



Right Science

8

***Teacher's
Resource Book***

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Chapter 1: Human Organ System

Learning Objective:

After this lesson, students will be able to

- list the major organ systems of the human body Like Nervous and Excretory system
- the body parts associated with each organ system
- the function of each organ system
- The common ailments related to these organ systems

Teacher Starter:

You can use the following related examples to give your students an understanding of Nervous system,

- A ball comes toward you and you swing your bat.
- A big dog barks in front of you and you begin to sweat.
- You walk past a bakery and the wonderful aroma makes your mouth water.

Then you can proceed your class by letting them know that these functions are possible because a working nervous system.

Also let your students aware of the fact that the body must be cleaned internally from all the toxins which are created in the body. The body continuously need to detoxify and cleanse itself to thrive.

Teaching:

Try to make the lesson as convenient and understandable by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter. Inform them about the nervous system, tell them that nervous system is a complex collection of nerves and cells that carry messages and control actions. Tell them the nervous system has three main functions. (i-e detection, interpretation and reaction)

Also Inform them about the excretory system. Tell them about the main job of excretory system (i-e to cleanse and detoxify the body continuously. Let them aware how toxins are filtered by our organs and expelled out from the body). At last, discuss the common ailments related to nervous system and excretory system and how they can be cured or prevented.

Exercises

Answer the following questions

Q1. What is the name of the biggest part of the human brain?

Ans: Cerebrum is the largest part of your brain, it makes up 85% of the brain's weight.

Q2. What is nervous system? Give a detailed account on nervous system.

Ans: The nervous system is a track through which your brain sends and receives messages about what is happening in the body and around it. This track is made up of billions of nerve cells also known as neurons. These nerve cells combine together to form nerves.

Nervous system is divided into two parts;

1. Central Nervous System
2. Peripheral Nervous System

Q3. Which part of the body control its actions?

Ans: The Brain controls all body functions



Q4. What is the main function of vertebra and spinal cord?

Ans: Spinal cord is a bundle of nerves that looks like a tightly woven ponytail hanging off the back of your brain. Brain uses spinal cord to send messages. Spinal cord can transfer huge amount of data very quickly.

Spinal cord is protected by a long ring of bones called vertebrae. Its main function is to protect and give flexibility to the spinal cord.

Q5. How do nervous systems work? Write in detail.

Ans: Central nervous system is the control center that analyzes things and decides what to do. It sends signals to the peripheral nervous system which directs these signals through motor nerves to their appropriate gland or muscle.

These signals could be somatic like moving your leg or autonomic like beating of your heart. Simultaneously, if the sensory nerves of the peripheral nervous system detect stimuli, they send signals to the central nervous system which then decides what to do.

Q6. What do you know about the excretory system? Why is it so important?

Ans: The body has a filtration system called the excretory system. This excretory system filters your blood, collecting all waste material and extra water that you do not need from the blood and excrete it out of the body.

Q7. Write about some of the problems that kidneys face.

Ans:

- Malfunctioning set of kidneys can increase the blood pressure of the body.
- If kidneys do not filter properly the harmful waste material, it would accumulate inside the body tissues and poison the body cells.
- Chronic kidney disease is a common kidney problem which is caused by high blood pressure and diabetes.
- Kidney stones are another common problem of kidneys.
- Polycystic kidney disease is a genetic problem in which fluid-filled sacs or cysts form inside the kidney.

Q8. What are voluntary, involuntary and reflexive actions?

Ans:

Voluntary action

Action that we do knowingly is voluntary action. It takes time. Like eating, writing.

Involuntary action

Action that we do unconsciously is involuntary action, like respiration, digestion. It happens rapidly

Reflex action

Action we do in response to stimuli is reflex action. Like moving hand away on touching a hot object. It happens rapidly

Q9. What is the function of the myelin sheath?

Ans: The function of the myelin sheath is to facilitate the conduction of electrical impulses through the nerve cells.

Q10. What are meninges and cerebrospinal fluid?

Ans: Both the spinal cord and the brain are protected by a layer of membrane called meninges and a special liquid called cerebrospinal fluid. This fluid or liquid protects the nerve tissue, keeps it healthy and removes waste products.

Short answer questions

Q1. What is excretion?

Ans : The process by which waste products of metabolism and other non-useful materials are eliminated from an organism is called excretion.

Q2. What is the main nitrogenous waste produced by humans?

Ans: The main nitrogenous wastes excreted by humans are ammonia, uric acid and urea.

Q3. What organs make up the excretory system?

Ans: Excretory system is made of four major organs, kidneys, ureters, urinary bladder and urethra.

Q4. What vessels carry blood to the kidneys? Is this blood arterial or venous?

Ans: The renal artery carries unfiltered blood in to the kidneys while the renal vein drains the filtered blood from the kidney towards the heart.

Q5. What is the functional unit of the kidneys?

Ans: The functional unit of the kidneys is called the nephron.

Q6. Name three involuntary actions controlled by medulla in the hind brain.

Q7. What type of reflexes are the following?

Ans:

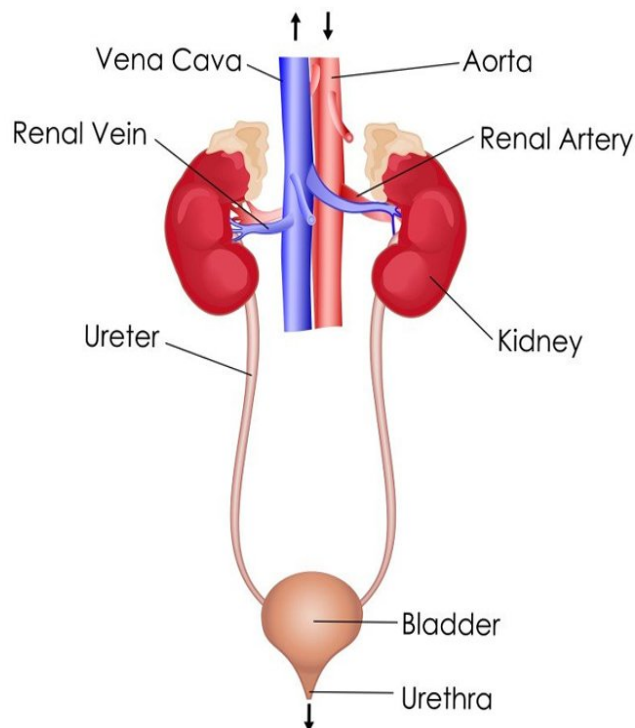
- **Sweating in summer:** Simple reflex
- **Knitting and swimming:** Conditioned and modified reflex
- **Blinking of the eyes:** Simple reflex
- **Solving mathematical sums:** conditioned reflex depending upon reasoning and past experience.

Q9. Why injury to brain stem results in death?

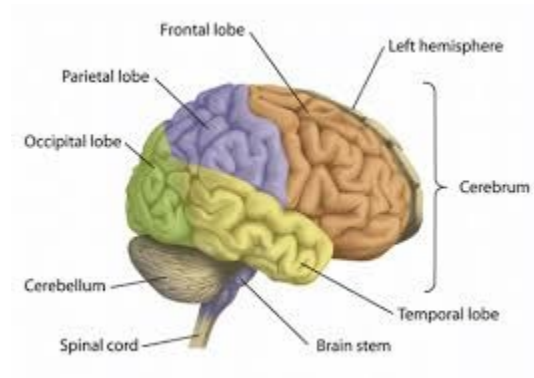
Ans: This is due to the fact that, brain stem is responsible for all the functions that your body performs to stay alive, like breathing, digestion of food and circulation of blood. It acts like the secretary of your brain and takes in, sends out and coordinates all the messages between your brain and your body.

Circle the correct answers:

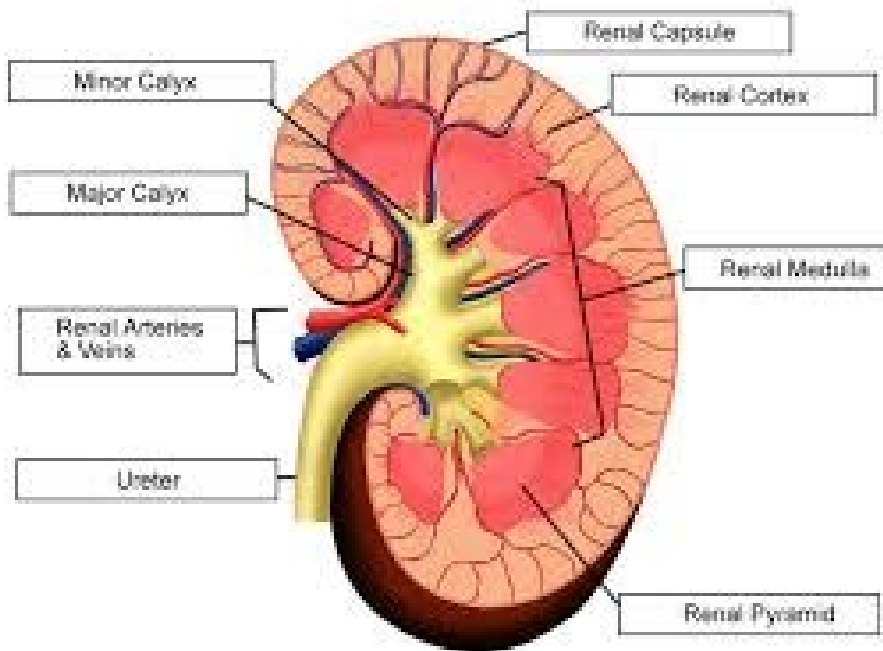
1. b) billions
2. d) breathing and growing
3. d) the cavity reaches the nerves and the nerves send a message to the brain
4. a) electrical impulses
5. c) Receptors
6. a) effector
7. a) reflex action
8. b) brain, spinal cord, nerves
9. a) balance and coordination
10. a) voluntary movement, speech, hearing, vision, memory, reasoning
11. c) the right side of the body
12. a) take in messages from other nerve cells
13. b) carry messages out of the nerve cell to other nerve cells
14. c) breathing, heart rate, blood pressure
15. b) the medulla, pons and middlebrain tissue
16. a) a fat column of nerve cells
17. b) Spinal nerves
18. e) all of the above
19. c) Uremia
20. a) Filtration, reabsorption, secretion
21. d) Urinary bladder
22. c) Lungs
23. a) They do not have any capsule.

Identify urethra in this diagram, Label the Excretory system

Label the parts of Brain



Label the parts of kidney



Fill in the Blanks

1. Brain
2. Nerves
3. signals
4. Meninges
5. Central nervous system
6. Somatic nervous system
7. Blood pressure
8. Connective
9. Nervous system
10. Reflex action
11. Cerebrum, 85%
12. Peripheral nervous system
13. Brain stem
14. Somatic nerve cell
15. Neurons

State whether true or false

1. False
2. True
3. False
4. False

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Chapter 2: Heredity in Organisms

Learning Objective:

After this lesson, students will be able to describe

- About Cells, inside a cell
- Chromosomes, Genes & DNA
- The characteristics inherited from parents to offspring
- The similarities and uniqueness among organisms
- A basic explanation of heredity
- How a Punnett Square is used

Teacher Starter:

You can start your class by reminding them what they have learnt earlier that cells are the building blocks of our body. Cells also reproduce by dividing and duplicating them. Also give them relevant examples in order to grasp the concept of heredity, as the phenomena of inheritance of traits or features of parents to offspring. How this genetic information is carried within chromosomes. Lastly tell them how similar we all are as human beings and how unique each of us are, from the others.

Teaching:

Try to make the lesson as convenient and understandable by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter.

Heredity is known as the phenomena of inheritance of traits or features of parents to offspring's or progeny. A trait is any characteristic that is transferred from parent to offspring. It is the continuity of features from the prior generation to the next which is present in the fertilized egg or zygote. That zygote develops into an organism of a particular type. So Heredity and Evolution are one of the most crucial branches of biology since without understanding it, the cycle of life on Earth cannot be understood. Without heredity, there can be no evolution either. Genetics is that branch of biology which deals with heredity and variation. Here is the comprehensive study of heredity and evolution that could be relevant for CBSE Class 10 students.

Heredity – How are traits transferred from the parents to the offspring?

The genetic information is carried within chromosomes, the chromosomes are found in the nucleus of a cell. Long coiled molecules of DNA make up chromosomes. The genes are contained in the DNA; they are the units of heredity and are responsible for inheritance. The expression of characteristics is contained in genes. Different traits are formed by different genes. The gene carries the genetic code for a particular characteristic. The height of a person, the facial features such as nose or jawline are all controlled by different genes.

The inheritance of characteristics in an organism is contributed to equally by the mother and father. The mother and father provide equal amounts of genetic material to their offspring. Therefore, each trait has two factors, one that comes from the mother and the other that comes from the father.

Most of the genes have more than two variations, they are called alleles. E.g. there are two alleles for the height gene, one is short and one is tall. The offspring may inherit the same alleles from both parents or two different alleles from them. When the offspring inherits two different alleles then it interacts in a particular way.

There is a dominant trait and a recessive trait.

The dominant trait comes from the gene that decides the trait in the presence of the other identical gene. The trait that does not get to express itself is called the recessing trait. The dominant trait is denoted using capital letters while the recessive trait is denoted using small letters.

Variation and its importance

Variation is the term given to the difference in the characters or traits that exist among the individuals of a species. Variations may occur during reproduction, it can happen due to an error in DNA copying or due to sexual reproduction. Evolution happens thanks to variation.

The various causes and variations are that there could be some positive gene mutation, an adaptation of the genes to the environmental changes or a different combination of the genetic material.

It is important to note though that variation occurs both in sexual as well as asexual reproduction. Although, the variation that takes place in sexual reproduction is far more than the changes brought about by asexual reproduction.

Genotype

Genotype is the genetic makeup of an organism. Genotypes are represented by letters. Each letter stands for a trait that is inherited from each parent (as a result of sexual reproduction). One code of the trait comes from the father and the other comes from the mother.

Therefore there are always three possibilities with genotypes. For eg. For the height of an offspring, it can be HH, Hh or hh.

Phenotype

Phenotype is the expression of genotype. It is actually the result of how the genes interact with the environment. The characters that one can observe in an organism are known as the phenotype. Colour of the eyes, the hair etc.

Rules of Inheritance

When two of a species crossbreed to produce an offspring, then their progeny is known as the first filial generation (F1-generation). When the first generation cross breed amongst themselves to produce second progeny then that is known as the second filial generation (F2 generation).

Gregor Johann Mendel, who is also known as the father of Genetics, proposed the rule of inheritance by conducting experiments on peas. His laws of inheritance are statements about the way certain characteristics within organisms are transmitted generation to generation.

He chose to experiment with pea plants of distinct characters, cataloging and interpreting the results.

Among the traits that Mendel studied, he studied the colour of the plant's flowers, the shape and the colour of the pea pods, the shape, the height of the plant and the colour of the seeds.

Monohybrid Cross– when tall pea plants were crossed with the shorter pea plants, then in the F1 generation only tall plants were produced. A quarter of the F2 progeny of F1 tall plants were

short and that indicated that both short and tall genes were inherited but in F1 only the tallness trait was dominant.

Dihybrid Cross – Tall plants that had round seeds were crossed with short plants that had wrinkled seeds. In F1, tall plants were obtained. F2 produced a combination of the above traits along with some new combinations.

Therefore the expression of a particular trait is controlled by the gene. Mendel stated that heredity was controlled by particles that are called germinal units or factors. He also stated that phenotype is based on genotype. Every trait is based on two genes, one from the mother and the other from the father. When different alleles for a particular characteristic are inherited then the dominant trait will be expressed.

Evolution

Inform them about circulation system of Animals, how it works, what are the main organs involved in the process. also discuss the common ailments related to circulatory system and how they can be cured and prevented.

Also Inform them about the transportation in plants. Tell them about the main functions happening in plants. Give them an idea of what actually happening in transpiration and translocation.

Exercises

Answer the following questions

Q1. What is cell and what is meant by cell division?

Ans: A cell is like a tiny factory in which various chemical reactions are taking place in different portions. A single cell divides into two identical cells, and these two cells divide into four identical cells and the process goes on and on. This process is called cell division and cell reproduction because new cells are being formed by the division of old ones.

Q2. What is the reason to cell to divide? Write the process of division of cell.

Ans: Cells divide for three main reasons, to replace lost or damaged cells, for reproduction and to help in the growth of the structure in which they are present.

Q3. What is Mitosis? Write in detail about phases of Mitosis.

Ans: Mitosis is how non-reproductive or somatic cells divide. During mitosis, a cell replicates all of its organelles (bodies present inside a cell) including chromosomes and produces two daughter cells which are identical to each other and to their parent.

Mitosis has four phases. Prophase, metaphase, anaphase and telophase.

Prophase

When cell gets the chemical signal from the growth factors that it is to duplicate it enters into prophase. In prophase cell prepare to get divided. Their protein and DNA shrink to make it easier for the cell to divide.

Metaphase

During metaphase, chromosomes line up in the middle of the cell with the help of a tiny tube like structure called the spindle. Spindle's job is to move and bring chromosomes together.

Anaphase

During anaphase, chromosomes divide, half the chromosomes move to one end of the cell, and



the remaining half move to the other end. When chromosomes reach their corresponding poles, the cell membrane starts to squeeze at the center.

Telophase

During this phase, the cell forms nuclear membrane around each set of the separated chromosomes and cell membrane completes its contraction from the center of the cell forming two new identical daughter cells. Each daughter cell contains the same number of chromosomes as the parent cell. This splitting of the cell is called cytokinesis or cell cleavage.

Q4. What the term 'meiosis' stands for? Write in detail.

Ans: Meiosis happens when it's time to reproduce an organism. Meiosis reduces the number of chromosomes by half. That's why meiosis is also called reduction division. The cells produced by meiosis are called haploids because they have half the number of chromosomes as the original cell.

Q5. We use the term 'hereditary', what its stand for?

Ans: Heredity is passing of traits from parents to their kids. The passing on of mental and physical traits from parents to their children is called heredity.

Q6. What are traits?

Ans: Traits are unique characteristics that describe the personality of a person and their physical appearance. Traits are the special qualities that can be transferred from one generation to another

Q7. Define these terms:

Chromosomes, DNA, Genes

Ans:

Chromosome

A chromosome is a packaged and organized structure containing most of the DNA of a living organism. It is not usually found on its own, but rather is structured by being wrapped around protein complexes called nucleosomes, which consist of proteins called histones.

DNA

DNA is a molecule composed of two chains that coil around each other to form a double helix carrying the genetic instructions used in the growth, development, functioning, and reproduction of all known living organisms.

Genes

Genes are the molecular unit of heredity. The transmission of genes to an organism's offspring is the basis of the inheritance of phenotypic traits. Most biological traits are under the influence of polygenes (many different genes) as well as the gene–environment interactions.

Q8. Who is called father of the genetics?

Ans: Gregory Mendel, an Austrian is the "father of the genetics".

Q9. What is Punnett square? What it is used for?

Ans: The Punnett square is the main way to figure out the pattern of gene coming from parents to the kid. It shows all the possible combinations of genes.



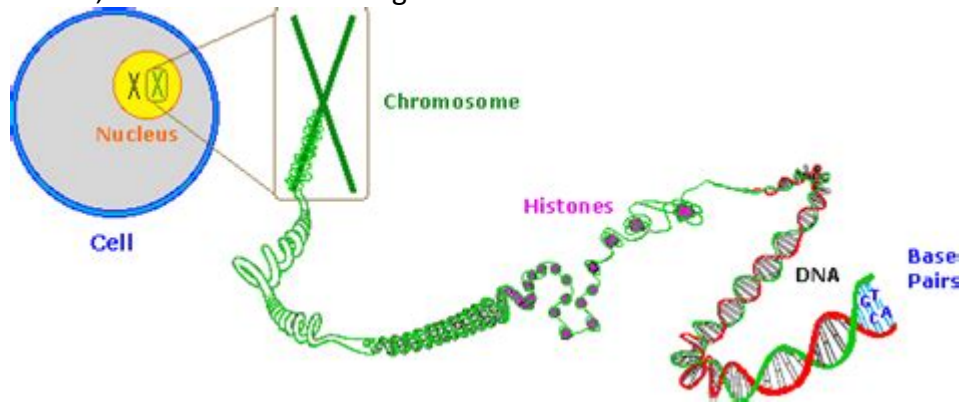
Reasoning questions

- a. Give the common name of plant on which Mendel performed his experiments.
Ans: The Pea Plant
- b. What are genes? Where are the genes located?
Ans: The total complement of genes in an organism or cell is known as its genome. The region of the chromosome at which a particular gene is located is called its locus.
- c. How does the genetic information in our cells instruct the formation of proteins?
Ans: First, enzymes read the information in a DNA molecule and transcribe it into an intermediary molecule called mRNA. Next, the information contained in the mRNA molecule is translated into the "language" of amino acids, which are the building blocks of proteins.
- d. In what form the instructions for forming a species' characteristics stored in the cells?
Ans: These instructions are stored inside each of our cells in the form of chromosomes.
- e. Besides for protein formation, what else does DNA do?
Ans:
- f. How is the concept of a chromosome related to the concept of the gene?
Ans: Genes control the genetic traits, and genes are DNA, which is organized into chromosomes. A gene is a region of DNA segment that controls certain trait of inheritance, while chromosome is the basic inheritance unit in cells.
- g. What is DNA?
Ans: DNA is a molecule composed of two chains that coil around each other to form a double helix carrying the genetic instructions used in the growth, development, functioning, and reproduction of all known living organisms.
- h. What are genes?
Ans: Genes are the molecular unit of heredity. The transmission of genes to an organism's offspring is the basis of the inheritance of phenotypic traits. Most biological traits are under the influence of polygenes (many different genes) as well as the gene–environment interactions.
- i. What are chromosomes?
Ans: A chromosome is a packaged and organized structure containing most of the DNA of a living organism. It is not usually found on its own, but rather is structured by being wrapped around protein complexes called nucleosomes, which consist of proteins called histones.

- j. Write a sentence explaining the relationship between the words DNA, genes, and chromosomes.

Ans: Chromosomes are long strands within a cell that can contain hundreds or thousands of genes and genes contain DNA.

- k. On the back, draw a sketch showing where DNA is located in a cell.



Ans:

- l. Name three examples of genetic traits that you inherited from your parents.

Ans: High cholesterol levels, Color blindness from your mother, Lactose intolerance. ...

- m. Name two traits that you acquire during your life.

- n. How are traits passed from parent to their offspring?

Ans: Each parent gives half of their genetic material to their children. The combination makes a unique combination of their parents genes.

Circle the correct answers:

1. b) Meiosis 11
2. b) Line up at the equator
3. d) Chromosomes
4. a) DNA
- 5c) Chromatid
6. c) 40
7. a) Karyotype
8. a) Telophase
9. c) Sex cells
10. c) 46
11. c) genetically different
12. a) DNA
13. e) nucleosomes
14. e) homologous chromosomes
15. c) Cytokinesis
16. a) double helix
17. d. 2,3,1,5,4

State whether “True” or “False.”

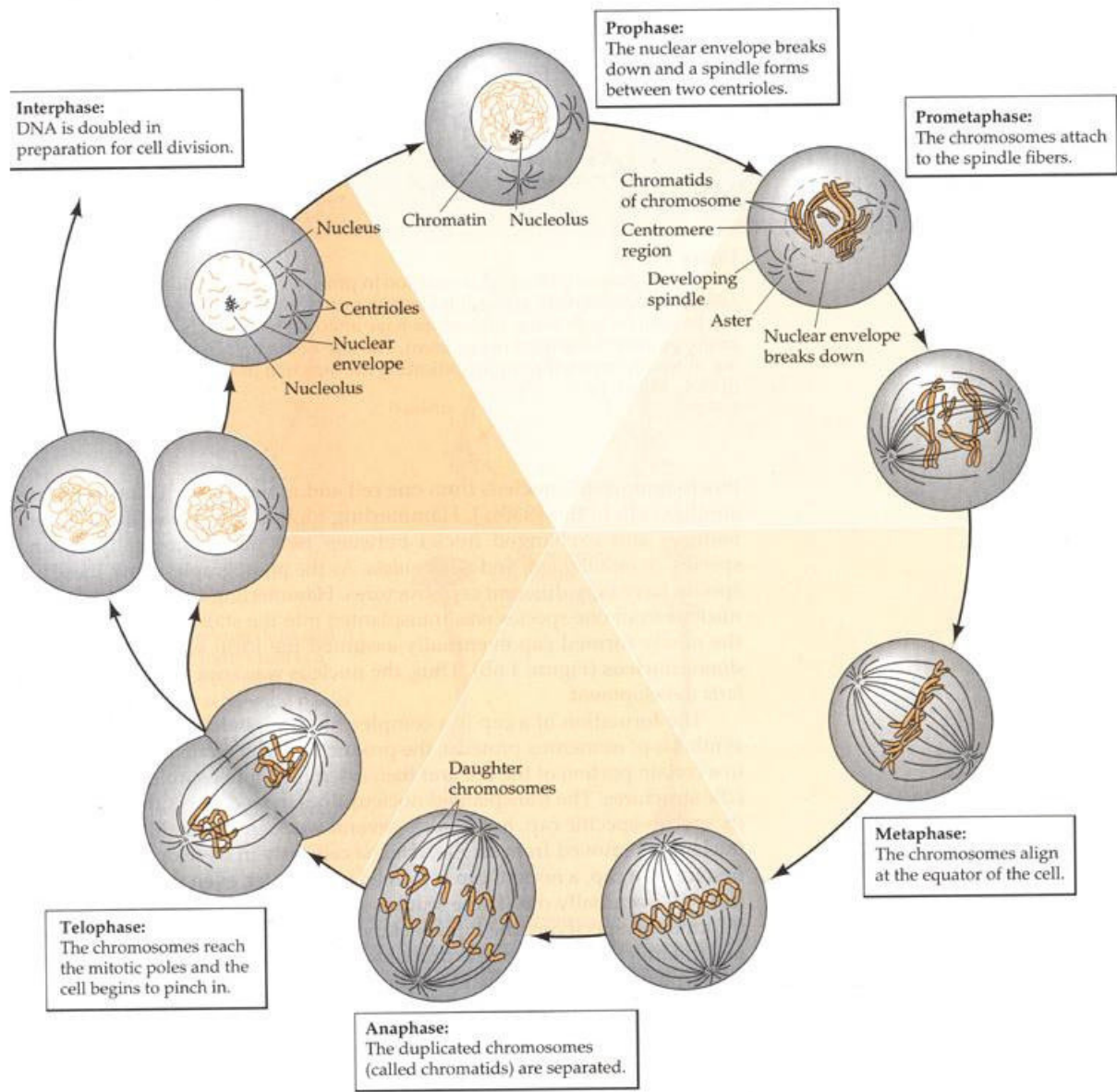
1. True
2. False
3. True
4. False
5. False
6. False
7. True
8. True
9. False
10. True
11. True
- 12.. True
13. False
14. True

Fill in the blanks.

1. Both growth and reproduction rely on meiosis.
2. Asexually reproducing organisms produce offspring that are genetically identical to the parent.
3. Sexually reproducing organisms produce offspring that are different from the parents and have a unique combination of traits.
4. The combination of traits makes them either better adapted or less adapted to the environment.
5. All cells in the body originate from the pre-existing cells.
6. During a series of cell divisions, cells increase in size and numbers.
7. A non-reproductive organism grows in size and maintains its body cells through mitosis.
8. The brown eye gene is called the Allele gene and the blue eye gene is called the HERC2 gene.
9. _____ are unique characteristics that describe the personality of a person and their physical appearance.
10. Cells communicate with each other by using chemical signals to control their division.
11. A human body cell has 46 chromosomes organized in 23 pairs.
12. DNA contains segments of information called genes.
13. After Mitosis, each daughter cell has two complete sets of chromosomes as the parent cell.
14. _____ happens when it's time to reproduce an organism.
15. DNA contains all the information about making new proteins.
16. During metaphase, chromosomes line up in the middle of the cell with the help of a tiny tube-like structure called the spindle.
17. The study of how heritable traits are transferred from parents to their offspring is known as genetics.
18. Cells do not divide all the time. They spend most of their time in a stage called interphase, busy duplicating their DNA.
19. Cell divides to maintain their surface volume ratio.



Complete the cell cycle.



Chapter 3: Biotechnology

Learning Objectives

In this lesson we will learn about

- Biotechnology
- How Biotechnology works
- The link between DNA, gene and chromosomes
- DNA replication
- Bacteria
- Introduction of gene in bacterium
- Genetic modification

Teacher Starter

The chapter and the concept is relatively new to your students. So you may start connecting their previous studies and try to relate to them. Tell them biotechnology is a rapidly growing field that uses research tools from biology and chemistry to find solutions to current scientific problems. Some biotechnology professionals look for the genetic basis of disease or factors that affect lifespan. Others focus on solving food shortages, the climate crisis, or criminal investigations.

Teaching

Now start explaining what is mentioned in the chapter. Try to make the lesson as convenient and understandable by explaining things mentioned in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter. The resources mentioned in the chapter try to explore common laboratory techniques used for treating disease and improving diagnosis, and examine the ethical debate over Biotechnology. Chapter also demonstrate the multifaceted nature of biotechnology and How biotechnology is helping the world by providing breakthrough products, reducing environmental problems, feeding the hungry, using cleaner and safer energy and technologies to fight rare diseases.

NGSS Standard

Exercise

Answer the following questions

Q1. What do you understand by the term Biotechnology?

Ans: Biotechnology is comprised of two words you are familiar with, these are 'bio' and 'technology'. Bio is short for biology which is the study of life and technology is another word used for tools. Biology combines with technology equals biotechnology.

Q2. Write in detail how biotechnology works?

Ans: Biotechnology allows scientist to look closely to the genes of living organisms and make enhancements in them. It allows scientists to look closely at plants and learn how they grow,

work and react to their surroundings and introduce a certain gene in them that helps them to grow faster, adapt to their environment and become more nutritious.

Q3. What are DNA, chromosomes and gene? Write how they linked with each other?

Ans: To understand the relation between chromosomes, DNA and gene you can think of it as one big city. In which a single DNA molecule is a small house on a street. A single street of houses is a gene and all the streets of houses in a neighborhood are a chromosome. The entire city made of all different neighborhoods is a set of chromosomes.

Q4. What is meant by DNA replication? Write in detail.

Ans: The process of DNA splitting itself into two identical DNA helices during cell division is called DNA replication. DNA has a double helix structure with two strands of nucleic acid twisted together.

Before DNA replication, two strands of DNA must be unzipped into two single strands. To unzip DNA strands these pairs must be broken first. It is done by an enzyme called helicase. Helicase disturbs the hydrogen bond between the four bases separating two strands into a Y-shape called replication fork.

One of the strand is directed towards the replication fork and the other strand directed away from the replication fork. Single strand binding proteins bind with the two strands temporarily to keep them separated.

DNA polymerase adds new bases to the strands. The new bases couples with the complementary bases on the strand. A subunit of polymerase complex proofreads the new DNA to make sure there are no mistakes in the new DNA sequence.

Finally, an enzyme called DNA ligase seals up the new DNA in two continuous long strands. The new copies of DNA automatically winds up into a double helix.

Q5. What are bacteria? Are they important for us and if yes, then how?

Ans: Bacteria are the simplest organisms alive. They are unicellular organisms and they can only be seen with a microscope. They come in various types of shapes including rod, spherical and spiral shapes.

Most bacteria are good. In a healthy body 85% are good bacteria and remaining 15% are bad bacteria.

- Bacteria live inside our body and help us to digest certain foods and vitamins like vitamin K
- They also help us to fight against other harmful bacteria.
- Bacteria are also used in making foods like cheese, yogurt, bread, pickles and soy sauce.
- Bacteria break down dead plants and animals to make soil and get rid of dead tissues.
- Bacteria fertilizes soil with nitrogen which is essential for the growth of plants.

Q6. How can genes are introduced into a bacterium? Write all the steps.

Ans: A bacterium does not go through meiosis or fertilization to reproduce. However, it can exchange genetic information very actively. The genetic information carried in DNA can be transferred from one cell to another. But, this is not a true exchange because only one partner

collects the new information. There are three ways of introduction of another gene into a bacterium;

1. **Transformation:** the bacterium takes up foreign DNA or gene from its surrounding through its cell membrane.
2. **Transduction:** DNA transfers from one bacterium to another through a bacteria infecting virus called bacteriophage.
3. **Conjugation:** DNA transfers from one bacterium to another by direct cell-to-cell contact that is facilitated by plasmids.

Q7. What is genetic modification? How is it useful in our daily life? Support your answer with examples.

Ans: Genetic modification is the change in the gene of living being to introduce desirable properties in it. It is also known as genetic engineering. Genetic modification is the process of changing the DNA in an organism. This process may include changing one base of the DNA, removing a whole segment of DNA or introducing additional copy of a gene. It is like altering the recipe for making life-gene found in every organism.

For example, if a plant 'A' has pest resistance trait then we can copy its DNA and introduce it into another plant 'B', so that the plant 'B' will have the pest resistance trait.

Q8. How application of biotechnology is helpful to us? Give some solid examples.

Ans :Biotechnology is helping the world by providing breakthrough products, reducing environmental problems, feeding the hungry, using cleaner and safer energy and technologies to fight rare diseases. Let's have a look on the great things biotechnology has been doing for us.

Healing the world

Biotechnology is helping us to heal the world by bringing natural resources and man's own genetic code and make up to heal the world, also promoting further research by reducing rate of infections. Biotech is saving children's life. It is creating new precise tools to detect diseases. It is increasing lives of people suffering from life threatening diseases. Biotechnology is always finding new less harmful processes to make various products helping to reduce health risks and side effects.

Feeding the world

Biotechnology is feeding the world by increasing growth and yield of crops and increasing insect resistance of crops. Biotechnology is helping farmers to develop more products with only fewer inputs. It is helping people to develop crop with improved nutrition profiles to reduce the deficiency of various vitamins and other minerals in humans. The most commonly used bacteria in food industry are lactic bacteria. It develops flavor and colour of the products. Biotechnology makes it possible for us to prepare food that is free from allergens and toxins like mycotoxin. It also helps us to maintain oil level in food products to prevent cardiovascular problems.

Fueling the world

Biotechnology uses biological processes like fermentation and biocatalysts such as enzymes, yeast and other microorganisms to manufacture various useful products. These biological processes reduce the chemical steps involved and energy requirement in manufacturing products reducing the cost of the manufacturing plant. Biotechnology also helps us in lowering



the temperature for cleaning clothes which decreases water usage and waste formation saving billion of rupees annually. Using biofuels reduces the emission of greenhouse gases by 52% or more, which in turn decreases our reliance on petrochemicals.

Saving environment

Environmental biotechnology removes pollutants from our environment. The process that uses microbial organisms to remove pollutants from environment is called bioremediation. Bioremediation uses bacteria to remove agricultural chemicals like fertilizers and pesticides from water. It also remove toxic metals like oxides, selenium and arsenic compounds from water. Mercury is formed as a by-product in many industries but it is

Reasoning questions

1. Describe three ways that biotechnology can help people live better lives in a healthier world.

Ans: Biotechnology helps us in;

- Healing the world
- Feeding the world
- Saving environment

2. Define plasmids.

Ans: Plasmids are genetic structure in a cell that can replicate independently of the chromosomes, typically a small circular DNA strand in the cytoplasm of a bacterium or protozoan. Plasmids are much used in the laboratory manipulation of genes

3. Some very useful products made with the help of biotechnology are

Ans: Detergent, Bread, Carpet, Plastic food packaging, Synthetic rubber, Biofuels, Tissue paper etc.

4. Blue biotechnology is helping to improve aquatic environment for marine life.

Ans: It controls the spread of harmful and possibly deadly water borne organisms protecting not only other organisms living in the water but also humans who use this water for drinking, cleaning and washing purposes. Blue biotech uses bioremediation to remove oil from the water. It uses oil eating microbes to break down hydrocarbons and degrade it into carbon dioxide.

Circle the correct answers:

1. b) Bread
2. b) Escherichia
3. a) Fermentation
4. c) Nucleus
5. b) Genes are short segments of DNA that code for a product.
6. d) 46
7. d) Chromosomes
8. a) Nitrogen fixation
9. d) Be able to transfer desired genes from one organism to another

10. d) Can readily take up plasmids containing humans genes and then produce the human proteins encoded by those genes
11. d) Vaccine
12. c) Bread mold

Fill in the blanks.

1. The human genome is the entire DNA of a human.
2. The X and Y chromosomes are known as the sex chromosomes.
3. Chromosomes 1 to 22 are known as autosomes.
4. The number of human genes is about 20,000 to 25,000.
5. Humans have 23 pairs of chromosomes.
6. Environmental biotechnology removes pollutants from our environment.
7. Using biofuels reduces the emission of greenhouse gases by 52% or more, which in turn decreases our reliance on petrochemicals.
8. The process that uses microbial organisms to remove pollutants from environment is called bioremediation.
9. Diabetes occurs when your body doesn't use insulin well or doesn't make enough insulin.
10. DNA transfers from one bacterium to another through a bacteria infecting virus called bacteriophage.
11. Of all the bacteria in a healthy body 85% are good bacteria and remaining 15% are bad bacteria.
12. DNA has a double helix structure with two strands of nucleic acid twisted together.
13. Our genes are tiny segments of DNA that contains complete coding of our genetic composition.
14. Adenine (A) couples with thymine (T).
15. DNA polymerase adds new bases to the strands during DNA replication.
16. DNA ligase seals the new DNA in two continuous long strands.
17. E-coil can divide every twenty minutes.

Here are various biotechnology products which are used to save lives: Write their uses

- i) **INSULIN**
Insulin is a hormone which helps keeps your blood sugar level from getting too high (hyperglycemia) or too low (hypoglycemia).
- ii) **VACCINES**
Vaccines provides active acquired immunity to a particular disease.
- iii) **GROWTH Hormone**
Growth hormone is a peptide hormone that stimulates growth, cell reproduction, and cell regeneration in humans and other animals.
- iv) **BETA-ENDORPHIN**



Beta-Endorphins behave like Endorphin (which is a natural painkiller, that are produced in the brain). This helps in relieving the pain. Endorphins bind opiate receptors in the brain.

v) INTERFERON

This medication is used to treat various cancers (e.g., leukemia, melanoma, AIDS-related Kaposi's sarcoma). It is also used to treat virus infections (e.g., chronic hepatitis B, chronic hepatitis C, condylomata acuminata).

State whether “True” or “False.”

1. Bacteria, viruses and some fungi are micro-organisms. **True**
2. Yeast is a type of fungus. **True**
3. Bacteria are smaller than viruses. **False**
4. There are bacteria in yogurt. **True**
5. Antibiotics such as penicillin are made by viruses. **False**
6. When microbes respire they produce oxygen gas. **False**
7. Biotechnology is polluting our environment. **False**
8. Biotechnology helps people reduce their use of pesticides. **True**
9. Biotechnology helps people produce more food with less input. **True**
10. Biotechnology help the earth produce more nutritious food. **True**
11. Humans have been using other organisms to make new products for about 10,000 years. **True**
12. Biotechnology uses biological processes like fermentation and biocatalysts such as enzymes, yeast and other microorganisms to manufacture various useful products. **True**
13. Bacteria reproduce by meiosis. **False**
14. Genetic modification can make plants to grow bigger or faster or make more fruits for people to eat. **True**
15. There is five ways to introduce another gene into bacterium. **False**
16. The DNA that makes up the gene on chromosome string is called non-coding DNA. **False**
17. Dogs have 46 chromosomes. **False**
18. First 22 pairs of chromosomes inside us are called autosomes. **True**
19. Genes are like string of beads in which vacuoles are the beads. **False**



Chapter 4: Pollutants and their effects on environment

Learning Objectives

In this lesson we will learn about

- Pollutants
- Effects of Pollutants on environment
- Air Pollution and its effect on environment
- The Greenhouse effect
- Global Warming
- Climate Change
- Indoor air pollution
- Biological Pollutants
- Saving the Earth

Teacher Starter

You may start the lesson by enlightening your students about the environment and its features, also give an idea how important an environment is by giving some relevant examples.

Tell your students that we the humans are polluting our surroundings (environment). Tell them Pollution has become a large problem and is causing great harm to our environment. Tell them about the different types of pollution and the sources of these pollution. Also let them aware about the preventative measures so that they can protect the environment from further damage.

Teaching

Thoroughly read the chapter in the class and make it as understandable and convenient for the kids to understand well. Ask different questions during or by the end of the topic in order to ensure that each and every concept should be clear to the students. Emphasize more on environment, the pollutants which causing the damage to the environment. The types of pollution we are encountering and how to take preventive measures to avoid further damage.

Exercise

Answer the following questions

Q1. What is air? How it becomes polluted?

Ans: Air is a mixture of useful gases, it contains 21% oxygen, 78% nitrogen and 1% other trace gases. When particles, gases, biological molecules get mix up into the air, they make air contaminated or polluted. The contamination of air because of the presence of particles or gases which have damaging and toxic effect, is called air pollution. Things that pollute the air are called pollutants. Some common pollutants include carbon monoxide gas, nitrogen oxide, sulphur dioxide, dust particles and any chemical that evaporates and enters into our atmosphere.

Q2. What are the causes of air pollution?

Ans: Air pollution can occur because of both the human and natural actions. Natural actions such as evaporation of organic compounds, volcanic eruption, forest fires, dust, natural radioactivity and pollen grains are causes of air pollution.

Some things we do also cause air pollution. We rely on fossil fuels for the production of energy. The vehicles we use to get from one place to another like cars, buses, motor bikes, trains and trucks all burn lots of fossil fuel to work emitting fumes of gases. Automobile engine emit hazardous gases like carbon dioxide, nitrogen oxides, hydrocarbons and particulates. Factories burn fuel to get energy emitting huge amount of chemicals, carbon monoxide and particulates that get into the air.

Some fertilizers emit ammonia gas into the air which is hazardous.

Other air pollution causes include, decomposition of garbage and disposal of solid waste which are emitting hazardous methane gas.

Each pollutant in the air is directly or indirectly harmful to human health. Following table shows some common air pollutants with their properties, sources and effects;

Q3. At an individual level, how can you help reduce air pollution?

Ans: There are various ways, such as

- Use less electricity and support alternative energy sources that do not use fossil fuel.
- Reduce the use of disposable items such as plastic cups, spoons and plates.
- Use public transport instead of driving.
- Reduce waste material, reuse and recycle the things you use wherever possible.
- Plant new trees as they absorb carbon dioxide from the atmosphere
- Eat less meat as cows are the biggest producers of methane gas.
- Use water carefully
- Walk to shop or market or you can ride a bicycle.
- Help in community projects to clean up your environment

Q4. Explain the difference between pure air and polluted air.

Pure Air:

- Pure air contains around 78% nitrogen, 21% oxygen, and 0.03% carbon dioxide also small amounts of argon, methane, ozone, and water vapours.
- Smog is not present.
- Not harmful for human beings

Polluted air:

- Polluted air includes gases like sulfur dioxide, nitrogen dioxide, carbon dioxide, etc. and other particulate matter.
- Smog can be present.
- Harmful for human beings as cause diseases like asthma

Q5. Explain circumstances leading to acid rain. How does acid rain affect us?

Ans: Acid rain is caused due to more of smoke released in the atmosphere and the smoke which is present in the atmosphere contains sulphur dioxide and nitrogen dioxide which gets mixed

with the rain and ultimately comes down on the earth as acid rain. it is harmful to us as it decreases the quality of the soil and acid rain affects the forests, trees and plants

Q6. Describe the 'Greenhouse effect' in your own words.

Ans: While other planets in Earth's solar system are either scorching hot or bitterly cold, Earth's surface has relatively mild, stable temperatures. Earth enjoys these temperatures because of its atmosphere, which is the thin layer of gases that cloak and protect the planet.

There's a delicate balancing act occurring every day all across the Earth, involving the radiation the planet receives from space and the radiation that's reflected back out to space. It's this equilibrium of incoming and outgoing radiation that makes the Earth habitable.

The exchange of incoming and outgoing radiation that warms the Earth is often referred to as the greenhouse effect because a greenhouse works in much the same way.

Q7. Prepare a brief speech on global warming that you have to make in your class.

Ans: While other planets in Earth's solar system are either scorching hot or bitterly cold, Earth's surface has relatively mild, stable temperatures. Earth enjoys these temperatures because of its atmosphere, which is the thin layer of gases that cloak and protect the planet.

However, 97 percent of climate scientists agree that humans have changed Earth's atmosphere in dramatic ways over the past two centuries, resulting in global warming.

Carbon dioxide (CO₂) and other greenhouse gases act like a blanket, absorbing IR radiation and preventing it from escaping into outer space. The net effect is the gradual heating of Earth's atmosphere and surface, a process known as global warming.

These greenhouse gases include water vapor, CO₂, methane, nitrous oxide (N₂O) and other gases. Since the dawn of the Industrial Revolution in the early 1800s, the burning of fossil fuels like coal, oil and gasoline have greatly increased the concentration of greenhouse gases in the atmosphere, especially CO₂.

Deforestation is the second largest anthropogenic source of carbon dioxide to the atmosphere. Atmospheric CO₂ levels have increased by more than 40 percent since the beginning of the Industrial Revolution, The greenhouse effect, combined with increasing levels of greenhouse gases and the resulting global warming.

If global warming continues unchecked, it will cause significant climate change, a rise in sea levels, increasing ocean acidification, extreme weather events and other severe natural and societal impacts.

Many scientists agree that the damage to the Earth's atmosphere and climate is past the point of no return or that the damage is near the point of no return.

I agree that we have passed the point of avoiding climate change, so there are three options from this point forward:

- Do nothing and live with the consequences.
- Adapt to the changing climate (which includes things like rising sea level and related flooding).
- Mitigate the impact of climate change by aggressively enacting policies that actually reduce the concentration of CO₂ in the atmosphere.

In my opinion, the damage isn't to that point yet, and that collective efforts and action can save the planet's atmosphere.

Q8. Discuss in detail the process of ozone depletion.

Ans:

Ozone is a gas composed of three atoms of oxygen. Good ozone is simply an invisible layer of ozone gas in the stratosphere where the concentration of ozone is fairly high. Ozone layer sits between earth and sun. It turned out that industries which manufacture products like soaps, solvents and insulating foam were using chemicals called chlorofluorocarbon CFCs. These chemicals were heavier than air but over time (about 2-5 years) wind carries them high into the stratosphere. When CFCs reach stratosphere they start ozone depletion. Ultraviolet rays from sun hit CFCs molecules and break them releasing chlorine atoms. Chlorine atoms react with ozone molecules and start a chemical cycle that damages ozone layer causing it to become depleted or thinner. One chlorine atom can destroy more than 100,000 ozone molecules.

Q9. Is ozone depletion related to global warming?

Ans: Ozone (O_3) depletion does not cause global warming, and it is not the result of global warming either. But both of these environmental problems have a common cause: human activities that release pollutants into the atmosphere altering it.

Q10. What is the difference between stratospheric and ground level ozone?

Ans: Ozone in the troposphere (the layer of atmosphere in which we live) is a toxic compound dangerous for breath. Its concentration doesn't should be over few ppb (part per billion) also if few quantities are produced for sterilization of air and water. It is a secondary pollutant, because produced from others pollutants like NO_x .

On the other hand, ozone is very useful in stratosphere because it stops the UV rays, coming from the sun. It is produced from the sun rays themselves but it can be destroyed from chemical substances as chlorofluorocarbons used for refrigerators and other ones used as propellant for spray cans

Q11. What is the effect of global warming?

Ans: Here we discuss some of the changes wrought by global warming.

- Increase in average temperatures and temperature extremes
- Extreme weather events
- Glacier (Ice) melting
- Sea levels and ocean acidification
- Adverse effect on Plants and animals
- Adverse Social effects

Short answer questions

1. What are the natural sources of air pollution?

Ans:

- Dust from natural sources, usually large areas of land with little or no vegetation
- Methane, emitted by the digestion of food by animals, for example cattle
- Radon gas from radioactive decay within the Earth's crust.
- Smoke and carbon monoxide from wildfires



- Vegetation, in some regions, emits environmentally significant amounts of Volatile organic compounds (VOCs) on warmer days.
- Volcanic activity, which produces sulphur, chlorine, and ash particulates

2. Which of the following is not a greenhouse gas? Carbon dioxide Sulphur dioxide Methane Nitrogen

Ans: Nitrogen

3. How Sulphur dioxide is dangerous to our health?

Ans: Sulfur dioxide irritates the skin and mucous membranes of the eyes, nose, throat, and lungs. High concentrations of SO_2 can cause inflammation and irritation of the respiratory system, coughing, throat irritation, breathing difficulties, can affect lung function, worsen asthma attacks, and worsen existing heart disease in sensitive groups. This gas can also react with other chemicals in the air and change to a small particle that can get into the lungs and cause similar health effects.

4. What are the anthropogenic sources of air pollution?

Ans: These are mostly related to the burning of multiple types of fuel.

- Smoke stacks of fossil fuel power
- Mobile sources include motor vehicles, marine vessels, and aircraft.
- Controlled burn practices in agriculture and forest management.
- Fumes from paint, hair spray, varnish, aerosol sprays and other solvents
- Waste deposition in landfills, which generate methane.
- Military resources, such as nuclear weapons, toxic gases, germ warfare and rocketry.
- Fertilized farmland, a major source of nitrogen oxides

5. What is ozone?

Ans: Ozone is a colorless unstable gas with a pungent odour and powerful oxidizing properties, formed from oxygen by electrical discharges or ultraviolet light. It differs from normal oxygen (O_2) in having three atoms in its molecule (O_3). Ozone layer in the stratosphere absorbs most of the ultraviolet radiation reaching the earth from the sun.

6. What are CFCs?

Ans: Chlorofluorocarbons are any of a class of compounds of carbon, hydrogen, chlorine, and fluorine, typically gases used in refrigerants and aerosol propellants. They are harmful to the ozone layer in the earth's atmosphere owing to the release of chlorine atoms on exposure to ultraviolet radiation.

7. Which gas is present in large amount in the upper part of stratosphere?

Ans: Oxygen

Critical thinking

1. What line of action will you adopt to reduce the amount of CO₂ in the air?

Ans:

- Use less electricity and support alternative energy sources that do not use fossil fuel.
 - Reduce the use of disposable items such as plastic cups, spoons and plates.
 - Use public transport instead of driving.
 - Reduce waste material, reuse and recycle the things you use wherever possible.
 - Plant new trees as they absorb carbon dioxide from the atmosphere
2. Predict what will happen if the amounts of greenhouse gases are drastically reduced in the atmosphere?

Ans: Even if carbon emissions stopped completely right now, as the oceans catch up with the atmosphere, the Earth's temperature would rise about another 1.1F (0.6C). Scientists refer to this as committed warming. Ice, also responding to increasing heat in the ocean, will continue to melt. There's already convincing evidence that significant glaciers in the West Antarctic ice sheets are lost. Ice, water, and air – the extra heat held on the Earth by carbon dioxide affects them all. That which has melted will stay melted – and more will melt.

Circle the correct answers:

1. c) Smoke
2. a) Dust particles
3. b) Carbon-monoxide
4. b) It decreases the oxygen levels produced
5. d) Volcanic ash
6. b) Smog
7. a) Changes soil for plant
8. c) Creating the hole in the ozone layer
9. a) Factories
10. c) Elderly people d) People with asthma
11. a) The ozone hole is shrunk
12. b) Include smog c) Are put directly into the atmosphere d) Cause instant death when inhaled
13. d) All of the above
14. d) All of these
15. c) aerosol
16. d) All of the above
17. c) Van Mahotsav

Fill in the blanks:

1. Global warming is caused due to increased concentration of CO₂ in air
2. Burning of coal and diesel releases Greenhouse Gases.



3. Petrol engines give off gaseous oxides of Nitrogen and Sulphur.
4. Acid rain is caused by oxides of Nitrogen.
5. The stratosphere layer is the layer of the atmosphere that contains the protective ozone layer.
6. Chemicals intended to kill insects and other organisms that damage crops are called pesticides.
7. Rain that is acidic in nature is called Acid Rain.
8. CFCs are man-made compounds that have been widely used as refrigerants and in spray propellants and foam blowing.
9. Sprays we use to kill insects and pests, furniture varnishes, perfume spray, glues, cleaning materials, air fresheners and paints are all causes of indoor air pollution.
10. When plants are made toxic due to acid rain animals that feed on them suffer from health problems.
11. Smoking tobacco smoke can cause problem of respiratory track and can also cause lungs cancer.
12. Ozone Hole is not exactly a hole where no ozone is present but a region with disturbingly thin layer of ozone.
13. Deforestation is the removal of trees by humans or naturally.
14. Factories burn fuel to get energy emitting huge amount of chemicals, carbon monoxide and particulates that get into the air.
15. Pollen of plants, hair of pet animals, fungi and bacteria are all biological pollutants.
16. Rising sea level could flood coastal citites displacing millions of people living in the low-lying areas.
17. Trees take in carbon dioxide and use it to prepare their food by photosynthesis.
18. Things that pollute the air are called Air Pollutants.
19. Some pollutants like carbon monoxide, nitrogen dioxide and sulphur dioxide enter into the air directly from a process such as burning of fuels.
20. Greenhouses are made of glass and are designed to hold heat inside.

State whether “True” or “False.”

1. The average home creates more pollution then does an average car. **False**
2. The only health effect of ground-level ozone pollution is coughing. **False**
3. Ozone in the Troposphere is a harmful pollutant. **True**
4. Indoor pollution is 10 times more toxic than outdoor pollution. **True**
5. When air is polluted, you can always smell and see it. **False**
6. Acid precipitation is created by reactions in the atmosphere, and can fall many miles from where pollution originated. **True**
7. We can survive without air for sometimes but we cannot survive even for a few minutes without food. **False**
8. A brick kiln emits lots of smoke and other harmful gases causing air pollution. **True**
9. Carbon monoxide is produced by complete burning of fuels such as coal, petrol and diesel. **False**
10. Carbon monoxide is a poisonous gas. **True**



11. CFCs are not used in air conditioner. **True**
12. Parts of polar ice cap would melt, causing increased flooding. **False**
13. Each day, an adult breathes about 35 pounds of air! **False**
14. Before the industrial revolution, there was no air pollution. **False**
15. Global warming is also known as the greenhouse effect. **True**
16. Global warming is helpful. **False**
17. Acid rain leaches humus from the soil. **True**

Match the term in column 'I' with the suitable definition in column 'II' (Matched)

Column I	Column II
Ozone layer	Earth's protective screen
Secondary pollutants	Pollutants formed in the air by the reacting primary pollutants
Deforestation	Removal of trees
Pollutants	Things that contaminate air
Eutrophication	Excessive growth of plants and algae in water due to increased availability of nutrients

Look at the picture carefully and write in detail what you can see and what are the causes of this situation.

The picture is about smog. Smog is a kind of air pollution, originally named for the mixture of smoke and fog in the air. Smog is a problem in a number of cities and continues to harm human health. It often stays for an extended period of time over densely populated cities or urban areas

It can inflame breathing passages, decreasing the lungs' working capacity, and causing shortness of breath, pain when inhaling deeply, wheezing, and coughing. It can cause eye and nose irritation and it dries out the protective membranes of the nose and throat and interferes with the body's ability to fight infection, increasing susceptibility to illness.

Chapter 5: Chemical Reactions

Learning Objectives:

After this lesson, students will be able to:

- Define the Chemical Reactions
- Energy changes during chemical reactions
- Exothermic & Endothermic Reactions
- Speed of Chemical Reaction
- Types of Chemical Reaction
- Law of conservation of Mass

Teacher Starter

You may start the lesson by exploring their previous knowledge. By giving various examples, help them differentiate between physical and chemical change. Then discuss what the main characteristics of a chemical change are? Enlighten them that there are two main characteristics that are eminent in every chemical reaction (i-e irreversibility, and change in properties). With the help of different examples, explain different types of chemical reactions. Also explain them that there are some unwanted chemical reactions like rusting and oxidation of food. At last let them aware of the fact that during a chemical reaction the overall mass of the products are always equal to the mass of reactants.

Teaching

Engage yourself effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners. You can start by reading the chapter and make the chapter understandable and convenient by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter.

Exercise

Answer the following questions

Q1. What is meant by chemical reaction?

Ans: Chemical reaction is when you take two ordinary things, mix them together and have something extraordinary.

Q2. When a chemical reaction occurs what changes happens?

Ans: A chemical reaction happens when molecules of one substance break apart and combine with the molecules of another substance to form a new substance

Q3. Write the definitions of endothermic and exothermic reactions.

Ans: Some chemical reactions release energy in the form of heat or light. These are exothermic reactions. While some chemical reactions absorb energy in order to proceed. These are called endothermic reactions.

Q4. What is Law of conservation of mass? Write in detail.

Ans: In context of chemistry, law of conservation of mass says that the mass of the products is always equal to the mass of the reactants. In all chemical reactions mass is conserved because the same atoms are present in reactants and products, although they are combined differently.

Q5. What is combustion? Support your answer with examples.

Ans: Combustion reaction

Combustion is the other name of burning. Combustion reaction happens when hydrocarbons (compound containing carbon) reacts with oxygen present in the air producing carbon dioxide, heat and water. Heat is the most useful product of combustion reaction.

The basic form of a combustion reaction is;

Hydrocarbon + Oxygen → Carbon dioxide + water + Heat

A simple example of combustion reaction is the burning of methane

Methane + Oxygen → Carbon dioxide + water + heat

$\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g}) + \text{heat}$

Burning of naphthalene is another example of combustion reaction

Naphthalene + Oxygen → Carbon dioxide + water + heat

$\text{C}_{10}\text{H}_8 + 12\text{O}_2 \rightarrow 10\text{CO}_2 + 4\text{H}_2\text{O} + \text{heat}$

Q6. How many types of chemical reactions are there?

Ans: Following are the types of chemical reactions.

- Synthesis or combination reaction
- Decomposition reactions
- Displacement reaction
- Combustion reaction
- Neutralization reaction
- Precipitation reaction

Some other types of chemical reactions include

- Redox reaction:
- Thermal decomposition reaction
- Hydrolysis:
- Isomerization

Q7. What is the method of balancing equations?

Ans:

- Write down your given equation
- Write down the number of atoms per element.
- Save hydrogen and oxygen for last, as they are often on both sides.
- Start with single elements.
- Use a coefficient to balance the single carbon atom
- Balance the hydrogen atoms next.
- Balance the oxygen atoms

Q8. Balance the following equations: After balancing the reactions determine the types of chemical reaction.

Equation	Type of Reaction
1. $3\text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$	
2. $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$	
3. $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$	
4. $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$	
5. $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$	

Short answer questions

1. What do you mean by a precipitation reaction?

Ans: The formation of insoluble solid particles in chemical reaction is called precipitation and the insoluble solid is called precipitate.

2. Write a balanced chemical equation for the following chemical reaction:

a. Solution of barium chloride and sodium sulphate in water to react to give insoluble barium sulphate and the solution of sodium chloride.



b. Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

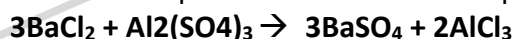


3. Write the balanced equation for the following chemical reactions:

a. Hydrogen + chlorine \rightarrow hydrogen chloride



b. Barium chloride + aluminum sulphate \rightarrow barium sulphate + aluminium chloride



c. Sodium + water \rightarrow Sodium hydroxide + hydrogen



4. Name two biochemical reactions which are exothermic.

- Respiration
- Decomposition of organic waste

5. Write two less useful chemical reactions from your daily life.

Ans:

- Rusting of Metals
- Oxidation of food

Write the correct answers in the blank spaces:

1. b) This is a chemical change.
2. a) They can be observed when the identity of a substance changes.
3. b) The Law of Conservation and Mass
4. a) NO₂
5. a) Replacement
6. b) Products
7. a) Reactants
8. c) Chemical reaction
9. c) combustion
10. a) a balanced equation
11. d) catalyst
12. c) Endothermic
13. b) 2
15. c) water and Salt
16. a) the reactants to the surroundings
17. b) combination
18. a) Products
19. c) carbon dioxide

State whether “True” or “False.”

1. Catalysts facilitate chemical reaction. **True**
2. If you add vinegar and baking soda to a bottle and loosely cap the bottle, the cap will most likely remain on the bottle. **False**
3. Ice melting is an evidence of a chemical reaction. **False**
4. During a reaction a catalyst gets used up and has to be replaced all the time. **False**
5. Increasing the temperature of reactants increases number of particles in the reaction. **False**
6. There are five main factors that affect the rate of reaction. **False**
7. Dissolving salt is a chemical reaction. **False**
8. Products in a chemical reaction are usually formed more quickly at higher temperatures.

True

9. In a combustion reaction, matter is destroyed. **False**
10. $\text{Mg} + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ Single replacement **True**
11. Compounds have the same characteristics before and after a reaction. **False**
12. Compounds can be decomposed to their elements. **True**
13. Rusting of metals is a combustion reaction. **False**
14. The reaction between quicklime and water is an endothermic reaction. **False**
15. A chemical reaction in which a substance combines with water is called Hydrolysis. **False**

Circle the word or phrase that correctly completes each sentence below.

1. exothermic
2. conservation
3. energy
4. reaction
5. exothermic



Fill in the blanks:

1. Most of the chemical reactions cause chemical changes and are irreversible.
2. All chemical reactions start with reactants and end with products.
3. Law of conservation of mass says that the mass of the products is always equal to the mass of the reactants.
4. Sometimes chemical changes produce new smells.
5. Foods like milk and fats such as butter and lard turn sour when they react with the oxygen present in the air.
6. Catalysts are substances that increase the rate of reaction by speeding up the reaction without being used in the reaction.
7. The number of atoms of each element on the reactant side will be equal to that on the products side.
8. Cooking an egg is another endothermic reaction.
9. A mixture is something in which two substances are mixed in such a way that they can be easily separated.

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Chapter 6: Acids, Alkalis and Salts

Learning Objectives:

After this lesson, students will be able to:

- Describe Acids
- Physical and Chemical properties of acids
- Describe Bases
- Physical and Chemical properties of bases
- Indicators of Acids, Bases
- pH
- Neutralization

Teacher Starter

You may start the lesson by exploring their previous knowledge. By giving various examples, talk about the basics of acids and bases and how acid-base chemistry is related to chemical equilibrium. Tell them that substances which taste sour are acids and substances which taste bitter and are slippery to touch are bases.

Upon examination of various substances they may learn that some substances do not have taste. So how do we classify them as acids or salts? Tell them these are classified with the help of indicators. Also give them an idea of pH values of different chemicals, acid-base equilibrium, acid-base properties of salts, and the pH of salt solutions.

Teaching

Engage yourself effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners. You can start by reading the chapter and make the chapter understandable and convenient by explaining things mention in the chapter. You may ask questions, in order to understand how much they grasp the concept of the chapter.

Exercise

Answer the following questions

Q1. Define the terms: Acid, alkali and salt.

Ans: Acid:

a substance with particular chemical properties including turning litmus red, neutralizing alkalis, and dissolving some metals; typically, a corrosive or sour-tasting liquid of this kind.

Alkali

a compound with particular chemical properties including turning litmus blue and neutralizing or effervescing with acids; typically, a caustic or corrosive substance of this kind such as lime or soda.

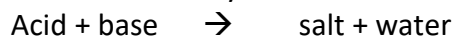
Salt:

any chemical compound formed from the reaction of an acid with a base, with all or part of the hydrogen of the acid replaced by a metal or other cation.



Q2. What is a neutralization reaction?

Ans: When an acid reacts with an alkali they both cancel each other and form neutral products. At the end of the reaction there is nothing acidic or basic in the reaction container. This process is called neutralization. Neutralization is a process in which acidity or alkalinity of a solution is removed. When an acid neutralizes a base or a base neutralizes an acid the neutral products formed are always salt and water.



Q3. What are strong and weak acids? Give one example of each?

Ans: The key difference between weak and strong acid is that weak acids ionize partially in water whereas strong acids ionize completely. For example, Hydrochloric acid is a strong acid. Whereas, acetic acid is weak acid.

Q4. How does a strong acid differ from a concentrated acid?

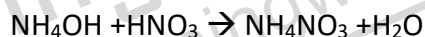
Ans: A strong acid is an acid that dissociates completely into its ions. Examples of strong acids are nitric acid, sulfuric acid and hydrochloric acid.

On the other hand, a concentrated acid is an acid that has not been diluted with water. It is an acid in its purest form. Typically, in the laboratory, acids can come in various concentrations.

Not all strong acids are concentrated, and not all concentrated acids are strong.

Q5. Name a salt of a strong acid HNO₃ and a weak base like NH₄OH. Represent the reaction that takes place.

Ans: The salt which will form on the above reaction is Ammonium Nitrate NH₄NO₃. Following reaction takes place



Q6. Name a strong base and a weak base.

Ans: NaOH (Strong)

NH₄OH (Weak)

Q7. What is 'pH' scale? Explain briefly.

Ans: pH scale measures the number of protons released in the solution. pH scale goes from 1-14. A neutral solution has a pH of 7 which means it has equal number of hydrogen and hydroxide ions. Water is neutral solution and has a pH of 7 because it dissociates into equal amount of both hydrogen and hydroxide ions. Any solution having pH less than 7 is acid solution. Any solution with pH greater than 7 is an alkali. As you go down the pH scale from 7, acidity increases and the strongest acids have a pH of 1. As you move up the pH scale from 7, alkalinity increases and the strongest alkalis have a pH of 14.

Q8. What are indicators? Name the common acid-base indicators used in the laboratory with their color change.

Ans: We use special dyes to tell which substance is acidic and which substance is basic. These dyes are called indicators. They change their color when come in contact with an acid or a base. Some naturally occurring indicators are litmus, turmeric and China rose petals. Litmus is the



most commonly used natural indicator. When you dip a blue litmus paper in an acid solution, it turns red. And when you dip red litmus in an alkali, it turns blue indicating the nature of solution.

Q9. What is a universal indicator? What is its advantage?

Ans: You can measure how strong or weak an acid or alkali is by using a special indicator known as universal indicators. Universal indicator is a mixture of several indicator dyes. These dyes are obtained from plants. Unlike litmus paper, universal indicator tell us exactly how strong and how weak an acid or base. It has many different colour changes depending on the exact pH of the sample being tested. It turns red for strong acids, green for neutral solutions and purple for alkaline solutions.

Reasoning questions;

1. Hydrochloric acid is considered as a strong acid whereas acetic acid is a weak acid. Why?

Ans: Hydrochloric acid is considered as a strong acid because it dissociates completely in water. But Acetic acid dissociates partially when dissolved in water. Most of its molecules remain in molecular form in the solution.

2.

3. A universal indicator is more meaningful than an ordinary indicator.

Ans: A universal indication not only indicates acidic or basic nature. It also indicates the pH values aswell.

Circle the correct answers:

1. a) Neutral

2. d) 9

3. d) H_3PO_4

4. c) Acids turn red litmus blue

5. a) Bases do not change the color of red litmus

6. d) Basic

7. a) Hydrochloric acid b) Carbonic acid c) Acetic acid d) Formic acid

8. a) $HCOOH$

9. c) Calcium hydroxide

10. c) Copper hydroxide

11. b) Basic

12. a) less than 7

13. d) $Ca(OH)_2$

14. b) $2KOH$



Fill in the blanks.

1. The new substances formed when an acid reacts with a base are Salt and Water.
2. Salt+Water is evolved during a neutralization reaction.
3. When dilute sulphuric acid is added to lime water, the reaction mixture becomes hot
4. Hydrochloric acid is present in our stomach.
5. The gas which escapes out from many aerated soft drink is Carbondioxide
6. The chemical name of lime water is Ca(OH)₂
7. Neutralization Reaction is the reaction between an acid and base.
8. An aqueous solution of sodium hydroxide changes red litmus to blue.
9. Phenolphthalein indicator turns acidic solutions to colorless and basic solutions to magenta.
10. The chemical name of moist baking soda is NaHCO₃+H₂O

Complete the following word equations.

1. Zinc + hydrochloric acid → Zinc Chloride + Hydrogen (Gas)
2. Sodium hydroxide + Hydrochloric acid → Sodium Chloride+ Water
3. Calcium hydroxide + sulphuric acid → Calcium Sulfate +Water

State whether “True” or “False.”

1. All acids turn blue litmus red. **True**
2. Neutral solution can change the color of litmus. **False**
3. Orange juice turns blue litmus red. **True**
4. Substances which are neither acidic nor basic are called neutral. **True**
5. An acid and a base neutralise each other and form salt and water. **True**
6. Sodium hydroxide and hydrochloric acid neutralize each other and form salt and water. **True**
7. DNA is an abbreviation for deoxyribonucleic acid. **True**
8. The word acid comes from the Latin word acidus(meaning sour). **True**
9. Pure water is neutral. **True**
10. Stomach acid is more acidic vinegar. **True**
11. Bleach is more basic than baking soda. **True**
12. Acids react with compounds containing hydroxide ions to form water and a salt. **True**
13. Any aqueous solution in which [H⁺] and [OH⁻] are equal is described as a neutral solution. **True**
14. Most pH values are whole numbers. **True**
15. You can calculate hydrogen ion concentration of a solution if you know the pH. **True**
16. The words strong or weak refer to the extent of ionization or dissociation of an acid or base. **True**

Give formulas of these acids, bases and salts

- | | |
|--|--|
| boron silicide <u>B₄Si</u> | magnesium phosphide <u>Mg₃P₂</u> |
| sodium hydroxide NaOH | zinc hydroxide <u>Zn(OH)₂</u> |
| iron(III)chloride <u>FeCl₃</u> | aluminium sulfide <u>Al₂S₃</u> |
| Sulfuric acid <u>H₂SO₄</u> | sulfurous acid <u>H₂SO₃</u> |

Name the following acids:HBr Hydro Bromic AcidHNO₃ Nitric AcidHNO₂ Nitrous AcidHI Hydoiodic AcidHF Hydrogen FluorideH₃PO₃ Phosphorous acidHC₂H₃O₂ Acetic AcidH₂CO₃ Carbonic AcidH₂SO₃ Sulfurous Acid

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Chapter 7: Force and Pressure

Learning Objectives

In this lesson we will learn about

- Pressure
- Calculating and using the pressure
- Pressure in Solids
- Pressure in fluids
- Hydraulics
- Pressure in gases
- Gas Laws
- Charles 'Law
- Guy-Lussac's Law
- Aerosols

Teacher Starter

Recall what they have learnt earlier, give some relevant examples before get started. Then tell your students what the pressure means in science, which is defined as the force over a given area. Given the same force, the smaller the area of contact, the more pressure is applied. You can give them the examples of heel and a nail. You can also have a short activity upon which you use different objects, to check their impact on the trough. The students will learn as the surface area reduces. The impact (pressure) increases. Similarly, you can have the activities related to the fluids and gases as well.

Teaching

Thoroughly read the chapter in the class and make it as understandable and convenient for the kids to understand well. Ask different questions during or by the end of the topic in order to ensure that each and every concept should be clear to the students. Ensure that students will be able to identify pressure among solids, liquids and in gases. How pressure effects the volume of liquids and gases.

Exercise

Answer the following questions

Q1. What is force and what is pressure? Write their definitions with examples.

Ans: The force applied on a unit area is called pressure. Pressure depends on how much force is applied and over the area on which force is applied. Greater the force more the pressure

Q2. How does fluid exert pressure?

Ans: A fluid exerts pressure in all directions.

Q3. What are the factors pressure exerted by liquids depend on?

Ans: Pressure by liquids depends on

- the density of the fluid and



- The depth

Q4. What is atmosphere?

Ans: Our planet Earth is wrapped in a thick blanket of gases. This blanket is several hundred kilometers thick and is known as the atmosphere.

Q5. We observe that wheels of buses and trucks are heavier than the wheels of cars and motorbikes. Why?

Ans: This is due to the fact that it's the tyres that moves and stop the car. All the force we have applied have their effect on tyres. So heavy vehicles require heavy tyres than the lightweight vehicles.

Q6. What are the effects of force?

Ans: Force can cause:

- A stationary object to move
- A moving object to change its speed
- A moving object to change its direction and motion
- An object to change in size and shape

Q7. What is meant by aerosols? Write in detail how aerosol cans work?

Ans: Aerosols are mixture of tiny particles of solid or liquid suspended in air or any other gas. Air you inhale looks clear but it contains millions of tiny particles of solids and liquid droplets and germs. These tiny particles are aerosol.

An aerosol can is made of steel and it contains two fluids one is called the propellant gas and the other is called the product. The product is a substance that you actually use (the paint, varnish, hairspray or whatever it might be). While the propellant helps to push the product out of the can. When the propellant is forced into the can during manufacturing it turns into a liquid under high pressure and mixes with the liquid product inside the can. When you press the nozzle the pressure is released and the propellant turns back into a gas. Propellant disappears in the air leaving behind the product you actually want.

Q8. What are Gas laws and write about different gas laws?

Ans: One of the most incredible things about gases is that even if they are chemically different from each other, they all more or less follow the gas laws. Scientists after a lot of research discovered gas laws and these three gas laws tell us about the behavior of gases with respect to their volume (V), temperature (T) and pressure (P). But these laws only work if the temperature of the gas is measured in Kelvin scale instead of Celsius.

Q9. What do you know about hydraulics? How does hydraulic system work?

Ans: A liquid under pressure can transmit forces and this effect can be used by machinery to do work. Engineers use this effect of liquids in various machines to make them work. The branch of engineering that uses liquids in this way is called hydraulics

Consider a simple hydraulic system consisting of two glass containers filled with incompressible fluid (mostly oil is used) having pistons and an oil filled pipe connecting two containers. If you



apply downward force on the piston of left container then the force is transferred to the right container through the fluid in the pipe, pushing its piston upward. Since the fluid used is incompressible therefore almost all of the force applied to the left piston is transferred to right piston.

Q10. How do car brakes work?

Ans: When the driver presses down the brake pedal, force from the driver's feet is transferred to the brakes through a fluid. When the brakes are pushed a lever pushes the piston into the master cylinder which is filled with incompressible fluid. A system of pipes connect this master cylinder with four slave pistons one at each wheel so that the brake force is equally spread. Pushing the piston of master cylinder increases pressure inside it and the hydraulic fluid get squirted through the system of pipes into the four slave pistons on each wheel. This hydraulic system multiplies the force applied by the driver's foot on brake pedal into enough force to apply all four brakes to stop the car.

Reasoning questions;

1. Every object left above the surface of the Earth without a support, fall downwards.

Ans: this happens, because of the gravitational pull exerted by the earth on this object.

2. If gravitational force act between you and your friend. Then why should not you pull each other?

Ans: This is because we both have been pulled by a much stronger/massive object (earth) which neutralizes the force we act on each other.

3. Calculate the pressure produced by a force of 800 N acting on an area of 2.0 m².

$$F=800 \text{ N}$$

$$A=2.0 \text{ m}^2$$

$$P= 800/2$$

$$P= 400 \text{ Pa}$$

4. The pressure of a gas contained in a cylinder with a movable piston is 300 Pa. The area of the piston is 0.5 m². Calculate the force that is exerted on the piston.

$$\text{Pressure} = 300 \text{ Pa} \quad \text{Area of Cross-section} = 0.5 \text{ m}^2$$

$$\text{Force} = \text{Pressure} \times \text{Area of Cross-section}$$

$$= 300 \text{ Pa} \times 0.5 \text{ m}^2$$

$$= 150 \text{ N}$$

5. A swimming pool of width 9.0 m and length 24.0 m is filled with water to a depth of 3.0 m. Calculate pressure on the bottom of the pool due to the water.

$$L= 24.$$

$$W= 9$$

$$D= 3$$

$$P= L \times W \times D$$



$$P = 24 \times 9 \times 3$$

$$P = 648 \text{ Pa}$$

6. What is the total force on the bottom of the pool due to the water in the problem 3?

$$F = P \times A$$

$$F = 648 \times 24 \times 9$$

$$F = 139,968 \text{ N}$$

7. Why is it difficult to cut vegetables with blunt knife?

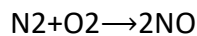
Ans: The reason lies in the very principle of Pressure. Blunt knives have increased area. So the pressure is reduced. So, sharper the edge, the more force from the cutting pressure is concentrated on a smaller area.

8. How the pressure of a liquid does depend on its depth?

Ans: The simplest explanation is that as you go deeper in a fluid, the weight of the fluid column above you increases. This weight divided by the area gives you the pressure.

Write correctly balanced equations for the following reactions:

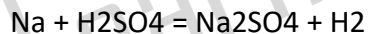
1. Nitrogen and oxygen, when lightning strikes.



2. Iron and dilute sulphuric acid



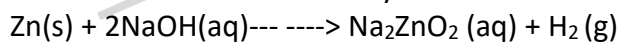
3. Dilute sulphuric acid poured over sodium



4. Copper sulphate from copper and concentrated sulphuric acid



5. Zinc is heated with sodium hydroxide solution



Circle the correct answer:

1. b) Higher than
2. b) Decreases
3. d) Gravitational force
4. b) force / area on which it acts
5. b) Attraction + Repulsive force
6. b) Pascal
7. b) valves
8. a) the mechanical energy is transferred to the oil and then converted into mechanical energy
9. c) Drum



10. b) Air is less dense and takes up a greater volume and area
11. a) The pointed end
12. c) Kelvin

Fill in the blanks.

1. Our planet Earth is wrapped in a thick blanket of gases. This blanket is several hundred kilometers thick and is known as Atmosphere.
2. Earth's atmosphere is about 300 miles (480 kilometers) thick.
3. The pressure exerted on us by the weight of air around us is called Atmospheric pressure and it is remarkably large.
4. The standard value of air pressure is 14.7 pounds at sea level; it's like holding a small car above your head and shoulders all the time.
5. Pressure depends on how much force is applied and over the area on which force is applied.
6. A Liquid under pressure can transmit forces and this effect can be used by machinery to do work.
7. Fluids used in hydraulic system is mostly an incompressible of some sort.
8. An aerosol can is made of steel and it contains two fluids one is called the propellant gas and the other is called the product.
9. Kelvin Scale uses absolute zero as its zero so there are no minus numbers in it
10. Aerosols are one of the major causes of environmental issues including ozone depletion and air pollution.
11. Gas molecules move from high pressure environment to low pressure environment so that they can spread out again.
12. Disk brakes contain a disk, a caliper and a brake pad.
13. Car brakes are very common example of piston driven hydraulic system.
14. Hydraulic system connects two cylinders having different diameters to a tube which transfers force applied to smaller cylinder to the larger cylinder.
15. Piping systems, pumps, flow measuring devices, hydraulic press, braking system of cars, lifting and excavating arm on diggers and water turbines all are designed using hydraulics.
16. Aerosols can cause asthma and acid rain which destroys land and plants.

State whether "True" or "False."

1. Accessories used in a hydraulic power unit adjust pressure and are used to generate flow and direction of the fluid. **True**
2. The SI unit of pressure is newton per square metre(N/m^2). **True**
3. Gravitational force exists nowhere in the universe. **False**
4. The pressure exerted by liquids decreases with depth. **False**
5. A force can never stop a moving object. **False**
6. The nail penetrated into the planks easily because a large force acts on a small area. **True**
7. Due to the atmospheric pressure of air, we experience a force equal to that exerted by a mass of 1 kg on every square centimetre of our body. **False**
8. Atmospheric pressure is caused by the weight of air molecules above the atmosphere. As we go to higher altitudes, the air becomes thinner and the atmospheric pressure decreases. **True**
9. Pressure is the thrust acting on a unit area of an object. **True**

Numerical

1. The elephant weighs 20,000 N stands on one foot of area 1000 cm². How much pressure would it exert on the ground?

Ans: Data

$$F=W=20,000 \text{ N}$$

$$A= 1000 \text{ cm}^2= 0.1 \text{ m}^2$$

$$P= W/A$$

$$P=20000/0.1$$

$$P= 200,000 \text{ N/m}^2 \text{ or Pa Ans}$$

2. Calculate the pressure produced by a force of 800 N acting on an area of 2.0 m².

$$F= 800 \text{ N}$$

$$A=2.0 \text{ m}^2$$

$$P= 800/2$$

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3. The pressure of a gas contained in a cylinder with a movable piston is 300 Pa. The area of the piston is 0.5 m². Calculate the force that is exerted on the piston.

$$P= 300$$

$$A= 0.5 \text{ m}^2$$

$$F= P \times A$$

$$F= 300 \times 0.5$$

$$F= 150 \text{ N}$$

4. A swimming pool of width 9.0 m and length 24.0 m is filled with water to a depth of 3.0 m. Calculate pressure on the bottom of the pool due to the water.

$$L= 24.$$

$$W= 9$$

$$D= 3$$

$$P= L \times W \times D$$

$$P = 24 \times 9 \times 3$$

$$P= 648 \text{ Pa}$$



Chapter 8: Measuring Things

Learning Objectives

In this lesson we will discuss about

- Measurement
- The Metric System
- SI system, why do we use it
- Mass, Measuring mass
- Time, Measuring time
- Volume, Measuring Volume of Solids, liquids and Gases
- The Meniscus

Teacher Starter

Place some common measuring tools such as the ruler, yardstick, tape measure, and scale. Explain to students that these tools are used to measure. Tell them, the ruler, tape measure, and yardstick are tools for measuring the length, width, and height of an object. Model how to use these tools by lining up the end of an object with the end of the tool and identifying the nearest inch as the length, width, or height. Now ask them what the scale is used to find out? Enlighten them that the scale is used to measure the mass of an object.

Teaching

Letting the students aware about the basics, let the students explore the concept of measurement of physical quantities. Also talk about what are the different sources of measurement of different quantities. Enlighten them about the base quantities, and what actually are the derived quantities. List out some common physical base quantities and derived quantities and explore the tools and units to measure them.

Exercise

Answer the following questions:

Q1. Why do we need to measure things?

Ans: We measure things to know how big or small they are. Almost every field of science experiment involves taking measurement, understanding them and sharing them with other scientists.

Q2. What is meant by measurement and how do we measure things?

Ans: Measurement means compare to a fix standard value. To measure something is to give a number to some property of the thing. Measuring something puts the amount of the thing into numbers. Measurement can be written using many different units.

Q3. How did people in old times measure the things? What do you think those methods were practical?

Ans: How we measure distance has changed a lot throughout history. King Edward II defined an inch as the length of three barleycorns in 1324, and in the late 18th century, a metre was

defined as one ten-millionth of the distance from the equator to the North Pole. Neither of these are sufficiently accurate or practical for modern applications.

In 1875, a bar was made from an alloy of platinum and iridium and was nominated to be the International Prototype Meter. While more practical, this is still not as accurate as we can now achieve. One of the issues with physical artefacts like this prototype is that, over time, the length can change.

Q4. What is metric system? Write its importance in everyday life?

Ans: By the late 18th century there were many different systems of measurement that it became very difficult to convert these measurements across different countries. It became essential to develop a single worldwide system of measurements to facilitate trade and corporation between countries. In 1790s French national assembly asked a group of intelligent scientists to develop a standard system of measurement that everyone can understand and use for measurement. After a lot of work scientists developed a measurement system and called it metric system. The basic unit of metric system was metric (unit of length). All other units of length were related to metre by the factor of 10 which made conversion from different units easier. They defined metre as the distance from the North Pole to the equator.

Q5. What is the latest system of measurement around the world and why it is important?

Ans: Several nations together held a conference in Paris in 1960 to create a standard system for measurement for all. They created the International System of Units abbreviated as SI. SI is the modern metric system used in science, industry, market and medicine. It defines metre as the distance light travels in a vacuum over a time interval of $1/299,792,458$ of a second. After its creation many nations started using SI for measurement. Now a days SI is used worldwide for measurement which make it easier for all countries to work with each other as scientists from one nation are sure that their second is the same time as everyone else's. It's like speaking the same basic language.

Q6. What is mass and write its symbols also?

Ans: Mass is the amount of matter present in an object. Mass remains constant. The SI unit for mass is kilogram (kg). Other units of mass include tons and gram (in metric system) pound and ounce in US system (imperial system). Bigger objects are measured in larger units such as tons while, smaller objects are measured in grams (g) and milligrams (mg).

Q7. What are the different apparatus for measuring mass? Write the names with pictures.

Ans: Now a days you can weigh things using various devices.

Beam balance



Electronic balance



Bathroom Scale



Q8. How do we measure length and what are the instruments used to measure length?

Ans : Length is the measurement of something from one end to another. You measure length all the time. You measure your height, thickness of your pen and width of your bed room. Four

commonly used units for measuring length are millimetre, centimeter, metre and kilometre. All these units are related to each other. Following are few instruments used to measure length.

- Ruler and Tape measure
- Vernier Caliper
- Screw gauge

Q9. How do we measure time? Write a short note on different types of clocks.

Ans: Ancient people used various ways to measure time. They used sun, moon, stars and other heavenly bodies for the measurement of time. They made use of the phases of the Moon, as its phases last almost a month so it was easier for them to measure that length of time. They needed a shorter period of time than a month so they invented weeks. A candle divided into segments was used by the Saxons to measure time. Since each segment of the candle took one hour to burn so that's how it helped in measuring time.

Ancient Egyptians used sundial to tell the time of the day. Sundial is the oldest known device used for measuring time. It uses the movement and cycle of sun to predict the time of the day. As the Sun rises from the east and sets in the west shadows formed by the pillar like object called the gnomon tells the time of the day. Sundials use the length of the gnomon shadow to measure time. It also helped earlier people about the longest and shortest days of the year. The main problem with older clocks was that they only used continuous processes to work like the movement of the Sun. But then scientists started using oscillation of pendulum and vibrations in clocks to make these clocks more accurate. Around the end of 13th century mechanical clock was invented.

Modern clocks

Today there are various types of clock that we use to measure time. Modern clocks work in the same way. They need a power source to run the clock like a battery, a time base or oscillator to ensure accuracy of time and a display to show the time.

Mechanical clocks

Mechanical clocks depend on pendulum or a balance wheel to provide constant movement. They use gears to move the arms of the clock and for changing the display. They use swinging of pendulum to measure time. Many grandfather clocks, antique clocks are mechanical clocks having complex gears in them. They are considered as an art and are very expensive.

Crystal clocks

Crystal or quartz clocks are one of the most accurate and efficient type of clocks. They use crystal quartz oscillators which resonate with a constant frequency of about 32,768 Hz. Quartz is an ideal resonator for clocks because it is very stable and its frequency does not change with the change in temperature.

Atomic clocks

Atomic clocks are the most precise clocks of modern time and usually are standard to set other clocks. They are so accurate that they have not missed or gained more than a second in 300 years. They are regulated by the atomic vibration of cesium metal. Atoms of cesium are constantly moving from positive to negative energy levels. Atomic clock uses their vibrations and frequency to measure time. The base unit in SI, 1 second is defined as the time taken by the 9,192,631,770 vibrations of cesium-133 to happen.

Q10. Write a detailed account on measuring volume.

Ans: Volume is the amount of space a solid, a liquid or a gas occupies. In SI system volume is often expressed in cubic units such as cubic metre (m^3), cubic centimetres (cm^3). Volume is a derived unit so we need other measurement to find volume of an object.

Volume of a box = length * width * height

Volume of Irregular Solids

You can use water displacement or displacement of any other liquid to measure volume of irregular piece of rock. Take water in a graduated cylinder, note its volume and then add the piece of rock in it. The water will rise by an amount equal to the volume of the rock piece. Thus the difference between the initial and the final volume of water tells the volume of the rock.

Measuring volume of liquids

Since liquids take the shape of the container in which they are placed therefore measuring their volume is quite easy. You just have to pour the liquid in the measuring apparatus to measure its volume.

All of these tools measure volume of liquids in litre (L) or millilitre (mL).

Reasoning questions;

1. It is easy to measure volume of liquids.

Ans: As liquids change volume at different temperature and pressure, volume to mass is only consistent at standard temperature and pressure. However, in most cases it is not practical to weigh liquids, so it is easier to measure a liquid on its volume than mass.

2. Atomic clocks are the most accurate one.

Ans: Because it measures the oscillation of atoms, that is why atomic clocks remain precise. They experience an error of 1 second every one-hundred million years or so. Today, atomic clock is considered to be one of the most precise clocks in the world.

3. Reading of meniscus is important.

Ans: as without this We won't be able to take an accurate reading looking up at the liquid level or down into it..

Circle the correct answer:

1. c) Seconds
2. d) Kilogram
3. a) above the scale
4. a) base quantities
5. c) Position the eye in line with the base of the meniscus
6. c) Vernier caliper
7. c) 9.99 cm
9. c) A
10. c) 2.23
11. a) 8.0mm b) 5.3 mm c) 8.5mm d) 3.5mm 12.

12. Look at the picture and answer the given question.

Question 1

a) Explain the differences of base quantities and derived quantities?

Ans: **Base quantities (Scalar Quantities):**



Independent quantities who have single standard units.

Derived Quantities (Vector Quantities):

Quantities derived by multiplying or dividing 2 base quantities.

b) Name the five base quantities and their SI units.

Length	meter
mass	kilogram
time	second
electric current	ampere
thermodynamic temperature	kelvin

c) State the unit of force in terms of base SI units.

$$1 \text{ N} = 1 \text{ kg m/s}^2$$

Question 2

Convert the units of the following quantities:

a) A length of 15 meters to feet

$$\text{Ans: } 15 \text{ m} = 49.2 \text{ feet}$$

b) A month with 30 days to seconds

$$30 \times 24 \times 60 \times 60 = 2,592,000 \text{ seconds}$$

c) A speed of 50 mph to m/s [Hint: 1 m = 3.28 ft, 1 mile = 1069 m]

$$50 \text{ mph} = (50 \times 1069) / 60 = 890.83 \text{ m/s}$$

13. Two students measure the lengths of adjacent sides of their dorm room. One reports 15ft 8in. and the other reports 4.25 m. What is the area of the room in square meter?

$$15 \text{ ft } 8 \text{ in} = 4.7752 \text{ m}$$

$$\text{Area} = 4.25 \times 4.7752$$

$$\text{Area} = 20.2946 \text{ m}^2$$

14. A student is 160 cm tall. Determine his height in kilometre and millimetre.

$$160 \text{ centimeter} = 0.0016 \text{ kilometer} = 1,600 \text{ millimeter}$$

15. A chapati has a radius of 16cm. what is its area?

$$A = 2 \times 22/7 \times 16$$

$$A = 100.57 \text{ cm}^2$$

a) MASS

1. A bag of cement has a mass of 50 kg. Convert the unit to gram(g)?

$$\text{Ans: } 50 \text{ kg} = 50 \times 1000$$

$$= 50,000 \text{ g}$$

2. A wooden block has a mass of 380 g. Convert the unit to kilogram(kg)?

$$380 \text{ g} = 380/1000 = 0.38 \text{ kg}$$

b) TIME

1. Convert 8 hours to minute?

$$\text{Ans: } 8 \times 60 = 480 \text{ minutes}$$



2. An airplane took off from Kuala Lumpur airport at 1400 hours and arrived at New Delhi airport at 1830 hours. Calculate the duration of the journey in minutes and seconds?
 $1830 - 1400 = 430$ hrs = $(4 \times 60) + 30 = 270$ minutes = $270 \times 60 = 16,200$ seconds

c) AREA

1. The floor area of a science laboratory is 40 m². Find the area in cm² and mm²?

$$40 \text{ m}^2 = 40 \times 1000 \times 1000$$

$$40,000,000 \text{ mm}^2$$

2. The measurements of A4 size paper is 300 mm long and 210 mm wide. Find the area of the paper in m²?

$$\text{Ans: } 300 \times 210 = 63,000 \text{ mm}^2 = 630 \text{ cm}^2$$

d) VOLUME

1. A beaker has a volume of 7.68×10^4 mm³. Determine its volume in cm³?

$$\text{Ans: } 7.68 \times 10^4 = 798.72 \text{ mm}^3 = 0.79872 \text{ cm}^3$$

State whether “True” or “False.”

- Volume is a measure of the amount of matter that makes up an object. **False**
- In a vacuum, all objects fall toward the center of the Earth with the same acceleration. **True**
- Is it true that 1 foot is 45 centimeters? **False**
- Two objects with the same volume always have the same mass. **False**
- Volume of solids is measured in cubic units. **True**
- Crystal or quartz clocks are not the most accurate and efficient type of clocks. **False**
- Atomic clocks are the most precise clocks of modern time and usually are standard to set other clocks. **True**
- To read a meniscus you first need to know what type of meniscus your liquid develops. **True**
- Ancient Egyptians used sundial to tell the time of the day. **True**
- We can use liquid displacement to measure volume of an irregular solid. **True**

Short Question Answer

1. Estimate your age in seconds.

Ans: depending on an average age of class 8 students. It is around 13 years, which means
 $13 \times 365 \times 24 \times 60 \times 60 = 409,968,000$ seconds

2. What role SI units have played in the development of science.

Ans: With the development in the field of science and technology, the need for a commonly acceptable system of units was seriously felt all over the world particularly to exchange scientific and technical information. Due to simplicity and convenience with which the units in this System International (SI) are amenable to arithmetic manipulation, it is in universal use by the world's scientific community.

3. What do you understand by the zero error of measuring instrument?

Ans: It is the incorrect reading that you have on your instrument when it is measuring something that *you know* should read zero. For example, you have a scale and you have nothing on it. The scale reading should be zero. If it reads a number different than zero, that is your Zero Error for the scale



4. Why the use of zero error is necessary in measuring instrument?

Ans: It is necessary to calibrate the zero error while measuring any instrument and adjusting all the readings of the future measurements that way. This way you can correctly measure the readings with utmost accuracy.

5. Make a list of ten things that are sold by volume (ml) and ten things that are sold by mass (kg).

Ans:

Kilogram	Litres
Meat	Liquid Acids
Pulses	Liquid Soap
Onion	Engine Oil
Potato	Brake fluid
Tomato	Lubricant
Mangoes	Palm Oil
Strawberries	Diesel
Wheat	Petrol
Rice	Milk
Wood	Juice

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Chapter 9: Sources and Effects of Heat

Learning Objectives

In this lesson we will discuss about

- The concept of heat as a form of energy.
- Sources of Heat
- Expansion and contraction of matter
- Application of thermal expansion in solids
- Expansion in Liquids
- Expansion in Gases

Teacher Starter

With an introduction to the ideas of heat energy, explore prior knowledge and understanding of heat among students, tell them that heat is also a form of energy, and like any other energy, it also has some source, discussing different sources of heat by giving examples of their surroundings help the students classify these sources as kinetic, electrical and chemical sources of heat energy. Also enlighten them about heat transference and how heat is transferred. You can also elaborate by giving the suitable examples about the thermal expansion in solids, liquids and gases, and how we applies this expansion phenomena in our daily life. Also discuss what we have experienced as a result of thermal expansion and what measure we take in order to mitigate the adverse effect these expansions.

Teaching

Letting the students aware about the basics of heat, let the students explore the concept of heat as a form of energy. Also talk about what are the different sources of heat energy. Give them the concept of heat transference. You can also elaborate by giving the suitable examples about the thermal expansion in solids, liquids and gases, and how we applies this expansion phenomena in our daily life. Also discuss what we have experienced as a result of thermal expansion and what measure we take in order to mitigate the adverse effect these expansions.

Exercises:

Answer the following questions

Q1. We hear the word 'heat' constantly, what it really means in science?

Ans: When we hear the word 'heat' we think of something warm or hot. But science defines heat differently. Science says that heat is a form of energy transfer from one body to another because of the temperature difference. When two bodies having different temperature are brought together, heat energy flows or transfers from the hotter body to the colder body. This transfer of energy in the form of heat as a result increases the temperature of the colder body and decreases the temperature of the hotter body. Objects with different temperature keep transferring heat until both reach at the same temperature. Often people think that heat and temperature are interchangeable but that's not the case. Temperature is hotness or coolness of an object while heat is the transfer of energy. Heat is measurable but it is not a substance. The SI unit for heat is the joule (J), sometimes it is also measured in calorie (cal).

Q2. What are the different sources of heat? Which is the biggest source of heat? Write in detail.
 Ans: There are various sources that we use to get heat. Some of these sources are described below.

- Sun
- Fossil Fuels
- Waste Materials
- Electricity

Sun- the major source of heat

Sun provides heat and light to the Earth and keeps it warm and alive. This form of heat is also called solar energy. The amount of energy Earth receives from the sun totally depends upon the angle with which sun rays hit the surface of Earth. This is the reason that some regions of Earth are hotter such as tropical regions around the equator than other regions like Polar Regions. Sunlight strikes the equator at right angle so the equator gets all the sunlight directly and solar energy is concentrated in regions around it, resulting in increased regional temperature. While sunlight strikes the Polar Regions as if they are tilted like the tilted flashlight so the same sun rays get spread over a bigger area resulting in lower temperature in Polar Regions. The atmosphere over the tropical region is hotter than the atmosphere over other regions of the Earth. We know that air flows from hotter to cooler places (air current) so warm air from the tropical regions moves towards the cooler regions (poles).

Q3. Write about two natural and two artificial sources of heat in detail.

Ans : **Solar Energy** Solar is the first energy source in the world. It was in use much earlier before humans even learn how to light a fire. Many living things are dependent on solar energy from plants, aquatic life and the animals. The solar is mostly used in generating light and heat.

Naturally occurring fossil fuels are the second most important source of heat. A fuel is a substance that we burn to get heat energy. Some most important fuels include wood, coal, natural gas, oil and charcoal. They do not give off heat automatically like the Sun; we produce heat by burning these fuels.

Biomass is another type of natural fuel. Biomass is any organic material obtained from plants or animals that we can burn to get heat energy. Biomass stores the energy from Sun and then releases this energy upon burning.

Waste materials Heat energy that is excess for certain industries is utilized in some other application. For example, Methane gas is a natural fuel. It is also produced by treating waste material in a biodigester (also known as bioreactor).

Electricity

Electricity is a form of energy that can be converted into heat energy, thus it is a source. There are many appliances that we use every day which convert electricity into heat.

Q4. What is meant by contraction and expansion of matter?

Thermal expansion happens when an object expands and becomes bigger on heating. When we heat an object we actually increase its temperature which is the average kinetic energy of the molecules in an object. So when the kinetic energy of molecules increases they move faster and take up more space. This results in the increase of the size of object. Examples of thermal

expansion include the rising of mercury in a thermometer in response to heat. Hot air balloons also expand and rise on heating.

All three states of matter expand on heating because their molecules move faster. As a result their molecules move slightly away from each other. The opposite of expansion happens when you remove heat from objects- they contract or shrink. If you remove heat from a gas its molecules come closer and the gas converts into a liquid. Liquids can turn into solids by removing more heat.

The amount of expansion differs in solids, liquids and gases. Solids expand very little when heated, liquids expand a little more than the solids and gases expand a great deal when heated.

Q5. Identify and explain uses of devices and systems to generate, transfer, control and remove thermal energy.

Ans: We know that thermal energy is a good and useful thing. The question is, how do we control it so that it does what we want?

A good example of this is the heating system in your home.

Thermostats control nearly all types of heating and cooling equipment, keeping room temperatures, cooking devices, hair dryers, etc. Within a set range. By doing so, they ensure comfort, cut energy waste, and offer considerable convenience.

A thermostat has a temperature sensor and an activating switch. Some are mechanical, others electronic. Thermostats are either manual or digital.

Q6. Describe ways in which thermal energy is produced naturally.

Ans: Heat can be produced naturally with the following means, solar energy, geothermal energy, chemical reactions, and decay are all natural sources of thermal energy.

Q7. Explain the operation of technological devices and systems that respond to temperature change.

Ans: Application of thermal expansion, we use the property of thermal expansion in the following devices.

Bimetallic strip

A bimetallic strip is a thin strip of two different metals such as copper or brass and iron welded together. When the bimetal strip is heated the brass or copper expands more than the iron this causes the strip to bend with the brass on the outside. And if the strip is cooled it bends with the iron on the outside.

Bimetallic strips are used in thermostats as switches to control temperature, in fire alarms, in oven thermometers to measure temperature and in switches to regulate toasters.

Thermostat

A thermostat is an automatic valve which regulates the flow of temperature. It controls the temperature by switching a heater on and off. Thermostat is something that keeps heat the same.

It has an outer dial to set the temperature at which thermostat switches on and off. This dial is connected with the bimetallic strip through an electric circuit. This bimetallic strip provides the expansion and contraction which results in opening and closing the electric circuit of the system.

Thermostats are used in electric irons, fish tanks, home heating/cooling systems, refrigerators, ovens and car flashers

Q8. What problems might heat-related expansion cause for bridges or railways?

Ans: Bridges

Bridges are built from concrete and other quite strong materials. But these materials expand just like any other material. When this happens a bridge could collapse or crack. To prevent breakage of bridges, special expansion joints or rollers are placed on the large bridge which allows the bridge to get longer or shorter without causing any crack or breakage.

Railway tracks

Railway tracks are built from bars of steel supported with wooden links. These steel bars expand on hot day and can cause serious damage. To avoid this kind of expansion, gaps are left between sections of railway track. These gaps provide a buffer for thermal expansion. Or joints may overlap slightly. As the track expands the extra length is taken up by the rails sliding past each other. Also tracks are bolted to the wooden links and when the steel expands too much it can pull out these bolts. Therefore instead of placing bolts in holes, bolts are fitted in slots so that tracks have room to slide in place as the temperature increases.

Q9. What is biomass? Write in detail.

Ans: Biomass is any organic material obtained from plants or animals that we can burn to get heat energy. Biomass stores the energy from Sun and then releases this energy upon burning. Biomass comes in many different forms but wood is the mostly used form of biomass. Other forms of biomass include manure and garbage. Humans have been burning biomass to get heat energy from the beginning of time. We can directly use the heat produced by burning biomass for cooking, for industrial processes and for making electricity.

Circle the correct answers.

1. b) Energy
2. a) Joule
3. b) Heat
4. a) Increase
5. d) Nuclear energy
6. a) Methane
7. a) less dense
8. b) the volume of the balloon before and after
9. a) move more faster than the cooler object
10. d) energy movement flowing slowly from cold to warmer region
11. d) Mercury-in-glass thermometer
12. d) both (a) and (b)
13. c) a thermal interaction.



Fill in the blanks.

1. The degree of hotness is called temperature.
2. Temperature of boiling water is 100 °C.
3. Shining bodies are poor radiator of heat energy.
4. The SI unit for heat is the joule (J), sometimes it is also measured in calorie (cal).
5. Heat causes gas molecules to move faster which means that the volume of a gas increases more than a liquid or a solid.
6. Another type of thermometer is digital thermometer. It uses a computer chip instead of mercury to tell the temperature of your body.
7. A Bimetallic strip is a thin strip of two different metals such as copper or brass and iron welded together.
8. A Thermostat is an automatic valve which regulates the flow of temperature.
9. Railway tracks are built from Steel bars supported with wooden links.
10. Thermal Expansion of solids occurs due to increase in volume.
11. Methane gas is a natural fuel.
12. Biomass is any organic material obtained from plants or animals that we can burn to get heat energy.
13. Sun not only gives us heat and light it also makes it possible for us to live on Earth.
14. A thin wire expands in length called bimetallic strip.
15. Thermostats are used in electric irons, fish tanks, home heating/cooling systems, refrigerators, ovens and car flashers.
16. Some most important fuels include wood, coal, natural gas, oil and charcoal.
17. Biogas is a mixture of 60% methane (CH₄) and 40% carbon dioxide (CO₂).

State whether “True” or “False.”

1. Heating generally causes molecules to vibrate more rapidly and move further apart causing expansion. **True**
2. Water expands nearly 50% just as it turns to ice. **False**
3. The expanding of water upon cooling can cause pipes to burst. **True**
4. When water freezes or water vapor condenses, heat energy is released. **True**
5. Wet surfaces dissipate heat much faster than dry surfaces. **True**
6. Heat transfer modes always require the presence of some medium in which to occur. **False**
7. Pressure cookers prepare food much faster than conventional cookers. **True**
8. Solar panels are placed on the roofs of houses to trap the heat from the sun. **True**
9. Usually liquids become lighter when they expand and become denser or heavier when they contract. **True**
10. Dial thermometer uses a bimetallic strip to tell the temperature. **True**
11. If you heat a gas at constant pressure, its volume will increase which means it will contract. **False**
12. Concrete roads and pavements are built in segments and after every segment there's a small gap left for thermal expansion. **True**
13. When a solid contracts the particle size remains the same only the space between particles increases. **False**



14. All three states of matter do not expand on heating because their molecules move faster.

False

15. A thermometer magnifies the expansion of liquid by allowing it to expand up a very thick tube.

16. Electricity is a form of energy that can be converted into heat energy, thus it is a source.

False

17. Pipelines carrying gases or liquids also expand when the temperature is decreased. **False**

18. Sunlight hits the equator directly, resulting in high regional temperature. **True**

19. Water becomes less dense if you cool it from 40C down to 00C. **True**

20. Biodigester digests organic material to produce Biowaste. **True**

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Chapter 10: Lenses

Learning Objectives

In this chapter we will learn about

- Refraction
- Refraction of light
- Dispersion of light
- Prism

Teacher Starter

Start your class by identifying how light responds to objects in the classroom. Tell the students to look around the room to find examples of items (mediums) that transmit, reflect, refract, and absorb light.

You can also put few items (like mirrors, glass, lenses, and prisms) in the room. Let the students observe how light behaves with each of the items.

Teaching

Start with reading of chapter and translate them in what language they can understand well. Later on ask each and every student to read the chapter and understand carefully. Make sure that each and every concept should be clear to all students. Tell your students about importance of light and its reaction after interact with different materials. Point to the picture given in the chapter. Tell them about mirror and brief that why they are able to see themselves in the mirror. Ask them that are they able to touch or exchange anything with the image of him? Why? Briefly discuss mirror and all its types with little experiments with magnifying glass.

Exercise

Answer the following questions

Q1. What are lenses? How many kinds of lenses are there? Write in detail.

Ans: A lens is a transparent piece of glass or plastic with at least one curved surface. A lens works by refraction: it bends light rays as they pass through it so they change direction.

There are two main types of lenses, known as convex (or converging) and concave (or diverging).

Convex lenses

In a convex lens (sometimes called a positive lens), the glass (or plastic) surfaces bulge outwards in the center giving the classic lentil-like shape. A convex lens is also called a converging lens because it makes parallel light rays passing through it bend inward and meet (converge) at a spot just beyond the lens known as the focal point.

Concave lenses

A concave lens is exactly the opposite with the outer surfaces curving inward, so it makes parallel light rays curve outward or diverge. That's why concave lenses are sometimes called diverging lenses. (One easy way to remember the difference between concave and convex lenses is to think of concave lenses caving inwards.)

Compound lenses

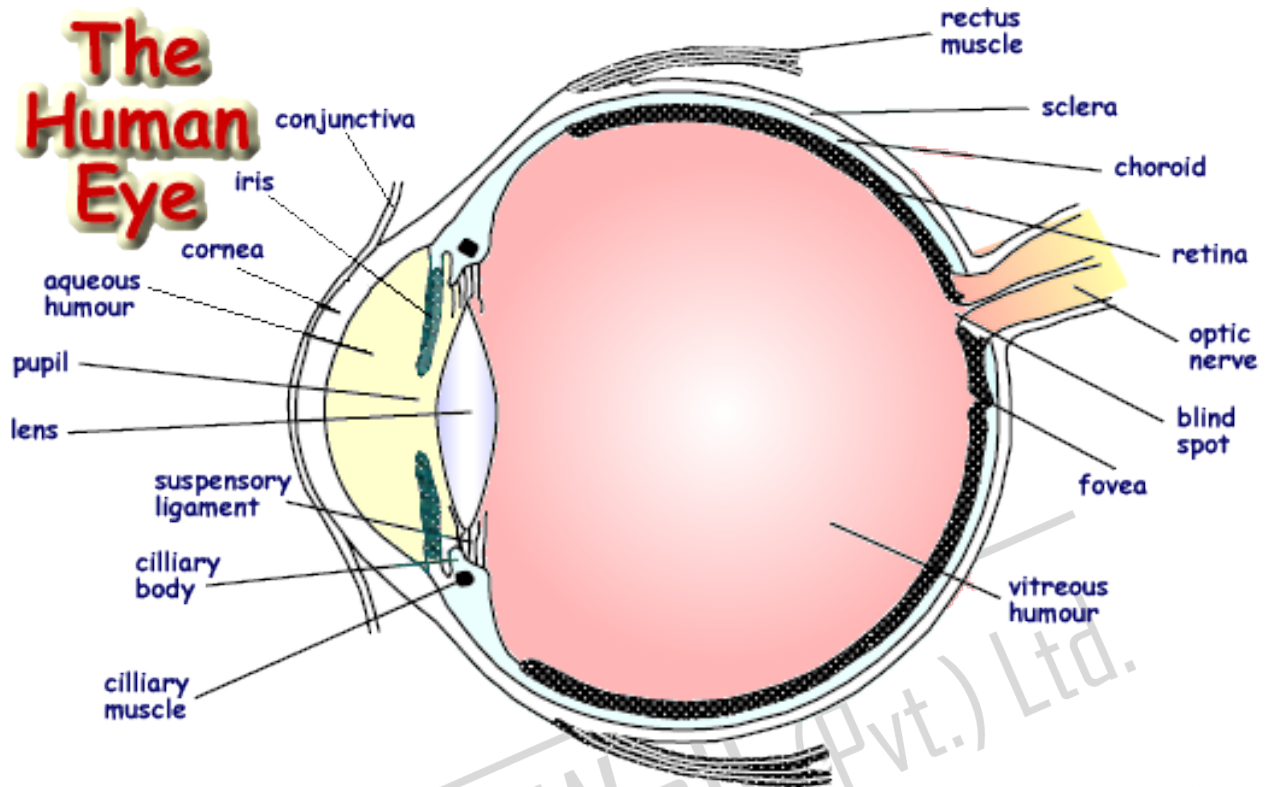


It is a combination of convex and concave lenses. A lens that uses two or more simpler lenses in this way is called a compound lens.

Q2. Differentiate between concave and convex lens.

Concave Lens	Convex Lens
A concave lens is thinner in the middle and thicker at the edges.	A convex lens is thicker in the middle and thinner at the edges.
It is also known as Diverging Lens	It is also known as Converging Lens
Used in Glasses, some telescopes, spy holes in doors, etc. It is also used for the correction of problem in short sight	Used in camera, focus sunlight, overhead projector, projector microscope, simple telescope, magnifying glasses, etc. It is also used for the correction of problem in long sight.
Negative Focal Length	Positive Focal Length
It diverges the incident rays away from the principal axis.	It converges the incident rays towards the principal axis.

Q3. Draw a well labeled diagram of a human eye and explain the functions.



Q4. What is myopia? How can it be corrected?

Ans: Myopia (also called nearsightedness) is the most common cause of impaired vision in people. Myopia occurs when the eyeball is too long, relative to the focusing power of the cornea and lens of the eye. This causes light rays to focus at a point in front of the retina, rather than directly on its surface.

Nearsightedness can be corrected with glasses with concave lens, as the diverging effect of concave lens helps in focusing the image on retina.

Q5. What is hypermetropia? How can it be corrected?

Ans: Hypermetropia, sometimes called hyperopia, is the term used to define being longsightedness. This occurs when the image of a nearby object is formed behind the retina. This means that light is focused too far back in the eye, causing things which are close up to appear blurred.

Longsightedness is corrected using a convex (outward facing) lens. This is placed in front of a hypermetropic eye, moving the image forward and focusing it correctly on the retina.

Q6. Give some possible measures to take care of the eye.

Ans: There are things you can do to help keep your eyes healthy and make sure you are seeing your best:

Eat a healthy, balanced diet. ...

Maintain a healthy weight. ...

Get regular exercise. ...

Wear sunglasses. ...

Wear protective eye wear. ...

Avoid smoking. ...

Know your family medical history. ...

Know your other risk factors.

Q7. Write the use of lenses in these things.

a) Telescope

The Telescope used two convex glass lenses: one at the front, known as the objective, and one toward the rear where you view that served as an eyepiece.

b) Microscope

A compound microscope uses multiple lenses to magnify an image for an observer. It is made of two convex lenses: the first, the ocular lens, is close to the eye; the second is the objective lens.

c) Binocular

Binoculars used a convex objective and a concave eyepiece lens

d) Camera

a camera with a single element lens has a convex lens.

Q8. What are contact lenses and how are they useful for us?

Ans: A contact lens, is a thin lens placed directly on the surface of the eye. Contact lenses can be worn to correct vision, or for cosmetic or therapeutic reasons.

Q9. What are the outside parts of eye and how do they protect the eye?

Ans: To protect the eye from the outside eyelashes, eyelids and eyebrows work together. Your eyelids can shut out light so that you can sleep. They also shut very fast when they feel something harmful is trying to get into the eye. Eyelashes are very sensitive. They trap and stop dust and other particles from entering the eye, as the eyelid shuts. Eyebrows keep dust and sweat out of the eye.

Short answer question

1. An object moved from infinity to the convex lens. State and explain the nature and position of the images formed by the lens during this process.

Ans: Image formed at focus. Real, inverted and extremely small.

2. Name some parts of our eye.

Ans: Iris, Pupil, Cornea, Sclera, Conjunctiva



3. State the function of eyelids.

Ans: One of the main functions of the eyelid is to protect the eye and keep out foreign bodies. Another important function of the eyelid is to regularly spread tears on the surface of the eye to keep it moist.

4. What are rods and cones?

Ans: **Rods** are responsible for vision at low light levels. They do not mediate color vision, and have a low spatial acuity.

Cones are active at higher light levels and are capable of color vision and are responsible for high spatial acuity.

Circle the correct answers.

1. a) Convex
2. b) Refraction
3. b) Concave
4. c) Larger and upside down
5. a) Reflect
6. d) Plane
7. b) Virtual
8. b) blind spot
9. a) Virtual, upright, smaller
10. a) Myopia
11. b) Concave
12. b) Microscope
13. b) Upside down
14. b) Telescope
15. b) Concave
16. a) movable
17. c) tear gland
18. b) light rays meet
19. d) lens to the focal point
20. a) Convex
21. a) aqueous humor

Fill in the blanks:

1. The blind spot is located where the optic nerve leaves the eye.
2. The size of pupil becomes large when you see in dim light.
3. The angle of incidence equals the angle of reflection.
4. The muscles alter (adjust) the thickness of the eye lens.
5. The spectrum of white light has seven colours.
6. The optic nerve carries the electrical signals from the retina to the brain.



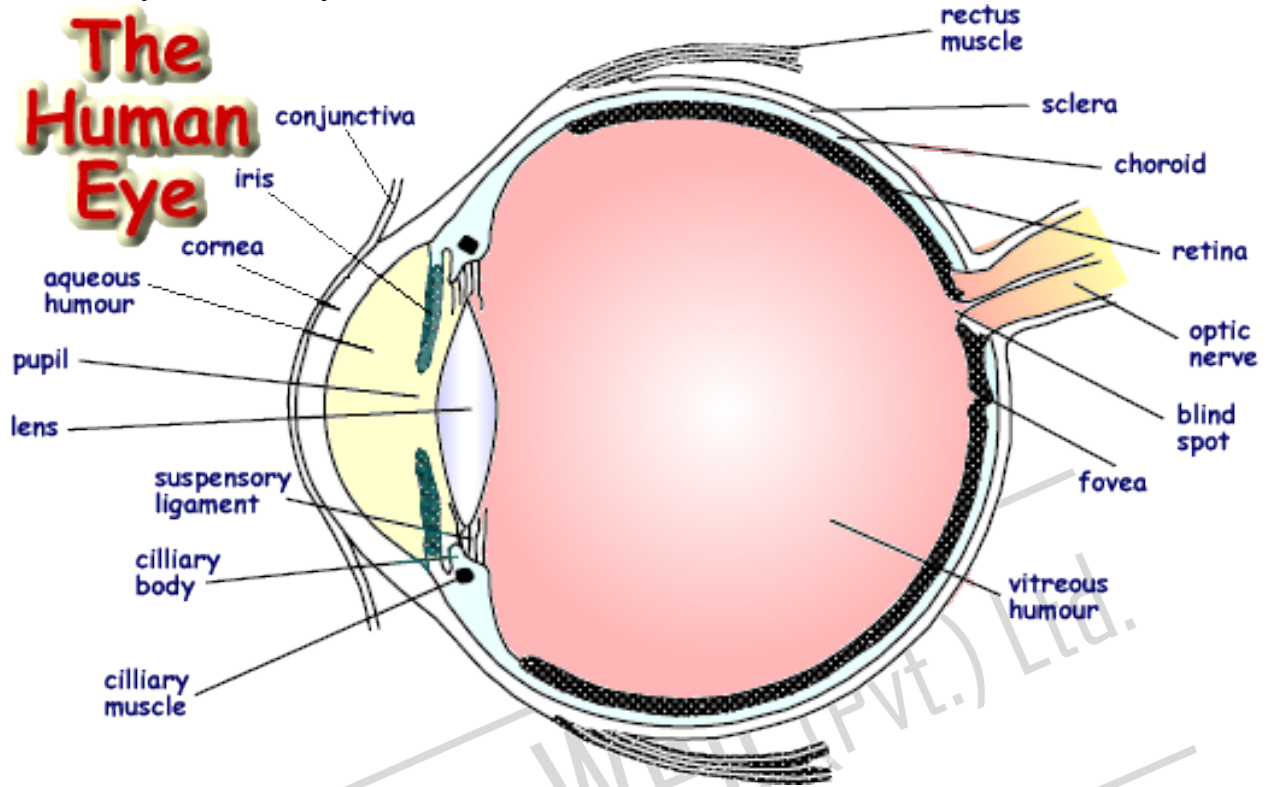
7. Both the digital and simple camera contains an aperture or opening that lets the light in for short period of time.
8. A microscope uses a small objective lens.
9. Each eye sees a separate real and inverted image our brain combines them so we see one magnified image.
10. Cones are present in the part of retina called fovera, which is responsible for sharp central vision.
11. Sometimes a person may not have some type of color blindness so the person cannot see some colors.
12. Retina is like a movie screen that shows the image of stuff you are seeing.
13. Small glands present inside the upper eyelid are called tear glands.

State whether “True” or “False.”

1. The moon is a luminous object. **False**
2. The pupil is black because it absorbs all light that falls on it. **True**
3. There are no light sensitive cells in the blind spot in the eye. **True**
4. Rubbing the eye is the best way of removing a dust particle from the eye. **False**
5. Eyes alone cannot see the object. **True**
6. An eye lens focuses light behind the eye at cornea. **True**
7. In order to remove short sightedness, a convex lens is used. **False**
8. The size of the image depends on the size of the lens. **False**
9. The purpose of the surface is to capture the real image so it can be seen. Without the surface, there is no image. **True**
10. Most binoculars contain a series of lenses and no prisms. **False**
11. Multiple types of lenses are used in devices that we use every day. **True**
12. People who do not like wearing spectacles wear contact lenses. **True**
13. Long-sightedness also known as hyperopia happens when the images are focused after the retina. **False**
14. Concave or diverging lenses are also called negative lens because their focal length is positive. **False**
15. A tiny tube called tear duct carries tears down to the back of the nose. **False**
16. Rod cells show us objects with colors. **False**



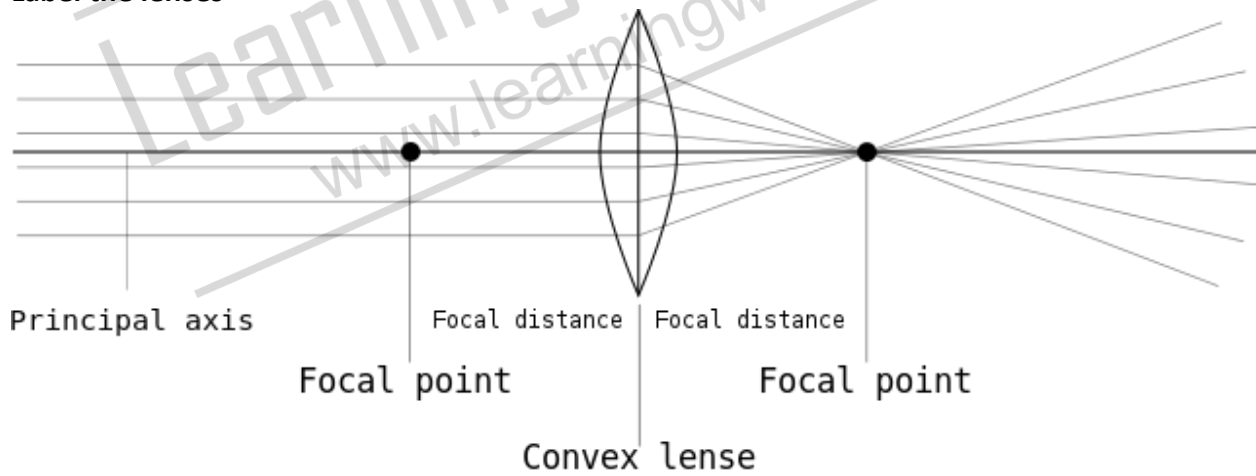
Label the parts of the eye



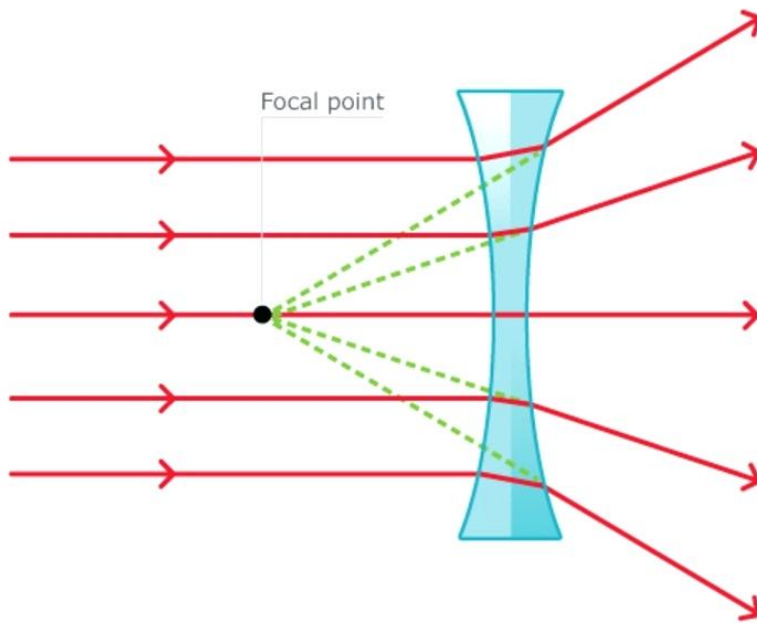
Which lens is this?

Convex lens

Label the lenses



Refraction of light through a diverging lens



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Concave Lens

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Chapter 11: Electricity in Action

Learning Objectives

In this chapter we will discuss about

- electricity
- types of electricity (static & current)
- conductors or insulators of electricity
- circuits & circuit diagrams
- types of circuits (series & Parallel)
- Fuse & circuit breakers
- Heating, Chemical & Magnetic Effect of Electricity
- How Electricity reaches to our homes

Teacher Starter

Start by asking students about what is the most important thing in their routine, try to link it with electricity. As most of the things we use are electrical equipment. Give them a brief background about electricity, its historical discovery, about Ben Franklin and Thomas Edison. Also, aware students about the basic principle behind the electricity. Its working in an electrical circuit. Then introduce some examples of conductors and insulators of electricity from their surroundings.

Teaching

Make sure each and every student engage in the discussion in the classroom, you can link the importance of electricity from their daily lives. Let them aware about the famous and very dangerous kite flying experiment by Ben Franklin. Tell them about Thomas Edison, the inventor of Electricity and Electric Bulb. Enlighten them about the basic principles of electricity. Develop an understanding of electrical current.

Exercise

Answer the following questions

Q1. What is electricity? How it is produced?

Ans: Electrical energy is caused by moving electric charges called electrons. Electricity is a type of energy that comes from electrical energy. Electricity is a secondary energy source – we get it from the conversion of other sources of energy. The process of generating electricity to use for power takes place in power stations.

This happens when turbines are turned, this spinning of turbines cause the magnets to turn within copper wire coils. The moving magnets within the coil of wire cause electrons (charged particles) to move within the wire – this is electricity.

Q2. What is meant by bicycle dynamo?

Ans: A bicycle dynamo is a kind of generator attached with the bicycle to create electricity for its lights. The dynamo contains a wheel that touches the back tyre. As the tyre spin the wheel

spins the magnet present inside a coil. This spinning of magnet produces enough electric current to turn the bicycle light on.

Q3. How do powerhouse generators work? Write in details with examples.

Ans: Generator used in a power station uses the same effect of electromagnetic induction to produce electricity like the bicycle dynamo. It spins a magnet inside a coil of wires to produce electricity. But the main difference between a power plant generator and a bicycle dynamo is that the power station generator is way bigger than the bicycle dynamo.

A power station generator uses an electromagnet instead of a permanent magnet. This electromagnet with coil is mounted on a rotary shaft called the rotor. Around the rotor is a series of coils having thousands of turns of wire in each coil. These huge generators of power plants also produce an enormous amount of electric current.

Q4. Explain why most electronic devices require DC power, not AC power.

Ans: this is due to the fact that it is easy to control DC than AC, that's why you see DC more.

Q5. For producing electricity, the energy from flowing water is preferred to energy obtained by burning coke. State two reasons for it.

Ans: Burning requires a fuel (wood or coke in this instance) this causes depletion which leading to environmental imbalance, it also causes a lot of air pollution. On the other end, Hydro energy is conventional renewable energy, and it is not harming the environment as badly as the burning does. So producing electricity from flowing water is preferred to energy obtained by burning coke.

Q6. What are the sources of electricity? Write about each source in detail.

Ans: Electricity is a secondary form of energy which means that we get it from the conversion of other energy sources such as coal, wind, sun, oil, natural gas, biomass and other natural sources. These natural sources are called primary sources of energy. These energy sources that we use to produce electricity can be renewable or non-renewable. Let's have a look at some common sources that are used to make electricity.

Solar Power-Electricity from the Sun

Sun is the ultimate energy source of our planet. We can use this form of energy to produce electricity. Electricity obtained by the conversion of sun's energy or solar energy into electricity is called solar electricity or solar power. A device called the solar panel also known as the module contains the solar cells or photovoltaic cells made from silicon. These photovoltaic cells directly convert the sunlight into electricity.

Wind Power-Electricity from Wind

Wind power uses kinetic energy of wind to generate electricity. This is done by using a wind turbine containing propeller blades, the turbine is then connected with a generator to generate electricity. A wind turbine works the opposite of a fan. A wind turbine uses wind to produce electricity while a fan uses electricity to produce the wind. When the wind blows, it turns the

propeller blades around a rotor. The rotor is connected with a main shaft which spins the generator to produce electricity.

Geothermal Energy-Electricity from Earth

Geo means earth and thermal means heat. Geothermal energy is produced inside the Earth surface. We use this heat from the earth as steam or as hot water to produce electricity. Geothermal energy is a clean and renewable form of energy because heat is constantly being produced within the Earth by the slow decay of radioactive particles in Earth's core. The temperature on the surface may change but four feet deep underground the temperature remains the same about 55°C. A system of pipes is buried more than four feet under the Earth's surface. A liquid is pumped through the pipes to absorb heat from the underground. Pipes then bring back the hot liquid, this hot liquid is then used to drive an electrical generator.

Biomass-Electricity form Waste

Biomass is natural organic material such as plants and animals. When biomass is burned it releases heat, this heat energy is then converted into electricity. It is a renewable form of energy as the waste is being produced constantly. Biomass contains stored energy from sun.

Hydro power- Electricity from water

Hydro means water, so hydro power is made from the force of falling water. Hydropower is one of the cleanest, reliable and less expensive sources of electricity. It converts the kinetic energy of falling water into electricity by using a turbine. When the sluice gates are opened and the water is released from the reservoir through the dam with force, this force spins blades of a giant turbine. Turbine is connected with an electrical generator that produces electricity as the turbine rotates.

Marine Energy- Electricity from Tidal Power and Wave

Tidal power and wave technologies are used to produce electricity from ocean. Tides are caused by the gravitational pull of the sun and moon and the rotation of Earth. Tidal energy system uses a structure similar to a dam called barrage. The barrage is constructed across an inlet of an ocean bay or a lagoon that creates a tide basin. Barrage has sluice gates which control the level of water and allow the tidal basin to fill on the incoming high tide and empty through an electricity turbine system on the outgoing tide also called ebb tide. There is a two way system that generates electricity on both the incoming and outgoing tide. Its biggest disadvantage is the effect it can have on plants and animals in estuaries of the tidal basin. Waves breaking on the sea shore on a windy day possess huge amount of energy. This energy can also be used to make electricity. Since storm driven waves are destructive so the generators used have to be very strong which makes this technology expensive to build.

Q7. How electricity reaches us?

Ans: From power stations electricity is transferred to cities, towns and villages through the electrical grid system. Power stations are huge and are situated near the source of energy. After production electricity is transmitted to the areas where the consumers are located. Electricity is carried from power stations to the step up transformer. Then, It reaches the substations where



the voltage is lowered to between 2000 to 13000 volts so it can be transferred to small power lines. Electricity is then taken through lines to a pole transformer, which further reduces the voltage between 120 to 240 volts to take the power safe to use in our homes. From here electricity comes into your home through a service box, where an electric metre is located to measure how much electricity is used in home, school or business.

Q8. Write short notes on the following terms with illustrations.

1) Electronics

Electronics get its name from electrons. Electronics is the study of the behavior of electrons under diverse conditions of applied electric field. Scientists studied behavior of electrons and developed many useful device called electronic devices. A device that controls the flow of electrons is called an electronic device. There are many electronic devices that we use every day such as computers, cell phones, digital cameras, pen drives, ATMs and iPods. Electronic components that make up an electronic circuit such as transistors, diodes, capacitors and rectifiers all have something very important in common. Whatever job they do they all control the flow of electrons in very precise manner. Most of these components are made of semi-conducting solids.

2) Diodes and capacitors

A diode is a device used in electronic circuits that allows the current to flow in only one direction, but blocks the flow in the opposite direction. A special type of diode known as the light emitting diode (LED) emits light when current passes through.

Diodes are often used to change an alternating current (AC) into a direct current (DC). A device used in electronic circuit to temporarily store a small electric charge is called the capacitor. There are two types of capacitors polarized and non-polarized capacitors. Polarized capacitors have much larger capacitance than non-polarized capacitors.

3) Convertors and rectifiers

A device is used to convert alternating current to direct current and direct current to alternating current known as the converter. A type of converter that only converts alternating current into direct current is known as rectifier.

4) Transistors

Transistor is easily the most important electronic component. It is a tiny electronic component that can work either as an amplifier or a switch. Transistor is a three terminal device in which voltage applied to one terminal called the base can control the voltage applied to the other two terminals called the collector and the emitter.

Transistors are made from silicon, a chemical found in sand. Silicon is a semiconductor. We know that conductors are materials which can pass electricity through them while insulator does not allow the passage of electricity. Semi-conductors only allow electricity to pass through them under specific conditions. When a transistor works as an amplifier it takes a tiny current from one end and converts it into much larger current, in other words it boosts the electric current. When you turn up the volume of music system you are actually amplifying the electrical signals that form the sound. When a transistor works as a switch it takes tiny current flowing through its one part and make a bigger current flow through its other part.in other words smaller current

switches onto the larger current. A transistor switch is used to open or close an electronic circuit. When transistors are connected together they make devices called logic gates. Logic gates can carry out very basic form of decision making.

Q9. What are the terms AC, DC means? Write about them in detail. Why they are important for the electricity provision?

Ans: There are two main types of electric current in our world; direct current (DC) and alternating current (AC). We know that the electric current is the flow of electrons.

When the stream of electrons is flowing through a circuit in one direction, this type of current is called direct current or DC.

When flowing electrons change their direction after short time and they do it over and over again, this type of electric current is known as alternating current or AC.

Scientists describe this change of direction as 'frequency'. Currents that change their direction more during certain amount of time are said to have higher frequency. Usually electrons switch direction about 50-60 times every second.

AC electricity is used to deliver power to homes, schools, offices and factories as its voltage is easy to change using transformers also it requires a simple generator.

Q10. Describe how hydro energy can be converted into electrical energy.

Ans: Hydropower converts the kinetic energy of falling water into electricity by using a turbine.

Dams are built to retain water in the reservoir. More electricity is produced if there is more water in the reservoir. When the sluice gates are opened and the water is released from the reservoir through the dam with force, this force spins blades of a giant turbine. Turbine is connected with an electrical generator that produces electricity as the turbine rotates. This electricity is then transferred via cables to factories, schools and homes.

Q11. What is geothermal energy? What are its advantages?

Ans: Geo means earth and thermal means heat. Geothermal energy is produced inside the Earth surface. We use this heat from the earth as steam or as hot water to produce electricity. The temperature on the surface may change but four feet deep underground the temperature remains the same about 55°C. A system of pipes is buried more than four feet under the Earth's surface. A liquid is pumped through the pipes to absorb heat from the underground. Pipes then bring back the hot liquid, this hot liquid is then used to drive an electrical generator.

Short answer questions

1. What are logic gates?

Ans: A logic gate is an elementary building block of a digital circuit. Most logic gates have two inputs and one output. At any given moment, every terminal is in one of the two binary conditions low (0) or high (1), represented by different voltage levels.

2. What is the frequency of AC Current?

Ans: The standard voltage and frequency of alternating current (AC) electricity used in homes varies from country to country throughout the world. Typically, either 120-volt AC or



240-volt AC is used. Also, most countries use 50Hz (50 Hertz or 50 cycles per second) as the AC frequency.

3. What are the advantages and disadvantages of using renewable and nonrenewable resources for electricity generation?

Ans: **Advantages of non-renewable energy sources**

- Abundant and affordable.
- cost effective and
- Available throughout the world.

Disadvantages of Non-Renewable Energy

- Once gone they can't be replaced or revitalized.
- Mining and by-products causes damage to the environment.
- Contribute to global warming.

Advantages of renewable energy sources

- Renewable and so will never run out.
- Require less maintenance than traditional generators.
- Reduces the costs of operation.
- Little or no waste products
- Minimal impact on the environment.

Disadvantages of Renewable Energy

- difficult to generate the quantities of electricity
- Non-reliability of supply.
- The current cost of renewable energy technology is also far in excess of traditional fossil fuel generation.

4. What are three environmental impacts of using fossil fuels for electricity generation?

Ans: Air Pollution, global warming and climate change

5. What is the minimum wind speed required for generating electricity in a wind mill?

Ans: In general, 12.6 kph (3.5 m/s) is the typical cut-in speed, when a small turbine starts generating power.

Fill in the blanks

1. Tidal power and wave technologies are used to produce electricity from ocean.
2. Batteries provide direct current which is produced by a chemical reaction inside the battery.
3. Transistors are made from silicon, a chemical found in sand.
4. A device is used to convert alternating current to direct current and direct current to alternating current known as the convertor.
5. Electric wires are constructed from metals like copper, iron and silver.
6. Electricity is transmitted at high voltage so that large amount cans travel proficiently.



7. Usually electrons switch direction about 50-60 times every second.
8. Scientists studied behavior of electrons and developed many useful device called electronic devices.
9. A diode has two terminals called the anode and the cathode.
10. Biomass is natural organic material such as plants and animals.
11. Circuit breaker protect the circuit from an overload.
12. Rectification process makes AC current to flow in constant direction
13. A bicycle dynamo is a kind of generator attached with the bicycle to create electricity for its lights.
14. Hydropower is one of the cleanest, reliable and less expensive sources of electricity.
15. Current flows through the diode only when the positive voltage is applied to the anode and the negative voltage is applied to the cathode.

Circle the correct answer:

1. b. AC power
2. c. Electrons
3. a. electromagnet
4. b. Shaft, wire coil, magnet and turbine
5. d. Fossil fuels
6. a. There can be major changes to the land where the power station is built.
7. b. Heat from Earth's interior can be used to produce steam
8. b. Switch
9. d. electric circuit
10. a. electric current
11. b. boosts the electric current
12. c. Capacitor
13. d. Higher frequency
14. c. Microchips
15. a. Electronic
16. c. 1000-800
17. d. Polarized
20. From power
18. c. Wire system

Complete the blanks after studying the diagram.

1. Which of the above symbols represents a negative electron or a Cathode?
 - a. 1
2. Which of the above symbols represents a positive proton or Anode?
 - b. 2
3. Which of the above symbols represents a battery or direct current?
 - c. 3

Chapter 12: Exploring Space

Learning Objectives

In this lesson we will learn about

- Our Galaxy (The Milky Way)
- Other Galaxies
- Sun and the Solar System
- The stars and how stars formed
- The life and death of a star
- The Constellations
- The Beginning of Universe (The Big Bang)
- components of solar system like planets, moons, asteroids, meteoroids, comets etc

Teacher Starter & Teaching

You can start by asking the students about their prior knowledge about our Planet, our Moon, other Planets and our Sun. ask them what they see on the sky at night. Enlighten them about the fact that, there are planets, stars and even galaxies lurking in our skies. This whole thing is called the observable universe. Tell them this universe also begins at some point the scientists call it 'Big Bang'. You can also make them aware about the life cycle of a star and what are the possible consequences when stars die out (either it turns into a supernova or a blackhole), try to involve your students and make them things as much understandable by using information presented in the book and find other relevant sources on the internet.

Exercise

Answer the following questions

Q1. Why telescopes are known as most amazing creation of the mankind? Write your view about it?

Ans: Human eyes can see distant objects. We can see the Sun it appears like an orange ball to us but actually it is so big that you can line up 109 Earths on the face of the Sun. Sun looks small because it is far away from us. Andromeda galaxy which is 2.5 light years away from the Earth appears like a tiny point on the sky. It is obvious that as objects move further away from us they appear small to us, when the distance increases too much it becomes harder to see these objects. To see distant objects scientists developed devices some are stronger others are less strong. Telescope is one of the humankind's most amazing inventions. A simple device that made far away objects look bigger and clearer. When curious humans pointed the spyglass towards the sky to see the space their view of the Earth and the solar system changed. Most of the knowledge we have today of our solar system, Stars, Moons and other planets is obtained with the help of telescopes. In 1609, an Italian physicist and astronomer Galileo became the first person who pointed the telescope on the sky to see the Stars, Moons and planets. His telescope was a long tube with a convex lens used as an objective lens and a concave lens is used as an eyepiece. With his telescope Galileo was able to make out mountains and craters on the moon. He saw a ribbon of diffused light bending across the sky, which was later discovered as our Milky Way galaxy. Unfortunately the image formed by Galileo's telescope was upside

down. After Galileo and Isaac Newton, scientists made advancements in telescopes and made bigger and more complex telescopes. As a result astronomy thrived and astronomers discovered new stars, planets and their moons.

Q2. Write about different kind of telescopes in detail.

Ans: Now a days there are several type of telescopes that are used today to explore the universe

Refractors Refractors are the type of telescopes that use lenses to collect and focus the light just like binoculars do. It is like one half of a pair of giant binoculars. Light enters the refracting telescope through the objective lens. It then travels down the length of the telescope towards the eyepiece. Eyepiece is where the magnification happens. Since the telescope tube is closed from both ends it does not suffer from dirt inside. We know that when light travels through a medium it slows down and changes direction. Lenses are designed to bend light in a certain way. But the amount of light bends depends on the nature of light. When white light passes through a convex lens it's every colour component bends at a different angle, hence is focused at different points. Different colour images are lined up differently creating a blurry image with fringes of colours along the boundaries. This problem is called chromatic aberration or rainbow halo. Some refractors prevent this problem by using coated lenses they are called achromatic refractors. Refractors that use either multiple lenses design or lenses made of some other type of glass (such as fluorite) to prevent chromatic aberration are called apochromatic refractors. Refractor has good resolution, high enough to see details in planets and stars. However it is difficult to make big refractors as we cannot make big objective lenses. It is expensive and is less helpful in observing faint and deep sky objects such as other galaxies and nebulae.

Reflectors In 1680, Isaac Newton developed reflectors to prevent chromatic aberration problem. They are also called Newtonian telescopes after the name of its inventor. Instead of using lens to focus light, Newton used two mirrors (primary and secondary) because they do not have aberration problem. The light enters the tube and reflects off a primary mirror at the other end, before bouncing back up the tube near the top where it bounces off the secondary mirror which is smaller in size. Reflectors can use bigger mirrors too, so reflectors can be made much bigger than the refractors, which is why most of the bigger telescopes used today are reflecting. The bigger a telescope is the more details it reveals in distant objects and thus the more we learn about them. The Newtonian reflectors were a highly successful design and remain one of the most popular telescopes in use today. They are less expensive than the refractors. **Radio telescopes** Radio telescopes are used to detect the noise from radio wavelengths in space. Scientists discovered that the objects in space give off radio noise. These telescopes capture these noises and convert them into data or information for the researchers to understand. A radio telescope can draw a picture of an object it is listening to, from the noise it captures from the object.

X-ray telescopes This type of telescopes are mostly used to study stars, the Sun and supernovas. Since Earth's atmosphere interferes with the x-ray signals therefore x-ray telescopes work better at very high altitudes where the air is thinner. They work best in the space

Q3. Why can't we fly a plane into space?

Ans: The aircrafts we fly on the Earth are useless in the space because these aircrafts use



oxygen to burn their fuel while there is no oxygen in the space. Also scientists did not know how to break an aircraft from the gravitational pull.

Q4. Write short notes on:

Ans: **Space shuttle**

The United States created the space shuttle as reusable launch vehicle to carry astronauts and cargo to the space and back again. It carried many people to the space and orbited around the Earth. In the orbit, the space shuttle travels around the Earth with the speed of about 17,500 miles per hour (28,000 Km/hour). At this speed, the crew can see sunrise and sunset after every 45 minutes. It was designed like a moving van. Scientists sent satellites through space shuttle into the space so they could orbit around the Earth. It also carried large parts into the space to build an international space station there. The space shuttle is not just a vehicle for taking stuff into the space, but it's a laboratory too. A reusable science lab built to use on a space shuttle flight. Scientists performed experiments in the space. Performing experiment in the space is different than experimenting on the Earth. The space shuttle has three main parts; the orbiter, the external tank and the solid rocket boosters. The orbiter is the main section that has wing and it looked like an airplane. The astronauts live in this part. The external tank is a large fuel tank and the solid rocket boosters are like two thin rockets that boost the craft through the thickest part of the atmosphere. The space shuttle launches like a rocket but lands like an airplane. The solid rocket boosters only helped the shuttle to blast off the Earth like a rocket. They fall off the shuttle into the ocean just 2 minutes after the launch, where they can be recovered for reuse. When the fuel tank used up all the fuel it also dropped off the orbiter. At the end of the mission the orbiter returns to the Earth and lands like an ordinary airplane.

Space station

Space stations are space craft that revolve around our planet Earth. It has compartments containing every facility required so that people can live in it for several months. Scientists live there to carry out experiments at near zero gravity and observe various things. World's first space station named 'Salyut' was launched by Soviet Union in 1971, after a decade Moscow sent their first man into space. The United States sent its first space station named Skylab into orbit in 1973. These stations stayed in the space for short period of time. Russia launched the first module of the Mir space station on February 20 1986. The last module was placed on April 26, 1996. Astronauts lived on Mir for a short time from February 1987 to June 2000. Mir was deorbited and burned up during the re-entering to the Earth's atmosphere in March 2001. In 1990s, the United States together and five other space agencies representing fifteen countries agreed to build and run a bigger space station. They called it International Space Station (ISS). The International Space Station (ISS) weighs almost 400 tons. So it was impossible to build it on the Earth and then launch it into the space, there is no rocket big enough or powerful enough to lift this heavy space craft. To solve this problem scientists decided to launch it into the space in pieces and was build piece-by-piece in the space. First piece of ISS was launched by a Russian rocket in 1998. More pieces were added and after two years (in 2000) it was ready for people. It is the most complex and the largest structure humans have ever launched into the space. It orbits the Earth at an altitude of 220 miles above the Earth. It circles the earth every 90 minute at an average speed of 17,500 miles per hour (28,000 kph), completing 16 orbits per day.



Current plans call for the space station to be operated through at least 2020, longer if parts are repaired and replaced as they damaged. The space station is a home where astronauts live. It also acts as a science lab where the scientists perform scientific experiments and study the effect of weightlessness on humans, plants and animals in space. The international space station is as big inside as the house of five bed rooms and is powered by solar panels. From Earth it looks like a star, except it does not blink, and is often the brightest thing on the sky apart from the moon.

Space probe

To know more about the solar system and what is beyond it, NASA, European Space Agency, Japan, Russia and other countries have sent automated devices into the space to explore the solar system and to tell us what is out there. From early satellites revolving around the Earth to the interplanetary missions, these automated machines have increased our knowledge about the space. Different from satellites revolving around the Earth we have sent automated machines called space probes to other planets and the edges of solar system. A space probe is an automatic, unmanned device sent to explore the space and to collect scientific information. A probe is launched from the Earth with a set of scientific instruments and tools to study the soil, atmosphere, composition of other planets and their moons. Probes are designed to conduct experiments and they do not have people on them. These probes have helped scientists to get information about the solar system. They also help us understand about the weather changes happening on other planets. This information helps scientists in planning other space missions. Most of the probes are not designed to come back to Earth but some may bring back samples and data to the Earth. Some of them have landed on other planets and some have flown past other planets and taken pictures of them. Most probes send information and data to Earth by radio signals. It takes about two weeks for their signals to reach the Earth. Humans have been sending probes into the space since the 1950s. Sputnik 1 was the first space probe launched into the space by Soviet Union on 4 October 1957. On January 1958, United States also sent a probe named Explorer 1 into the space. These first probes studied Earth from the space. Two years after sputnik soviet engineers sent Luna 1 to the moon. The first probe that went to another planet was Mariner 2. In 1962 Mariner 2 flew past Venus and it confirmed that Venus is very hot. Other Mariner probes went to Mars and Mercury. In 2003 NASA launched twin robotic rovers named opportunity and spirit. They were headed to mars to look for the evidence of water. They landed on Mars in 2004. They examined the soil and the rocks there and sent back pictures and a lot of evidence that water was once all over the surface of Mars. The Cassini probe was launched in 1997 to study Saturn. It is the biggest and the most expensive probe that is ever sent to another planet. The Cassini probe contained some of the most advanced onboard instruments. It moved into orbit around Saturn in 2004 and studied its ring system and moons for about ten years. The New Horizons spacecraft was launched into the space in 2006 to study Pluto. It flew past Pluto in 2015 and it was the first spacecraft to go near this dwarf planet. Now it is moving further away from the sun to explore distant objects for the first time

Q5. Who are astronauts? What do they do in the space?

Ans: Space can be dangerous. Astronauts (called cosmonauts in Russia) wear special suits that protect them from extreme hot and cold weather in the space. There is no oxygen in the space



so they must take their own supply of oxygen with them. These special space suits are necessary to wear while working outside the spacecraft. A space suit is much more than just a suit. It is fully equipped with necessities of an astronaut. It is sort of a single person's spacecraft. A spacesuit protects astronauts from extreme temperatures. They also supply astronauts with oxygen so that they can breathe. They contain water to drink during spacewalk. They protect astronauts from getting injured and from harmful radiations. The lack of gravity causes health problems on long trips. Without gravity to work against human heart and bones weakens. Astronauts may feel cooped up and they get on each other's nerve when they are away from home together. The first US astronauts were selected in 1959, before the beginning of spaceflight operations. NASA selected seven military pilots as the first American astronauts. These seven men are known as the original seven or mercury-7. NASA has selected 21 more astronauts after the original seven. The backgrounds of NASA's selected astronauts include schoolteachers, scientists, engineers and doctors. Astronauts go through a training programme to prepare for the space travel. They study science subjects and mathematics and learn to operate spacecraft with the help of computer-controlled simulators. They exercise in gyms to improve their physical health. By bouncing around in fast-diving jet aircraft astronauts get used to of lack of gravity.

Q6. Who was the first man to go into the space?

Ans: Yuri Alekseyevich Gagarin was a Soviet pilot and cosmonaut. He became the first human to journey into outer space when his Vostok spacecraft completed one orbit of the Earth on 12 April 1961

Q7. Why do space need to be explored?

Ans: Humans have always been fascinated by the universe. Ancient people looked up at the sky and wondered about the Sun, the Stars and the Moon, and they came up with myths to explain them. As the time passed, humans developed technologies to explore the space. Exploring space is a risky business. It is extremely expensive and also it endangers the lives of astronauts. Other than that it is becoming a source of pollution in the space. Exploring space has several benefits too. Space exploration allows people to know more about the universe they live in. It told us that the Earth is round and how it rotates around the sun and not the other way around. It provides us with the deeper insight about the universe and gives us more information about the world we live in. It also provides us with new technologies. Scientists are always inventing new stuff for the space but these inventions are not just useful for astronauts and space. They can also be used in development of other daily life products. These include the GPS system that we use in cell phones and tablets, vacuum cleaners, firefighting apparatus, Teflon coated fiber glass we use as roofing material and MRI scans. It also creates jobs for technicians, engineers, scientists and other professionals. Space exploration helps us to solve many problems that we are facing right now such as the depletion of ozone layer. Scientists found out about it because they studied Earth's atmosphere from the space. They discovered its cause and banned the use of chlorofluorocarbons. Space exploration helps us in predicting weather and natural disasters.

Q8. Write about some landmark space missions.

Ans: Every time scientists launch space shuttle in the space they call it a mission. The space



shuttle is launched for about 135 missions. It was sent in the space on a mission first time in 1981. Its orbiter name was Columbia. The last space shuttle mission was sent in 2011.

Date	Orbiter name	Mission	Event
1981	Columbia	STS-1	First shuttle mission
1951	Atlantis	STS-71	First linkup with Russia's space station Mir
1998	Endeavor	STS-88	First international space station mission.

Q9. What is chromatic aberration?

Ans: chromatic aberration is a failure of a lens to focus all colors to the same point. It is caused by dispersion: the refractive index of the lens elements varies with the wavelength of light. The refractive index of most transparent materials decreases with increasing wavelength. Since the focal length of a lens depends on the refractive index, this variation in refractive index affects focusing.

Short answer questions

1. Satellites transmit non-stop information for use in all of the following EXCEPT

Ans: structural length

2. What is the difference between an astronaut and a cosmonaut?

Ans: The distinction is that they are titles awarded by different space agencies. They both mean essentially the same thing and they both come from Greek. Cosmonaut is used by the Russian Space Agency. Astronaut is used by NASA, ESA, CSA, and JAXA

Circle the correct answer:

1. b) Robert Goddard
2. d) 1957
3. c) Russia
4. a) Apollo
5. d) All of the above
6. d) Scientific
7. a) 2 lens
8. a) high
9. a) wavelength
10. a) Mirrors
11. a) Space station
12. c) Space shuttle
13. d) Sputnik
14. c) Space shuttle
15. b) Space station

16. a) Sky
17. d) Two large solar panels
18. b) Reflecting telescopes
19. a) one
20. a) 1991
21. b) Oxygen

State whether “True” or “False.”

1. America’s agency in charge of exploring space is called NASA. **True**
2. Probes have been used to investigate only other planets. **True**
3. Apollo 1 lunar mission never made it to the moon, but returned to Earth safely. **False**
4. The Hubble space Telescope is a probe. **False**
5. A space probe is a robot vehicle used to explore space. **False**
6. Models of the solar system have improved over time. **True**
7. Sputnik 1 was the first space probe launched into the space by Soviet Union on 4 October 1957. **True**
8. A space suit is much more than just a suit. **True**
9. Probes are designed to conduct experiments and they have people on them. **False**
10. Hubble looks like a school bus and is approximately 43.5 feet long and 14 feet wide. **True**
11. Most probes send information and data to Earth by radio signals. **True**
12. The space shuttle launches like a rocket but lands like an airplane. **True**
13. Spacecraft is a vehicle or a machine designed to fly in the space. **True**

Fill in the blanks.

1. An instrument used to see faraway objects is a Telescope.
2. Radio telescope is expensive than the reflecting telescope.
3. Astronauts go through a training programme to prepare for the space travel.
4. Gamma telescopes are best used at high altitude.
5. The first US astronauts were selected in 1959, before the beginning of spaceflight operations.
6. Mir was deorbited and burned up during the re-entering to the Earth’s atmosphere in March 2001.
7. During World War II the Germans created rockets as weapons of mass destruction.
8. The Newtonian reflectors were a highly successful design and remain one of the most popular telescopes in use today.
9. Refractors are the type of telescope that uses lenses to collect and focus the light just like binoculars do.
10. In 1609-an Italian physicist and astronomer Galileo became the first person who pointed the telescope on the sky to see the stars, moons and planets.
11. A space shuttle takes off like a rocket and lands like an airplane.
12. The first space station ever put into orbit was named Skylab.
13. The International space station was the first major space project in which the U.S. and Russia worked together.
14. The main purpose of the International Space Station is to support people for extended period in space.

15. The Hubble space telescope is powered by two very big solar panels.
16. Liquefied fuel is needed to give rockets enough power to escape Earth's gravity.
17. The first artificial satellite ever put into orbit was named Sputnik.
18. The space race took place between the USA and the Soviet Union.
19. A radio telescope can draw a picture of an object it is listening to from the noise it capture.
20. Probe are spacecraft's used to enter the atmosphere of alien planet.
21. Space capsule used to create lift during atmospheric reentry.

Definitions & Terms (Matched)

1. Circular or elliptical path around an object Orbit
2. Force that pushes a rocket thrust
3. Object that orbits a larger object Satellite
4. Largest artificial satellite ISS
5. U.S. agency in charge of space exploration NASA
6. Vehicle pushed in one direction by particles flying out of it in the opposite direction Rocket
7. Spacecraft that explores space without people aboard space Probe

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