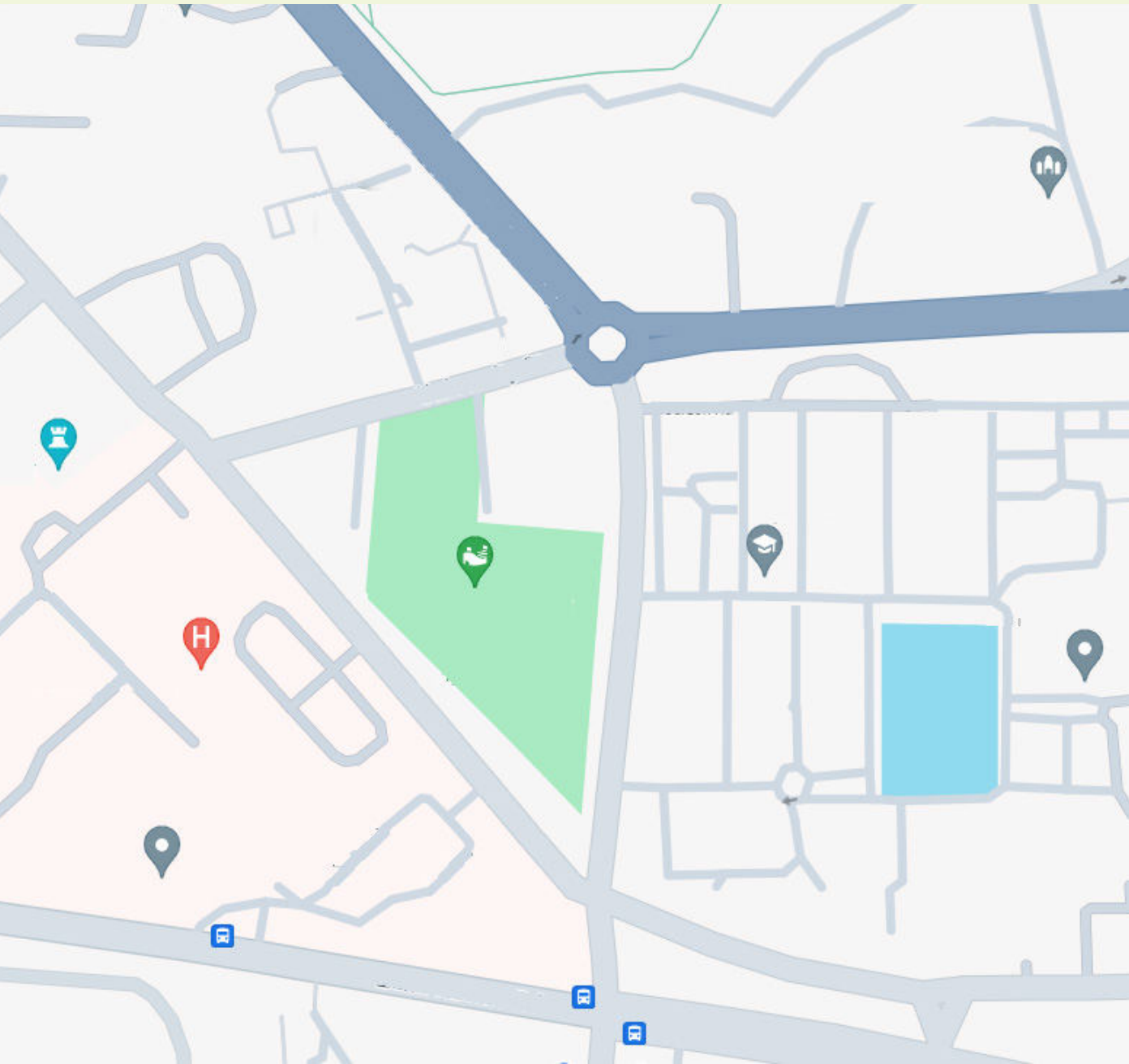
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Field Trip

Isn't it more enjoyable to learn the complex topics of physics through hands-on activities, perhaps during a field trip? In this Learning Experience Session, you will design your own trip, measure its distance, and analyse various aspects of your travel, such as motion, speed, velocity, acceleration, and more.





Sessions One and Two

- ✎ Have you ever examined the map of your route from home to school? Many of you may have, by using Google Maps on your mobile phones, but wouldn't it be exciting to create a map by hand to show the location of your house to your friends?
- ✎ Imagine your route on your way to school, starting from the door of your house. Which direction do you need to go at first? Some of you walk, some of you ride bicycles, some of you take rickshaws, or use other modes of transportation. Now, visualize the path from your house to school and draw it in the space provided below. If there are any significant landmarks or places nearby, such as, a river, pond, hospital, highway, etc., mark them and identify them separately as legends. For example, there is a specific symbol

Science

for hospital, a symbol for water body, or a symbol for the houses.

Now, take a moment to consider the following: What direction is your school from home, how much time does it take to reach there, and what mode of transportation do you use? Share this information with your classmates.

Now that you've imagined drawing a map, how fun would it be to turn that imagination into a real plan for a field trip or excursion using an actual map. So, let's go ahead and make that plan.

Follow your teacher's instructions and divide yourselves into small groups. Now, Discuss and decide on nearby places around the school where you can go for the field trip. Consider the following aspects while planning the field trip:

Where to go


How to reach the destination


When to go

Ensuring necessary permissions

Budget and expenses


If feasible, try to incorporate additional tasks or activities into the excursion.

 If going outside the school premises isn't possible, plan a captivating and educational activity within the school that allows you to learn the topics in a fun way.

 Document the complete field trip plan in your diary or notebook. Clearly specify which group members will handle specific tasks for the trip. Assign a few members from each group to the following responsibilities:

Keeping track of time using a watch/stopwatch

Measuring the distance of the destination from the school

 If the field trip is approved, consider and divide responsibilities for other aspects, including—

Food arrangements

Safety measures

Writing a report and recording the experience

Gathering necessary equipment and providing instructions for any additional tasks









- ✎ Each group should use tools like Google Maps or local maps to create a rough map of the route from the school to the chosen field trip location. On the maps, indicate the various modes of transportation or walking paths you intend to use. If needed, you can ask the teacher for help or use mobile phones or computers at home. If possible, managing a hard copy (printed copy) of the local map would be a great idea for better visualization.
- ✎ Alternatively, if the activity takes place within the school premises, you can assign different groups to different locations within the school area. For instance, you might select various classrooms, the school's memorial area, or a specific tree on the campus. Despite being in the school, you should still estimate the distances and time needed to reach each location during the activity. Create a simple map in your notebook to clearly mark these locations.



Sessions Three and Four

- ✎ Today is the day of your field trip! You must be very excited! Remember, having fun with science activities is important, but being responsible is equally vital to make the trip enjoyable.
- ✎ If possible, use a GPS device or smartphone to track the route from the school to your destination before the field trip. Make sure you have the necessary permission and instructions from the teacher before using your mobile phone.
- ✎ Input your destination in the Google Maps application to mark the route you'll be taking. Keep track of the distance. If you're traveling by bus or another vehicle, follow your teacher's instructions and carefully observe the speedometer in front of the driver to estimate the speed.
- ✎ If you're the timekeeper for your group, calculate the time taken for each kilometer of the journey. If there are landmarks on the way, note them down and use them for timekeeping. If landmarks aren't available, use your mobile phone to keep track. Also, record the total time taken from the start to the end of the journey.
- ✎ Even if the field trip happens within the school premises or if the destination isn't too far from the school, each group should measure the distance from the starting point of the journey. Use a meter scale or a measuring tape for this. Keep track of the time it takes for the entire journey, from start to finish.
- ✎ After the trips are complete, return to the classroom and have each group share their experiences. Pay close attention when one group shares. Discuss what you enjoyed, what new things you learned, and share these with everyone.

Science

-  Now, let's use the field trip experience to better understand some important concepts. Begin by exploring the concepts of distance and direction. Carefully read the 'Distance and Direction' section from your Investigative Study book.
-  After reading, identify on the map you created for your home-to-school route which part represents distance and which part represents direction. Use a pencil or different colored pens to mark this. Can you make an estimate of the measurements of these aspects?
-  Can you calculate the distance and displacement from your current position in the classroom to the blackboard?
-  While doing this, have you noticed something interesting? Even though the blackboard remained fixed, each of you were sitting at different benches, so the distance and displacement from each of your positions to the blackboard were different. Do you think that the position of an object is a relative concept?
-  The Investigative Study book has a few more examples of measuring distance and displacement. Study and discuss these with your classmates.
-  Now that you've learned about distance and displacement, let's determine which group reached the destination first and how much time it took.
-  Find out how much time it took from the start to the destination. Then, divide the distance by the time. This calculation will give you the average speed of your travel. If you determine the average speed separately for each group, you'll know which group traveled the fastest and which one traveled the slowest.
-  Calculate the average speed using the notes you took in your diary or notebook.

Speed, $v = s/t$

Distance, $s = \text{___} \text{ km} = \text{___} \text{ m}$

Time, $t = \text{___} \text{ min} = \text{___} \text{ s}$

-  What conclusions can you draw from your determined value?











- ✎ If you understand the above mathematical problem, it'd be easy for you to understand what velocity means. In the case of speed, if you specify the direction, you can find the velocity. For example, if your destination from the school gate was straight ahead, you can consider the journey along a straight line and then find the magnitude by dividing the distance by time. That way, you can find the velocity of your journey. Remember, when measuring velocity, you must also mention the direction alongside the magnitude. If we're dealing with motion in a straight line, there's no distinction between speed and velocity. In this scenario, the calculations for average velocity and average speed will be the same.
- ✎ Let's practice measuring the velocity and speed of objects around you. It's a fun activity that helps reinforce your understanding.
- ✎ Form four groups, each with four members. Begin by measuring the length of your table or bench. Since the international unit of length is meters, you may convert the length to meters. Although, if you prefer to use inches, centimeters, or feet, that's fine too (Remember, 1 inch = 0.0254 meters).
- ✎ Have two people hold one side of the bench slightly elevated, creating a ramp-like inclined surface. Now, take a pen, marker, or a small piece of brick/stone and roll it down the inclined surface.
- ✎ Keep track of the time it takes for the object to reach the lower edge from the upper edge of the surface. If you don't have a watch, you can use the phrase 'one-one thousand' to count seconds (it takes approximately one second to say this phrase naturally).
- ✎ Change the slope of the ramp to different levels and calculate the velocity with which the object moves from top to bottom.

Height of the bench from the ground (in m or cm)	Distance (s) m	Time (t) s	Speed, $v = s/t \text{ ms}^{-1}$

- ✎ You can definitely find out the velocity too from these, can't you?

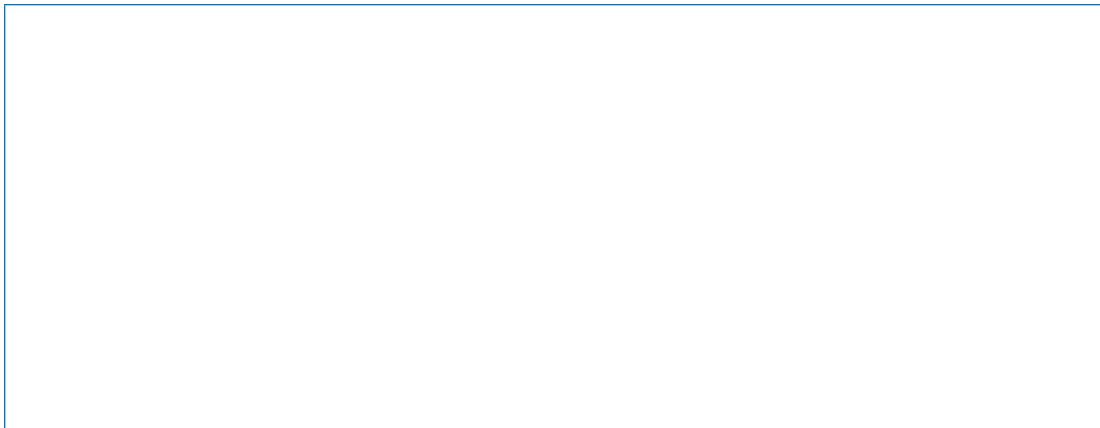



Sessions Five, Six and Seven

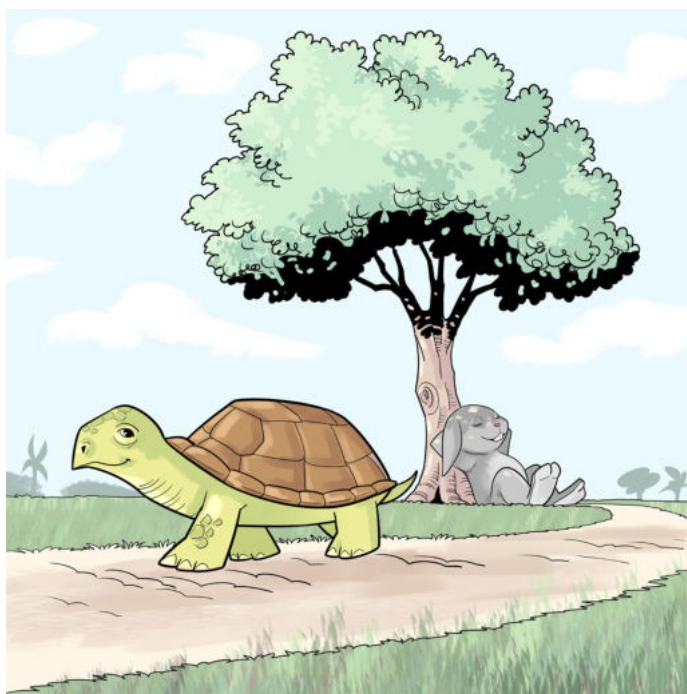
-  In the previous session, when you tilted the bench to determine velocity, you likely observed that as the bench was tilted more (with the end higher from the ground), the object placed on it fell faster.
-  If you've ever tried running downhill, you might have noticed that even though your initial speed may not be high, but it significantly increases as you descend. Similarly, when a vehicle starts from rest, you notice a gradual increase in speed. Conversely, if you throw an object upward from a tilted bench, even though the initial speed might be higher, you'll see that as it ascends, the speed decreases gradually until it reaches zero, and then the object starts falling downward.
-  The process of increasing speed with time is called acceleration, and the process of decreasing speed is called deceleration.
-  You might have questions about how acceleration or deceleration occurs. The Investigative Study book can provide answers to these questions. Read the section 'How does acceleration happen?' and feel free to ask the teacher if you have any queries.
-  Consider the four types of forces and the examples provided in the book. Try to relate them to real-life situations. If you haven't encountered such situations, discuss them with your classmates or family members and ask them to share experiences related to this.
-  In this session you will learn by combine physics with a little math to create equations of motion and solve fun problems.
-  Let's start by looking at the chapter in your Investigative Study book that discusses 'Equation of Velocity.'
-  The first equation of motion given in the book, $v = u + at$, can be used to determine the velocity of an object after a specific time if you know the initial velocity and acceleration.
-  For example, when you were traveling, if you monitored the speedometer of the car/bus, then you know the acceleration. So, now you can use this equation to know what the velocity of the car was after a certain time.
-  A similar example is provided in your textbook. Give it a try and solve it on your own.


- ✎ Here's another mathematical problem for you. Solve it in your notebook or in the blank space provided below.
- ✎ A car is moving with a velocity of 25 ms^{-1} . In 4 seconds, it gains an acceleration of 5 ms^{-2} . What will be the final velocity of the car?


- ✎ A train starts its journey from a stationary position and achieves a velocity of 35 ms^{-1} after moving 2 minutes with uniform acceleration. What is the acceleration of the train?
- ✎ Look up the 'Equation of Displacement' from your Investigative Study book. Notice how the second equation of motion, $s = ut + \frac{1}{2} at^2$, is derived from the first equation of motion if we know the average velocity..
- ✎ Solve the example related to this equation given in the Investigative Study book in your notebook.
- ✎ Do you recall when we calculated the acceleration of the sliding ring in the fifth session? If you want, we can use this equation to calculate the acceleration of the ring more easily. In that case, if we assume $u = 0 \text{ ms}^{-1}$, we get $s = \frac{1}{2} at^2$ or, $a = \frac{2s}{t^2}$.
- ✎ This means, if you double the total distance traveled, and then divide it by the time squared, you'll get the acceleration. Try it out, if you want.
- ✎ Use the second equation of motion to solve some more mathematical problems.
- ✎ Do you remember when you used the first equation of motion ($v = u + at$) to find the final velocity of a car? Can you tell how far the car will travel with that acceleration? Calculate it below.

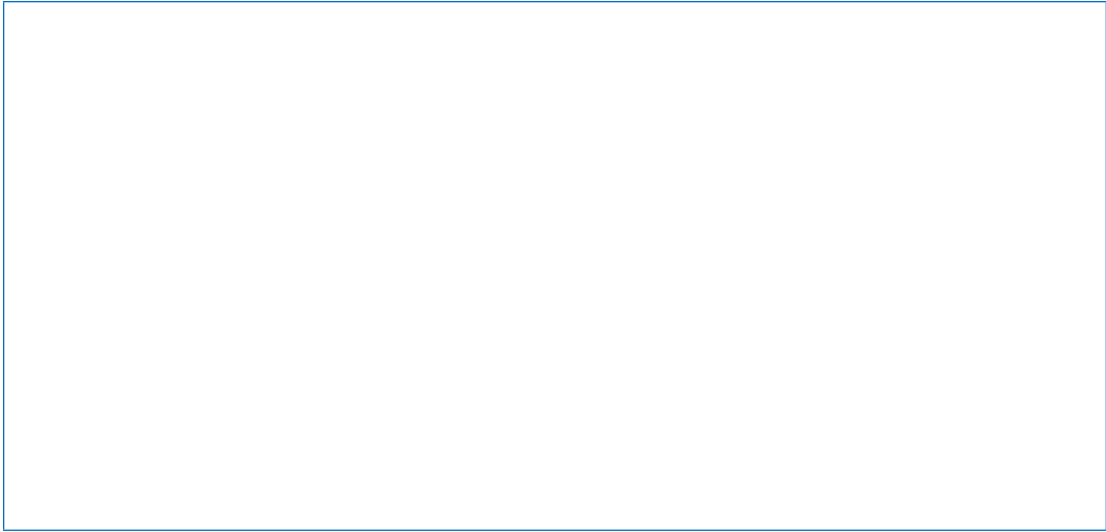





 You will remember the story of the race between the tortoise and the hare from your childhood. In that story, even though the hare raced far ahead, it became lazy and fell asleep, while the tortoise continues to move steadily and wins the race. Let's solve a similar fictional story using the equations of motion.

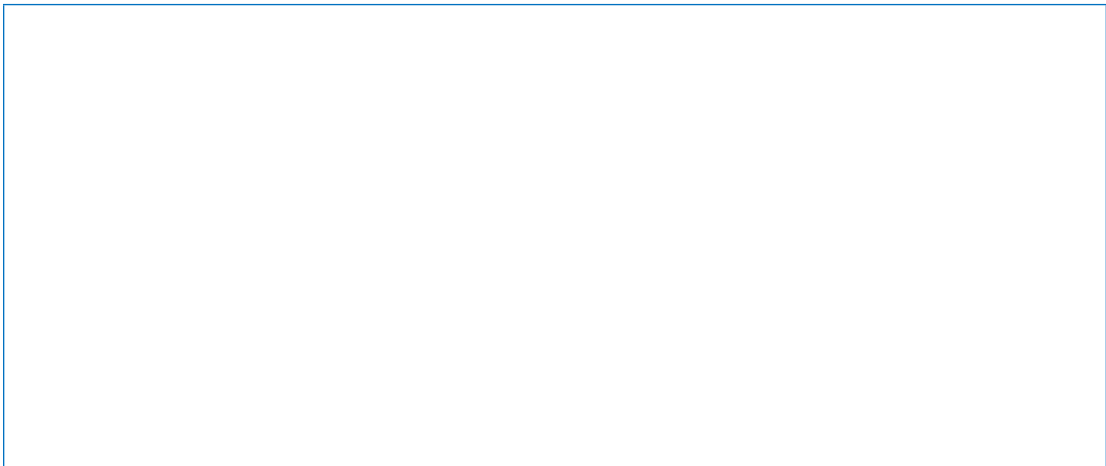


 A tortoise and a hare participate in a 3 km race. The hare starts running with an initial velocity of 0.07 ms^{-1} and an acceleration of 0.002 ms^{-2} . On the other hand, the tortoise starts with an uniform average velocity of 0.25 ms^{-1} . After the race begins, the hare runs for 1 hour. Then, the lazy hare sleeps for 4 hours, thinking that the tortoise is far behind. When the hare wakes up and realizes that the tortoise has passed him in the race and moved ahead, it starts running again with the same initial velocity and acceleration as before.









 The question is, how much ahead will the hare be from the tortoise after 1 hour of the race starting? And who will win the race? Analyze this mathematically.




-  In the previous two equations, the variable 't' represents time. However, there are situations where measuring time might not be possible or necessary, and we need an equation of motion that doesn't involve 't.' You can find such an equation in the 'Equations of Motion' section of your Investigative Study book. Try to solve the mathematical example provided there in your notebook.
-  Discuss the following mathematical problem with a classmate and solve it.
-  Imagine a truck driver who was initially driving a truck at a speed of 60 kmh^{-1} . When the driver saw a pedestrian 50 meters ahead, they immediately applied the brakes, and the truck came to a stop just 2 meters in front of the pedestrian. Calculate the truck's acceleration (deceleration) based on this information.



 Session Eight

-  In our daily lives, we often use the term 'work' to describe various activities, but in the world of physics, it has a precise meaning. For instance, reading a book or watching TV might be called 'work' in everyday language, but in the language of physics, these activities are not referred to as work. However, when you use a pen or pencil to write, that is indeed considered as work in the realm of physics. To gain a clearer understanding of the specific definition of work in physics, let's explore the 'Work & Energy' section in your Investigative Study Book.
-  Now you can understand why reading a book or watching TV isn't considered 'work' in physics. However, when you use a pen or pencil to write, that's truly work in the world of physics. By applying force with your hand, the pen moves, and work is done.
-  When you play soccer and kick the ball, the ball's motion changes. This is also a form of work. To calculate the amount of work, you've learned the formula, $W = F \times s$, which depends on the force applied and the displacement.
-  So, what does work encompass, and is the ability to do work the same for everyone? Doing work requires energy. When you write, you're applying force to the pen, and this energy comes from the food you ate earlier, converted into thermal energy in your cells' mitochondria. Learn more about this in the 'Transformation of Energy' section in your Investigative Study book.
-  Do you remember the Learning Experience Session from 7th grade titled 'A Variety of Toys Fair'? You made a toy by attaching two sticks to both sides of a plastic bottle, and you used rubber bands and a spoon to create a toy that could swim in water. When you twisted the rubber band, you stored some energy in it, and when you released the bottle into the water, the rubber band untwisted and that stored energy was converted to make the spoon rotate. This type of stored energy is known as 'potential energy'.
-  Read the 'Potential Energy' section in the Investigative Study book, where more examples are provided to help you understand better.
-  You've learned that when we lift something up, potential energy accumulates within it. The process to find out how much potential energy is stored is very simple and given in your Investigative Study book. Study this process.
-  When you climb stairs, you can determine the amount of gravitational potential energy gained at that height by multiplying your weight by the height you've climbed.

-  Let's conduct an experiment to investigate if increasing height also increases potential energy. Use a spring balance to measure the weight of an object around you, such as a piece of brick or a water bottle. Then, hold the object at various heights, calculate the potential energy, and record the results in the table below. If you don't have a spring balance, you can find the mass using a regular balance. And as you already know, by multiplying the mass with the acceleration due to gravity $g = 9.8 \text{ ms}^{-1}$, you can find the weight of the object.

Weight of the Object, $W = mg$ (N)	Height, h (m)	Potential Energy, $E = mgh$

Science


- ✎ If the mass of an object remains the same, its weight will also remain unchanged. As a result, the potential energy of the object will continue to increase as the height increases.



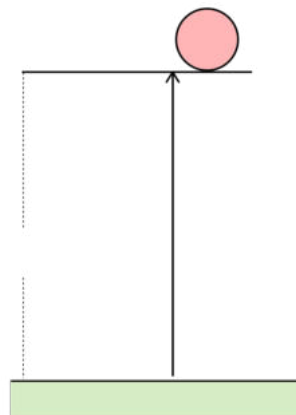
Session Nine

- ✎ In the previous session, we lifted an object and calculated its potential energy. Now, if we allow the object to fall downward, what will happen? You can guess from common knowledge that the higher it falls from, the more forceful the impact will be when it reaches the ground.
- ✎ Let's conduct a simple experiment. Take a bucket of water and drop a piece of brick or stone from various heights—1 foot, 2 feet, 3 feet, 4 feet, and 5 feet. Observe and note which height results in the most significant splash.
- ✎ You might have wondered about how the potential energy, gained from lifting the object upward, transforms when it falls downward. Let's now explore the concept of kinetic energy and learn how to calculate it.
- ✎ Read the 'Kinetic Energy' section in the Investigative Study book carefully, and discuss it with your classmates. If you have any questions, feel free to ask the teacher for clarification.
- ✎ Now, it's clear that the work done (potential energy) by a piece of brick or stone with mass 'm' creates $\frac{1}{2} mv^2$ amount of kinetic energy. This means that when work is done with the help of stored or potential energy, it doesn't destroy the energy but rather transforms it into another form, in this case, kinetic energy.
- ✎ The discussion above highlights that kinetic energy depends on the square of velocity. If the velocity doubles, the kinetic energy becomes four times greater. This is why driving at high speeds increases the risk of accidents.
- ✎ The Investigative Study book contains an example mathematical problem for you to explore. Please take the time to study and see if you can solve it on your own.
- ✎ Energy cannot be created or destroyed; it can only change from one form to another. This principle is known as the Conservation of Energy. When you analyze the potential energy of the stone you lifted up in the earlier session, you'll notice that it's at its maximum when it's at the highest point. As the stone falls downward, its potential energy decreases, while its kinetic energy (the energy of motion) increases. Just before the stone touches the ground, its potential energy becomes zero, and its kinetic energy is at its maximum.


It's important to note that some energy is lost due to air resistance and the impact on the ground, and this lost energy transforms into heat and sound energy rather than kinetic energy. However, for now, we'll keep things simpler and won't delve into those aspects.


 After studying the principle of conservation of energy, you've learned the equation $mgh = \frac{1}{2}mv^2$ from the Investigative Study book. Use this equation to solve the following mathematical problems:


- I. If an object with a mass of 10 kg is thrown upward with a velocity of 100 ms^{-1} , how high will it rise?
- II. If an object with a mass of 5 kg is thrown upward with a velocity of 50 ms^{-1} , at what height will its potential energy and kinetic energy be equal?
- III. If an object is thrown downward from point A (see figure), what velocity will it have when it hits the ground?









Session Ten

 You should be familiar with the name of our country's first domestically constructed nuclear power plant, which is located in Rooppur, Pabna. The main method of energy production at this facility is based on Albert Einstein's theory of relativity, famously represented by the equation $E = mc^2$. To learn more about this topic, refer to the section titled 'Relationship between Mass and Energy' in your Investigative Study book.

 Now, let's explore another concept that has applications in our daily lives, known as 'power.' While we often use the term "power" in influential or leadership contexts, in physics, it has a specific meaning. Power refers to the rate at which work is done, or, in other words, it's the amount of work done per unit of time.

 Do you want to know who is the most powerful student in your class today (in the context of physics and figuratively)? To do that, let's study how power is measured from the Investigative Study book in the section on 'Power.'

Science

-  Now, let's measure who for one day is the most powerful one in your class.
-  Count the steps on the staircase that connects the first floor to the second floor of your school. Multiply this count by the height of a single step to determine the height of one floor in the building.
-  Use a weight measuring instrument to measure your own weight.
-  Measure how much time it takes for you to climb up one floor using the stairs as quickly as possible. Record the same information for other students in your class as well. If there's anyone who is not able to climb stairs, measure their weight and record an average time for them.
-  Now, using the table below, calculate the physical power of you and your friends, and identify the student with the highest power.
-  Height of one floor of the building, $h = \text{Total number of steps} \times \text{Height of one step}$. $h = \text{-----} \text{ (m)}$

Student's Name	Weight (m) Kg	Time taken to climb one floor (t) s	Work done $W = mgh$ (J)	Power $P = W/t$ (W)

Retrospection

🗉 What kinds of everyday problems can you solve using the equation of motion?

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Science

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🗨 Using Newton's laws of motion, can you tell which vehicles are most risk to accidents? give logic.

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Our Laboratory

Have you seen how many things there are in the laboratories of scientists? How would it be, if you had your own such laboratory where you could experiment with different kinds of materials like real scientists? In this experience, let's explore how to turn your classroom into a laboratory! You must be thinking, so many things are required to set up a laboratory, and how to get so many things? In fact, we can choose the materials for our laboratory from the things that we use in our homes or in our daily needs. Let's get started!



Session One

- ✎ When we think of scientific research, we often imagine large laboratories with scientists in aprons running around, right? But isn't scientific research possible without expensive equipment and massive laboratories? As you have already known, fantastic experiments can be conducted with our everyday materials. In higher classes, you will probably do many complex experiments in physics, chemistry, and biology; and some might gain practical experience in really large research labs. Since that is not possible at this moment, how about making a small laboratory by collecting materials of our daily use? In this learning experience, you will do this very work. For the time being, our lab will mainly conduct various researches in chemistry. So, keeping this in mind, the laboratory will have to be arranged.
- ✎ First of all, think about what you need in a laboratory. Your science teacher can help you in this regard. If there is another chemistry teacher in the school, you can also take his opinion. If there is an opportunity, you can visit a research lab to see what kinds of equipment they have. For now, you don't need a whole room for your laboratory. Instead, you can get an old large carton to store and organize all your materials in it.
- ✎ Discuss in small groups what kind of materials you might need. Some examples of materials are mentioned below. Apart from them, you can think about what else can be used.
- Various equipment or apparatus for experiments (various types of containers, measuring instruments etc.)
 - Chemical substances
 - Laboratory notebook for keeping records of work
 - First aid for safety
 - Cleaning supplies
- ✎ After discussing with your team, make a list based on various categories or types of things that might be needed. Again, a sample list is given below, but this is just a sample. Think for yourself, what you might need in this laboratory.

Type of material	Sample list of materials
<p>Various equipment for the experiment</p>	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Containers of different sizes <input checked="" type="checkbox"/> Measuring instruments and materials (scales or rulers, scales and balances, stopwatches, thermometers etc.) <input checked="" type="checkbox"/> Candles/spirit lamps <input checked="" type="checkbox"/> Spoon, tongs <input checked="" type="checkbox"/> Containers of various sizes (used old water bottles, old small containers of various sizes, empty pickle jars, etc.) <input checked="" type="checkbox"/> Paper, glue, scotch tape, pens, markers, etc. for labeling containers of various materials
<p>Chemical substances/ materials</p>	<p>It depends on what experiments you will do. The chemical materials required in this learning experience should be collected in time, and stored in specific containers after labelling.</p>
<p>First aid for safety</p>	<p>Antiseptic ointment, cotton, scissors, gauze, band aid, Bernal, hand sanitizer etc.</p>
<p>Cleaning supplies</p>	<p>Multiple pieces of rags</p>
<p>And, an old large carton to store and organize all the materials of the laboratory; making shelves in that carton to store different things in small cartons or boxes of different sizes</p>	





Science

- ✎ Have you finished your list? Now, listen to the names of the materials on the lists of different teams, and let others know your list. Since the entire class will be creating a single laboratory, discuss all the lists of the teams and decide what is needed. Keep a few things in mind when making decisions about materials;
 - It is best if you can collect materials that are thrown away, used daily, very cheap or free.
 - Discuss with the teacher about whether it is possible to get in the school the materials on the list that are not commonly used at home (such as an alcohol thermometer).
 - Discuss simple alternatives to materials that are not readily available at home or at school.
- ✎ Decide which team will collect which materials in the next session, and the collection of which materials will be the responsibility of the teacher.
- ✎ Your first lab test will be in the next session. For that, you will need a small amount of powdered turmeric, lime, and lemon. The teacher will be responsible for bringing the materials for the first day, but you can do this experiment at home using the same materials.




Session Two

- ✎ As per the decisions of the last session, have all the teams brought their assigned materials? Now, following the teacher's advice, organize them in a carton or a box. In your absence from school, your teacher can take responsibility for properly maintaining this small laboratory.
- ✎ You can observe different types of chemical reactions by using everyday materials. Let's try some of such experiments.
- ✎ Arrange the items brought from home into different shelves first.
- ✎ Fill half of a glass/water bottle with water and add half the amount of powdered turmeric to it. Stir it well. You'll see the colour of the water has turned mustard yellow.
- ✎ Now mix some lime in this solution and stir it well. See what happens. The yellow colour changes to red, right? Are you getting surprised?
- ✎ Do you think the yellow colour can be brought back somehow? Let's try and see.
- ✎ In the solution, add lemon juice drop by drop by cutting and squeezing a lemon. See if the yellow color is returning slowly.




-  Yes, the colour of the solution has turned yellow again.
-  We frequently observe such changes. For example, have you noticed how the color of the tea changes when lemon juice is added to the tea liquor to make lemon tea? You can observe the colour change by doing this work in the classroom.
-  All of this is actually a kind of change. Write down with reasons in Table-1 below what kind of changes have taken place in the above two experiments. In some changes, no new substance is produced. Only the physical state of the substance changes. These changes are physical changes. In some changes, new substances with different colours and properties are formed. These changes are chemical changes.
-  Table 1 Identification of changes and reasons for them.

Experiment	Change and rationale for it
Experiment of turmeric, lime and lemon juice	
Color examine of tea liquor with addition of lemon juice	

-  Before ending the session, arrange different used materials in the shelves of the cartoon.



Sessions Three to Eight



-  Chemical changes occur as a result of chemical reactions. To understand why a particular substance reacts with another, it is essential to have a good understanding of the structure of the substance.
-  You have already known that the atom of a chemical element is composed of electrons, protons, and neutrons. It is important to know how these three types of particles are arranged in an atom. This arrangement is necessary to understand why a particular substance reacts with another substance. With the help of your teacher, learn about the structure of atoms, rules of electron configuration, determination of chemical signals, isotopes, atomic number and mass number of elements, etc. from your Investigative Study book. You will need to know these things to explain the chemistry experiments that you will do in this learning experience.
-  Now, if you know the number of electrons in any substance, you can surely find out the electron configuration in its energy level, right? Draw the electron configuration of the following elements to revise a little—

Name of element and symbol	Atomic number	Electron configuration
Fluorine (F)	9	
Potassium (K)	19	

Name of element and symbol	Atomic number	Electron configuration
Cromium (Cr)	24	
Copper (Cu)	29	





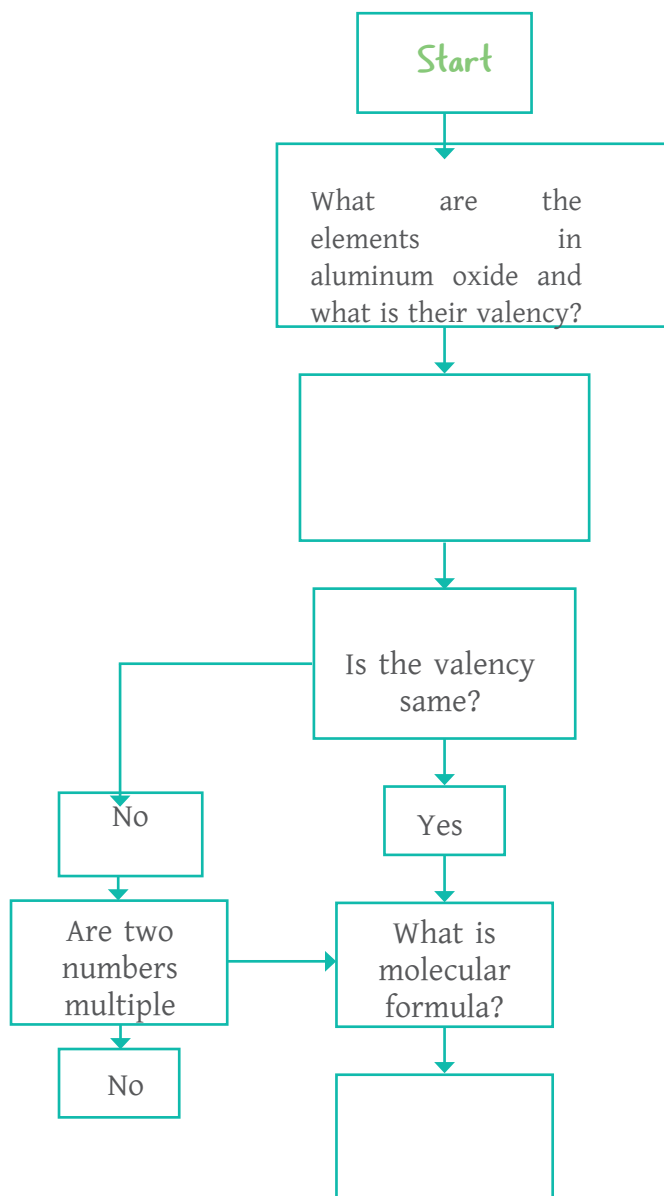
Session Nine

-  From the discussion in the previous sessions, you must have understood that depending on the electron configuration of the last energy level, how an element will participate in a chemical reaction by exchanging or sharing electrons with another element. Earlier you got an idea about symbols and formula. Even then, read the 'Rules for Writing Symbols, formulas of Compound and Molecular formulas' section from the 'Chemical Reactions' chapter of the Investigative study book to brush up a bit. Discuss in pairs and understand.
-  So, now tell one thing. The molecular formula of the molecule methane is CH_4 . How many atoms are there? Write down your answer below.

Name of the Element	Number of Atoms in the Element

Science

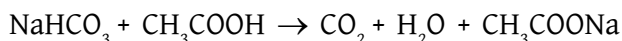
-  In order to write the chemical formula of a compound, you need to have a good understanding of valence. Read the section 'Rules of Writing Valences and Molecular Formulas' from Investigative Study book again.
-  The compound named 'Aluminium Oxide' is composed of the elements aluminium and oxygen. Use the flow chart below to determine what the formula of this compound will be.






Sessions Ten and Eleven

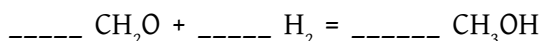
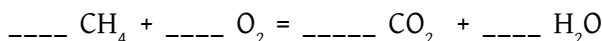
- ✎ The molecular formula of the compound is known from the valency. Now let's learn about chemical reaction equations and reactions.
- ✎ If someone challenges you to inflate a balloon with using your mouth or any device, would you be able to take on that challenge? However, if you complete the experiment that you are going to do now, you will definitely be able to take on this challenge.
- ✎ In a half-liter water bottle, add 1 cup of vinegar. Now, take two to three teaspoons of baking soda in the balloon that you want to inflate. Then attach the balloon to the mouth of the bottle in such a way that the baking soda does not mix with the vinegar.
- ✎ Tie the balloon tightly to the mouth of the bottle with string or tape. Now, carefully inverting the balloon, release the baking soda powder into the bottle. That's it, now watch what happens!
- ✎ You can certainly see that as soon as baking soda has been added to vinegar, bubbles have started to form. And the balloon is also slowly inflating itself.
- ✎ Can you guess what is happening here? When enough air enters the balloon, carefully release it from the bottle, and tie a knot in the mouth. Can you tell what inflated the balloon? For this, you need to know about chemical reactions and the method of writing reaction equations. What you did was a chemical reaction and the equation of this reaction is:—




- ✎ Here NaHCO_3 (baking soda) and CH_3COOH (vinegar) have reacted to form three new compounds named CO_2 (carbon-dioxide), H_2O (water) and CH_3COONa (sodium acetate). Among them, CO_2 (carbon-dioxide) gas has inflated your balloon.
- ✎ If you wish, you can light a candle and carefully hold the balloon's air in front of the fire of the balloon. Notice what happens?
- ✎ Now, let's learn the rules of writing chemical reactions. Read the section 'Chemical Equation and Balancing (সমতাকরণ)' from the Investigative Study book carefully. If you have any question, make sure to ask the teacher to clarify your understanding.

Science

 Now, try to balance the equations below—



Sessions Twelve, Thirteen and Fourteen

 You have already known how to write chemical reactions. Now, let's learn about different types of chemical reactions. Before that, let's do another interesting experiment.


Squeeze some lemon or onion into a bowl and extract the juice. A teaspoon of juice will be sufficient.


Take a cotton bud or a piece of cloth twisted on the head of a stick and dip it in the juice. Write something on a white piece of paper using the juice. If you want, you can write the title of this experience or your own name.


Let it dry for a few minutes. If you ask a friend what is written on the white paper, he/she won't be able to answer because the juice has dried and has mixed with the white paper.

Light a candle or hold the paper over a fire and gently heat it (so that it does not burn). You will see that the writing is slowly turning a dark brown color and becoming clear.

This is how you can make invisible ink and send secret messages! Behind all of this is chemistry. So, let's learn about different types of chemical reactions from the Investigative Study book.

 Read the sections on addition, combustion, substitution and decomposition reactions from the Investigative Study book to learn how these reactions occur.

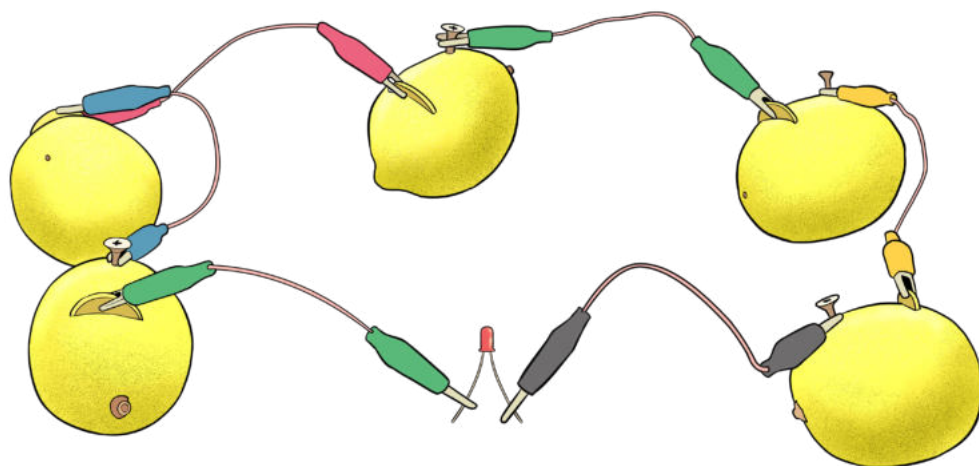
 Collect information from your teacher about what materials you will need to experiment on these reactions.

 Now, with the help of your teacher, complete the experimental instructions for each of these four types of reactions in the Investigative Study book one by one.



Sessions Fifteen, Sixteen and Seventeen

- ✎ Another important use of chemical reactions is energy conversion. Plants convert solar energy into chemical energy through the process of photosynthesis. Different animals and we consume chemical energy through food, which provides us with other energy in our bodies. In this way, all the energy starting from the stored energy in plants and animals to the energy of fossil fuels is chemical energy. Let's do some experiments on the conversion of different types of energy through chemical reactions.
- ✎ To convert chemical energy into heat energy, take one spoon of lime in a test tube or glass. Now add half a cup of vinegar or lemon juice and see what happens?
- ✎ Touch the bottom of the test tube or glass and check if it feels cold or hot?
- ✎ Read the section on the conversion of energy through chemical reactions in the Investigative Study book to further clarify your understanding.
- ✎ Let's do another experiment on the conversion of chemical energy to other forms of energy.
- ✎ For this, you will need 4 to 6 lemons, a zinc rod (corrugated tin is zinc-plated, you can also cut a piece of corrugated tin), a copper rod (the ones inside electrical wires that are as thick as a pencil nib), some electricity-conductive wire, an LED bulb (light bulb).
- ✎ Now insert a copper rod and a zinc rod in two ends of each lemon. Complete

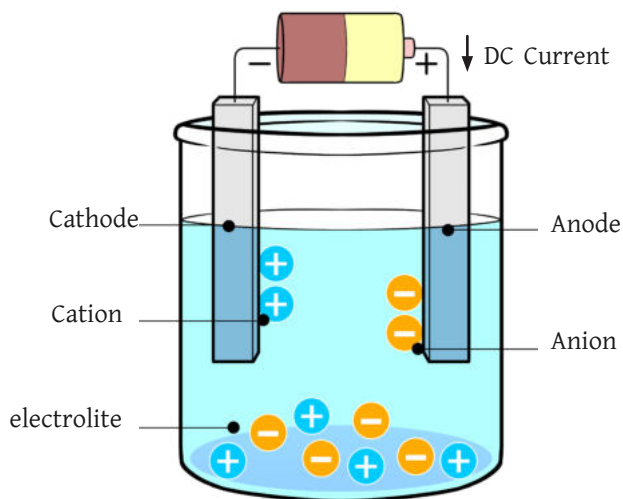


Science

the circuit by connecting the copper rod of one lemon to the zinc rod of another lemon by using conductive wire. The copper part of the first lemon will act as the negative and the zinc part of the fourth lemon will act as the positive terminal. Now connect the short end of an LED light to the negative terminal of the lemon circuit and the long end to the positive terminal. Now see what happens!


✎ Surely, you can see that the LED light has turned on! You have converted chemical energy into electrical energy, which by turning on the LED light is generating light energy and a bit of heat energy.

✎ Compare the metal rods involved in the reactions that occurred in this experiment with the metal rods in reactions that occurred in the electrolysis process of salt (sodium chloride) in the Investigative Study book. Write down the similarities and differences below.




ইলেকট্রোলাইসিস প্রক্রিয়া

The metal rod used in the experiment, the reaction that has occurred	The metal rod used in electrolysis process, reaction that has occurred




-  Now, read the section ‘the conversion of chemical energy to light energy using a dry cell’ from Investigative Study, and tell which one of the copper and zinc rods is functioning as the anode and which one as the cathode? Write it down with reason.

Metal rod	Identifying anode/cathode and argument in favour it
Copper rod	
Zinc rod	

-  If you have a damaged battery cell at your hand, you can open it and observe the internal parts.

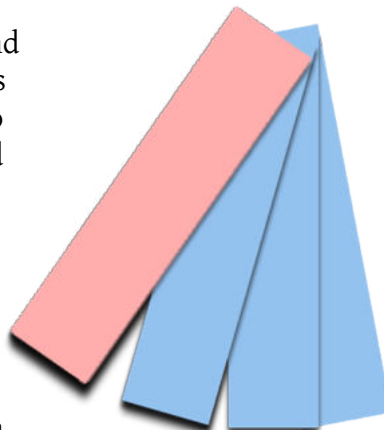


Sessions Eighteen and Nineteen







-  We use acids and bases in many cases of our daily lives. However, often we do not know which one is an acid and which one is a base. In fact, based on some characteristics and using some indicators, we can easily distinguish between these two. Before that,
-  Before this session starts, as per the teacher’s instructions, you will bring the following items from home:
-  1 lemon and 1 tamarind; 1 teaspoon of each of salt, lime, and detergent soap; 2 tablespoons of vinegar.

Science




- ✎ In addition to this, the teacher has provided you with some more chemical substances. Take these in test tubes or other containers and write their names on the containers.
- ✎ How can we identify which one is an acid and which one is base? Well then, let's use litmus paper to test and find out. But before we do that, let's learn about acids and bases, and their common characteristics.
- ✎ You may be wondering what litmus paper is. When colours extracted from a type of plant called lichen are applied to ordinary paper, then litmus paper is made. Litmus paper is used to test whether a solution is acidic or alkaline (ক্ষারীয়). Acidic solutions turn blue litmus paper into red, and alkaline solutions turn red litmus paper into blue. See the related image in your Investigative Study book. This litmus paper is a type of indicator. Indicators are substances that change their own colour to indicate whether an object is acidic, alkaline, or neither.
- ✎ Read the section 'Acid and Base' from your Investigative Study book.
- ✎ After you have finished reading, mix the objects that you brought in 5ml of water in a few test tubes or containers.
- ✎ Then, using the red and blue litmus papers given by the teacher, separate the sample objects into acids and bases. On the basis of their type, write them in the table below:



Name of the object	Acid or Base	Reason?



-  If you don't have litmus paper, don't worry. There are instructions in your Investigative Study book on how to make indicators from fruit and vegetable extracts. By following that, you can separate acids and bases.
-  Now, add litmus paper or an indicator made from fruit extract to a salt-water solution and see if there is any change.
-  You will see that the litmus paper has not changed its colour. There are many other salts like table salt that are neutral substances. This means they cannot change the colour of litmus paper.
-  However, you can test whether the salt you have brought contains iodine or not. To do this, take some salt and add a few drops of lemon juice to it. If the salt turns dark purple, you will understand that it contains a sufficient amount of iodine.
-  You have already learnt to separate acids and bases. Now let's learn about their uses.
-  Read the section 'the Uses of Acids and Bases' from the Investigative Study book and discuss it in pairs. Do you find any connection between what is written in the book and the uses of acids and bases in your or your family's life? That is, how are these used in your homes? Write it down below—

Use of Acids	Use of Bases	Use of Salt

-  Acids and bases have several chemical properties. Acids can dissolve metals. Avoid very strong acids.
-  You can do a test at home using common household acids such as vinegar. Take an egg and soak it in vinegar for two days. After two days, pick up the egg and see how the hard shell of the egg has dissolved!
-  This test must have had a lot of fun? But if the object is something other than an egg, it will not be so funny! You will be surprised to know that the soft drinks available in the market contain phosphoric acid, which is enough to damage the teeth if you drink too much, even if it does not melt the teeth!



Session Twenty

-  Many kinds of experiments have been done in our own laboratories, even if we see that new substances are created in various kinds of chemical reactions. Now, let's try an experiment, the results of which we can use in our daily life.
-  One of the household chemicals used in our daily life is soap. You can make your own soap using few chemicals. Let's know what to do to make soap.
 - The main ingredients required to make soap are oil or fat and strong base. You can use coconut oil as the oil or fat. And you need to use sodium or potassium hydroxide as the base, which you can find in your school lab.
 - First, take 15 grams (approximately 3 teaspoons) of NaOH or KOH and grind it well. Then, dissolve it with 50 ml of water to make a solution of base.
 - Take 60 ml of coconut oil in a large beaker or container. Slowly add the alkaline solution and keep stirring with a spoon or a glass rod.
 - In another beaker or container, make and keep a saturated solution by

Our Laboratory

mixing 20gm (approximately 4 teaspoons) of regular table salt in 200ml water.

☑ Then heat the mixture of oil and base for 10-15 minutes so that the water can boil well. At the same time, keep stirring occasionally until you can see two separate layers in the container.

☑ Stop heating, and then keep mixing the previously prepared salt solution in the pot and keep stirring.

☑ Leave this mixture for about 1 hour until it cools down very well.

☑ You will notice that a foam-like layer has formed. Now take a mold of the size that you want to make the soap. You can use something like a jar lid or a small bowl as a mold. Carefully separate the floating foam-like part from the container using a spoon, and place it in the mold.

☑ In this way, leave the mold carefully for 1 day.

☑ Your soap is ready. Check for yourself whether it can clean and produce foam in the next session.



Conclusion

✎ Though this learning experience is done, your lab work isn't over. Organize the materials you have used over the past several sessions in a proper place. If you put something in a container or jar, you must have labeled it. It will not be possible to store degradable items in this way, but apart from that you can use the collected items in various experiments at a later time.

Retrospection

❓ How did you feel about creating a laboratory on your own initiative? Any new thoughts come to mind while doing this?

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Science

💡 How can you improve the quality of the soap you make?

Genealogy of the Living World

The living world includes the countless creatures living around us. It is a huge family spreading all over the world. How are these organisms interrelated, what are their similarities and differences, and where is the position of the human being in this big family? This learning experience is about finding answers to these questions. Come on, let's create the genealogy (family tree) of the living world!





Sessions One and Two

In the beginning, think about how many kinds of creatures you see around you. Discuss with your classmates and make a list in the table below.

Table 1

Name of Organism	Name of Organism	Name of Organism	Name of Organism	Name of Organism	Name of Organism



Observe the above table well. Think about the characteristics of the familiar organisms. Which organisms have similar characteristics? You may consider many of these characteristics. For example: whether it can prepare its own food, modes of food intake and digestion, shape-size, whether it can walk, swim, or fly, whether it has hair on its body, etc.

Discuss among yourselves and try to identify the characteristics. Now identify which organisms listed in Table-1 have these characteristics and note them down in the table below.


Table 2

Characteristics of the organism	Name of Organism
Example: Can prepare own food	

Science

-  The characteristics of organisms have been identified. But how are these characteristics of organisms determined? You already know that cells are the structural units of organisms. But which part of the cell contains the characteristics of the organism? And how do these characteristics continue from generation to generation? Before answering these questions, let's review the structure of the cell.
-  In class 7, you have learned in detail about the structure of cells of unicellular organisms and multicellular plants and animals. Do you remember the cell organelles? If you remember, write down their names below.

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-  Now say, which organelles in this list contain the characteristics of organisms and continue them through generations? Many of you may know that all the characteristics of an organism are stored in its DNA. The specific part of DNA that contains information about a specific characteristic is called a gene. How this DNA resides in the nucleus inside the cell is shown in the picture in the 'Cell Division' chapter of your Investigative Study book. Look at the picture and discuss it with your classmates. Draw the picture in the space below.



- ✎ Do you understand how the nucleus, nucleolus, chromosomes, and DNA are organized inside the cell? Read the Cell Division and Heredity, Importance of Cell Division, and Cell Structure section from the Investigative Study book and discuss with your classmates.



Sessions Three and Four




- ✎ If you have come to know where the characteristics of organisms are stored in the cells. Now the question is, how do these characteristics of thousands of organisms continue from one generation to another? How do we carry forward the same characteristics from our childhood to old age? To get the answers to these questions, it is necessary to understand first, how does the physical growth or proliferation of organisms occur?
- ✎ The process that occurs at the cellular level for the growth or proliferation of organisms is called cell division. This division again has variations. In the previous 'Green Friend' learning experience, you have learned about amitosis, mitosis, and meiosis cell divisions. You have already learned that the cell divides in the amitosis process in the case of single-celled organisms. Again, in the process of growth of multicellular organisms, each cell divides into two daughter cells in the mitosis process, keeping all the characteristics of the cell unchanged. However, to recall the processes, let's take a look at these two processes again.
- ✎ Now let's come to what happens at the cellular level in the proliferation of various organisms including humans.
- ✎ Read the steps of meiosis cell division from the Investigative Study book and discuss them in groups. Draw in a notebook or on the board what happens in the stages of meiosis 1 and meiosis 2 and discuss with the rest of the class including the teacher the process of how four haploid cells are formed from one diploid cell.
- ✎ Now, think again about the previous question. How are the characteristics of organisms passed from one generation to the next? We will discuss these issues in the next session.



Session Five

- ✎ Now, it is time to arrange the organisms according to their characteristics. If all the organisms of the world can be considered as a family, then what will be the genealogy of this family? How are these organisms classified based on various characteristics? How are they related to each other?
- ✎ To understand this well, it is important to first understand the role of DNA in determining heredity.

Science

-  The characteristics of the parents are transferred to the children through DNA in sexual reproduction. Read about the importance of meiosis cell division and the role of chromosomes and DNA in heredity from the Investigative Study book and discuss with the rest of the class including the teacher.
-  You see, DNA carries the characteristics of an organism, and those characteristics are passed on to the next generation in sexual reproduction through meiosis.
-  Now think about the role of this meiosis cell division in the endless diversity that exists in the living world. Discuss it with your classmates and write your answers below.

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-  Share your answer with the rest of the class including the teacher. See what others have written. If you disagree with them, present your point with arguments.



Sessions Six and Seven

-  In the previous session, we discussed the creation of diversity in the living world. Now let's see how this vast living world can be classified into different categories based on these diverse characteristics.
-  Do you remember that at the beginning of this experience, you listed the known living things according to their characteristics? Similarly, all organisms discovered so far on Earth are classified according to their characteristics. If you look at that classification pattern, you will have an idea of how these organisms are related to each other.
-  In groups, read the classification of organisms from the chapter 'Classification of Organisms' from the Investigative Study book and discuss in groups.
-  You know that all living beings are divided into three domains and six kingdoms. Now look at the list of the known living things. Can you identify which of these living things fall under which domain and kingdom? Discuss

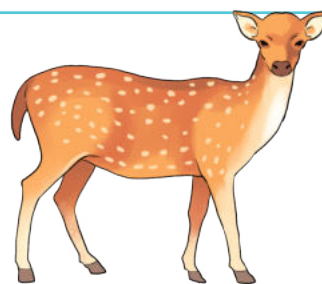
into different classes.

- ✎ With the help of the teacher, discuss the phyla (singular phylum) of the animal kingdom by yourselves and try to identify the characteristic patterns of the various phyla.
- ✎ Now your task is to do a comparative analysis between the characteristics of different phyla. Each group choose a phylum through a lottery. In the next session, you will present a comparative analysis of animals belonging to the assigned phylum with other phyla.



Sessions Eight and Nine

- ✎ Read carefully about the phylum assigned to your group. Compare it with other phyla and see why the animals in this phylum are different from others. Discuss it in groups.
- ✎ Now choose any other phylum through the lottery. Together with the group working on that phylum, present a comparative discussion of the characteristics of the animals in the two phyla assigned to you.

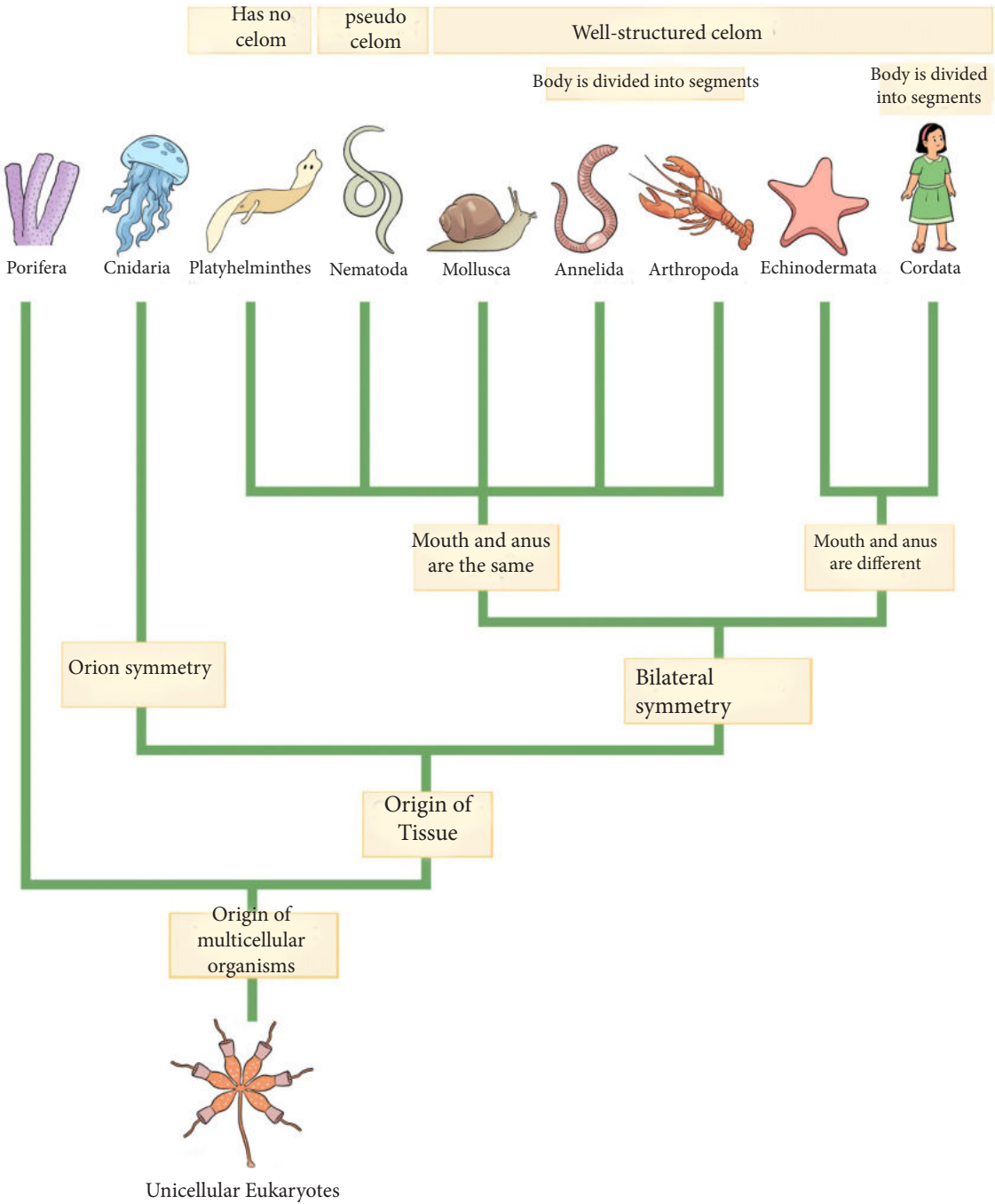


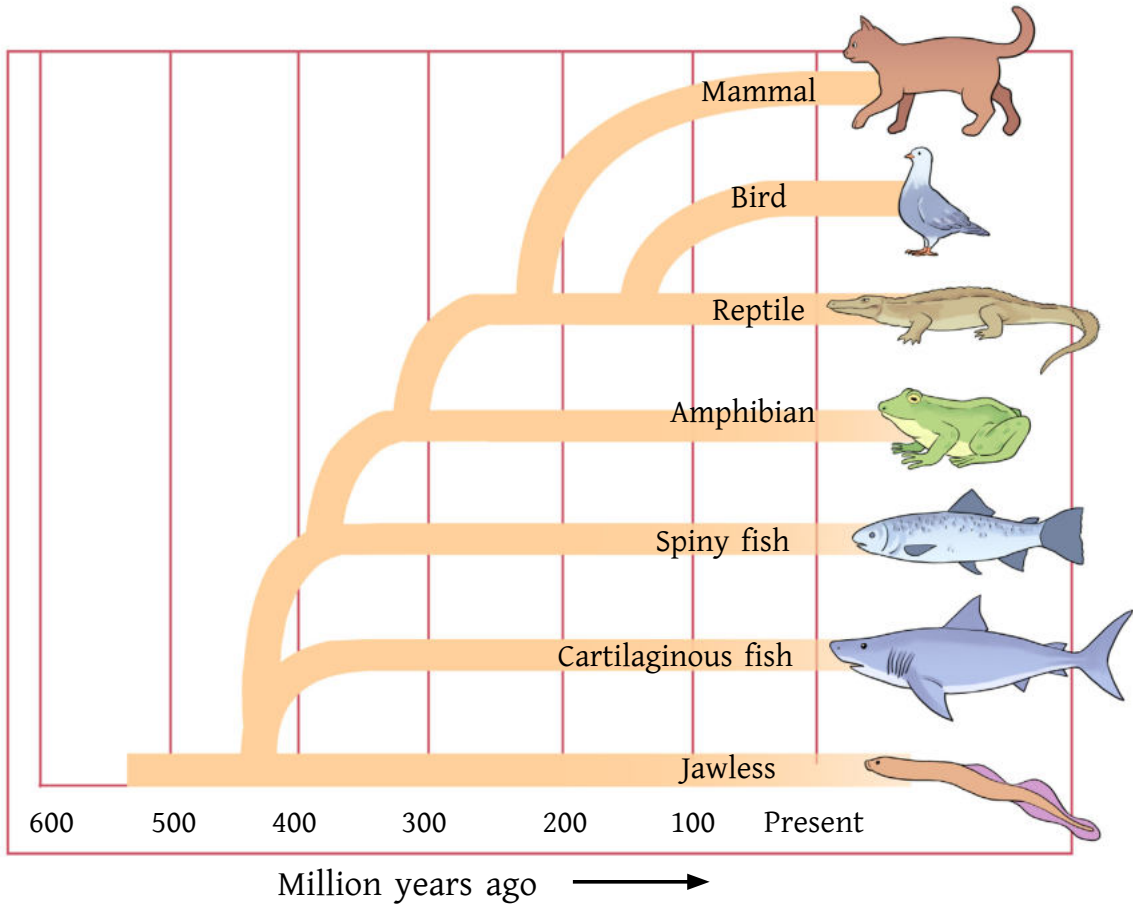
- ✎ After all the groups have finished their discussions, look again at the list of living things in Table 1. Can you now identify which of your chosen living things belong to the kingdom Animalia? Classify these animals according to the phylum names in the table below through group discussion.

Table 4

Porifera	Cnidaria	Platyhelminthes	Nematoda	Annelida	Arthropoda	Mollusca	Echinodermata	Cordata

Science





Evolution of different classes of vertebrates over time

- ✎ What kind of animal is the most on your list? Count it.
- ✎ Did you know that 80% of the animals discovered on the earth are insects? Many insects must have appeared on your list. Try to learn about the diverse world of insects, and their role in the Earth's ecology, from the Investigative Study book. Join the discussion with the rest of the class, including the teacher.



Sessions Ten and Eleven

- ✎ Now that you have come to know about animals with different characteristics, how was this diversity created? Which phylum of the animal is the most complex? How are the animals of different phyla related to each other? To

Science

know the genealogy of this vast family of animals, it is important to know the relationship between them. Similarly, it is necessary to understand how their characteristics have evolved over time and become more complex from simple.

- ✍ See the diagram. Can you understand how the characteristics of the various phyla of animals have become more complex and integrated over time from the earliest single-celled protists? Discuss with the rest of the class with the help of the teacher.
- ✍ You have already learned that apart from vertebrates, there are two more sub-phyla in Chordata. You have also learned from the Investigative Study book that there are seven classes of vertebrates. Many vertebrates belonging to these seven classes have arisen at different stages of evolution; many of them have become extinct over time.
- ✍ The time and sequence of evolution of vertebrates are shown. Looking at this diagram, can you understand what the pattern of evolution of vertebrates is? Discuss with classmates.
- ✍ You must understand which category in this list we humans are included. It goes without saying that humans belong to the vertebrates of the Chordata phylum. More specifically humans are also mammals like cows, goats, whales, and dolphins. To create a genealogy of the living world, it is necessary to know more precisely where the position of humans is. Read and discuss in groups the position of humans in the animal world section from the Investigative Study book.
- ✍ Now it's time to make the genealogy. Sit in groups and draw a complete genealogy of the animal kingdom on a large piece of paper or poster paper, with the main objective of identifying the position of humans in this large family. Here you can show the continuity of the relationship between these huge fauna like this,
Kingdom (Animalia) > Phylum > Subphylum > Class > Group > Family > Genus > Species
- ✍ Hang the genealogy you have made on a blank wall in the classroom. Check out other group's work as well. Join the discussion with everyone with the help of the teacher.

Retrospection

🗨️ Which animal has the most similar characteristics with humans? explain

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🗨️ Which classifications of plants and animals makes the most logical to you?
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Music Festival

Singing and humming brings so much joy! Imagine a beautiful day when you feel like singing aloud "What a wonderful world!" In this exercise section, through singing and playing with sound, you'll learn about the fascinating world of waves in physics. From cheering enthusiastically on the sports field to comprehending the creation and propagation of sounds, you'll dive into the fundamental concept of 'waves'.





Session One

- ✎ Many of you may have various musical instruments at home. Flutes, harmoniums, tabla, ektara, and guitars are popular instruments found in many households. Besides these, there could be more unique musical instruments. With your parents' permission, bring a musical instrument to school. Even if you don't have one at home, that's perfectly fine. Did you know there are many musicians who create beautiful tunes by clapping their hands, tapping various objects, playing music with leaves (Patar Bashi), or even by using their voices to make musical tones!
- ✎ So, if you can make a simple whistle made of mango seed (Aam-Aatir Bhepu), flute made from a leaf (Patar Bashi) or a hand drum (Dugudugi), that's enough to bring it to school. And if you can't, don't worry, because you can play and listen to the ones your friends bring.
- ✎ All the musical instruments brought from home should be handled with care right from the start. Keep them safely in your classroom or in your school principal's office with their permission. No one should touch the instruments without permission, and they should only be used during the designated session under the guidance of the science teacher. Ensure there's no unnecessary disruption, and work together to run the session smoothly.
- ✎ At the beginning of the session, organize benches or tables to display the musical instruments neatly so that everyone can see them and they can be used comfortably.
- ✎ Now, divide your class into 4 or 5 groups as instructed by the teacher and take turns exploring the musical instruments, two groups



at a time. If someone can play any musical instrument, they can perform it for the class.

When it's being played, listen carefully and pay close attention to how the instrument is played, where the sound originates, and how it is produced.

- ✎ Observe keenly how the musical instruments are structured, how one instrument differs from another. Which one produces sound in what manner, which




one requires striking a surface, or blowing air to create sound. Carefully notice whether stopping the striking or blowing causes the sound to cease.

-  Next, open your Investigative Study book and read the section on the 'Origin of Sound'. Discuss this with your classmates and try to understand the connection between the structure and function of musical instruments.
-  In this chapter, you've learned a new word, 'wave'. Through this learning experience, you'll discover many new aspects about both waves and sounds. To understand waves, let's revisit what you studied in the sixth grade about 'Simple Harmonic Motion'. Take another look at the section on 'Simple Harmonic Motion' in your Investigative Study book.






Homework

-  When you arrive home today, grab a long piece of string or rope, attach a small weight to one end, and hang it from a fixed support and swing it back and forth. Now, take a ruler and measure the length of the string. Then, use the formula $T = 2\pi \sqrt{\frac{l}{g}}$ to calculate the time period (T). Experiment with changing the length of the string while keeping the weight constant, and observe if there's any change in the value of T. Record your findings in your notebook.











Sessions Two and Three

-  In today's session, we'll delve deeper into the concept of waves. But before that, let's divide the class into groups of 4-5 and prepare some materials.
-  Each group will need a nylon string or rope that's 3-4 meters long. Tie the rope to the window grill or, hold one end and shake the other end a little hard. Are you see a wave going down the rope to the other end?
-  Now, take a spring. Attach one end of the spring to a fixed point and hold the other end while someone pulls it at regular intervals. Alternatively, you can attach one end to a fixed point and release it after stretching it a bit. Observe what happens. What do you notice about the behaviour of the spring? Do you

Science

notice the spring going back to its initial position?

-  Check if your experiments match with the illustrations in your Investigative Study book. (7.2.2 Types of Waves)
-  Now, study the sections 'Basics of Waves' and 'Types of Waves' from your Investigative Study book. Discuss the examples provided in the book with your group and see if they relate to anyone's real-life experiences.
-  You've learned that there's a relationship between vibration and sound, as well as the concept that waves can transfer energy from one place to another without changing the medium's position. Let's do another experiment to explore this further.
-  Under the guidance of the teacher, divide yourselves into groups of 4-5 students. Each group should have two plastic or paper cups. If these cups are not easily available, you can cut a bottle and use it as a substitute. Additionally, gather some sharp objects for puncturing the cups and provide different types of strings or wires to each group.
-  First, make two small holes at the bottom of one cup so that the string or its end can pass through. Then, thread the string or its end through one hole and bring it out through the other hole, securing it by tying a knot. Optionally, you can attach a small stick to prevent the string from slipping through the holes. Similarly, attach another cup on the opposite side.
-  You've just made your own cup telephone. Now, two members from each group should stand at opposite ends, holding the cup with the string or wire taut. One member will hold the cup to their mouth and talk into it, while the other member holds the cup to their ear. Try communicating through the cup phones and observe how the sound is transmitted.
-  Compare the quality of communication between the groups since each group is using a different type of string or wire.
-  Does this experiment clarify the concept of waves transmitting energy (in this case, sound energy) through a medium without the medium itself changing position?









Homework


When you go home today, take a round bowl and stretch a thin polythene sheet over it. You can also cut a balloon and use its rubber instead of the polythene sheet. Sprinkle some very light objects, like puffed rice, cumin, or dried chili seeds, on top of the sheet. Now, hold a steel or brass plate near the bowl (without touching it) and gently tap the surface of the plate with a large spoon a few times to create sound. Observe if there's any movement or change in the position of the seeds on top of the covered bowl.





Session Four


-  Let's now learn about some quantities related to waves and practice how to measure them.
-  From your Investigative Study book, find the section on 'Wave Variables' and study it.
-  Learn what is meant by wavelength, period, and frequency. Look at the accompanying illustrations and try to recall the experiments you conducted with the string and spring.
-  Take a closer look at the derivation of the mathematical equation $V=f\lambda$. This equation represents the relationship of these three quantities. If needed, don't hesitate to seek help from your teacher to clarify the concept.
-  $V=f\lambda$ is a fantastic mathematical equation because this tiny equation allows you to calculate the speed of sound. See if you can solve the following mathematical problem using this equation.
-  The time taken for 100 oscillations of a sound source that produces a vibrational sound is equal to the time it takes for the sound produced by that source to travel a distance of 140 meters. If the frequency of the source is 245 Hz, what is the speed of sound in the air?



 In previous grades, you've learned that when a light beam is obstructed and returns in the direction it came from, it's called reflection of light. Since sound is also a type of wave, when sound is obstructed, it also gets reflected, and we call this phenomenon an 'echo'.


 However, to hear an echo, the time between the original sound and the reflected sound should be at least 0.1 seconds. This is because if the time is less than that, we can't perceive the two sounds separately. So, for an echo to be heard in the air (assuming the speed of sound is 332m/s), the distance between the source and the reflecting surface should be at least 16.5m. If your classroom's length from wall to wall is equal to or greater than this distance, you can attempt to produce an echo.

 Let's consider the movement of bats. You might think that bats navigate in the dark using only sound. But that's not entirely true. Bats do have eyes and can see, but they use ultrasound (high-frequency sound) and its echo to detect obstacles or locate food in the dark. They emit sound waves at frequencies too high for humans to hear (beyond the range of 20Hz to 20KHz). There are various other practical applications of echoes as well. Locate the relevant section in your Investigative Study book and explore it with a fellow classmate.


 The book presents two examples of mathematical problems employing the equation $d = vt/2$. Try to solve these problems yourself and write down the solutions in your notebook.



Session Five

 You might be thinking that the title of this learning experience session is Music Festival, and wondering when actually will this festival take place, and how? Fear not! It is going to take place before this session ends, but here's the twist: you'll be the ones creating the musical instruments for the festival.




 Before we go into that, let's explore how sound changes with different frequencies.

- ✎ To start, gather 8 similar cups or glasses made of glass. You'll also need a metal spoon. Find out if your school has 8 similar cups/glasses like that.
- ✎ Arrange the glasses in a row. Fill the first glass to the brim with water, the second with slightly less water, and so on, reducing the water level in each glass until the last one is empty.
- ✎ There you have it! Your musical instrument, called 'Jol Torongo' (Water Waves), is ready to be played. Gently strike the rim of each glass with the metal spoon and observe the type of sound produced and any differences you notice.
- ✎ If any of you have knowledge of musical notes, you can try tuning the glasses according to the following notes:


Note	Sa (সা)	Re (রে)	Ga (গা)	Ma (মা)	Pa (পা)	Dha (ধা)	Ni (নি)	Sa (সা)
Frequency	256Hz	288Hz	320Hz	341Hz	384Hz	427Hz	480Hz	512Hz

- ✎ You'll notice that the sound changes with the water levels. Higher water levels create higher pitches, and lower water levels result in lower-pitched sounds. Understand this principle and try creating your own musical instruments based on it.
- ✎ With the teacher's guidance, form groups of 5-6 students and plan how to make your own musical instrument. What materials will you need? How will you gather them? Discuss and prepare these details in advance.
- ✎ After planning, work together in your groups to create the musical instrument. Feel free to give it a unique name of your choice.


Science

-  Now look at the other groups plans. Look at everyone plans, including your own, and decide which is the best plan. Now everyone will make that musical instrument together. But before that, draw or write down the plan or design of the musical instrument that everyone chooses, and don't forget to mention why you chose it.

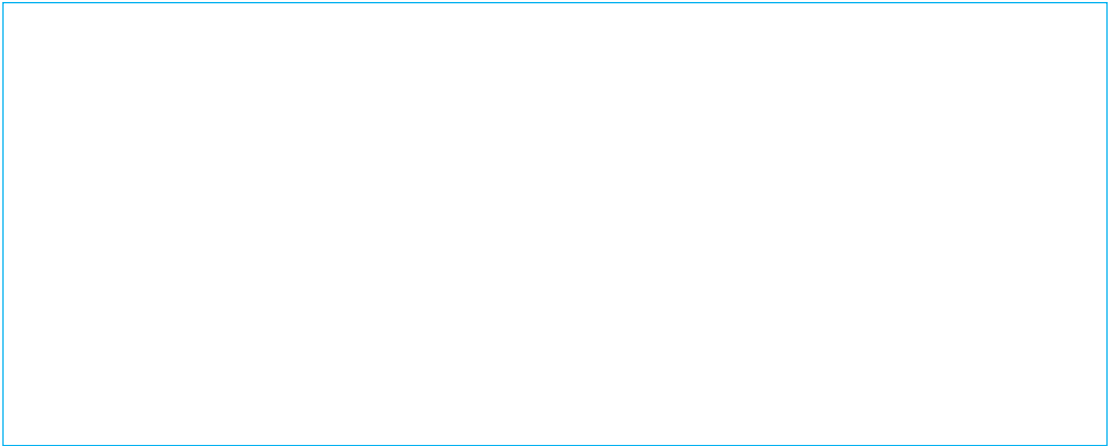
Musical instrument plan or design	Give reason, why it seems most effective and realistic?

-  Everyone in the group should share the work, in the next session bring the necessary materials and make the musical instruments of your group in the session.

Session Six


-  According to the plan, everyone in the group work together to make your own musical instruments. You can give it a name also if you want.

- ✎ Once you've made the instrument, explore how it works. In the box below, describe (with a picture if possible) how the instrument produces the changes in pitch or sound.



- ✎ Finally, if you wish, everyone in the class can join and orchestrate a song or melody employing your newly crafted musical instruments. If that's not possible, you can organize an exhibition for all of your handmade instruments within the classroom.

Retrospection

 What is your favorite musical instrument? How does it produce sound?

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 Are there any musical instruments that stand out in your area?

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 If asked to classify the different types of musical instruments, on the mechanism by which they produce sound, how would you classify them?

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Environmental Protection

The topic of environmental protection is not new for anyone. Earlier in various classes you have done a lot of work for environmental awareness. But have you ever thought about how your own daily activities on the environment? Let's take a look back at ourselves in this learning experience. Our task this time is to explore if we are unknowingly harming the environment in our daily lives, and to find real solutions to it.





Session One

- ✎ You may have done a lot of work on environmental awareness before, and you are probably very annoyed with the environmental pollution in your surroundings. But why does this environmental pollution actually occur? This waste is generated from the very things that we use daily. Apart from this household waste, various wastes are also generated from sources such as factories, hospitals, which contribute to polluting the environment.
- ✎ First, let's see how much waste is generated in your school every day. Divide into groups of 5/6 students each. Discuss with everyone in your group, and in your notebook take notes of what kind of waste your group has thrown away all day (everything from chocolate or chips-packets to tissue paper). After collecting others' data, add your group's data too and note down in the chart below.

Type of Waste	Quantity

Science





-  Now exchange information with the other groups in your class. After you have compiled all the information of the groups, think about how much waste is produced in a day just from your class.
-  Now, think about how many classrooms there are in your school and how many students there are in total. Can you estimate how much waste is generated from your school in a day? Try doing some calculations!
-  While thinking about waste production, it is, in fact, important to think about another issue, which is the use of resources. It is important to consider how many types of products we use in our everyday lives, how many types of resources we use, and how much we use. Before the next session, your task is to record the amount of resources you use, and the amount of waste you produce in a day.
-  You can use a small table like the sample one below to record this information.

Table 1

Date:			
Used things/goods/ resources (Example: food, water, gas, electricity, money, etc.)	Amount of used things/goods/ resources	Type of waste generated (Example: polythene packets, dirty water, food waste, smoke, etc.)	Generated waste and its quantity

Date:			
Used things/goods/ resources (Example: food, water, gas, electricity, money, etc.)	Amount of used things/goods/ resources	Type of waste generated (Example: polythene packets, dirty water, food waste, smoke, etc.)	Generated waste and its quantity






Session Two

- You must have kept an account of your used products or resources at home? Moreover, you must have made a list of your own waste?
- It is important to mention that resources refer to everything we use. Again, all the goods we use come from some natural source. The thread of the shirt that you use may have come from a silkworm’s cocoon, the lead of the pencil in your hand from graphite mines, and the wooden part in the pen might have come from the wood of a tree. The electricity used to run tube lights or





Science

electric fans at home may have been generated in a power plant whose main fuel is coal. So, the trees, coal, water, graphite from mines—all of these are natural resources. Some of these natural resources are naturally replenished after being consumed, while others take a long time to replenish.

-  Read the topics- Resources, Characteristics of Resources, Characteristics and Differences between Renewable and Non-renewable Resources from the chapter 'Renewable and Non-renewable Resources' from your Investigative Study book. Discuss in groups to see what ideas you have about resources.
-  The information that you have collected in Table 1 gives an account for your consumption in only one day. Similarly, if this information is collected for two weeks consecutively, how would it be? From that account, you can get an idea of the usage of resources in your regular life, isn't it?
-  In a diary or notebook, draw a table like Table 1 for the next 15 days and record the list and quantity of everyday consumable items, and the list and quantity of waste generated. Don't forget to write the date of each day on the table!



Sessions Three to Eight

-  In order to keep track of the resources you use, let's spend some time on a different task for these days! In the previous session, you have learnt about renewable and non-renewable resources from your Investigative Study book. In the next sessions, you can learn more details about various types of resources. You can read different parts of this chapter in groups and discuss them yourselves, you can also talk with the teacher.
-  There are many types of resources, but all of them are not available to us. Moreover, many resources, especially mineral resources, are not equally available in all parts of the world. What natural resources are available in Bangladesh? To learn more about this topic, you can read about different types of mineral resources of Bangladesh from the chapter 'Natural Resources of Bangladesh'. You can identify different types of mineral resources on the map of Bangladesh by discussing in groups.
-  Also, talk to other groups and see what they have learnt.
-  We depend on nature for all the goods we use. However, can the excessive extraction of natural resources impact the environment? To know that, you can read the rest of the parts of the same chapter.





Session Nine

- ✎ You must have recorded the list and quantity of daily-use goods and also the list and quantity of generated waste over the past two weeks, right? In the meantime, you have also developed an understanding of various types of resources. Let's now analyze your data a bit.
- ✎ What is the main source of the goods that you use? Discuss this in your group and calculate. How much waste have you and your group members collectively generated in just two weeks? If you compile the information of everyone in the class, where will this amount end up?
- ✎ Think about it differently. How many members are there in your family? Compare the amount of waste you have produced alone, and estimate how much total waste has been produced by your family members in your house in two weeks. Where will this amount end up, if you calculate this over a year?
- ✎ There is no need to discuss the relationship between waste production and environmental pollution again, right? Now the question is, what can be done to reduce the amount of waste? Take a closer look at your list of information and think. Which of the goods or materials on the list you have used that could have been avoided? What is the effect of all these things on the environment? Discuss in groups and write the names of these items in the list below.

Table 2

Used Materials/ goods/ resources	Materials that you could have avoided to use	Impact on the environment

Used Materials/ goods/ resources	Materials that you could have avoided to use	Impact on the environment

Science

Used Materials/ goods/ resources	Materials that you could have avoided to use	Impact on the environment



Session Ten


 In the previous session, you have calculated the resource consumption in the family and household waste. Now let's see how the environment is polluted through the production of waste. Write down in the table below how the environment is polluted by different wastes and what are the causes of pollution.

Table 3

Waste generated	Elements of the environment that are polluted and the causes of pollution

- ✎ Present the work of your group in front of everyone to get feedback from the students of other groups. This way, all groups will present their works. Based on the feedback from other groups, you will refine your group's work. This way, each group will present their tasks. Based on the opinions of other groups, you may rethink your group's work.
- ✎ You have learnt about which elements of the environment are polluted through daily activities. You have also learnt about the causes of pollution. Now, it's time to find ways to prevent pollution. Different methods are to be applied to prevent pollution of different elements of the environment. However, before that you can read again the sections on Forest Resources, Water Resources, Impact on the Environment due to Extraction of Natural Resources, and Caution in the Use of Natural Resources from the chapter 'Natural Resources of Bangladesh'.

Table 4

Name of Pollution	Ways to prevent pollution
Water pollution	<ul style="list-style-type: none"> ➤ Not to throw garbage into the water ➤ Using moderate amount of chemical fertilizers on agricultural land; Not to use excessive chemical fertilizers ➤ Using sanitary latrines

Science

	➤ ➤ ➤
	➤ ➤ ➤
	➤ ➤ ➤
	➤ ➤ ➤



Home work

From your daily work, you have learnt about environmental pollution, the causes of pollution, and how to prevent it. On one hand, measures need to be taken to reduce the production of waste materials. On the other hand, waste materials are to be reused and recycled to reduce pollution. You must understand that waste management plays an important role in reducing pollution. How is waste collected and managed in your area? Who is in charge of this? Where are the wastes taken after they are collected from homes? Collect information on this topic before the next session and write it down in Table 5. Some sample questions are given in the table below. You can also find answers to other questions to satisfy your curiosity.

Table 5



Who are in charge of waste management? What is their role?	
How is waste collected?	
Where is waste taken after collection?	
Is there a system to separate different types of waste?	
Is there a system to reuse and recycle waste materials?	
Where does non-biodegradable waste eventually end up?	



Sessions Eleven, Twelve and Thirteen






- ✎ In this session, discuss the information brought by the members of your team. How effective is the waste management process in your area? How could it be done better? Make decisions through discussion among yourselves.
- ✎ Now, you have to do an important task. You have to create a waste management model that is most suitable for your area. This work needs to be done with enough realistic thinking so that it can be implemented in reality. You can present this model to your local officials so that it effectively contributes to local development. However, you need to analyze some things before building this model.
- ✎ You have already got an idea about different types of waste. Now, think a bit- which of these wastes are recyclable? Or which ones can we avoid using? Which ones can be used for other purposes without throwing them away? You must already be familiar with these three words: Reuse, Reduce, Recycle. Fill in the following table by looking at your own information list. Complete the table next page by looking at your 15-day waste generation list (Table 1).

Waste generated	Decomposable or non-decomposable	Reuseable or not, if so how	Which may not be used, or the use may be limited	Which can be used for other purposes without being thrown away

-  Now think about which of these various wastes are biodegradable, and which ones are non-biodegradable? How can the biodegradable wastes be managed to minimize environmental pollution the most? For example, compost can be made from the waste generated every day in the kitchen, which can be used in local nurseries, rooftop gardens, or agricultural fields. What can be done in the case of non-biodegradable waste?
-  Discuss with your classmates the waste materials that, according to you, are recyclable. Modify your list if necessary. Divide the recyclable waste materials into two categories. Separate those that can be reused without any treatment.

Science

Reusable waste materials without treatment	Reusable waste materials with treatment

-  Discuss in groups, if necessary, take the help of experts or the experienced.
-  Now, think about how to collect waste most effectively so that its management is easier. After the collection of waste, think about what steps can be taken to minimize environmental pollution the most and simultaneously prevent the wastage of resources. Create an effective waste management model.
-  Keep the following questions in mind while planning your model.
 - How will waste be collected?
 - How to separate decomposable and non-decomposable waste?
 - What will be the way to use decomposable waste?
 - Where will non-decomposable waste be deposited?
 - How to separate non-decomposable waste from reuseable waste? How will they be used?
-  When work is done by all teams, organize a presentation day when not only members responsible for waste management but also councillors or members of the community can be present. You can get valuable feedback from them as well as suggestions on how to actually use this model.
-  Now think about it, which group's waste management model is the most effective for you? Why?

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Retrospection

 What was everyone’s opinion about your team’s waste management model?

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Science

 What changes to your team's waste management model would make it more effective?

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 How will your role in using resources in your personal life change after doing this experience?

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Incredible Body Machine

Our human body can be compared to a big machine just like the different parts of a machine do different jobs separately to make the machine accomplish entire work. Different systems of the human body keep our entire body system functioning and balanced through certain functions.

In the previous class also, you have learned about different systems of the human body. Now in this class too, let's see how some other systems keep our physiological activities functioning through their interaction!



Step-1



Sessions One and Two

- ✎ What do we do if we touch something hot by mistake? We instantly remove the hand, don't we? If we don't remove the hand, it will have blistered after a while. It is also difficult to stand with the cold ice in the hand for a long time, it seems that the hand is getting paralyzed. Can you tell which part of the body helps us sense the feeling of cold and heat?
- ✎ You guessed it right; we get the sense of touch through our skin. Just like the peel protects the inside of a fruit or vegetable, the skin covers our body. When the skin of any part of our body is cut, we feel it through pain. Again, you must have noticed that when touched, some parts of your body might feel more sensitive, while others might be less sensitive. You often make your friends feel heckled by tickling them.
- ✎ We don't feel pain or don't get a sense of touch even though some parts of our body are cut. Can you tell which parts these are? Think carefully and write your answer below :

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- ✎ Let's do a fun activity-
- ✎ Do this activity in pairs. With one's eyes closed or blindfolded, write some familiar words like- pen, flag, goat etc. on the skin of one's arm with the opposite end of a pen or pencil.
- ✎ Blindfolded you have to say what your friend has written in your hand. In this way, both of you can play the game by writing with the opposite side of the pen.
- ✎ Now consider that apart from this feeling, the skin also performs other functions. You must have noticed that we sweat on hot days. Take a look, why do we sweat, and when do we sweat? Why do we not sweat in winter?
- ✎ What are the functions of the skin? What is the structure of the skin? To know about it, open the integumentary system section from the chapter on 'Organs and Systems in the Human Body' in the Investigative Study book. Read and

discuss this section in groups of 5/6. After you have finished reading, talk to the rest of the class including the teacher.

 Can you say which parts of the skin we do not see? Write your answer below.


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 Now, one by one from each group, stand up and identify the parts of the skin that are visible on your body and describe the parts. Take the help of the Investigative Study book if needed.

 Why do we sweat? How sweat is secreted in different parts of the skin? Write your answer below.

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 You have learned about the integumentary system. Now think about what functions the skin has to perform to keep our body healthy and stable. With the help of the Investigative Study book, write your answer below.

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Science

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 Skin is a very important part of our body. So, it is very important to take care of it. It is also very important to make everyone aware of how and why skin care is necessary. After returning home from school or playing sports, you might wash your hands or face well. Also discuss in groups how and when to take care of the skin especially according to the seasons. After the discussion, share your opinion with the rest of the class and listen to the opinions of others.



home work

Like humans, all other animals have skin. But are the functions of the skin of all animals exactly the same? Choose some other animals such as polar bear, turtle, porcupine and think about what are the special features of their skin type? What kind of extra benefits do these features give them?

Name of the animal	Special features of the skin	Extra benefits these features give them
Polar bear		
Turtle		
Porcupine		
Chameleon		

Name of the animal	Special features of the skin	Extra benefits these features give them

Step-2





Session Three






- ✎ Just like a machine needs fuel to run, our body also needs fuel to function. The animal or human body needs water, food, and oxygen. You learned about food digestion in the learning experience 'Factory of Digestion' in class seven. We need oxygen to make energy from the food we digest. Oxygen oxidizes the food to produce heat energy, which keeps our body moving. This system is called the Respiratory System.
- ✎ If you pay attention, you'll see that we don't get energy only by eating food. As you all know besides food, we need oxygen to survive which we take in through breath. Let us now learn in which part of our body this breathing process is completed.
- ✎ Before we continue, let's begin by taking some deep breaths. Breathe in slowly through your nose. Hold it for a few seconds, and then exhale slowly through your mouth. Repeat this for two to three minutes.
- ✎ Now, let's all in the class do a fun activity. Each of you should take a balloon. The teacher will help you to get the balloons.
- ✎ Let's see how big you can inflate the balloon with just one puff of air (exhalation) with a full chest breath.
- ✎ After you've inflated the balloon, hold it in your hand and tie the knot carefully without letting the air out. Now, see whose balloon is bigger based

Science

on the estimation of the eye! As you can observe, not everyone's lungs can hold the same amount of air. Some have more capacity to hold their breath, while others have less. Share your thoughts with the class about why you think some have more capacity, while others have less.

-  Now do we all have the same breathing pace? Let's do another little experiment to count how many breaths each of you take each minute.
-  At the beginning, sit in your seats very slowly and steadily. All of you, including the teacher, must keep count of how many times you inhale and exhale in a minute. One or two students from the class as volunteers can take charge of keeping time by using the clock. When the volunteer says 'start', count how many times you breathe in and out. When the volunteer says 'Done' after one minute, write it in the table below

Normal breathing rate _____ times per minute

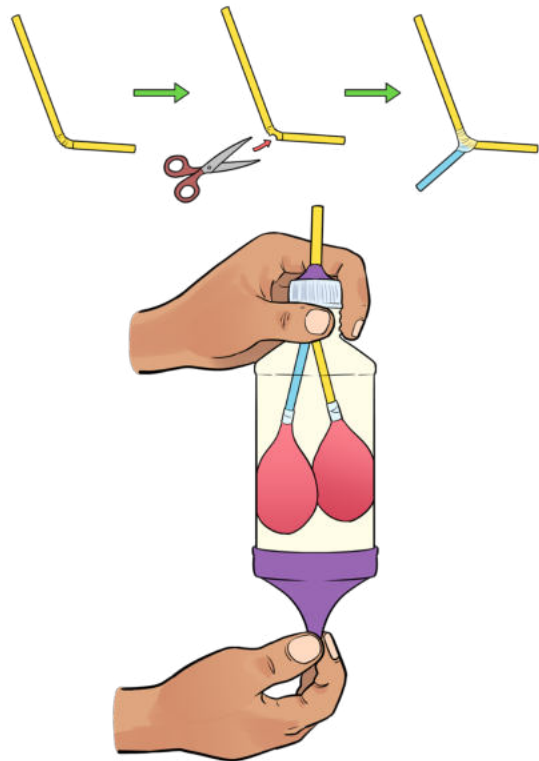
-  Ask the teacher how many times s/he took breath. Compare with the rest of the class. (If you want, you can some time to watch the breathing rate of the volunteers. In that case, someone of you have to keep the count of the time by using the clock). Surely, the number of breaths taken by everyone is not exactly the same.
-  You all know that when we inhale, we take in oxygen with air and when we exhale, we release carbon dioxide. But it's not as simple as that, because air isn't made up of just oxygen. Air includes various gases, along with things like dust particles and germs. The organs in the Respiratory System work to separate oxygen by filtering out dust particles, germs, and other gases from air. Now, let's learn which organs make up the human Respiratory System.
-  If you know how the respiratory system is formed, it will be easier to understand its function. So first take a good look at the figure of the 'Human Respiratory System' from the Investigative Study book. Now discuss in pairs and understand where these organs are located, what are their functions by reading the book.
-  Carefully observe the organs in your body that can be seen from the outside or felt, if necessary, touch and feel them.
-  Now, let's make a model of how the Respiratory System functions. Divide into groups of 5/6 as the teacher instructs. All in the group discuss how the model of the respiratory system can be made.

- ✎ Here is a sample model to understand how the respiratory system functions. If you want, you can make the model in another way. For the model given here, your group will need four balloons, a plastic water bottle, drinking pipe/straw, scotch tape, scissors. Collect these materials before coming to the next session.



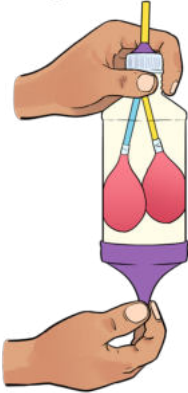
Sessions Four and Five

- ✎ Let's make a model of the main organs of the respiratory system in order to better understand the entire respiratory system.
- ✎ Cut one end of a soft drink tube or drinking straw with scissors and insert the ends of the other two straws into it in such a way that forms a shape like the English letter Y.
- ✎ Now, take a scotch tape and wrap it around the point where the three straws meet. Make sure to wrap it tightly so that no air can come out through the hole at the junction.
- ✎ Now, attach two balloons to the open ends of the Y-shaped straws and seal them with tape to prevent air from coming out. By blowing air through the open end, make sure that the balloon is inflating and that no air is coming out through the connections.
- ✎ Cut off the bottom part of a plastic water bottle.
- ✎ Make a hole in the mouth of the bottle so that you can insert the open end of the Y-shaped tube through it. Turn the tube along with the balloon upside down and insert it through the bottom of the bottle's mouth so that there is some excess over the bottle's mouth. Now seal the hole in the mouth of the bottle well and attach the mouth to the bottle. If needed, you can use tape around it to stop the air from getting out.



Science

- ✎ Take another balloon and cut off the thick end of it. Now, attach this balloon to the bottom of the bottle as shown in the picture. Wrap the scotch tape tightly so that the balloon is stuck to the bottom of the bottle.
- ✎ Well, now your model of the Respiratory System is ready!
- ✎ Pull down the balloon connected to the bottom of the bottle as shown in the picture. You will see that the two balloons inside the bottle inflate from their uninflated condition.
- ✎ In this case, which part of the model can be compared to which organ of the respiratory system. Read the "Air Intake and Discharge Zone" section in the Investigative Study book and try to find out the relationship with the model. Discuss it in groups and write your answer below.

Different parts of the model		Comparable parts of the respiratory system
1. Y-shaped middle tube or straw coming out from the mouth of the bottle		
2. Tube or straw attached to the balloon and spread in both sides		
3. Two balloons tied with straws		
4. Bottle		

- ✎ You need regular exercise, physical activities, and sports to keep this important system healthy. Additionally, practicing yoga positions (Yogasana) and breathing exercises (Pranayama) regularly can be helpful. Here are some instructions for Pranayama that you can try at home by yourself. Let's all do it together as a class, following the teacher's guidance.
- ✎ Sit in a normal position and breathe in through your nose. Pause for a moment, and then exhale slowly through your mouth. Try to make your exhaling period last as long as your inhaling period. Repeat this process 5 to 10 times.

- ✎ You can also do this exercise by lifting your arms as you breathe in, and then bringing your arms down as you breathe out.
- ✎ Now, using the thumb of your right hand, close your right nostril and inhale through your left nostril. Hold on your breath for a while and close your left nostril with your ring finger. Now, remove the thumb and exhale slowly through the right nostril. Repeat this process 5 to 7 times.
- ✎ Then do the reverse activities using the left hand in the same way.
- ✎ After practicing these pranayama exercises, don't you feel more energized and lively compared to how you felt before?

Step-3






Session Six

- ✎ Some raw materials are needed to produce something in a machine. During or at the end of production some waste or by-products are also created. Now, think for a while and say where the food and water we eat every day go. What is produced as waste after our body gets nutrients from this food and drink? What is produced as liquid waste? In which part of the body is this waste produced?
- ✎ You might say that our body's liquid waste is discharged in the form of sweat and urine. You have already learned how the Integumentary System produces sweat. But can you say in which part of the body is urine produced? What is the name of this process?
- ✎ Many of you may already know that urine is produced in the excretory process. The main organ of this excretory system is the kidney. Now let us see how this process of excretion takes place.
- ✎ You can compare the excretory process to filtration. But in this case the process is reversed. When we take tea by straining it, the tea leaves at the bottom accumulate in the strainer which we dispose later, and the liquid tea comes out through the strainer. In excretory process, the process of separating this waste happens in a reverse way. It means that the excretory system absorbs nutrients or necessary substances for the body and removes liquid waste from the body.
- ✎ Study the structure and function of kidney well from the Investigative Study book. After reading, discuss it in groups as usual.



Session Seven

-  In this session, let's study the structure and function of the excretory system closely. In the previous session, you have known a bit about the structure and function of kidney. Today, read carefully again the description of the main organs of the excretory system, the structure of the kidney and the stages of blood purification and discuss them in groups.
-  You can draw the structure of the excretory system and kidney separately in the exercise book for a better understanding of the whole process. If you face any problem to understand, take the help of the teacher.
-  Now your task is to explain the whole thing to the other members of the group. By lottery select one person from your group who will go to the next group and explain the entire process of the excretory system. Similarly, a member from another group selected by lottery will come and explain the same to the rest of your group. While explaining it, if anyone in your group has any question, you can discuss it with him/her. This will give everyone a clear idea. There are two points to note while explaining this. Write down the answers to the following questions in advance to facilitate the discussion.

- How do different organs of the excretory system work together? What is the individual role of each of these in the excretion process?

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- How do the different organs of the excretory system work to keep the body healthy and stable and to keep the normal metabolism going?

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Step-4



Sessions Eight and Nine

-  If you think of a bicycle, its wheel is turned by pulling a chain. Pulling the chain requires pedals where you apply force with your feet. Only then the bicycle moves. Again, you have to press the brake to stop again. And you control which way you go by holding the handle. That means, you can ride your bicycle in an orderly manner when each part of it works separately. Similarly, the various systems of the human body keep our whole body system functioning through performing certain functions.

-  Do you remember what the system is? Discuss it in class and revise it.

-  Now discuss the systems of the human body in pairs. Discuss with a friend the names of different systems and their functions from the pictures on the next page. Write the functions of these systems in one sentence in Table 1.

Science

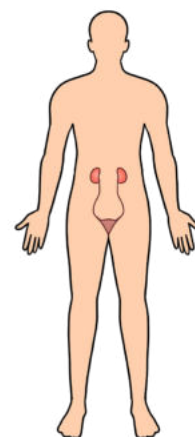
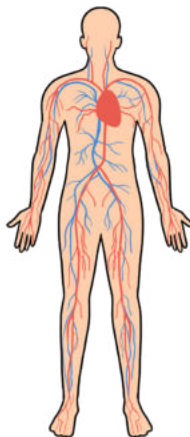
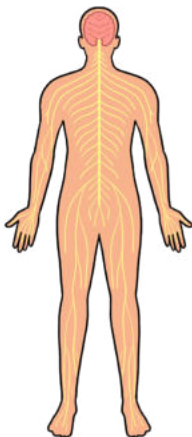
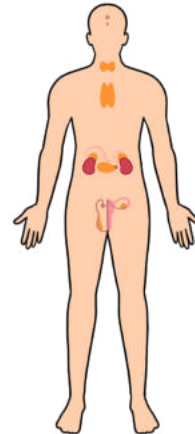
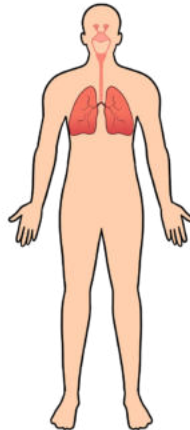
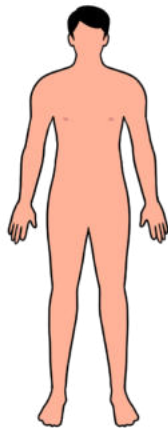
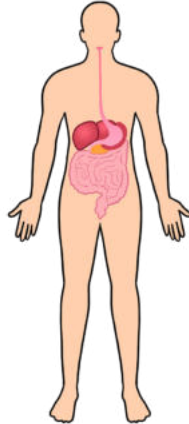
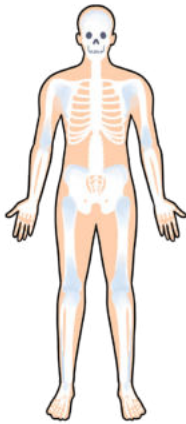




Table 1

Name of the System	Main function (in one sentence)
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2.	

 Now think of the matter. When you go to the doctor if you are sick, what kind of test does the doctor give? Often it is a blood test, or a urine test, isn't it? Have you ever wondered how to detect if there is a problem in different parts of the body through a urine or blood test? You have already learnt how the excretory system works. You will also learn about the circulatory system in the upper class. But does the function of these systems have any relationship with the function of other systems of the body?

 For this session, you can invite a professional doctor to your class to learn more about this, preferably if you have a parent who is a doctor. Learn the followings by asking him/her :

- What common diseases can be detected through urine tests?

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- Disruptions in which systems of the body cause these diseases?

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- ✎ Now sitting in a group, draw a picture of the human body and identify the different systems. According to the information obtained from the doctor, show in the picture the functions of which system are related to the functions of the excretory system and explain it to the rest of the class.
- ✎ You can understand that to keep the body healthy, all its systems have to work as a big system, and all these systems affect each other's work. So, it is important to take care of the whole body to stay healthy.
- ✎ What are the best practices to keep healthy the systems that you have learned so far? You can make a list by discussing it in groups.
- ✎ Now show your group's list to the other groups. See if anything important comes up on their list. You can make a list of best practices from everyone's list and hang it in your classroom so that you don't forget to take care of yourselves!

Retrospection

 What did you learn in this learning experience that you want to share with your family members?

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 Which system of the human body do you think is the most important? Why?

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✍️ What changes in personal habits would you like to make after working this experience?

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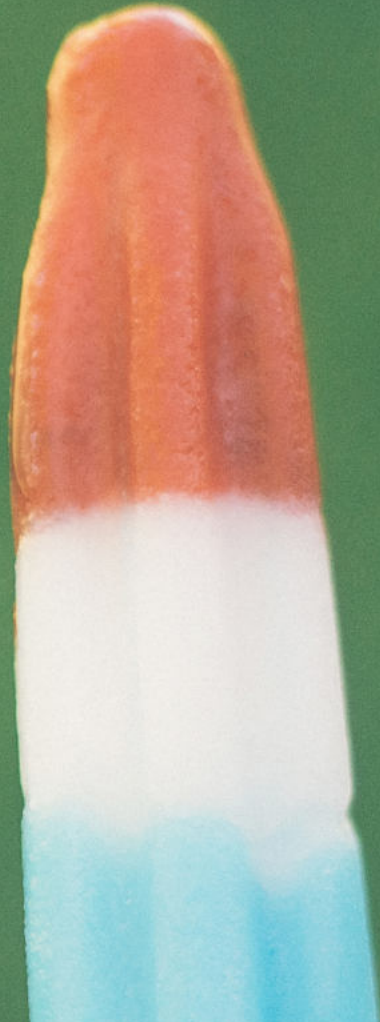
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Food Adulteration!

Food Adulteration is a social problem that all of us have faced in our daily lives. This problem is quite harmful to public health. Some unscrupulous people are adulterating the daily necessities including food for more profit. Through this, people are being affected by various complex diseases, and are even exposed to the risk of death. The presence of adulterants in essential food items has become a cause of danger for the general people. In the market, we can observe the presence of harmful chemical substances in various types of food, including vegetables, milk, fruits, and fish-meat. Adulterated food can cause of various diseases. This time our inquiry is about this important issue.



Before the session starts

- ✎ You have already known that food adulteration has now become a national problem. You may have heard about it in the newspapers, on television, or even in your own lives you have fallen victim of food adulteration.
- ✎ At the very beginning of the session, your task is to collect information about food adulteration from newspapers, television news, the internet, the elders at your home, or local food traders, and grocery owners in your area. Then fill in the table below. If you want to collect information about more than one food, you can copy the table below in your note book and do the work. Even you can add new questions, if you want.

Table 1

Do you know about food adulteration?	Yes	No				
Type of food	Vegetables	Fish-Meat	Milk	Processed	Others	
What type of food contamination?	Chemicals	Germs	Micro Plastics	Textile Dyes	Impurity	Others
Where does food adulteration occur?	Home	Restaurant	Market	Factory	Others	
Cause of adulteration?	Textile Dyes	Pesticides	Antibiotics	Cont. water	Formalin	Others

Health effects of consuming adulterated food	Cancer	Skin disease	Lung problems	Long-term health risks	Food poisoning	Others
Have you or someone in your family become ill by consuming adulterated food?	Yes	No				
What can be done to eliminate food adulteration?	Quality control of food	Government regulations and laws	Mass awareness	Proper food production and storage	Others	

You can write down the 'others' box by yourselves. More than one answer may be ticked. If you want more than one may be ticked.



Session One





-  Share your collected information with your classmate beside you in class.
-  Now it's time to analyze the data collected by everyone in the class. Each student has collected information about each type of food adulteration from different sources. Each one of you has collected information on food adulteration from one source for each type of food. So, in order to understand the overall picture, you can make a small statistics. For this, you have to write down all the information of your class in a specific data table/datasheet (তথ্যসারণি). Before that, find out how many informants there are.
-  You can use the following data table/datasheet (তথ্যসারণি) or you can make a similar one on your notebook.

Table 2

Question	Statistics			
Total informants	-----Person(s)			
Do you know about food adulteration?	Option	Tally	Frequency	Percentage
	Yes			
	No			
Type of food	Vegetables			
	Fish-Meat			
	Milk			
	Processed			
What type of food contamination?	Chemicals			
	Germs			
	Micro Plastics			
	Textile Dyes			
	Impurity			
Where does food adulteration occur?	Home			
	Restaurant			
	Market			
	Factory			

Cause of adulteration?	Textile Dyes			
	Pesticides			
	Antibiotics			
	Contaminated water			
	Formalin			
Health effects of consuming adulterated food	Cancer			
	Skin disease			
	Lung problems			
	Long- term health risks			
	Food poisoning			
Have you or someone in your family become ill by consuming adulterated food?	Yes			
	No			
What can be done to eliminate food adulteration?	Quality control of food			
	Government regulations and laws			
	Mass awareness			
	Proper food production and storage			

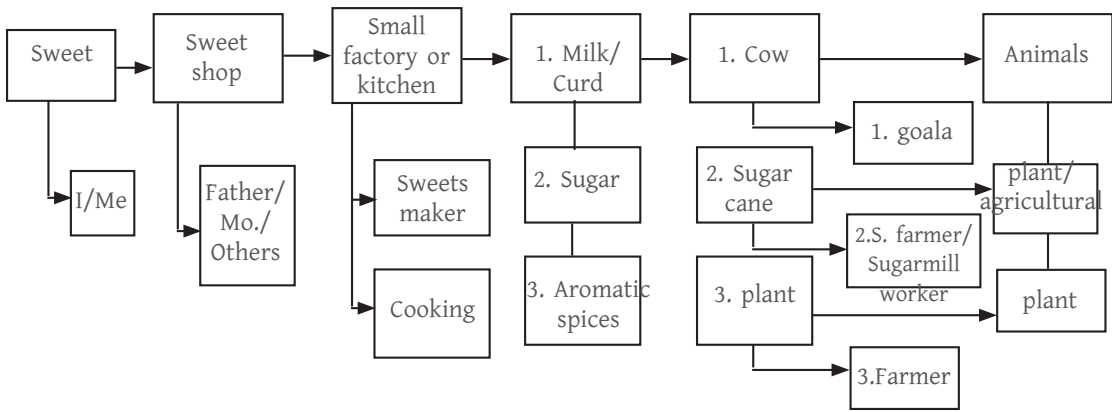
Based on the data collected by everyone in the class, you get an overall statistic on food adulteration.

 Now divide into a group of 4/5 students and discuss this statistics.

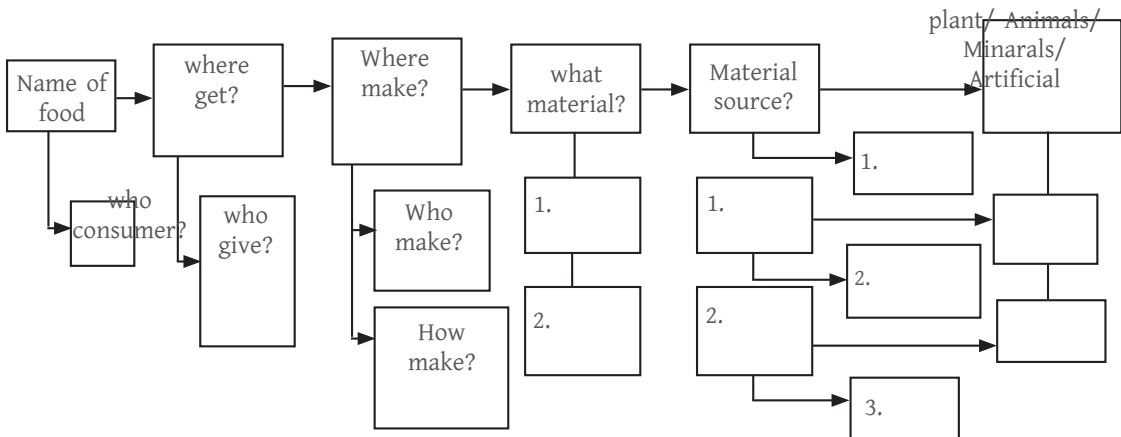
 Home work

The food that you eat may not come directly to you. Just as you have to rely on many people for it, you also depend on other living beings. Let's now search for the source of any food item.

Observe the diagram below. It shows from where and how the ingredients for making sweets/rosogolla came to you.



Based on your collected information, can you now show how your selected food was made and where the ingredients came from? Write down in the blank space of the diagram below.



Now fill in the box/boxes with red- ink pen or coloured pencil to identify the stages at which food is adulterated or who is/are involved in food adulteration.



Session Two





- ✎ Have you noticed one thing from the activity and the homework of the previous session? One of the major aspects of food adulteration is chemical substances? So do you think that the use of chemistry in our life is negative? That is not at all. With the development of science, some dishonest people have developed pseudo-science. There is immense role of chemistry in our life. Let's learn something about that in this session.
- ✎ Thoroughly read the section on Household Chemistry from the chapter 'Uses of Chemistry in Daily Life' from the Investigative Study book. After reading, share with your classmates. Ask teacher's help if necessary.
- ✎ You have already known the use of table salt, baking powder, and vinegar. Let's conduct an experiment on the use of salt and vinegar in food preservation.
- ✎ Take four glass bottles or plastic bottles and put 1 or 2 green chilies or small vegetables/fruits in each bottle. Fill the first bottle with water, the second bottle with salted water, and the third bottle with vinegar. Keep the fourth bottle empty and preserve it for a few days.
- ✎ Your task will be to observe the vegetable or fruit inside the bottle for the next week.
- ✎ In addition to the above mentioned ones, many other chemicals are also used to preserve food. Marmalade is made by soaking fruit or vegetable pieces in sugar syrup for a long time and squeezing out the syrup. While making Marmalade, the watery part of the fruit can be reduced by increasing the amount of sugar and keeping it almost dry. Marmalade retains the shape of fruits or vegetables. Marmalade is made from fruits and vegetables like mango, bell, pumpkin, pineapple, etc.
- ✎ Make a list of which chemical substances are used for what purposes in the household. You can take help from the Investigative Study, and you can also discuss with your classmates next to you.


Table 3



Name of the chemical used in household	The purpose in which the chemical is used



Session Three

-  One of the chemicals used in the household is soap. You prepare your own soap in 'Our laboratory' experience. Now let's find out how soap cleans dirt?
-  Read the Cleaning mechanism section of Soaps and Detergents from the Investigative study book to learn how soaps remove dirt. Also read the Chemistry of Cleaning section to find out what other chemicals are used as cleaning materials.
-  After reading, share with your classmates. Ask teacher's help if necessary.
-  Complete the table below on the basis of reading the Cleaning mechanism of Soaps and Detergents section. Discuss in the same group that you formed earlier in this experience and complete the table.

Question	Student`s answer
 what is chemical name of soap?	

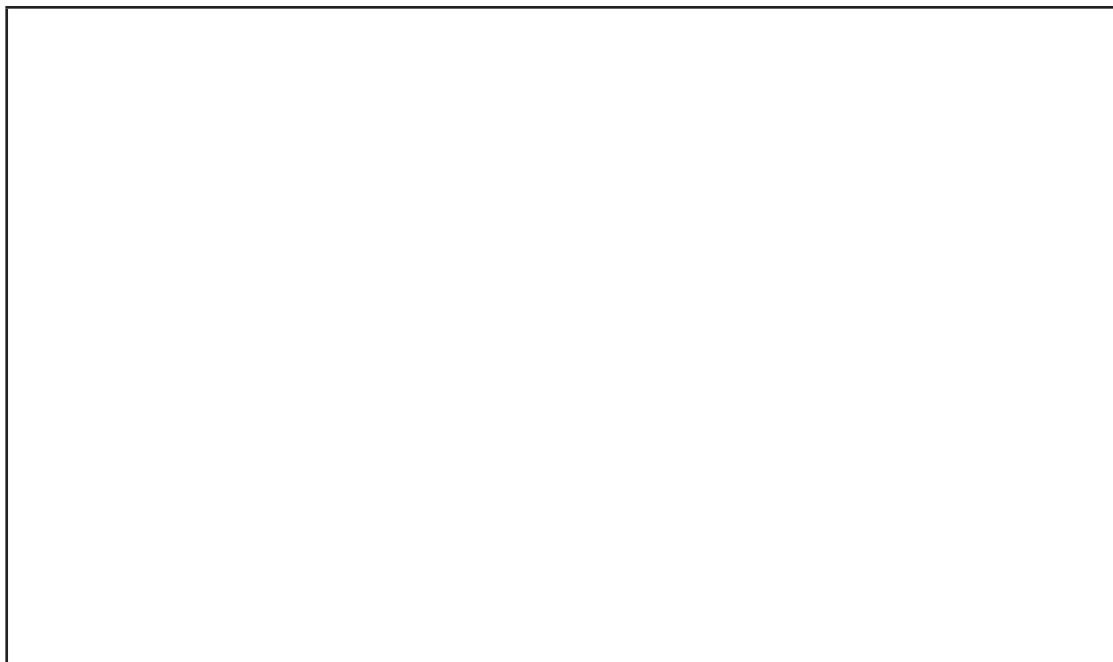
Question	Student`s answer
<p> According to your opinion what are the names of the two parts of soap?</p>	
<p> What are the components and properties of the two parts of soap?</p>	<p>١ </p> <p>٢ </p>
<p>How does soap have two parts when removing dirt from clothes? Draw a picture.</p>	

Question	Student`s answer
Which part of soap plays a greater role in removing dirt from clothes? Why?	



Session Four


- ✎ Apart from the household use, there is no field where chemistry is not used, including agriculture, industry, and the textile sector. Let's learn how chemistry is used in various fields.
- ✎ Read carefully the section on 'Chemistry in Agriculture and Industry' from the Investigative Study book. After reading, share with your classmates. Ask teacher's help if necessary.
- ✎ Now, think about one thing very deeply. Isn't industrial waste being released somewhere while chemistry is used in various fields? As a result, isn't the environment being polluted?
- ✎ Then, after reading the section 'Industrial Waste and Environmental Pollution' from the Investigative Study book, discuss with your classmate next to you how the environment is being polluted. Ask teacher's help if necessary.
- ✎ You have surely known that due to micro plastic pollution, even the DNA of our body can be harmed. Can you write about how microplastics can enter our bodies from polluted plastic wastes? You can also draw pictures in the empty space next page.




- ✎ From food adulteration to environmental pollution, mass awareness is required to prevent these things. Chemistry is intricately linked to our lives, but its misuse brings risks to our lives. If you become aware yourself first, and then make the neighbors aware, it will be the most significant work.
- ✎ You will do this work in the next session. However, you can finish the planning in this session. Divide the class into groups of 6-8 students.
- ✎ The survey you conducted on food adulteration will be very useful now. You can use the survey statistics to write a report, create a poster, or create various types of charts or graphs. Discuss and decide among yourselves which group will do what.
- ✎ Also, decide materials you will need to complete the task, and how it will be presented or displayed.




Session Five


-  Now, it's time to start working. Since you have planned in advance, don't waste time, rather get to work. The task is entirely in your hands. You can work on raising awareness in any way you want- through reports, posters, banners, comics, etc. For your work, make sure to keep these issues in mind: In the context of awareness -

 - Awareness while buying food.
 - Awareness during food preservation.
 - Awareness while preparing food.
 - Awareness while consuming food.


-  In the context of industrial waste, environmental pollution, and pesticides -

 - Negative effects and solutions of these in the ecosystem

-  Make sure that these contents are there. You can also add more points if you want.

-  At the end of the work, discuss together how the work of all groups will be presented or displayed. If you want, you can attach it somewhere where the crowd is more.

Retrospection

 What are the most dangerous/adulterated foods in your area? What kind of contamination occurs in these foods?

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 What kind of awareness do you want to create in your family to avoid the dangerous/adulterated food?

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Science

 What can you do in your community to raise awareness for safe food?

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ডিজিটাল তথ্য সেবা: টেলিমেডিসিন ও কৃষি কল সেন্টার

মাননীয় প্রধানমন্ত্রী শেখ হাসিনা ২০২১ সালের মধ্যে বাংলাদেশকে 'ডিজিটাল বাংলাদেশ' এ রূপান্তরিত করার ঘোষণা দিয়েছিলেন ২০০৮ সালে। ২০২১ সালের আগেই বাংলাদেশকে ডিজিটাল বাংলাদেশে রূপান্তর করা হয়েছে। বর্তমানে ডিজিটাল পদ্ধতিতে প্রায় সকল সেবাই জনগণের দোরগোড়ায় পৌঁছে দিচ্ছে সরকার।

ডিজিটাল স্বাস্থ্যসেবা- টেলিমেডিসিনের মাধ্যমে বিনামূল্যে ও সহজে স্বাস্থ্যবিষয়ক পরামর্শ প্রদান করা হচ্ছে। দেশের বিভিন্ন পর্যায়ের ১৮টি হাসপাতালে বর্তমানে উন্নতমানের টেলিমেডিসিন সেবা চালু আছে। টেলিমেডিসিন পদ্ধতিতে রোগীগণ বিশেষায়িত হাসপাতালের চিকিৎসকদের পরামর্শ নিতে পারছেন। মোবাইলের মাধ্যমেও রোগীগণ বিশেষায়িত চিকিৎসকের সেবা গ্রহণ করতে পারছেন। করোনা মহামারির সময়ে এই সেবা গুরুত্বপূর্ণ ভূমিকা রাখছে।

ডিজিটাল কৃষি সেবা- কৃষি সম্পর্কিত সর্বাধুনিক প্রযুক্তি, সেবা ও তথ্য সবার মাঝে ছড়িয়ে দেওয়ার লক্ষ্যে কৃষি কল সেন্টার চালু করা হয়েছে। কৃষি কল সেন্টারটি খামারবাড়ি, ঢাকাতে কৃষি তথ্য সার্ভিসের সদর দপ্তরে স্থাপিত। কৃষি কল সেন্টারের ১৬১২৩ নম্বরে ফোন করে কৃষি বিষয়ক যে কোনো সমস্যার তাৎক্ষণিক বিশেষজ্ঞ পরামর্শ নিতে পারেন দেশের জনগণ।

Academic Year 2024

Class Eight Science | Exercise Book

সমৃদ্ধ বাংলাদেশ গড়ে তোলার জন্য যোগ্যতা অর্জন করো
– মাননীয় প্রধানমন্ত্রী শেখ হাসিনা

মিতব্যয়ী হওয়া ভালো

তথ্য, সেবা ও সামাজিক সমস্যা প্রতিকারের জন্য '৩৩৩' কলসেন্টারে ফোন করুন

নারী ও শিশু নির্যাতনের ঘটনা ঘটলে প্রতিকার ও প্রতিরোধের জন্য ন্যাশনাল হেল্পলাইন সেন্টার
১০৯ নম্বর-এ (টোল ফ্রি, ২৪ ঘণ্টা সার্ভিস) ফোন করুন



Ministry of Education

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