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The current 10th grade science textbook in your hands is developed in accordance with the National and State Curriculum Framework and the Law on the Right to Education. This book helps the student to review the different concepts that have been learned through the learning experiences provided in the school and to gain comprehensive knowledge about these concecepts. Lessons in textbooks are presented in such a way as to help prepare the student for competitive exams and also to prepare him for intermediate education. The new science textbooks are specially designed with appropriate pedagogy, in line with the Continuous Comprehensive Assessment (ECA), which we are now implementing in school education. These manuals help the teacher evaluate students who learn during teaching processes. They facilitate the effective learning of different concepts of science in the scientific method, in addition to gaining knowledge about concepts. It is essential to complete the syllabus during the stipulated time that students must write the on-board exam in class-10. But remember that completing the curriculum means getting students to understand concepts and try to achieve learning skills. It is mandatory on the part of the teacher to implement teaching strategies, such as, by causing the student to read the contents of the manual, discussions, analyses, laboratory activities, excursions, preparation of reports, etc. The teacher must take special care to avoid the practice of memorizing scientific information from guides and question banks. Classroom teaching of science must be such as to encourage children to think and work scientifically. It must also increase love for nature. Even it should allow you to understand and appreciate the laws that govern nature in building so much diversity all around. Scientific learning isn't just about revealing new things. It is also necessary to take a step forward without interrupting interrelationship and interdependence, together with understanding the intrinsic principles of nature. High school children possess the cognitive ability to understand and the characteristics of the transformative world around them. And they are able to abstract concepts. At this level, we cannot extinguish their ability to think sharply with the drying of simple equations and theoretical principles. To do this, we should create a classroom learning environment that gives them the opportunity to apply scientific knowledge, explore more alternatives in problem solving and establish new relationships. Scientific learning is not limited to the four walls of the class. It has a clear connection to the lab and the field as well. Therefore, there is a lot of importance for field experience/experiments in teaching science. 5. vFreedistributionbyA.P.Government There is a great need for mandatory implementation of the instructions in the National Curriculum- 2005, which emphasizes the connection of science teaching with the local environment. The Law on the Right to Education 2009 also suggested that priority should be given to the achievement of learning skills among children. Teaching science should also be such as to help cultivate a new generation with scientific thinking. The key aspect of teaching science is to make children understand the thought process of scientists and their efforts behind each discovery. The framework of the state curriculum- 2011 stated thatchildren should be able to express their own ideas and opinions on different issues. These scientific books are prepared to meet the established standards of the SFC and thus help children become self-contained researchers capable of thinking intensely from a scientific point of view. The new textbooks are designed to achieve the desired academic standards. So teachers should develop different teaching learning strategies to make their students achieve class-specific academic standards. We should avoid learning methods for the successful implementation of the Continuous Comprehensive Assessment (ECA). It is very shared to know more about different methods of assessing students' progress through summative and formative evaluation. The new manuals reflect the continuous comprehensive evaluation and teaching method of the concepts discussed. This is very useful to teachers and students. In the new textbooks, the design of concepts and activities helps to achieve specified academic standards. Teachers need to plan appropriate teaching strategies to improve academic standards among students by the end of lesson teaching. For the effective implementation of the continuous comprehensive assessment, teaching must move away from the methods of memorizing concepts. Teachers need to have a good understanding of assessment methods to help them assess children's progress in a constructive and comprehensive way. The new manuals are not limited to simply providing the necessary information about concepts. instead, they focus on new teaching strategies and evaluation techniques, which are very important for both teachers and students. Thanks to VidyaBhavan, Rajasthan Rajasthan their cooperation in the design of these new text books, writers for preparing lessons, editors for checking textual problems and the DTP group for the composition of the manual. We invite suggestions from teachers, teachers, parents, students and others to make this book more meaningful. Teachers play a key role in children's comprehensive use of the text book. Hopefully, teachers will make every effort to use the text book correctly, so as to inculence scientific thinking among children and inspire them to be great scientists. Director, SCERT, AP, Hyderabad 6. vi Dear teachers... NewScienceTextBooksarepreprepreinuhawaycaedesives of observation of children andresearcheatiasm. Official documents of national and state worksCurriculumframe and the right to set fire to The Ladreasingtorrengrossroutechangesinscienceteaching. These manuals shall be adopted in accordance with such aspiration. Therefore, science teachers must adapt to the new approach in their teaching. In view of this, let's observe certain Dos and Don'ts: • Thereisanimmediateneedtodcardthepractice5pedoptedintheschoolssonasonafalsebelief that teaching the 10th grade means preparing children for public exam. In the 10th grade, the learning process should focus on achieving quality standards. • Avoid practices such as using guides and question banks, asking children to read only important questions,focusingonlessonswhichhelpinscoringmoremarks. • Readthelessonthroughforeyoustartingandaskkidstoreadthetext. Theinititititiadiscussiontokethechildrenundertheconceptsinthelessons. • Encouraging children to focus their views and now writing answers. Give weightagetosuchtypeofwritinginexamination. • Someinstructionsaregitinthebooktextgardingthecollectionofcertaininformation bytheteacher. Collectsuchinformation andmakeitaenabletostudents. • In the public examination, the weighting will be given to all aspects of the programme. Except for the foreword of the manual anything else must be treated as part of the curriculum. • Textual concepts are presented in two ways: one as classroom teaching and the other as laboratory performance. • Labactivitiesapartandparcelofesson.So,teachersmustmakethechildrenconduct allsuchactivities during thelessonitself,butnotseparatedly. • Teachersareadvisedtofollowfollowingstretchingstepswhiletransitionlessons-mind mapping, reading lesson and identifying new words by children, performing activities, demonstrations anddiscussion, completion and evaluation. • Inthetext,somespecialactivitiesrepresentedboxitems:'thinkanddiscuss,letusdo,conductinterview,preparereport,displayinwallmagazine,participateinTheatreDay,do fieldobservation,organizespecialdays'. To make everything that was compromises. • The abbreviation (A.S.) given at the end of each question in the learning indicates academic standard. • • useinternetservicesforlearningscienceontheirow. • Planandexecuteactivitieslikescienceclub,elocution,drawing,writingpoetryonscience, making models etc.to develop a positive attitude among children regarding the environment, biodiversity,ecologicalbalanceetc. 7. liveFree distributions by A.P.Government • As part of the continuous comprehensive assessment, observe and record children's learning skills during various activitiesin the classroom,laboratory and field. We believe that you have to do this, do it from here and think scientifically, not just a hole in lessons, but, in fact, a valuable exercise in motivating children to systematically explore and properly prepare the basics of life. Dear students... Learning science is not about writing to the subject. Skills would be logical thinking and systematic work, learned through it, must be practiced in the same way. Toachievethis,instead of the scientificbyrote,onemustbeableto studythemanalytically. That means, inthe northto understandthe concepts of science, you need to cancel the speech, description, conducting the experiment, making observations, confirming with your ideas and the conclusions of the wings. This book helps you do that. What you need to do to achieve such things: • In the 10th grade the range of concepts is wide. So go through each lesson well before detheactualalswithinhit. • Write down the points you've encountered so you can better understand the lesson. • Think about the principles in the lesson. Identify the concepts you need to know further to understand the lesson in depth. • Donothesitytodiscussalyaboutthequestionsgivenunderthesub-heading ThinkingandDiscussions'withfriendss. • You can get two more whileleadingexperimentordiscussingaboutalesson. Express them freely and clearly. • Plan to implement the experiment/lab period, together with the teachers, to understand the concepts clearly. While learning through experiments you might get to know more things. • Observahoweachlessonsshelpfultopreservenature.Putwhatyoulearningtopractice. • Analyze how it was linked to the link to life anddiscuss the things you learned in your science class with farmers, artisansetc. • Work as a group during interviews and excursions. Preparing reports and displaying them is a must. Discuss the prepared report. • Listouttheobservationsregardingeachlessontobecarried through the internet, school library andlaboratory. • Fieinnotebookorexams,writealitically,expressionyourownopinions. • Read books related to the text book as many as possible. • DisorganizedylftheScienceClubprogramsinyourschool. • Observe the problemsfadedbythepeopleinyoyoungwhatwhatsolutionsyou cansugestthroughourscienceroom. 8. VIII ACADEMIC STANDARDS S.No. Explanation of academic standard 1. 2. 3. 4. 5. 6. 7. by asking questions and making hypotheses Experimentation and investigation in the field. Competences for information and communication of project projects drawing, model making appreciation and aesthetic sense, applying values to everyday life, concern for biodiversity. Children are able to explain, cite examples, give reasons and give comparisons and differences, explain the process of concepts given in the manual. Children are able to develop their own brain mappings. Children are able to ask questions to understand, clarify concepts and participate in discussions. They are able to make assumptions about certain issues. To understand the concepts given in the manual, children are able to do experiments on their own. They may participate in and report on field investigations. Children can systematically collect information (through interviews, the internet, etc.) and analysis. They are able to carry out their own project work. Children are able to explain their conceptual understanding by drawing figures and making patterns. The ability to plot graphs using data or data collected information. Children are able to appreciate the power of man and nature, and have aesthetic sense towards nature. They are also able to follow constitutional values. Children are able to use the scientific concept to cope with their daily life situations. They are able to express their concern about bio diversity. (9) If, in the case of ixFreedistributionbyA.P.Government 22222 33333 44444 55555 66666 77777 88888 9 9999 10101010Nutrition - Breathing Power System - Transport Energy Release System - Excretion of circulatory system - Waste disposal system Coordination - Reproductive binding system - System Generation Coordination in Life Processes Our Environment - Our Concern Natural Resources Heredity - From Parent to Descent10 June 10 June/July 24 July 10 July 10 August

10 10 September 10 September 94 1 5 October 116 10 November 144 15 December 166 10 January 193 10 February 212 Page No.Periods Month INDEX 11111 10. x NATIONALANTHEM OUR - RabindranathTagore Jana gana mana adhinayaka Jaya el Bharatha bhagya vidhata! Punjab Sindh Gujaratha Maratha, Dravida Utkala Banga! Vindhya Himachala Jamuna Ganga, Uchchala Jaladhi taranga! Tray shubha name jage! Tray shubha asisha mage! Gahe tray jaya gattha! Jana gana mangala dayaka jaya el! Bharatha bhagya vidhatha! Jaya him! jaya him! jaya him! Jaya jaya jaya jaya he! GAJ India is my country; All Indians are my brothers and sisters. I love my country and am proud of its rich and varied heritage. I'll always strive to be worthy of it. I will give my parents, teachers and all the elders respect, and I will treat everyone with politeness. I'll be good with animals. For my country and my people, I swear my devotion. Only in their well-being and prosperity is my happiness. 11. FreedistributionbyA.P.Government 1 Nutrition - Food Supply System Food is by all living organisms, mainly for growth and repair. Several organisms need food to maintain body temperature as well. A wide variety of substances are taken as food from single-celled organisms, such as amiba to complex complex organisms like the human body. Even with in the human body cells require a wide variety of substances as food. The way food is acquired also varies from cell to cell and body to body. You have studied in previous classes about how different organisms get their food. Let's remember some of them. • Get their food heterotrops? • Do autotrophies receive their food? Let us study about autotrophic and heterotrophic ways of nutrition and find out why most plants are called as autotrophs. Autotrophic nutrition We know that autotrophies are organisms capable of using light energy to synthesize chemical compounds. They acquire nutrients such as some minerals and water from the soil, as well as some gases from the air. They are capable of producing complex compounds such as carbohydrates, proteins, lipids, etc. from these very simple substances. These compounds produced by them are used for the supply of energy to most of the living organisms and all animals, including human beings. Most of the things we eat are made from plants. Even if we depend on products of animal origin, we find that these animals depend on Chapter 12. Nutrition - Food Supply System2 Class X fig-1: Fotosynthesis oxygen sunlight plants carbon dioxide water for their food. But what plants do they use to perform their life processes? Scientists have worked for centuries to find out plants perform these life processes. We know that, of all the processes of life, the process of photosynthesis makes plants the universal food supplier for all living organisms. You've studied something about photosynthesis in previous classes. Von Helmont and other scientists believed that plants obtain their food material not only from the soil, but also from other sources. • Can you think of some of the raw materials needed for photosynthesis? • What could be the final products of the photosynthesis process? Let's study the photosynthesis process in detail to learn more about this. Photosynthesis Photosynthesis is the process by which plants containing chlorophyll green pigment build complex organic molecules from relatively simple inorganic ones, using sunlight as an energy source. The process of photosynthesis is very complex. There are several stages in it and several intermediate compounds are formed. Scientists have been trying to formulate a simple equation for photosynthesis over the past 200 years. An equation that has been readily accepted and is still widely used is that formulated and proposed by C.B. Van Neil in 1931, which is following. His opinion was, for each molecule of carbohydrates formed, a water molecule and an oxygen molecule are produced. This is a very simplified equation and does not reflect the complexity of the photosynthesis process, but we will use it for now. CO2 + 2H2 0 CH2 O + H2 0 + O2 would be the reaction to show that glucose (C6 H12 O6) is synthesized? Write a balanced equation to show this. (See chemicals reactions, carbon and its compounds chapters). Light chlorophyll 13. FreedistributionbyA.P.Government 3 You know? Van Neil first worked on purple sulfurous bacteria and discovered that light plays a specific role in photosynthesis. Instead of H2 O they used H2 S as starter material. There is no release of oxygen during photosynthesis, elemental sulfur is evolved. Later, he imagined a similar process of photosynthesis in plants and proposed the aforementioned equation. Later Robert Hill showed O2 is released from the water. Then the equation was changed after the following (changes are still being made). 6CO2 + 12H2 0 C6 H12 O6 + 6H2 0 + 6O2 Mild chlorophyll It is known that plants synthesize carbohydrates, the smallest simpler first and from them, the most complex, would be starch and cellulose. Plants are also capable of synthesizing all other compounds such as proteins, fats, etc. Animals are not able to synthesize carbohydrates and they must depend on plants for the same thing. Can we say that photosynthesis is the basic energy source for most of the living world? Why, why not? Let's examine the presence of carbohydrates in the parts of plants. Activity-1 The presence of starch (a type of carbohydrates) in leaves Let's take a leaf from a plant (we can select such plants that have soft and thin leaves) well exposed to sunlight. Arranage machine, this is what it looks like in the figure. glass of boiling water leaves methylated alcohol gauze tripod stand boiling tube bunsen burning petridish solution of iodine fig-2(a): Boiling leaves in methylated spirit fig-2(b): Iodine test 14. Nutrition - Food Supply System4 Class X Boil the leaf in methylated spirit over a water bath. It becomes pale white due to the removal of chlorophyll. Notice the leaf. Take the leaf carefully from the test tube using a brush. Spread the leaf in a petridish and add a few drops of iodine tincture/betadine solution on it. Notice the leaf again. • What do you see? The presence of starch will be indicated by a blue-black colour. Do you think solar energy turns into chemical energy through the process of photosynthesis? Try to do the same test on the leaf of a potted plant kept in the dark for about 10 days to test the effect of sunlight. Materials essential for the photosynthesis process What are the materials that you think would be essential for the synthesis of carbohydrates in the photosynthesis process? (Hint: Van Neil's proposed equation) • Do you think the equation tells us about all the materials involved? It took scientists over 300 years to find out about them. We still don't know about any more material involved in this process. Let's study how scientists have experimented to learn about some of the materials needed for the photosynthesis process. Water and photosynthesis In the 7th grade we have already studied howVon Helmont has that water was essential for increasing the mass of plants. He didn't know about photosynthesis at the time. Later, it was found that the increase in the body mass of plant plants material occurred due to the photosynthesis process. We will study more about this in the following sections. Read the Chapter Nutrition in Plants in the 7th grade discuss with your friends and write a note on the Von Helmont experiment focusing on how he concluded that water was important for plant growth and body mass growth. Air and photosynthesis Let's talk about an experiment on photosynthesis. We studied some experiments in our previous classes. It helps us learn about the role of air in the process of photosynthesis. It is interesting to learn about the experiment, which was one of the many stages in the gradual development of our understanding of photosynthesis. Joseph Priestly (1733-1804) in 1770 conducted a series of experiments 15. FreedistributionbyA.P.Government 5 which revealed the essential role of air on the growth of green plants (photosynthesis was not yet known to scientists at the time). Remember, Oxygen was discovered by Priestlyin1774thenameoxigen was later invented by Lavoisier in 1775. Priestly noticed that a candle burning in a closed bell jar soon goes out. Similarly, a mouse would soon suffocate in a closed space of the bell jar. Heconcludedthataburringrananimal, both in some way, air damage. When he put a mint plant in the same bell jars, he found that the mouse remained alive and the candle when lit from the outside continued to burn in the presence of the mint plant. Priestly hypothesis follows: Plants restore air what breathing animals and burning candles remove. What did Priestly do to introduce the mint plant without disrupting the experimental set? Lit the candle outside? Priceney's experiment confirmed that gas exchange was being made, and the plants gave a gas that supported combustion and was essential for the survival of the animals. But do plants take in the air and use carbon dioxide for photosynthesis and oxygen for breathing? make the choice? Massive amounts of gas exchange occur through stomata (usually present in leaves) as long as they are open. While plants also carry on gas exchange through loose tissues on stems, roots, etc. In fact, at the level of the organelles involved in the process of photosynthesis and breathing is made the choice of the necessary gas. Activity-2 Carbon dioxide is required for photosynthesis We need a destarched plant to begin with. For destarching we need to keep the plant in the dark for almost a week to remove starch (destarching) from the leaves. Arrange the device as shown in the figure. • Take a transparent bottle with a wide mouth. fig-3: Priestly Experiment 16. Nutrition - Feeding system6 Class X • Put potassium hydroxide pelts or potassium hydroxide solution in the vial. Potassium hydroxide absorbs carbon dioxide. • Insert the broken cork into the mouth of the vial. • Insert one of the leaves of the unwrapped plant (through a split stopper) split) transparent vial containing potassium hydroxide dioxide pelets/ potassium hydroxide solution. • Leave the plant in sunlight. • After a few hours, test this leaf and any other leaf of this plant for starch. After it was mentioned in activity-1. • The leaf that has been exposed to atmospheric air turns blue-black, and the leaf inside the balloon containing potassium hydroxide that absorbs carbon dioxide from the glass turns brown instead of blue-black, showing cacarbondiolidiesnecessaryforphotosysisisthe. • Why was the plant kept in the dark and then in sunlight? • Why did we study two leaves in this experiment? We have discussed the role of water and gas in the photosynthesis process so far. The scientist who was working on these lines noticed other factors affecting the photosynthesis process. Light and photosynthesis In Priestley's time, scientists didn't understand about energy, but a lot was later discovered about it. If energy is released when carbon dioxide and water are formed by combining oxygen with carbon and hydrogen, then it remains the other way around?. How about training oxygen again and putting it back in the air. Eventually, scientists learned that the energy situation would reverse. Oxygen formation would consume energy. That means that if the fig-4 plants: Mohl's half leaf experiment KOH wide mouth ball split cork pot of black blue plants (starch formed) no starch 17. FreedistributionbyA.P.Government 7 funnel tube test beaker water oxygen hydrilla plants fig-5: Hydrilla experiment form oxygen have to get energy to make it possible. Where did the energy come from? ADtch scientist, Jan Ingenhousz (1730-1799), found the answer. He studied how plants formed oxygen. In 1779, he noticed that it had happened only in the presence of light. In an experiment with the aquatic plant, Hydrilla, he observed that in bright sunlight, small bubbles formed around the green parts while in the dark did not form. He also found that the gas present in the bubbles was oxygen. It was further confirmed when Engelman in the early 20th century ingeniously detected the maximum rate point of photosynthesis. He used a thread of algae and exposed it to different colors of light (the colors we see in a rainbow) He then used oxygen-sensitive bacteria and found that crowd around the areas illuminated with red and blue light rays. This has led to several studies on the effect of light on photosynthesis, the role of different colour compounds called pigments in plants and the use of light energy. Oxygen is produced during photosynthesis in the presence of light • Arrange the device as shown in the figure. Make two identical sets. • Put a water plant, such as Elodea or Hydrilla, in a short funnel and keep it in a glass that Water. • Flip a tube filled with water over the funnel rod. Make sure that the water level in the glass is above the level of the inverted funnel rod. Place a device in the and the other in the dark for at least 2-3 hours. You see that instead of water there is air that fills up set kept in the sun. It's actually a gas that will collect in the test tube. Notice the other set up kept in the dark. Is there any difference in the amount of gas collected? Test the gas in the test tube by inserting a shiny matching stick or an incense stick that would burst into flames. This shows the presence of oxygen. • What precautions do you need while removing the test tube from the glass. Talk to your teacher. Labactivity Activity Bubbles 18. Nutrition - Food Supply System8 Class X Activity-3 Sunlight is required to form starch in green plants fig-6: Black paper experiment • Take a potted plant with destarched leaves. Remember the process of desstringing leaves mentioned in activity-1. • Coverofiofitosleaveswithblackpaperonwhichadesigniscut.Fixpaper on the leaf so that the light does not enter the dark side. • Place this plant in pots in sunlight. • After several hours of exposure to bright sunlight, test the leaf that is covered with black paper for the presence of starch. • Which part of the leaf turms black blue? What about the rest of it? • Notice the color of the leaves stained with iodine. Can you tell why it's stained differently? • It will be noted that only the parts of the leaf, which could get light through the cut design, becomes blue-black showing the presence of starch. Chlorophyll and photosynthesis Ingenhousz wanted to learn more about photosynthesis and conducted several other experiments. He proposed that only the parts of green plants can perform the process of photosynthesis. What about plants that have colored leaves? is it made that the new leaves that look dark red in color in several plants turn green? Plants with reddish or yellow ishonite leaves also perform photosynthesis? What made plants perform photosynthesis while even green animals (like some birds)could not? Such questions remained challenges until scientists were able to isolate the green substance from the plant parts and study its nature. 19. FreedistributionbyA.P.Government 9 The establishment of Ingenhousz's proposal came after several experiments until the mid-20th century, when scientists were also able to locate the site of photosynthesis and even isolate it. About four decades after Ingenhous' proposal, scientists could only isolate the green substance to observe its nature and find out if photosynthesis could be done with it. This became possible in 1817 thanks to the work of two Scientists Pelletier and Caventou who obtained an extract of the green substance and called it chlorophyll meaning green leaf. It was also found that pigments, other than green pigments, could also help in the process of by transmitting the energy of the sunlight caught by them to chlorophyll. • But where is chlorophyll and other pigments present in the plant? Where does photosynthesis take place? Try to name some where you think photosynthesis is taking place. • Do you think that the new reddish leaves of plants also perform photosynthesis? What could be the role of their color? The exact location of the photosynthetic part or part containing chlorophyll was not known until another 6 decades after the discovery of chlorophyll by Pelletier and Cavettou. It was thought to spread to the cells of the parts of green plants. In 1883, Julius Von Sachs observed that chlorophyll in plant cells does not spread throughout the cell. It's rather found in the organelles inside the cell. Such organelles have been called chloroplasts. They are present in large numbers in cells (around 40 – 100) of parts such as stomatous protection cells and ground tissues of plants. You studied Chloroplast in Class IX. Let's observe the figure. fig-7(a): T-S of cuticle leaves upper epidermis palisade parenchym xylem phloem air space guarding lower cell epidermis stomata parenchyma spongy 20. Nutrition - Food Supply System10 X Class Fig-8: T-S of chloroplast membrane stroma granum lipids thylocoide globules } granloop dna starch • What makes the chloroplast appear completely different from other cellular organelles? Know? If a cell is broken, the chloroplasts also break into pieces, so it becomes a very difficult task to isolate them to study the different stages of photosynthesis. It was not until 1954 that Daniel I.Arnon was able to separate plant cells so easily that whole chloroplasts could be obtained that could lead through photosynthesis. The chloroplast was found to be a membrane structure consisting of 3 membranes. The third layer forms stacked sacs as structures called granum. It is believed to be a site for covering solar energy. The intermediate portion filled with liquid is called stroma. It is believed to be responsible for the enzyme reactions that lead to the synthesis of glucose, which in turn unite to form starch. Substances found in chloroplast that capture sunlight are called photosynthetic pigments. There are several types of photosynthetic pigments involved in the process of producing organic molecules, such as glucose in plants. Chlorophyll is such a pigment that contains an atom of megnisium. It is similar in structure to hemoglobin heam. (The iron containing red pigment that carries oxygen into the blood.) Two major types of chlorophyll are associated with tilakoil membranes. Chlorophyll a is blue-green, and chlorophyll b is yellow-green. Around 250 to 400 pigment molecules are grouped as a light harvesting complex or photosynthetic unit in each granum. Such countless units work together in green plant chloroplasts in the process of photosynthesis. During photosynthesis several events occur in the chloroplast some of them are: 1. Conversion of light energy into chemical energy 2. Splitting the water molecule Reducing carbondioxide to carbohydrates Light is needed to initiate more events, while more evenabsenceofit. That, once the energy of light has been caught, can help reactions continue even in the dark. Light-dependent events 21. FreedistributionbyA.P.Government 11 or reactions are called mild reactions and have been found to occur in the grana, while the rest are called independent or dark mild reactions and occur in the stroma. Mechanism of photosynthesis 1. Light-dependent reaction (photochemical phase) In this reaction light plays a key role. A series of chemical reactions occur in a very rapid sequence initiated by light and therefore the phase is technically called the photochemical phase or light-dependent reaction. The luminous reaction occurs in chlorophyll containing tilakoids called the chloroplast grana. Several steps appear in the light-dependent reaction. Step I: Chlorophyll at light energy exposure becomes activated by photon absorption. (Photonisthesmallestuninitoflightenergy) Step II: Energy is used to divide the water molecule into two ion of components called hydrogen (H+), hydroxyl ions (OH-). H2 O H + + OH- The reaction is known as photolysis, which means the division of light (photo means light, lysis means breaking). This was discovered by Hill. Therefore, it is also called Hill's reaction. Step III: Very reactive water ions undergo a rapid change, as described below. Oh- ions through a series of steps produce water (H2 0) and oxygen (O2). Water can be used by the plant inside, but O2 is released into the atmosphere. H+ ions undergo a number of changes in the dark reaction. energy-capturing compounds such as ATP (Adenosine Tri Phosphate) and NADPH (NicotinamideAdenosine Diucleotide Hydrogen Phosphate) are formed at the end of the mild reaction. 2. Mild independent reaction (biosynthetic phase) This reaction does not require the presence of light and the expansion of phases after the day time can occur in some plants (the time difference between the two being even less than one thousandth of a second) and sometimes even in the dark. This is also called dark reaction. But the term dark reaction or light-independent reaction does not mean that they occur when it is dark at night. This just means that these reactions do not depend on light. H + Ions produced in photolysis are immediately lifted by the special compound NADP to form NADPH. In the dark phase NADPH hydrogen is used to combine it with CO2 by using ATP energy and to produce glucose 22. Nutrition - Food Supply System12 Class X (C6 H12 O6). This synthesis takes place in a series of stages using certain special intermediate compounds (mainly RUBP- Ribulease bis Phosphate) and enzymes. Eventually glucose is converted into starch. Plants are able to survive in a number of situations, from very hot, dry and brightly lit conditions to wet, wet and poorly lit conditions. Requirement and other factors vary from plant to plant. Heterotrophic heterotrophic nutrition conditions and acquring their food in different ways. I've studied about organisms that can capture light to produce their food. They are of a self-trophic nature. While those that can't be heterotrophic. obtain their food bodies Depending on the type and availability of food organisms can match a number of food and use strategies. Some organisms break down food materials outside the body and then absorb them. For example, molds of bread, yeast, mushrooms etc. that are called saprofite. Some other organisms derive nutrition from plants or animals without killing them. This type of parasitic nutritional strategy is used by a wide variety of organisms, such as Cuscuta, lice, leachs and bandworms. Others take all the material and break it down into their bodies. What can be taken in and broken down depends on bodys' design and is function. Because the food and how it is obtained differs, the digestive system is also different in different organisms. In single-celled organisms, would be amoeba, food can be taken by the entire surface, but as the complexity of the body increases, different parts become specialized to perform different functions. For example, amoeba [fig-9(a)] takes in food using the temporary finger as extensions (pseudopodia) of the cellular surface that merges over the food particle that forms the food vacuol. Inside the food vacuol, complex substances are broken down into simpler ones. Then diffuse into the cytoplasm. The remaining undigested material is moved to the surface of the cell and thrown out. In Paramoecium [fig-9(b)], which is also a single-celled organism the cell has a defined form. The food is taken in a certain place. Food is moved to the spot by the movement of the cilia covering the entire surface of the cell, where the food (cytostom) is ingested. fig-9(a): Nutrition in Ameoba fig-9(b): Nutrition in Paramoecium 23. FreedistributionbyA.P.Government 13 fig-11: Human food channel fig-10: Haustoria in couscous absorbs food through haustoria. They are root structures that penetrate the tissue of a host plant and can kill it. Thin, string as dodder stems can be yellow, orange, pink, or brown in color. The leaves are reduced to scales by minute. The flowers of the dodder, in nodules like groups, are made up of small petals, yellow or white, similar to the bell. The seeds of the dodder germinate, forming an anchoring root, and then send a thin stem that grows in a spiral until it reaches a host plant. It then dies around the stem of the host plant and forms haustoria, which penetrates through it. Water is drawn through the haustoria from the xylem of the host plant, and nutrients are drawn from its phloem. Meanwhile, the root rots after contact with the strain has been made with a host plant. As the dodder grows, it sends the new haustoria and settles very firmly on the Host. After growing in a few spirals around a host shoot, the dodder finds his way to another, and it to the strings and branch until it resembles a fine, densely entangled cloth of thin stems enveloping the host plant. Identify plants in the environment that are parasitic on other plants. Parasitic nutrition in Cuscuta Dodder (genus Cuscuta) is a leafless, twinning parasitic plant belonging to the morning glory family (Convolvulaceae). The genus contains about 170 twinning species, which are widely distributed in temperate and tropical regions of the world. Thedoddercontainsnochlorophyll (Cuscutareflexahasbeenen found to have a very small amount of chlorophyll) and instead Nutrition in human beings the human digestive system is very complex in nature. Different parts are involved and perform different functions by using different digestive juices and enzymes. Let's observe the figure of the digestive system and label the parts. The food channel is actually a long tube that extends from the mouth to the anus. We can see that this tube has different parts. Different regions are specialized to perform different functions. • What happens to food once it enters our body? 24. Nutrition - Food Supply System14 Class X We eat different types of food that must pass through the same digestive tract. It also needs to be converted into substances small enough to be used by our body. This needs different processes that can be studied after follows. Passing food through the food or gut canal Food is cut and crushed by our teeth in the mouth and mixed with saliva to make it wet and slippery (also called chewing). Saliva is secreted by three pairs of salivary glands. Two pairs are located in the side of the jaw and under the tongue. A pair is located in the palace. Saliva mainly contains an enzyme amylase (ptyalin) which helps to break down complex carbohydrates Food in the form of a soft sticky substance where some proteinsand carbohydrateshaverollybeenbrokendown is called chime. Now the food material passes from the stomach to the small intestine. Here the ring as the muscles called pilorec spincters relax to open the passage into the small intestine. Spinters are responsible for regulating the opening of the passage, so that only small amounts of food material can be passed into the small intestine at a time. fig-12: Oral cavity of the salivary palate salivary glands epiglottis fig-13: Peristaltic movement bolus peristaltic valve stomach esophagus to simple ones. The tongue helps to mix the food and push it to the next side. The lower jaw also helps throughout the process. We can find out the effect of salivary amylase on carbohydrates to see what might happen in our mouths. Activity-4 • Refers to activity - 7 action of saliva on wheat flour in the chapter Coordination of life processes. That's the way Our. You can also perform the activity by using Ganji (boiled rice water) soft foods mixed with saliva passing through the esophagus or pipe of wave foods as movements called peristaltic movements to the stomach. La La stomach, food becomes churned with gastric juice and HCl. Now the food is in semisolid state. Food digestion continues as most proteins are broken down into smaller molecules using enzyme pepsin that acts on them. language 25. FreedistributionbyA.P.Government 15 Thin intestine is the longest part of the food channel. It is the place of further digestion of carbohydrates, proteins and fats. It receives the secretion of the liver and pancreas for this purpose. These juices make as kinternalconditionoftheintestinetigradualtoabasicoralkalione. Fatsaredigestedbyconvertingthemintosmallglobulelikeformsbythe helpofthebilejuicesecretedfromliver. This process is called mulmulsification. Secreted pancreatic juice in the pancreas contains enzymes such as trypsin for the process of protein digestion and fat lipase. The walls of the small intestine secrete the intestinal juice that leads this process further, which is small protein molecules are broken down to smaller molecules. The same is the fat state. The digestion of carbohydrates that started in the mouth and did not appear in the stomach, is now resumed as the environment gradually changes into an alkaline one, and the enzymes become active for the breakdown of carbohydrates. Activity-5 Studying the diagram of enzymes Let's study the graph showing different enzymes and digestive juices and their functions. Table 1: some enzymes and juices of the intestine Enzyme/Substance Ptyalin (salivaryamylamylase) Pepsin Bile (No Enzymes) Amylase DuodenDuoden Paste Peptidases Zaharosis S.No. 1 2 3 4 5 6 7 8 Secreted by the salivary glands Stomach Pancreas Pancreas Intestinal wall Thin intestine Secreted in the oral cavity Duodenum Duodenum Duodenum Duodenum Duodenum Inintestine Gastric Juice Ball Juice Pancreatic Juice Pancreatic Juice Pancreatic Juice Intestinal Juice Intestinal Juice Gut Juice Acts on Carbohydrates Protein Fats Carbhoydrates Protein Fats Peptide Sugar (Sugar cane) Products Dextrins and Maltose Peptones Emulsification breaking of ats large in small globules Maltose Peptone Fatty acids and glycerol Amino acids Glucose • Names enzymes acting on carbohydrates? 26. Nutrition - Food Supply System16 Class X • What juice does not contain enzymes? • What enzymes act on proteins? The transport of digestion products from the intestine into the blood (through the wall of the intestine) is called absorption. Internally, the intestinal wall has a number of fingers would be projections called villi. Villi increases the surface for absorption. Blood vessels and lymphatic vessels are present in the form of a network in villi. The products of digestion are first absorbed into villas and hence into blood vessels and lymphatic vessels. Thus, after maximum absorption of food into the small intestine, the rest passes into the large intestine. Here most of the water is taken from this material. This material is then through the anus, which is the last part of the food channel. This passage of undigested material from the body through the anus is called defecation. Foods coming out of the anus still contain a considerable amount of protein, fats and carbohydrates, rough or carbohydrate or protein fibre. We will learn more points about coordination about the digestive system with other systems in chapter coordination in life processes. Scheme of the human digestive system • What do you think is the process of digestion? • What are his major steps? Food Mouth Bucal cavity pharynx heart stomach Piloric Stomach Esophagus Duodenum Thin intestine Thick intestine Anus Rect bile pancreas Health aspects of the food channel Human food channel usually works remarkably well considering how badly we treat it on occasions! Sometimes it revolts, and we either feel sick, or we have indigestion. 27. FreedistributionbyA.P.Government 17 Vomiting is the body's method of getting rid of unwanted or harmful substances in the stomach. Peristaltic movements of the stomach and esophagus reverse their normal direction and food is expelled. There are many causes of vomiting, but one of the most common is over eating, especially when food contains a high proportion of fat. Vomiting also occurs when we eat something very indigestible or poisonous. When we have a greenish vomit, usually called as bilious or liverish, we get a bitter taste and it is often the result of being eaten rich meals over several days. The liver is unable to cope with excess fat and we get a feeling of nausea. Indigestion is a general term used when there are difficulties in the digestion of food. Healthy people can usually avoid digestion-related problems by: a) having simple, well-balanced meals b) eating them in a leisurely way c) well mastimating foods d) avoiding taking violent exercise shortly after eating food e) Drink plenty of water and having regular bowel movements. A more serious form of indigestion is caused by stomach and duodenal ulcers. These conditions occur more often in people who can be described as hasty or concerned. Thus, ulcers occur more often in busy people who enter the habit of rushing over meals and rushing from one activity to another without sufficient rest. Those who are able to relax, who are not continuously tense, and who live at a slower pace, rarely get ulcers. You have studied recent research into peptic ulcers caused by some Class IX bacteria. The proper functioning of all life processes requires an adequate amount of food in all living organisms. Not just food intake, but the assimilation and expulsion of waste plays an important role. In the scream of fiber rich foods avoid constipation. Diseases caused by mal feeding We know that foods are source of maintenance of biological processes in a perfect way. Our diet should be a balanced one, containing an adequate amount carbohydrates, proteins, vitamins, mineral salts and fats. Two-thirds of the world's population is affected by food-related diseases. Some of them suffer through eating high calorie foods. Most of them face various diseases due to lack of balanced diet. It is very important to discuss food-deficient diseases. 28. Nutrition - Food Supply System18 X Class Food consumption that does not have one or more of a nutrient in the required amount is known as shore nutrition. Poor health, complete hunger, lack of awareness of nutritional habits, socio-economic factors are all the reasons for bad nutrition in our country. Mal nutrition is three types 1. Caloric malnutrition, 2. Protein malnutrition, 3. Protein malnutrition. Let's observe the harmful effects of mal nutrition in children. 1. Kwashirkor disease: This is due to protein deficiency in the diet. Body parts become swollen due to water accumulation in intercellular spaces. Very weak muscle development, swollen legs, fluffy face hard to eat, diarrhea, dry skin are symptoms of this disease. 2. Marasmus: This is due to protein and calorie deficiency. In general, this disease occurs when there is an immidate second pregnancy or repeated child births. Lean and week, swelling of the limbs, less devoloped muscles, dry skin, diarrhea, etc., are symptoms of this disease. 3. Obesity: This is due over eating and excess energy in take. It's a great health hazard. Obese children when they grow up, they will be the target of many diseases such as diabetes mellitus, cardiovascular cardio, kidney, gallbladder problems. Discuss junk foods and other eating habits that lead to obesity. Vitamin-deficient diseases Vitamins are organic substances. They are micro nutrients neededinsmallquantities. In factvitamins are not synthesized in the body, generally we do not suffer from vitamin deficiency. The source of vitamins for our body is in two ways. One is diet and the other is bacteria present in the intestin that synthesises and provides vitamins for the body. Vitamins are classified into two groups. One of these is water-soluble vitamins (Be-complex, vitamin C) and others are fat-soluble vitamins (vitamin A, D, E and K). Letusstudythefollowingchartshowingvitaminsavailableand disease deficiency. fig-14: Kwashirkor fig-15: Marasmus fig-16: Poveregra 29. FreedistributionbyA.P.Government 19 Vitamin Cereals, oilseeds, vegetables, milk, meat, fish, eggs. Milk, eggs, liver, kidneys, green leafy vegetables. Kidneys, liver, meat, egg, fish, oilseeds. Cereals, oilseeds, vegetables, milk, meat, fish, eggs, liver. Synthesized by bacteria present in the gut. Liver, meat, eggs, milk, fruit, cereals, leafy vegetables. Sweet potatoes, ground walnuts, liver, kidney, egg. Vegetables, nuts, vegetables, liver, milk, kidneys. Vegetables with green leaves, citrus, cabbage. Leafy vegetables, carrot, tomoto, pumpkin, papaya, mango, meat, fish, egg, liver, milk, cod liver oil, shark liver oil. Liver, egg, egg, cod liver oil, shark liver oil, (morning sun's rays). Fruit, vegetables, cabbage, meat, egg, sunflower oil. Vegatable with green leaves, milk. Beers Beers Glossitis Dellagra Pernicious Anemia Burning feat Nervi disorders Scurvy Eye, Skin Diseases Rickets Fertility Disorders Coagulation of Blood Vomiting, Seizures, Loss of Potites, Shortness of Breathing, Paralysis. Mouth cracks at corners, red and inflamed tongue, photophobia, scaly skin. Dermatitis, diarrhea, memory loss, scaly skin. Hyper irritability, nausea, vomiting, seizures. Lean and week, less appetite. Diarrhea, loss of leukocytes, problems with intestinal mucus. Problems with walking, sprains. Fatigue, mental depression, muscle pain. Delay in wound healing, bone fractures. Nightblindness, xerosthalmia, corneal insufficiency, scaly skin. Improper bone formation, Knocknees, puffed wrists, delayed teething, week bones. Sterility in men, abortions in women. Delay in blood clotting, over bleeding. Resources Deficiency Diseases Symptoms Thiamine (B1) Riboflavin (B2) Niacin (B3) Pyridoxine (B6) Cianocobalamin (B12) Pantothenic Acid Biotin Acid Ascorbic Acid (C) Retinol (A) Calciferol (D) Tocoferol (E) Phylloquinone (K) 30. Nutrition - Food Supply System20 X Class Keywords Glucose, starch, cellulose, chloroplast, grana, stroma, mild reaction, dark reaction, heterotrophic nutrition, parasitic nutrition, haustoria, food channel, glandsalivation, peristaltic movement, amylaline, ptyalin, pepsin, chime, sphincter, digestion, pancreas, enzymes, villi, bile juice, lipase, fat, liver, emulsion. • Autotrophicnutritioninvolvestheintakeofsimpleinorganicmaterialslikesomeminerals,water fromthe soil. Omegasesfromtheair.Byusinganexternalenergysourceliketheo Suntosynthesis complexhighenergyorganicmaterial. • Photosynthesis is the process by which living cells of plants containing chlorophyll produce food substances [glucose&starch] from Carbondioxide and waterprinusinglightenergy. Plantsreleased oxygen as a residual product during photosynthesis. • The photosynthesis process can be represented as 6CO2 + 12H2 O C6 H12 O6 +6H2 O+6O2 • Thematerialsrequiredforphotosthesisisisitlight:Carbondioxide,Water,photosynthesispgment chlorophyll. • The loroplastarethesitesofphotosisistesis.Lightreactiontakesplaceinthegranaregionandlight independent reaction occurs in the storma region. • The final products of photosynthesis are glucose water and oxygen. • During photosynthesistheinstallationeventswhichoccursintheloroplasty a) Conversionofluminaenergydintochemicalenergy b) Division of watermolecules c) Reduction of carbon dioxide in carbohydrates • HeterotrophicNutritionevolutioninvestheintakecommaterialpreparebyotherorganisms. • Theformofnutritiondiffersdependingingonthetypeandtheavailability of foodwellashow material is obtained by the body. • La single-celled, food can be taken by the entire surface, but as the complexity of organizations of growth of different partscomespecializedtoperformdifferentfunctions. • • large complex food molecules, such as carbohydrates, proteins, lipids, etc., are broken down into simplemolecules before being absorbed andused by animals. This processbreaking downofcomplexmoleculesintosimplemoleculesstimdidaditism. • Inhumanbeingsthefoodeatethenesbrokendownindiversestepswiththehelpifenzymessecreted bydigestiveglandswhichnassociatewithealimenteycanalandthedigestedfoodisabsorbed insmallintestinetoallcellsinthebody. What I learned chlorophyll light 31. FreedistributionbyA.P.Government 21 Improve your learning • Thedigestivesystemincludesthefoodstudiesthetratssevereassociatedbodies.Thefunctionsof systemaresfollows: a) Ingestion: Taking food into the body b) Digestion: Breakingupofcomplexfoodsubstancesinthesimplesubstancesbyspecific enzymes. So that they can be used by the body. c) Absorption: Thepassageofdigestedfoodthroughroughthewallsoffoodytract(details insmallintestin)incirculatorysystem. d) Defecation: Passage of undigested material from the body through the anus. 1. Writedifferencesbetween(AS1) a)autotrophicnutrition-heterotrophicnutrition b)Ingestion-digestion c) Mild reaction - dark reaction d) Chlorophyll-chloroplast 2. Yes reasons (AS1) a) Why is photosynthesis considered as the source of core energy for most of the living world? b) Why is it better to call the dark phase of photosynthesis an independent phase of light? c) Why is it necessary to break up a plant before conducting any experiment on photosynthesis? d)Whyisitnot possibletodemonstrate ingreenplantkeptinsunlight? 3. Giveexamples(AS1) a)Digestivezymes b)Organisms that vevevceheterocnutrition heterotrophic c)Vitamins d) Diseases of food deficiencies 4. Where do plants get each of the raw materials needed for photosynthesis? (AS1) 5. Explain the necessary conditions for autotrophic nutrition and what are the products? (AS1) 6. Withchemical equation aidexplacementofphotosintesthosintenthesis indetail? (AS1) 7. Name of the three finished products of photosynthesis? (AS1) 8. What is the connecting substance between the light reaction and the dark reaction? (AS1) 9. Most leaves have greener and brighter upper surface than lower ones why? (AS1) 10. Explain the structure of the chloroplast with the alcohol label. (AS1) 11. What is the role of acid in the stomach? (AS1) 12. What is the dedigestiveenzyme function? (AS1) 13. is the small intestine designed to absorb digested food, explain. (AS1) 14. fats digested in our bodies? Where is this process taking place? (AS1) 15. What is the role of saliva in food digestion? (AS1) 16. What will happen to protein digestion as the gut environment is gradually made alkaline? (AS1) 17. What is the role of roughages in the food track? (AS1) 18. Whatismalutritionexplainsomenutritiondeficiencycises. (AS1) 19. Howdongreenplantssuchasfungiandbacteriaobtaintheynoursever? (AS2) 20. If we continue to increase the concentration of in the air, what will be the rate of photosynthesis? (AS2) 32. Nutrition - Food supply Class X 21. What happens to breathing plants becoming more than sighing? (AS2) 22. Why do you think carbohydrates aren't digested in the stomach? (AS2) 23. What process do you take in your lab to study the presence of starch in the leaves? (AS3) 24. would you demonstrate that the green plant releases oxygen when exposed to light? (AS3) 25. Visitadoctorandfindoutkeepinginviewofdigestion.Prepareachartanddisplayinourroom. (AS4) i) Under what conditions does a patient need to become a glucose drip. ii) Until a patient is given glucose. iii) helps the patient's glucose recover. 26. If there were no green plants, all life on earth would be over! Comment? (AS5) 27. Drakaneatlylabeleddiagramofchlorplastfouninleaf, andit'sroleinphotosis? (AS5) 28. Do you draw the label diagram of the human digestive system? List the parts where peristaltase occurs. (AS5) 29. Raheempreparedamodel showing food passages through different parts of the elementary channel? Notice this and the label is pieces. (AS5) 30. Respect the foodagram andwritenoteonlightdependent,lightindependentreactions. (AS5) 31. Almost everyone alive depends on plants for food materials. do you appreciate the process of making green plant foods? (AS6) 32. Evenahardsolidfoodalsobesomesmothslurryslurrysthedigestivesystembytheenzymesreleased at a pertical moment. This mechanism is an amazing fact. Prepare a cartoon on it. (AS6) 33. What habbits foods are you going to follow after reading this chapter? Why is that? (AS7) Chloroplast Calvin Cycle Photo Chemical Photo Reaction Photochemical Reaction Thermochemical Reaction Thermochemical Reaction 33. FreedistributionbyA.P.Government 23 Fill in the blanks Choose the correct

answer 1. Plant synthesized foods are stored as _____ 2. _____ are places of photosynthesis. 3. Pancreaticjuicecontainsenzymesforcarryingtheprocessofdigestionof_____ and _____ 4. The finger as projections that increase the surface in the small intestine are called_____. 5. Gastric juice contains acid _____ 6. _____ vitamin sisnthesised by bacteria present in the gut. 7. Which of the most importantorganismsluafoods parasitic nutrition? ( ) a)Yeast b)Mushrooms c) Cuscuta d) Lipitors 8. The rate of Fotosyntesis is not affected by: ( ) a)LightIntensity b)Humidity C)Temperature d) Concentration of carbon dioxide 9. A plant is kept in a dark cupboard for about forty-eight hours before conducting any experiment on photosynthesis to: ( ) a)Removethephyllallallleavess b) Remove the starch from the leaves c) Make sure that no photosynthesis has occurred d) Make sure that the leaves are free of starch 10. Thedigestivejuicewithsoonzys ( ) a)Bile b)Gastricjuice c)Pancrtaticjuice 11. Insinglecelledanimalsthefoodistaken ( ) a) Through the entire surface of the body b) Mouth c) Teeth d) Vacuoles 12. Care Care of the plant takes carbondioxide from the air for photosynthesis ( ) a) Hair root b) Stomata c)Leafveins d) Sepals 34. Breathing - Energy release system24 Class X Using food to perform life processes is the key to life for all living beings in both multicellular and single-celled. In the chapter, on nutrition we discussed how the body attracts nutrients from the food taken in. Food provides energy for all bodily activities only after decomposition through the process known as breathing. Thus, breathing leads to the final use of food. When oxygen is breathing profusely normally, it takes control. Live body cells use food constantly to help our body function properly. They require the presence of gas, food and some chemicals. The term breathing derived from the Latin word breathing, which means to breathe, refers to the entire chain of processes, from inhaling air to using oxygen in cells. For starters, we will study the relationship between gas and the breathing process. Discovery of gases and respiration fig-1: Lavoisier Breathing - Energy Release System 2 Chapter Theliberationcameintouse,acenturyafterwordbreathing was used, way back in the 14th century. It was used long before people knew that air was a mixture of gases. They barely knew anything about all the life processes that took place internally in a living body. Breathing that has been used as a medical term, usually referred to as a process involving air passage and the production of body heat. It was not until the 18th century that Lavoisier and Priestley did a comprehensive work on the properties of gases, their exchange and breath, that we came to know something about how the gas exchange process continues in our body. You've already studied about 35. FreedistributionbyA.P.Government 25 some of the Priestley experiments in previous classes (You have an account of it in the chapter on nutrition as well). Remember the concepts and respond to the following. • Can it be said that Priestley's experiment helped us learn more about the composition of the air? ? Lavoisier also conducted several experiments to understand the property of the gases. In his early experiments, it is clear that Lavoisier believed that the gas released on coal heating powder in a bell kept over waterinatroughwaslikefixedair. In those days, carbonioxides known as fixed air. The next series of experiments dealt with the burning of phosphorus in a jar. From these studies, Lavoisier showed that whatever was in the atmospheric air that combined with phosphorus was not water vapour. His last words are that the substance that combines with phosphorus is either the air itself or another elastic fluid present, in a certain proportion, in that we breathe. It was breathable air, a component of the air that also helped to burn. • What was produced by burning according to Lavoisier? • What Lavoisier learned about the air in the • What conclusion can be drawn from Lavoisier's experiments? Lavoisier noted that there is a profound difference between the air in which a metal was burned and the air that served for breathing. The air we breathe precipitated lime water while after heating the metal it didn't. From this he deduced that there were two processes involved in breathing, and that of them probably knew only one. Therefore, he carried out another experiment in which he showed that about one-sixth of the volume of tainted air (a term then used to show the air from which the component needed to burn was removed) consists of curly acid gas (fixed air). Therefore, in order to recreate the common air in the tainted air, it was not enough just to add the appropriate amount of air needed for combustion or breathable air; existing cretous acid gas must also be removed. He immediately drew the logical conclusion about the breathing process. Either the eminently breathable air is changed into the lungs into chalked acid air; or an exchange takes place, the air eminently breathable being absorbed, and an almost equal volume of curly acid air being given up to the air from the lungs. He had to admit that there were strong reasons to believe that the eminently breathable air combined with the blood to produce the red color. fig-2: Priestley 36. Breathing - Energy release system26 X Class Lavoisier leads to several other researchers. • What gas do you think Lavoisier is talking about when he says acid gas? • Which gas according to it is breathable air? • What steps in the breathing process does Lavoisier mention as a deduction of his experiments? A few lines from a manual of human physiology, written by a renowned chemist, John Daper around the mid-19th century goes like this.. "The main materials that a living being receives are matter that can be burned, water and gaseous oxygen; and from their action on each other, all the physical phenomena of his life appear. What the body expels is water, carbon oxide, phosphorus, sulfur and others." Thus, we can see that the role of major compounds and elements in the process of breathing was known until the middle of the 19th century. The events involved were not very clearly understood, but, people believed that there was a certain relationship between the heat produced in the body and the breathing process. • It is a common observation that our breath is warmer than the air around us; Does breathing have anything to do with this? Letusstudytheeventsinvolvedinrespirationinhumanbeingsto figure out. Events / Steps in Breathing There are no strict demarcations of events involved in the breathing process. Itisaverycomplexprocessofseveralbiochemical andphysical processes. But for a general understanding of what's going on, we'll study under the following ends. Movement of air in and out of the lungs Gas exchange between alveoli and blood from the blood capillaries of the alveoli to the cells of the body and the return of carbon dioxide Oxygen exchange from the blood into cells and carbon dioxide from the cells in the blood The use of oxygen in cellular processes for the production of carbon dioxide and water, releasing energy to be used for life processes Gaseous exchange in the lungs Gas transport by gas exchange by gas exchange at the level of cellular respiration 37. FreedistributionbyA.P.Government 27 Breathing In previous classes we did experiments to find out what was there in the air we breathe. I saw that in a set with lime water, turned milky white quickly as we breathe in it compared to a similar set in which normal air was passed using a syringe or pichkari in lime water. (Experimentalset to test the presence of carbon dioxide in the exhaled air). Arrange the device as shown in the figure and try to do the experiment again to find out what's going on. • What does this experiment indicate? • Which gas converts milky lime water? • What gas do you think could be present in larger quantities in the air we breathe compared to the air around us? • We are also aware that water vapor deposits on a mirror, if we breathe on it. • Where does this water vapor come from in the exhaled air? We will have to study the air in our body through our respiratory system and the breathing mechanism to find out the exhaled air (Fig showing the respiratory system/ path). By the respiratory system we usually mean the passages that carry air to the lungs and to the microscopic air sacs in them, called alveoli (where gases are exchanged between them and the blood vessels) and vice versa. Let the air path respect us the path of air from the nar to the alveolus. nasal cavity of the nasal cavity epiglottystharynx trachea larynx pulmonary bronchial bronchiols capillary in which exchanges of O2 and CO2 appear fig-4: Human respiratory system fig-3: Respiratory gas water lime water 38. Breathing - Energy release system28 X Class Nostrils: Air usually enters the body through the nostrils nasal cavity: Air is filtered. The wet surface of the mucosa of the nasal cavity, and the hairs growing from its parts, remove some of the small particles of dirt in the air. In addition, as the inhaled air passes through the nasal cavity, its temperature is brought close to that of the body and takes water vapor so that it becomes wetter than before. Pharynx: Continuous heating and damping in this common passage of the digestive and respiratory system. Epiglottis, a flap like musculovecontrolsmovementoffoodandairtowards their respective passages. Larynx: This rigid box contains our vocal cords. When air passes from the lungs and over the vocal cords, it makes them vibrate. This produces based on our speech, song, etc. Trachea: Wind pipe channeling air to the lungs. Touch your neck to feel the tube as a structure. Bronchii: La La the end of the trachea or wind duct is divided into two bronchi-one leading to each lung. Bronchiole: Each bronchi is divided into smaller and smaller branches called the bronchiole. Alveolus: They eventually end up in groups of air sacs called alveoli in the lungs, which are very small and numerous. The gas exchange takes place here as the blood capillaries take up oxygen and remove carbon dioxide. Blood: Transports oxygen, collects CO2 at every cell of the body. The entire passage from the nostrils to the alveolus is moist and warm. Know? The interior of the lung is divided into millions of small chambers, thus greatly increasing the wet surface available for the transfer of gases between air and blood. The linings of the lungs are much folded and so their total surface area is enormous. If all the alveoli of our lungs are spread, they will cover an area of almost 160 m2. 39. FreedistributionbyA.P.Government 29 Think and discuss • What will happen if the respiratory tract is not wet? • Do both lungs have similar dimensions? • Why are alveolus so small and countless in number? Epiglotis and the passage of air from the nasal cavity, the air enters the pharynx. There's a complicated problem here. From the pharynx there are two passages, starting with almost the same opening and ending in the separate ones, one to the lungs and one to the stomach. It is important that one of them is one and the food in the other. It is also important that food does not enter the tube through which air enters the lungs. Traffic is properly maintained channeled by a flap like a valve, the epiglottis that protects the tube to the lungs, arresting the entrance of food. Follow the following figures and discuss in your class the epiglottis works while breathing or swallowing This valve is partially closed when swallowing food; diverts food to the stomach and keeps it away from the trachea or wind pipe, which is the way to the lungs. The epiglottis opens wider when we breathe, and air enters the lungs. Nervous adjustment is important in guiding the function of the epiglottis and the passage of food and air. Let's try to do an activity to feel what happens when we swallow food. • Why are we advised not to talk while eating food? Activity-1 Keep your palm around an inch away from your nose, feel like you are breathing out, don't remove it until you've finished the job. Breathe constantly for 1-2 minutes. Now take a piece of any fruit, chew it and before swallowing it keep your fingers from the other palm on your neck, now swallow it. • What have you noticed? What happens to your breath while you're trying to swallow? Epiglotis diverts air to the lungs Epiglottis diverts the food mass from the opening of the larynx fig-5(a): Breathing fig-5(b): Swallowing 40. Breathing - Energy release system30 Class X • What helps you swallow without diverting it to the wind duct? Mechanism to human beings We know that breathing is the process of inhalation and inhalation. The bodies involved are mainly mainly You can't see your lungs, but it's easy to feel them in action. Put your hands on your chest and take a deep breath. You'll feel the bigger chest. Now breathe the air and feel your chest return to its usual size. You just felt the power of your lungs! Thelonghemselvescanneither pulls in the air, nor push it out. Instead, the muscles of the chest wall and another flattened flexible muscle called the diaphragm help the lungs move air in and out of them. See the aperture works in the figure. • What is the role of the diaphragm and ribs in breathing? Are they both active in man and woman? The chest wall consists of ribs, muscles and skin. The ribs are attached at an angle to the spine (if you run your finger along one of the ribs, you will notice that it extends down from the spine). When we inhale, the chest wall moves up and expands. This causes an increase in the volume of the chest cavity. The diaphragm can be imagined as the floor if you think of the thoracic cavity as a room. When the diaphragm is relaxed when breathing, it is dome-shaped with the convex part of the dome that extends into the thoracic cavity. When the diaphragm contracts during inhalation, it flattens a little or the dome moves downwards. As a result, the volume of the chest cavity is increased. When the diaphragm flattens and the volume of the chest cavity is increased, the internal pressure decreases and the air from the outside rushes into the lungs. This is inspiration (inhalation). Then comes the reverse. The chest wall is lowered and moves inwards, and the diaphragm relaxes and assumes the shape of the dome. These changes increase the pressure of the pelunges;lorelastictissuecontracts sisqueezes the air through the nose to the external atmosphere. This is the expiration (expiration). fig-7: Movement of the ribcage during inhalation, exhalation diaphragm chest wall muscles rib lung bones fig-6: Movement of diaphragm 41. FreedistributionbyA.P.Government 31 You know? Our lungs are spongy in nature. They're not the same size. The lung to the left is slightly smaller making space for your heart! Lungs are protected by two membranes called pleura. Afluid filled between these membranes protects the lungs from injury and also helps in the expansion of the spongy and elastic lung muscle as they slide over each other. arelyonlyonecellthickk. Blood, dark red in color flows from the heart through these capillaries and collects oxygen from the alveoli. At the same time, carbon dioxide passes from the capillaries and into the alveoli. When we breathe, we'll get rid of this carbondioxide. Oxygen-rich blood is returned to the heart and pumped into all parts of the body. fig-8: The diffusion pathway for gas exchange between the lungs and blood capillaries You must have noticed that your breathing is slow and shallow when you are at rest. It's deeper and faster when you exercise hard. Indeed, breathing patterns show a wide, wide, they are coordinated with the body's moment-by-moment needs for oxygen supply and carbon dioxide removal. What other situations affect your breathing? It has been found that all breathing movements stop immediately when the nerves leading from the brain to the respiratory muscles are cut. • What can be concluded from this? • What happens during the breathing process? • What gas should be removed from our body during exhalation? Where does the extra amount of gas come from? • What is the composition of inhaled air? • When exhaled air is compared to inhaled air, is there a different composition? Gasexchange (alveoli to capillaries) Gas exchange occurs in the lungs through diffusion from the alveoli to the blood capillaries and vice versa. Carbon dioxide in the blood is exchanged for oxygen in the alveoli. These small air bags in the lungs are numerous and only a thick cell. They are surrounded by capillaries that branchiole alveolus capillary network of carbon dioxide oxygen blood cells 42. Breathing - Energy release system32 Class X As a result of gas exchange, the composition of inhaled and exhaled air is different. See table below. Approximate values are indicated in the table • Why does the amount of oxygen vary between exhaled air and inhaled air? % inhaled air gas % in exhaled air Oxygen 21 16 Carbon dioxide 0.04 4 Nitrogen 79 79 • What has the percentage of carbon dioxide in the exhaled air increased? Know? The total lung capacity of the human being is almost 5800ml. Normally at rest, which inhales or exhales about 500ml of air. 120ml of air remains in the lungs after complete exhalation. Remember the activity of your lung capacity in Class VII in the chapter Breathing in Bodies. Gas transport We know that air is a mixture of gases, which fills the lungs and alveoli when they enter our body. The relative amount of different gases in the air and their ability to combine with hemoglobin and other substances in the blood determine their transport through the blood into the body. When the oxygen present in the air falls within the normal limits (around 21%) then almost all of these are transported into the blood by binding to hemoglobin, a protein (quite similar to chlorophyll, the only major difference being that it has iron instead of magnesium as in chlorophyll) present in red blood cells. Because oxygen is defused in the blood, it quickly combines with hemoglobin toformoximoglobin. Notonlyhaemoglobincancombinewithoxygen, but conversely it can also happen to produce a molecule of hemoglobin and oxygen. Carbon dioxide is usually transported in the form of bicarbonate, while some of it combines with hemoglobin and the rest is dissolved in blood plasma. Study the following equation for a better understanding. Hb + O2 HbO2 HbO2 Hb + O2 43. FreedistributionbyA.P.Government 33 increases pressure on hofthetrachea. thehairsgrowingfromits You know? If hemoglobin is exposed to air at sea level, almost molecule combines with oxygen to form oxyhemoglobin. At a height of 13 km (approximately 8 miles) above sea level, the oxygen concentration is much lower than about a fifth at sea level. Under these conditions, only about half as gas exchange (capillaries to cells and back) In capillaries over tissues, hemoglobin meets a very different environment. Tissue cells are continuously using oxygen, therefore, the concentration of oxygen is quite low in them. There might only be a third of that in your lungs. Because the oxygen concentration is so low, oxyhemoglobin releases the oxygen molecule that enters the cells. In the reactions that occur inside the cells in our bodies, carbon dioxide and water are produced and energy is released for use for different purposes. Cellular breathing The term cellular respiration refers to the way in which cells release energy from the chemical bonds of the food molecules that enter them. It provides this energy for the essential processes of life. So living cells need to perform cellular respiration. It may be in the presence of oxygen that is aerobic breathing or in its absence, which is anaerobic breathing (fermentation). Cellular respiration in prokaryotic cells, such as that of bacteria, occurs in the cytoplasm. In eukaryotic cells cytoplasm and mitochondria are the places of reactions. The energy produced is stored in the mitochondria in the form of ATP. That's why mitochondria are called cell power houses. Accurate chemical details of the decomposition of sugar or other foods in a living cell do not occur as a single reaction, but appear in a series of small steps. does this affect the release of energy? Because changing the chemical nature of the molecule from one stage to another is easy, a small amount of energy is released at any stage. The complete breakdown of a sugar molecule with the release of all its available energy many oxygen molecules combine with hemoglobin to form oxyhemoglobin. This is important because the blood cannot carry enough oxygen into the tissues if hemoglobin is combined with few oxygen molecules. In fact, human life is impossible at such an altitude without an additional source of oxygen. Supply for such a supply is built into modern aircraft, which have pressure cabins that maintain a source of enriched air. When we go deep into the sea we will face a different kind of problems. fig-9: Mountaneer 44. Breathing - The energy release system34 Class X involves a number of different chemical reactions. From the breakdown of glucose energy is released and stored in a special compound, known as ATP (adenosine triphosphate). It's a small parcel of chemical energy. The energy currency of these cells is ATP an energy-rich compound that is able to provideenergy wherever it is needed inside the cell. Each ATP molecule gives 7,200 calories of energy. This energy is stored as phosphate bonds. If the link is broken, the stored energy is released. • No cells or lungs also need oxygen to perform cellu-lar breathing? Why/ Why not? In short, at the cellular level we may have the following paths starting with glucose (This is an example, remember that there are other components of food as well). Know? Glucose is the most commonly used sugar to derive energy in plants, animals and microorganisms. In all these organisms glucose is oxidized in two stages. In the first stage it is converted into two molecules of pyruvic acid. In the second stage, if oxygen is available pyruvic acid is oxidized in CO2 and water, a large amount of energy is released. If oxygen is inadequate or not used, pyruvic acid is converted into either ethanol or lactic acid and a very small amount of energy is released (almost one tenth of it is produced with an adequate amount of oxygen). Glucose Piruvate (3 carbon compound) +Energy Lacticacid +Energy Ex: Bacteria Ethanol + CO2 + Energy Ex:Yeast Oxygen Presence (aerobicbreathing) Absence or low amountofoxygen (anaerospiraton and fermentation) CO2 + H2 O + Energy Ex:Plantsandanimals Can energy be released without oxygen? • After suffering a strenous exercise we feel pain in the muscles, does adequate oxygen reach the muscles? • What forms in the muscles? fig-10: Mitochondria outer membrane inner membrane criste matrix 45. FreedistributionbyA.P.Government 35 fig-11: Athlete (Stenous exercise) Graph showing the effects of vigorous exercise on the concentration of lactic acid in the blood. When you sprint a hundred yards, you do a lot of muscle work. But don't start a foot race on the track and panting for a few minutes to stoke up with oxygen in the first place. In fact, you can run the race with very little extra breathing. The fastest sprinters don't breathe at all when they're running a hundred yards. Once you have reached your destiny, however, you feel very different. Depending on your training status and how hard you have run, you will have pants for a few minutes after the race, until your breathing gradually returns to normal. These facts could be related to what we have learned so far about ATP. The race may have been driven on the energy produced when AATPalreadyreadredy was converted to ADP. Unfortunately, this pleasantly simple idea is inappropriate, because I only carry enough ATP in a muscle to last about half a second when doing vigorous exercise. There must be another explanation for how we can first produce energy and then use oxygen later. One approach in the study of this problem was to analyze a person's blood during and after exercise. For obvious reasons, the athlete who took part in the experiment had to remain still where the machine was. He cycled a stationary bike, or ran on a tape mill rolling (belt moving as fast backwards as the athlete moved forward). Some results are displayed in the graph. The vigorous exercise lasted nine minutes (indicated by the bar at the base of the diagram) and blood samples were taken and analysed. A special compound in the blood, lactic acid, has been shown to vary greatly in its concentration, after you can see from the graph. Notice the graph of the accumulation of lactic acid in the muscles of an athelete and answer the following questions. (Graphic showing a variable amount of lactic acid in the muscles) x - axis = Time in minutes y - axis = Concentration of lactic acid in the blood mg/cm3 46. Breathing - Energy release system36 Class X a. What was the concentration of lactic acid in the blood to begin with? B. What was the greatest concentration achieved during the experiment? C. If the trend between points C and D continued at the same rate, how long could it take again to decrease the initial level of lactic acid? (Hint: Extend the line CD until it reaches the startup value.) D. What does high levels of lactic acid indicate about the state of breathing? The accumulation of lactic acid leads to muscle pain. If we take walking, brisk walking, slow jogging, running for the same distance we feel that there is an increase in pain levels this is due to the accumulation of lactic acid. It looks as if lactic acid was produced rapidly by the active muscles, and then only gradually removed from the blood after exercise. What is surprising is that the athlete needs a long time to recover. The simplest explanation we can produce at this stage is that the sugar in the working muscles has been changed to lactic acid. The energy stored in lactic acid molecules is lower than that in sugar molecules, and if the acid comes from sugar, then the energy released could be used to reconstruct the ATPfromADPand phosphate. During a 100m race a well-trained athlete can hold his breath all the time is not until after that he pants. In this case, the muscles use the energy released during anaerobic decomposition of glucose. Only after that, the athlete obtains the oxygen needed to remove lactic acid. Therefore, when we under-take the strenuous exercise we build what is called an oxygen debt, which must be repaid later. In a longer race athletes have to breathe all the time, so some lactic acid is removed while they are running, and they can go on for longer before they become exhausted. The presence of lactic acid in the blood is the main cause of muscle fatigue, but if the body is rested long enough fatigue goes. Anaerobic breathing I discovered that living things produce carbon dioxide and give energy. If these processes are caused by an oxidation process, what happens if the oxygen supply is interrupted? If human muscles can continue to release energy when they are out of oxygen, what can the cells of other living organisms do? Let's find out by doing some experiments. 47. 37 fig-12: Testing for heat and CO2 production in anaerobic breath liquid paraffin yeast in thermometer boiled and cooled glucose bicordonate solution Yeast experiments To test this idea we can see if it is possible to detect any increase in temperature and carbon dioxide production when living organisms are kept away from an oxygen source. Yeast increases rapidly if it is supplied with glucose in the solution. Indeed, wild yeasts are normally found growing on fruit skins would begrapesandapples,from whichtheyderive their food supply. Our immediate problem is to remove oxygen from the glucose and yeast solution. 1. You can remove the dissolved oxygen from the glucose solution by heating it for one minute, and then cooling it without tightening it. Now put in some yeast; Oxygen supply from the air can be interrupted by pouring an inch layer of liquid paraffin onto the mixture. 2. If you want to check if the oxygen has been removed from the mixture- turns, add a few drops of green diazine (Janus Green B) solution to the yeast suspension before pouring liquid paraffin (wax) over it. This blue dye turns pink when the oxygen is in short supply around it. 3. Arrange for any yeast gas to escape through a washing bottle containing bicarbonate/indicator solution (or lime water). I haven't described any control experiments trying to get them to work for you. You may prefer to perform the carbon dioxide production part of the experiment on a smaller scale using test tubes. If you do, then heat them to about 37o C in order to speed up the test. • What happens when a baker prepares a dough by mixing yeast in it? Fermentation Let's remember the activity of the maya dough and yeast powder that you performed in the 8th grade in the chapter The Story of Microorganisms. Why has the dough volume increased? What gas was released in that reaction? If yeast and sugar solution are left to stand without oxygen for a few days, they develop a characteristic odor, caused by the production of the new compound called ethanol, which was manufactured by yeast from LabActivity 48. Breathing - Energy release system38 X Class fig-13: CO2 - a glucose release tube heat test tube delivery lime sugar water. The same type of smell you can notice from canned idly, dosa dough to your home. But not in the fridge. Ethanol can be separated from the yeast-glucose mixture by the fractional distillation process, as ethanol boils at a lower temperature (70°C) than the sugar solution. Collect information about fractional distillation with the help of the teacher. Quite like aerobic breathing this is a process of energy production when there is no oxygen source. • Breathing is a way of releasing energy, do you agree? Justify your answer. Breathing versus burning Lavoisier around the century through a series of carefully conducted experiments, came to the view that breathing was a process like burning. He wrote in a compilation in 1783, breathing is a burning process. It's a very slow process and here oxygen is not only combines with carbon also with hydrogen. Robinson also stated that breathing is a type of burning and burning is the source of heat in animals. Activity-2 Observation of changes during the burning of sugar Arrange the appliance as shown in the figure and heat it over a flame. Is it melting? What if you warm up for a little longer? When glucose burns, carbon dioxide and water is produced and energy is released in the form of heat. We know that burning glucose gives us carbon dioxide, water and energy, while from the respiratory equation we get the same products. But, in essence, processes must differ for the following reasons. 1. Glucose should be burned at high temperature in the laboratory to release energy, if it were to happen in our cells, all cells would be burned. 2. Once glucose starts to burn, we cannot stop the process easily, but living cells are able to exer-cise control over the way glucose is burned in the presence of oxygen. 49. Free distribution of the Government A.P.39 3. Normally, water stops burning to be done while the cells con-tain a lot of water and breathing still goes on. What can you conclude from this? Heat production by living organisms Heat production was a characteristic of the burning of glucose or sugar, so you noticed earlier. Live animals and plants usually produce energy in the form of heat. We feel warm when we wear the sweater in the winter season. We know that sweater prevents the loss of heat produced by the body. Does that suggest any way that our bodies lose heat in the environment? • What are the other ways our body loses heat? Heat is constantly lost on the surface of the body, so it must be generated continuously in our bodies to replace what has been lost to keep body temperature constant. • Is the rate of heat always the same? During vigorous activity, a greater amount of heat is generated. We know that we feel hot after a form of intense exercise, it would be running. During cellular breathing, energy is released. Some of the energy is stored in the form of ATP. Some of the energy is used in our daily activities. And excessive energy is released in the form of heat. But in case of vigorous activity, it would be running, we need more energy. For this, the rate of breathing is increased. So the heat is also released in excess quantity. That's why we feel warm. If oxygen is not enough during vigorous excersise the muscles begin anerobic breathing. Therefore, lactic acid is formed. We know that the accumulation of lactic acid causes muscle pain. We get to a normal position after a break. Deep breathing helps us restore energy to our body. See in the Annex Evolution in the gas exchange system Gas exchange is a common life process in all living organisms, but it is not the same in all. Single-celled organismsAmoeba or multicellular organisms, such as Hydra and Planarians obtain oxygen and expel carbon dioxide directly from the body through the diffusion process. In other animals special organs are evolved. Terrestrial or aquatic animals adopted to different types of breathing and possess different types of respiratory organs, mainly depending on the habitat in which they live. Body size, water availability and type of circulatory system 50. Breathing - Energy release system40 X Class fig-15: Lenticells on the stem are some of the reasons why animals develop different types of respiratory organs. We'll see the tracheal respiratory system to insects like cockroach, grashopper etc. The tracheal respiratory system consists of series of tubes called trachea. It is divided into fine branches called tracheole that carry air directly into cells in tissues. Some aquatic animals, such as fish have developed special organs for breathing, which are known as gills or gills. Blood supplied to the gills through capillaries that have thin walls, which are exchanged gases. That's called branched breathing. The fish keeps its mouth open and lowers the floor of the oral cavity. As a result, the water from the outside will be drawn into the oral cavity. Now the mouth is closed and the floor of the oral cavity is raised. Water is pushed into the pharynx and is forced to bags the gill through internal branch openings. The gill blades are bathed with water and gas exchange takes place. Breathing through the skin is called skin breathing. An amphibian's frog can breathe through the processes of skin and lung breathing. Terrestrial animals, such as reptiles, birds and mammals, breathe through the lungs. Ask your teacher are the crocodiles and dolphins? Breathing in plants You already know about stomata in leaves where gas exchange takes place in plants. There are other areas on the body of the plant, as well as through which the gas exchange takes place as the surface of the roots, lenticeles on the stem, etc. (Fig showing stomata and lenticele). Some plants have specialized structures, such as the breathing roots of mangrove plants, and the tissue in orchids that produces oxygen is also needed by the plant to produce energy and carbon dioxide is released. But CO2 is necessary elsewhere in plants try to identify them. The conduction inside the stomatal Opeinings plant leads to a number of spaces between the cells inside the plant. That forms a continuous network all over the factory. The spaces are very large in leaves, much smaller in other parts of the plant. The air spaces are lined with water where oxygen is dissolved in this and passes fig-14: Leaves as a respiratory organ waterfilm stomata air spaces 51. FreedistributionbyA.P.Government 41 fig-17: Co2 evolved into breathing through the walls of porous cells in the cytoplasm. Here sugar is broken down into carbon dioxide and water with the release of energy. Carbon dioxide passes into air spaces by a similar method. The whole system works by diffusion; as oxygen is used cells, a gradient develops between the cells and the air in the Similarly between the air in the spaces and the air outside the stomata and the lenticele, so that the oxygen passes in. In the same way, as more carbon dioxide is released from the cells, a gradient appears in the reverse direction and passes into the air. Take a handful of moong or bajra seeds. Soak the seeds in water the day before to perform the experiment. Keep these seeds soaked in a cloth bag and tie with a tight string. Keep the cloth bag in a corner of the classroom. The next day collect the germs/seeds germinated from the bag, store in a plastic bottle/bottle (around 200 ml capacity). Take a small bottle of injection, fill three-quarters of the bottle fig-16: Aerial roots Airing the roots Most plants can aer their roots by taking oxygen through lenticels or through the surface of theirroothairs (astheyrwallsareverythin). They get oxygen from the air spaces between the soil particles. But plants that have their roots in very wet places, would be ponds or swamps, can not get oxygen. They are adapted to these water-logged conditions through which they have much larger air spaces that connect the stems with the roots, making the diffusion from the upper parts much more efficient. The most common adaptation is to have an empty stem. Next time you are of a pond or swamp cut the stems of some of the plants that are growing there and see how many are empty compared to a similar number of plant species growing in normal soil. The problem of air transport is more difficult for trees and not many survive with their roots permanently in the water. One exception is the mangrove shaft from the tropics, which forms aerial roots above the surface of the soil and takes oxygen through these roots. To learn more about breathing in plants we should perform the following activities. Activity-3 sprouted seeds glass of lime water

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