New Get Ahead

SCIENCE

Teaching Guide

Kulsoom Waqar
Based on Revised Pakistan National Curriculum

Oxford University Press
<table>
<thead>
<tr>
<th>Table of Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to the guide</td>
</tr>
<tr>
<td>Division of syllabus into three terms</td>
</tr>
<tr>
<td>Scheme of work</td>
</tr>
<tr>
<td>Unit 1: Human organ system</td>
</tr>
<tr>
<td>Unit 2: Heredity of organisms</td>
</tr>
<tr>
<td>Unit 3: Biotechnology</td>
</tr>
<tr>
<td>Unit 4: Environmental pollution</td>
</tr>
<tr>
<td>Unit 5: Chemical reactions</td>
</tr>
<tr>
<td>Unit 6: Acids, alkalis and salts</td>
</tr>
<tr>
<td>Unit 7: Forces</td>
</tr>
<tr>
<td>Unit 8: Measurement of physical quantities</td>
</tr>
<tr>
<td>Unit 9: Sources and effects of heat energy</td>
</tr>
<tr>
<td>Unit 10: Lenses</td>
</tr>
<tr>
<td>Unit 11: Electricity in action</td>
</tr>
<tr>
<td>Unit 12: Exploring space</td>
</tr>
<tr>
<td>Answers to the Exercises</td>
</tr>
<tr>
<td>Teacher notes in Urdu</td>
</tr>
</tbody>
</table>
Introduction to the Guide

The Teaching Guides for the *New Get Ahead Science* series provide guidelines for help of the teacher in classroom. This Teaching Guide includes:

- An introduction on how to approach *New Get Ahead Science* in class.
- Teaching strategies mentioned in the national curriculum.
- Sample lesson plans.
- Suggested answers to the exercises in the textbook.
- Suggested worksheet for assessments.
- Suggested scheme of work.

**How to Approach *New Get Ahead Science***

To teach *New Get Ahead Science* in a more constructive manner, teachers are advised to make classrooms more student-centered. Students are to be given a more active role in the classroom, to be encouraged to present their thoughts and ideas confidently, and be instructed to respect differing opinions. In order to achieve this, teachers are to facilitate students so that they can take more responsibility for their learning journeys. The following summarizes the methodology with which all units of *New Get Ahead Science* are to be approached, in order to make classroom more student-centered:

- Students to be given a chance to work independently, as well as collaboratively i.e. in groups. Real-life examples to be discussed by teachers and students.
- Students to be given tasks where they share opinions with each other and with the teacher. They are to be encouraged to give reasons for their opinions.
- Teacher to role-model the ideals of respect, collaboration, and active learning in the classroom. During group discussions, all students should be encouraged to work together.
- Teacher should facilitate students only when directions are needed; most of the time, students should work on their own while reading, writing, and discussing the lessons in specific units.

**Contents and Sequence of the Teaching Guide**

The Teaching Guide for *New Get Ahead Science* contains suggestions for starting a lesson and provide teaching strategies for each unit. The instructional model focuses on exploring background knowledge, where students participate actively.
Recommended Schedule for an Active and Student-centered Classroom

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploring knowledge through essential questions</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Teaching Methodology/Activity</td>
<td>25 minutes</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

The first part of each unit contains basic suggestions for taking the lesson forward in a constructive manner. The second part of the lesson contains answers to all questions present in the book. Students should be advised to come up with their own answers and teachers can use the Teachers Guide to assess students’ understanding and knowledge.

Teaching Strategies as per General Science National Curriculum

Examples of effective instructional strategies include, but are not limited to, the following:

- inquiry
- questioning and discussion
- investigation and problem solving
- demonstration and laboratory work
- problem based learning
- utilizing whole class, group, and individual work
- incorporating literacy strategies (reading, writing, speaking and listening)
- using student work to inform instruction

For detailed support on teaching strategies of Science, please visit Chapter 7 pages 55 to 64 in the General Science National Curriculum 2006.

Assessment Strategies as per General Science National Curriculum

Teachers learn about student progress not only through formal tests, examinations, and projects, but also through moment-by-moment observation of students. To assess students’ science knowledge, skills, and attitudes, teachers require a variety of tools and approaches, such as:

- selected response
- constructed/ created response
- performance assessment
- personal communication
- students’ self-assessment

For detailed support on assessment strategies of Science, please visit Chapter 8 pages 65 to 73 in the General Science National Curriculum 2006.
Division of Syllabus into Three Terms:

1st Term
Unit 1: Human organ system
Unit 4: Environmental pollution
Unit 7: Forces
Unit 8: Measurement of physical quantities

2nd Term
Unit 2: Heredity of organisms
Unit 5: Chemical reactions
Unit 9: Sources and effects of heat energy
Unit 10: Lenses

3rd Term
Unit 3: Biotechnology
Unit 6: Acids, alkalis and salts
Unit 11: Electricity in action
Unit 12: Exploring space

Scheme of Work

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topic-wise allocation of periods</th>
<th>Learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1: Human Organ System</td>
<td>2 period</td>
<td>The students should be able to:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• define sensitivity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain that all living things are sensitive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how animals are sensitive</td>
</tr>
<tr>
<td></td>
<td>2 periods</td>
<td>• define coordination and explain how coordination is brought about in higher animals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the endocrine system and explain the functions of the hormones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the nervous system and explain how it works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe and explain a reflex action and its importance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• define excretion</td>
</tr>
<tr>
<td></td>
<td>2 periods</td>
<td>• describe the structure of the excretory system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the structure and function of a nephron</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• name some diseases of the kidneys and discuss their treatment</td>
</tr>
<tr>
<td>Chapter</td>
<td>Topic-wise allocation of periods</td>
<td>Learning outcomes</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Unit 2:</strong> Heredity of Organisms</td>
<td>2 period</td>
<td>• describe the structure of chromosomes and genes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the kinds of cell division</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• know the behaviour of chromosomes during cell division</td>
</tr>
<tr>
<td></td>
<td>2 periods</td>
<td>• define heredity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe patterns of inheritance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• identify some genetic diseases</td>
</tr>
<tr>
<td><strong>Unit 3:</strong> Biotechnology</td>
<td>2 periods</td>
<td>• define the term biotechnology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the importance of biotechnology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe some uses of biotechnology in everyday life</td>
</tr>
<tr>
<td></td>
<td>2 periods</td>
<td>• define genetic engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the steps involved in genetic engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the uses of biotechnological product</td>
</tr>
<tr>
<td><strong>Unit 4:</strong> Environmental Pollution</td>
<td>2 periods</td>
<td>• define pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe how human activities are damaging natural resources and the environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how animal life is being threatened</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the importance of plants for the environment</td>
</tr>
<tr>
<td></td>
<td>2 periods</td>
<td>• explain how land and water pollution is harmful for us</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how air may be polluted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the harmful effects of air pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• define conservation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the importance of conservation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• suggest ways to conserve our natural resources and preserve life on Earth</td>
</tr>
<tr>
<td>Chapter</td>
<td>Topic-wise allocation of periods</td>
<td>Learning outcomes</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The students should be able to:</td>
</tr>
</tbody>
</table>
| Unit 5: Chemical Reactions   | 1 period                        | • describe a physical and chemical change  
• compare the physical and chemical change  
• discuss the different types of chemical reaction                                                                                                                                 |
|                              | 2 period                        | • explain what a chemical equation is  
• explain the method for writing a chemical equation                                                                                                                                 |
|                              | 2 period                        | • state the law of conservation of mass  
• explain how to balance equations                                                                                                                                                       |
| Unit 6: Acids, Alkalis, and Salts | 2 periods | • define an acid and describe its properties  
• list some uses of acids  
• define an alkali and explain its properties  
• list some uses of alkalis                                                                                                                                                           |
|                              | 2 periods                       | • define salts and explain the properties of salts  
• list some uses of salts                                                                                                                                                                |
|                              | 2 periods                       | • describe the ways in which salts can be prepared  
• describe different indicators  
• know the use of indicator                                                                                                                                                               |
| Unit 7: Force                | 2 periods                       | • define force and pressure  
• know the formula for calculating pressure explain the relation between force and pressure                                                                                          |
|                              | 3 period                        | • list examples of where we experience pressure in our everyday life  
• explain how liquids exert pressure  
• explain that a fluid exerts pressure equally in all directions  
• explain how hydraulic machines work                                                                                                                                               |
| Unit 8: Measurement of Physical Quantities | 3 periods | • explain what is meant by mass, volume, and time  
• explain the difference between mass and weight                                                                                                                                 |
|                              | 2 periods                       | • use of S.I unit in daily life  
• use the correct instruments for measuring mass, volume, and time  
• record measurements of mass, volume, and time                                                                                                                                 |
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topic-wise allocation of periods</th>
<th>Learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit 9: Sources and Effects of Heat Energy</strong></td>
<td>2 period</td>
<td>• explain the effect of heat on solids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the effect of heat on liquids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the effect of heat on gases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the effects of expansion and contraction in everyday life</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• identify useful applications of expansion</td>
</tr>
<tr>
<td></td>
<td>3 periods</td>
<td>• explain why evaporation causes cooling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe how the volume of a liquid changes when it solidifies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the different scales of temperatures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• use the formulae to convert different temperature readings from one scale to another</td>
</tr>
<tr>
<td><strong>Unit 10: Lenses</strong></td>
<td>2 periods</td>
<td>• identify a lens</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the different types of lens</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• state the rules of refraction of rays by a lens</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the formation of images by a convex and a concave lens</td>
</tr>
<tr>
<td></td>
<td>3 periods</td>
<td>• describe the use of lenses in optical instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the structure of the human eye</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• compare the eye to a camera</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• list some defects of vision</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• know the correction of poor eye-sight</td>
</tr>
<tr>
<td>Chapter</td>
<td>Topic-wise allocation of periods</td>
<td>Learning outcomes</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Unit 11: Electricity in Action</td>
<td>2 periods</td>
<td>The students should be able to:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Know the different sources of electricity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Explain the term electromagnetism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe a dynamo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how electricity and magnetism are related</td>
</tr>
<tr>
<td></td>
<td>3 periods</td>
<td>• understand different types of cell</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the motor effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how the motor effect is used to make electric motors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• define alternating current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how an alternating current and a direct current can be produced</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• identify electrical appliances which use alternating current or direct current</td>
</tr>
<tr>
<td></td>
<td>3 periods</td>
<td>• describe the process of electricity generation at a power station</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the problems of electricity generation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how electricity is distributed</td>
</tr>
<tr>
<td>Unit 12: Exploring Space</td>
<td>2 periods</td>
<td>• define telecommunication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the various means of telecommunication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain the kind of technology we use in everyday life</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe the uses of a television, a laser light, a computer, nuclear reactor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe artificial satellites</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• list the functions of artificial satellites</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe a rocket</td>
</tr>
<tr>
<td></td>
<td>3 periods</td>
<td>• explain how a rocket is launched into space</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• describe an astronaut and the clothes he wears</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• explain how astronauts survive in space</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• discuss the benefits and problems of space exploration</td>
</tr>
</tbody>
</table>
Lesson plan 1

Students learning outcomes
Learn about sensitivity in animals.

Materials
scissors, perfume, fruit, soft material, activity cards, chart of human nervous system, colour pencils

Keywords
Neuron, motor nerve cell, sensory nerve cell, nervous system, peripheral nervous system, central nervous system

Overview
Students will learn how all living things are sensitive. They will learn how animals are sensitive.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What tells the body what to do?
2. What protects the brain?
3. What are our 5 senses?

Method:
• First show students a simple machine (scissors) to show how its parts work together. Then talk about how the organs in your body work together in groups called system. The brain contains nerves that send messages all over the body through other nerves.
• The brain is part of the central nervous system along with the spinal cord. The spinal cord is a bundle of nerves that relay messages from the brain to different parts of the body.
• Students can be asked to make a table of voluntary and involuntary actions and list down all the activities they have done throughout the day in the table.
• Have students line up. Have one student be the brain. Pass activity cards down the line, when the ‘brain’ is tapped on the shoulder, have the student with the card do the activity.
• Conduct an activity by making 5 groups and one by one ask each group to close their eyes and identify different stimuli, e.g. smelling a perfume, tasting a fruit, touching something soft, or identifying something without looking. This activity will help reiterate the 5 senses and sense organs.
• Display a large chart of human nervous system and explain the role of nerves and cells. Ensure students understand the difference between central nervous system (CNS) and peripheral nervous system (PNS). Ask students to prepare a presentation on the functions of brain. They should explain the role of each part of the brain mentioned in textbook.
• With the help of charts and diagrams on the board, explain the structure of the nervous system. Explain the structure of the brain and the functions of each part. The brain is the main organ which controls all the parts of the body and helps them to work together. Explain what the nervous system is made of? Draw a neuron and explain how neurons are linked together to make up the nervous system. Draw a reflex arc on the board and explain the path of a stimulus to the brain or spinal cord and the response produced.
• Draw the structure of neuron on the board to explain the structure of nerves.
• Conduct in classroom:
  • Activity 1, page 5

Assessment
1. Which two parts make up the central nervous system?
2. Match each word on the left with its correct meaning on the right.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>behaviour</td>
<td>a bundle of nerve fibres surrounded by a protective, fatty sheath</td>
</tr>
<tr>
<td>sensory nerve</td>
<td>the ability to be aware of the surroundings by sight, hearing, etc.</td>
</tr>
<tr>
<td>sense organ</td>
<td>a special cell or organ that receives stimuli from outside the body or from other nerve cells inside the body</td>
</tr>
<tr>
<td>stimulus</td>
<td>a nerve that carries stimuli from receptor cells or sense organs</td>
</tr>
<tr>
<td>nerve</td>
<td>a nerve that carries messages (impulses) from the brain to muscles and other parts of the body</td>
</tr>
<tr>
<td>sense</td>
<td>a pattern of actions carried out by an animal</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>receptor</td>
<td>an action as a result of a nerve impulse, e.g. moving a muscle</td>
</tr>
<tr>
<td>motor nerve</td>
<td>one of the organs that allows an animal to detect its surroundings</td>
</tr>
<tr>
<td>response</td>
<td>anything that causes a living organism to do something</td>
</tr>
</tbody>
</table>

**Reinforcement/homework**

Exercise questions 1-4

**Lesson plan 2**

**Students learning outcomes**

Learn the coordination of organ systems in higher animals.

**Materials**

a big chart of urinary system, internal structure of a kidney, sheep's kidney

**Keywords**

Kidney, ureter, bladder, urethra, cortex, nephron, Bowman’s capsule, glomerulus, urea, renal artery, renal vein, urinary tubule, urine, excretion

**Overview**

Students will learn how coordination is brought about in higher animals. They will learn about the endocrine system and the functions of the hormones. Students will also learn how the nervous system works. They will discover what is reflex action and its importance.

**Teaching methodology**

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

**Essential questions**

Before starting the lesson, ask some questions to explore background knowledge of students, e.g.

1. Which one is the main organ of excretion?
2. Why is it important to remove waste from the body?

**Method:**

- In this lesson, students will review the functions of the human body’s excretory
system, including the four major organs of the urinary system. They should be able to explain the relationship between the circulatory system and urinary system.

- Show a big chart of urinary system and show internal structure of a kidney. Show a sheep’s kidney to understand the structure.
- Explain to the students that their body needs water to survive. If we go more than a couple of days without water, we would be very thirsty and our cells would not be able to keep functioning. But not all water is drinkable. Before you fill up your glass, the water must be filtered to remove impurities that could hurt you. Our body has a similar filtering system called the excretory system. The excretory system filters the blood to remove wastes that could be harmful to the body.
- There are four main parts that make up the excretory system: the kidneys, ureters, bladder, and urethra.

Assessment

1. Label the following diagram:

   ![Kidney Diagram]

2. What is the function of kidneys?
3. Match the part of the brain to its function:

<table>
<thead>
<tr>
<th>Part</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>medulla oblongata</td>
<td>the largest part of the brain which is concerned with receiving stimuli and the coordination of responses</td>
</tr>
<tr>
<td>cerebellum</td>
<td>controls many of the involuntary movements of the body, such as respiration, heartbeat, and digestion</td>
</tr>
<tr>
<td>cerebrum</td>
<td>serves as a pathway for the nerve fibres; also controls certain reflexes</td>
</tr>
</tbody>
</table>
Reinforcement/homework
Exercise questions 5-7

Lesson plan 3

Students learning outcomes
Learn the excretory system in animals.

Materials
dialysis chart, big chart of urinary system, internal structure of a kidney, sheep’s kidney

Keywords
Kidney, ureter, bladder, urethra, cortex, nephron, Bowman’s capsule, glomerulus, urea, renal artery, renal vein, urinary tubule, urine, excretion

Overview
Students will study the process of excretion, the excretory system, and the structure and function of a nephron. They will learn about the diseases of the kidneys and discuss their treatment.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.

1. What is the function of kidney?
2. How does the body get rid of waste products?

Method:

- Ask students to make a chart of the human excretory system. Some students can be asked to deliver a presentation on the Excretory System.
- Search internet for suitable videos about kidney malfunctions and show to students, or students may be asked to research about these malfunctions and prepare a report.
- Explain that stones form in the kidneys and may be found anywhere in the urinary system. Often, stones form when the urine becomes concentrated, allowing minerals to crystallize and stick together. They can vary in size, from small stones that can
flow through your urinary system, to larger stones that cannot. Some stones cause
great pain, while others cause very little pain.

- Urinary tract infections (UTIs) are bacterial infections of any part of the urinary
tract. When bacteria get into the bladder or kidney and produce more bacteria in the
urine, they cause a UTI. If the kidneys are unable to filter wastes from the blood, the
wastes build up in the body. Kidney failure can be caused by an accident that injures
the kidneys, the loss of a lot of blood, or by some drugs and poisons.

- Teacher will explain the working of the kidneys. Explain the role of the kidneys in
helping to maintain a balance of salt and water in the body.

- Show a fresh specimen of a cow's kidney in the class. Describe its shape and colour.
Make a longitudinal section and show them the inner structure through a hand lens.

- Explain, with help of charts and diagrams on the board, how kidneys help to filter
out poisonous waste substances from the body. Discuss kidney diseases and their
causes and effects. Explain how a kidney disease can be treated. Also, discuss
dialysis and kidney transplants; show a dialysis chart.

**Assessment**

Choose the correct answer:

i. In which of the following is urine stored before it is passed out of the body?
   a. bladder b. kidney c. urethra d. ureter

ii. In which part of the kidney does the filtration of dissolved salts occur?
   a. pelvis b. medulla c. cortex d. ureter

iii. The disease which results in glucose being excreted by the kidneys into the urine is
called:
   a. anaemia b pneumonia c. bronchitis d. diabetes

iv. The name of the part of the excretory system which carries urine from the kidney to
   the bladder is:
   a. ureter b. urethra c. aorta d. sphincter muscle

**Reinforcement/homework**

Exercise questions 8-11
Lesson plan 1

Students learning outcomes
Learn the cell division and function of chromosomes.

Materials
chart showing mitosis and meiosis

Keywords
Mitosis, meiosis, homologous, haploid number, chromosome, DNA,

Overview
Students will learn the structure of chromosomes and genes and explain the kinds of cell division. They will study the behaviour of chromosomes during cell division.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. Whom do you resemble in your family?
2. Do you know why?

Method:
- Students can be asked to make a family tree and try to find out about their characteristics.
- Explain in what way do we resemble each other? In what way do we resemble our parents? Explain that many of our features, for example, hair and eye colour, are controlled by a pair of genes which are transferred to us from our parents. The passing on of characteristics from one generation to the next is called heredity. The study of heredity is called genetics.
- Explain why identical twins raised apart would be ideal subjects for an experiment. Make sure students understand that identical twins have exactly the same genetic
makeup, so any inherited traits, including all physical traits, would be exactly the same. However, if raised separately, the twins would grow up with different environmental influences.

- Divide the class into groups, and assign each group to come up with a design for an experiment that would cast light on the nature-nurture controversy. All experimental designs should involve a pair of twins raised apart from each other.
- Ask the pupils to roll their tongues. Some can but some cannot. Explain the concept of traits after this activity. Students can be asked to prepare a presentation on genetic disorders.
- Students find the most and least common combination of traits in the class by marking their traits for tongue rolling, earlobe attachment, etc. Students then organize the leaves on a large “tree of traits.” Students distinguish between inherited and learned traits by creating a “family tree of traits” using handprints.
- Discuss the patterns of inheritance using the examples given in the text. Explain that genes in a pair may be exactly alike or they may be different.
- Explain that each chromosome is made up of a long chain of genes, and that a gene is an instruction for the production of one protein (or occasionally more) which is vital to the development of the cell. For example, one gene may ‘instruct’ the cell to make the pigment present in the iris of brown eyes, or to make the protease enzyme in the stomach. The chemical which forms genes is called DNA (short for deoxyribonucleic acid).
- Complete the lesson by showing how these instructions are passed from cell to cell when a single cell divides again and again to form a whole organism consisting of thousands or millions of cells. This type of division, which the students need to have explained to them in detail with the aid of clear diagrams, is called mitosis. It is important to point out that it does not take place only in a zygote but also occurs in all living, growing tissues.

**Conduct in classroom:**
- Activity 1, page 14

**Assessment**

Choose the correct answer:

i. Differences in characteristics within a species are called ______________.
   - a. features  b. heredity  c. identity  d. variations

ii. ______________ is the study of inherited characteristics.
Each chromosome makes an exact copy of itself by a process called ____________.

a. replication  b. variation
c. mitosis  d. division

**Reinforcement/homework**

Exercise questions 1-3

**Lesson plan 2**

**Students learning outcomes**

Learn the patterns of inheritance and genetic diseases.

**Materials**

model of DNA

**Keywords**

Heredity, variation, gene

**Overview**

Students will learn about heredity and the patterns of inheritance. They will be able to identify some genetic diseases.

**Teaching methodology**

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

**Essential questions**

Before starting the lesson, ask some questions to explore background knowledge of students, e.g.

1. What is the nucleus of a cell made up of?
2. Where have the millions of different living things come from?

**Method:**

- Draw structure of cell on board and explain the composition of nucleus. Explain with help of diagrams, the structure of chromosomes and genes. Discuss cell division and the behaviour of chromosomes during cell division.
- Show the students slides of the two kinds of cell division.
• Hair colour can be any shade from blond to black. Some people have very fine hair, others much coarser hair. These are not clear-cut variations and are thus more difficult to measure.
• It is simpler to look at the hair of each individual and note whether it is straight, wavy, or curly. You do, however, have to make sure that the curls are natural ones!
• Explain mitosis and meiosis with the help of a chart and ask students to list down the difference between mitosis and meiosis.
• Explain that a human male cell has 23 chromosomes with genes from the father. A human female cell has 23 chromosomes with genes from the mother. Discuss the patterns of inheritance from the examples given in the text.
• Encourage the students to note down how they resemble and how they differ from their family members.
• Conduct in classroom:
  • Activity 2, page 20

**Assessment**

1. Name the kind of cell division that is taking place in the following diagrams:
2. Differences between members of the same species are called variations. These variations can be inherited or environmental.
   
a) Look at the three characteristic features below. For each one say if the characteristic feature is inherited, environmental, or a mixture of the two.
   
i. Intelligence
   ii. Weight
   iii. Blood group
   iv. Eye colour
   v. Hair colour

b) Characteristic features are inherited when genes are passed from parents to their children. What structure in every living cell contains the genes?

Reinforcement/homework

Exercise questions 4-6
Biotechnology

Lesson plan 1

Students learning outcomes
Learn the importance of biotechnology.

Materials
packet of enzymatic detergents, bread, antibiotics

Keywords
continuous variation, heredity, variation, gene

Overview
Students will learn the term biotechnology and discover the importance of biotechnology. They will be able to describe some uses of biotechnology in everyday life.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What do all these people have in common?
2. In what ways do we resemble each other?

Method:
- Ask students what they have heard about genetically altered foods. Summarize their thoughts on the chalkboard, explain the term biotechnology that using modern technology to change or modify the biological structure of living organisms or to create new organisms for specific uses.
- Biotechnology is the use of biological processes, organisms, or arrangements, to manufacture products which increase the quality of human life. Explain in detail what biotechnology is. Then ask the students to prepare a chart about the uses of biotechnology. Discuss genetic engineering and explain transfer of genes into bacteria.
• Ask students to visit a local supermarket, read the food labels, see if they can find any foods that have been genetically altered, and if any were found, what did the label say? What does it mean if the label says “Naturally Grown,” “Made only from Natural Products,” or “Organically Grown?”

• Biotechnology is the combination of knowledge of a biologist and skills of a technologist to provide food, medicines, and new materials for industry. It can also help to clear up much of the waste that pollutes our environment. Explain that a biotechnologist may use the entire cells, or parts of cells, such as DNA, to control chemical reactions. Microorganisms can be grown in vast quantities before being ‘harvested’ for food. They are also a source of important molecules such as antibodies used in medicines.

• Discuss the use of biotechnology in various fields. It has helped farmers through the development of new kinds of plants and healthier and more productive animals to get more milk and meat. Better and more nutritious food is being developed from fast growing algae and fungi. Alternative sources of fuel such as biogas are being produced in the countries where there is more. Useful medicines such as vaccines and antibiotics are being produced from bacteria and fungi. Bacteria are also being used to pump oil from the ground.

• With the help of charts and diagrams, explain the process of genetic engineering. Explain that certain enzymes are called chemical scissors which are used to cut a portion of the DNA, (carrying a useful gene) from a bacterial cell. This portion of DNA can be then inserted into the DNA of another bacterial cell.

**Assessment**
1. What is DNA?
2. Draw a diagram of a small piece of the DNA molecule.
3. Briefly explain how DNA carries the genetic code.

**Reinforcement/homework**
Exercise questions 1-2

**Lesson plan 2**

**Students learning outcomes**
Learn about the genetic engineering and biotechnological products.

**Materials**
model of DNA, chart of making biofuel

**Keywords**
Variation, biotechnology, fermentation, microbe
Overview
Students will define genetic engineering and describe the steps involved in genetic engineering. They will describe the uses of biotechnological product.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. Other than milk, what is your favourite dairy product?
2. Do you know how your favourite dairy product is made?

Method:
- Display pictures of biotechnological products and explain the well-known biotechnological products. Explain that microbes grow quickly when given the right temperature and food supply. It is therefore, easier to grow microbes in large quantities than to develop ways of growing plant and animal cells on their own. Also, microbe cells are relatively simple. This makes it easier for scientists to genetically engineer new microbes for specific jobs.
- Describe the process of genetic engineering with the help of diagrams and charts. Discuss the ways that biotechnology has helped man in the fields of food, fuel, and health. Also discuss the use of biotechnology in industry and in mining.
- With the help of charts and diagrams, explain the process of genetic engineering. Explain that enzymes called chemical scissors are used to cut a portion of the DNA, (carrying a useful gene) of a bacterial cell, which is then inserted into the DNA of another bacterial cell. The gene located on the cut portion instructs the microbial cell to produce the required material, which it does in great quantities, because microbes grow and reproduce at a rapid rate.

Assessment
List five uses of modern biotechnology.

Reinforcement/homework
Exercise questions 3-5
Lesson plan 1

Students learning outcomes
Learn about the different types of pollution.

Materials
a chart of ozone depletion, a poster to show air pollution

Keywords
Pollution, pollutant, intensive farming, nutrient, fertilizer, fertile, chemical waste, sewage, oil spill

Overview
Students will learn about pollution and how human activities are damaging natural resources and the environment. They will discover how animal life is being threatened and the importance of plants for the environment.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What causes air pollution?
2. Have you visited the northern areas of Pakistan?
3. Why do you like to visit such places?

Method:
- Explain that air becomes polluted when too much fuel is burnt improperly in factories, furnaces, and car engines.
- Bring a chart in the class to show ozone layer around the Earth and greenhouse gases. Discuss about global warming and acid rain. Discuss the greenhouse effect and the depletion of the ozone layer due to air pollution and show pictures.
- Show aerosol and markers with a sign CFC free.
• The amount of carbon dioxide in our atmosphere has risen by over 10%. This large increase is thought to explain why the temperature of the northern hemisphere appears to be rising. This phenomenon is called global warming. Discuss the harmful effects of global warming. Discuss the harmful effects of nuclear radiation.

• Discuss the places are attractive because they are clean and free of pollution. Students can be shown pictures of a number of different diseases caused by pollution. Explain the kinds of pollution, i.e. air, water, land, noise pollution, etc. Land becomes polluted when it is covered with litter or when farmers spray pesticides. Insecticides spoil our air and water. They also contaminate food chains.

• Show the students pictures of rubbish and litter in the streets. Explain that rubbish is solid waste. If solid waste is not disposed of, it looks ugly and becomes smelly. If it is burnt, it often pollutes the air. If left in the open air, it attracts insects and rats. If it is buried, dangerous chemicals may drain from it and contaminate underground water.

• Conduct in classroom:
  • Activity 1, page 34

**Assessment**

Choose the correct answer:

i. Why does deforestation make global warming worse?
   a. Trees absorb moisture from the soil.
   b. Trees take carbon dioxide from the air.
   c. Trees make the landscape look attractive.
   d. There will be a shortage of timber.

ii. Which of the following will NOT result from global warming?
   a. rising sea levels
   b. more droughts
   c. more damaging storms
   d. a larger ozone ‘hole’

iii. Which one of the following pollutants can spread germs that cause diseases?
   a. farm chemicals
   b. leaking oil from oil tankers
   c. untreated human sewage
   d. chemical waste from factories
iv. Which of these elements may occur in fossil fuels?
   a. sulphur  
   b. nitrogen  
   c. helium  
   d. calcium  

v. Which of these compounds helps to cause the greenhouse effect?
   a. water  
   b. sulphur dioxide  
   d. CFCs  
   e. carbon dioxide  

**Reinforcement/homework**
Exercise questions 1-4

**Lesson plan 2**

**Students learning outcomes**
Learn the ways to control pollution.

**Materials**
five clean transparent jars or beakers, some water, vinegar, washing powder, engine oil, washing liquid, two slides, some cooking oil, two shoeboxes

**Keywords**
acid rain, ozone, global warming, conservation, natural resource, wildlife, extinct, endangered species, recycle, reuse, reduce, contamination

**Overview**
The teacher will explain how land and water pollution is harmful for us and how air may be polluted. She/he will explain the harmful effects of air pollution and define conservation and its importance. Students will be encourage to suggest ways to conserve our natural resources and preserve life on Earth.

**Teaching methodology**

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

**Essential questions**
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.

1. What causes air pollution?
2. How many kinds of pollution are there?
**Method:**

- Discuss water pollution and its causes.
- Encourage the students to make posters about pollution and its effects.
- Teacher will discuss about the importance of natural resources and their conservation. Students will be asked what they can do to clean the environment like participating in cleaning of schools, streets and cities. Students should be encouraged to participate in such activities.
- Discuss the importance of air for all living things. We all need air to survive. If the air we breathe in is polluted, it can cause illness. Explain that air becomes polluted when too much fuel is burnt improperly in factories, furnaces, and car engines.
- Discuss the greenhouse effect and the depletion of the ozone layer due to air pollution. The amount of carbon dioxide in our atmosphere has risen by over 10%. This large increase is thought to explain why the temperature of the northern hemisphere appears to be rising. This phenomenon is called global warming.
- Discuss the harmful effects of global warming. Discuss the harmful effects of nuclear radiation.
- Conduct in classroom:
  - Activity 2-3, page 35
  - Activity 4, page 36

**Assessment**

Answer the following questions.

i. Give one effect of acid rain.

ii. Name the main gas associated with global warming.

iii. How is that gas formed?

iv. Describe one possible effect of global warming.

v. Where would you find a catalytic converter?

vi. What does a catalytic converter do?

vii. Suggest two things humans can do to help reduce this global warming.

viii. Suggest two ways in which cutting down large areas of forest can be harmful to the Earth’s atmosphere and climate.

**Reinforcement/homework**

Exercise questions 5-8
Lesson plan 1

Students learning outcomes
Learn the differences between chemical and physical changes. Learn the importance of chemical reactions.

Materials
atomic modelling kit, a match box

Keywords
Physical change, chemical change, chemical reaction, synthesis

Overview
The teacher will describe a physical and chemical change. She/he will compare the physical and chemical change. She/he will discuss the different types of chemical reaction.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What is burning?
2. What happens when iron rusts, or when toast burns?

Method:
- As a starter activity bring a matchbox in the class, burn it and ask the students which type of change it is. Teacher will ask the students about different examples of physical and chemical changes.
- After writing a chemical equation on the board, explain the law of conservation of mass and the balancing of chemical equation. This can be explained with the help of different examples from textbook.
• Explain that new chemical compounds are made and it may be impossible to reverse the process. These are chemical changes, also known as chemical reactions. Discuss what happens when a chemical change takes place. Discuss the different types of chemical reaction with examples.
• Write the reactions on the board and explain how the substances have reacted to form new compounds.
• Conduct in classroom:
  • Activity 1, page 42

Assessment
Complete the following equations.
i. Nitrogen + Hydrogen $\rightarrow$ __________________________
ii. Sodium + Chlorine $\rightarrow$ __________________________
iii. Calcium + Chlorine $\rightarrow$ __________________________
iv. Copper + Oxygen $\rightarrow$ __________________________

Reinforcement/homework
Exercise questions 1-2

Lesson plan 2

Students learning outcomes
Learn to write balance chemical equations. Learn the law of conservation of mass.

Materials
periodic table, atomic modelling kit

Keywords
balanced equation, Law of conservation of matter

Overview
The teacher will state the law of conservation of mass and explain how to balance equations using this law.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity                                 | 25 min |
| Assessment                                     | 10 min |
Esential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. Write the equations on the board and ask students to count the number of atoms of the reactants and products on both sides of the arrow in the given equation?
2. Are they equal?
Method:
• Now write the equation: C + O → CO₂ Ask the students to count the number of the atoms of the products and reactants. Ask: Are they equal on both sides?
• Explain the importance of balancing equations and the law of conservation of matter, with more examples. Help the students to practice balancing equations.
• Write on the board a chemical equation Fe + S → FeS Ask the students to count the number of atoms of the reactants and products on both sides of the arrow.
• Conduct in classroom:
  • Activity 2, page 46
Assessment
1. Complete and balance the following equations:
   i. H₂ + O₂ → _______________________
   ii. CuO + C → _______________________
   iii. HCl + Mg → _______________________
   iv. C + O₂ → _______________________
   v. Fe + S → _______________________
2. What are exothermic and endothermic reactions?
Reinforcement/homework
Exercise questions 5-7
Lesson plan 3
Students learning outcomes
Learn about types of chemical reactions and energy changes in chemical reactions.
Materials
periodic table, atomic modelling kit
Keywords
chemical equation, chemical reaction, reactant, product, arrow, state symbol, balancing
Overview
Students will be taught to write a chemical equation and the methods for writing a chemical equation.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What is a change?
2. What change is observed when we burn a piece of paper?

Method:
- Use a funnel to put a spoonful of baking soda into a balloon. Set the balloon aside. Wipe the funnel clean with a tissue paper. Use the funnel to fill the bottle with water until it is 1/2 full. Stretch the opening of the balloon around the opening of the bottle. Be careful not to spill any baking soda into the water. Observe the change. What will happen when the baking soda mixes with water? What happens to the balloon?
- Teacher will show different cards on which different type of equation’s examples will be written. Concepts will be explained with the help of these cards. Students can note down these equations in their notebooks.
- For example:
  To show addition reaction by making a card of equation: A + B → AB
  To show decomposition reaction make a card of equation: AB → A + B
  To show combustion reaction make a card of: A + BC → AC + B
  To show neutralization reaction make a card of: AB + CD → AD + CB
- Explain exothermic and endothermic reactions with examples. When iron and sulphur are mixed and heated together, a new substance, iron oxide, is formed. Although you have to heat the iron and sulphur to start this reaction, it gives out heat once it gets going.
- A reaction which gives out heat is called exothermic. Fireworks are an example of exothermic reactions. Chemical substances are mixed in just the right amounts to
produce light and sound energy as well as heat energy. Some reactions take in heat while they are taking place.

**Assessment**
1. Combustion is useful because ________________________________
2. Neutralization is useful because ________________________________
3. Write true or false:
   a. There is a loss of mass when the reactants turn into products. ________
   b. A word equation shows what is happening in a reaction.________
   c. Chemical reactions involve temporary changes. __________
   d. Reactions always either take in or give out energy. __________
   e. Usually the temperature in a reaction goes up. __________
   f. There are often visible changes in a reaction. __________

**Reinforcement/homework**
Exercise questions 3-4
Acids, Alkalis, and Salts

Lesson plan 1

Students learning outcomes
Learn about acids and alkalis.

Materials
lemon, mango, bitter gourd, pickles, cakes, soft drinks, soaps, litmus paper

Keywords
litmus, corrosive, sour, hydrogen ion, pH paper, strong acid, weak acid

Overview
The teacher will define an acid and describe its properties and uses. She/he will define an alkali and explain its properties and uses.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What does lemon or orange taste like?
2. What does shampoo or soap taste like?

Method:
- Bring different items like lemon, orange, baking powder and salt and tell the students about the taste and other properties. Discuss the different uses of acid, alkalis, and salt by showing pictures like vinegar, drain unblocks and fertilizers. Ask students to list down different acids, alkalis and salts also list down their differences.
- Explain that acids are sour. The acids that we use in our food are weak acids. Discuss the physical properties of acids. Put a piece of paper in a beaker containing some sulphuric acid. Explain that acids like sulphuric acid are very strong. They are corrosive. Dip a litmus paper in some dilute hydrochloric acid. Explain that acids turn litmus paper red. Dip pH paper in an acid Explain that acids have a low pH
value. Set up an electrolytic cell with dilute hydrochloric acid solution. Explain that a current is flowing through the cell. This shows that acids are good conductors of electricity. Demonstrate the chemical properties of acids by performing the tests. Discuss the uses of acids.

• Conduct in classroom:
  • Activity 1–2, page 49

Assessment
The table below shows the pH of five different chemicals.

<table>
<thead>
<tr>
<th>chemicals</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5.8</td>
</tr>
<tr>
<td>B</td>
<td>6.9</td>
</tr>
<tr>
<td>C</td>
<td>7.0</td>
</tr>
<tr>
<td>D</td>
<td>7.3</td>
</tr>
<tr>
<td>E</td>
<td>7.6</td>
</tr>
<tr>
<td>F</td>
<td>9.7</td>
</tr>
</tbody>
</table>

a) Which chemical is the strongest acid?
b) Which chemical is the weakest alkali?
c) Which chemical is neutral?
d) What colour will A turn Universal Indicator?
e) What colour will the F turn Universal Indicator?
f) What colour will the C turn Universal Indicator?

Reinforcement/homework
Exercise questions 1-3

Lesson plan 2

Students learning outcomes
Learn about indicators and their uses.

Materials
weak alkali, strong alkali, litmus paper, pH paper

Keywords
weak alkali, strong alkali, salt, hydroxyl ion, corrosive, neutralize
Overview
Students will define salts, properties of salts and uses.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What are acids?
2. What are alkalis?

Method:
- Demonstration can be conducted in lab using different indicators and acid, alkalis and salt by the teacher to show colour change. They can then be individually asked to test different solution of cola, salt, soap, vinegar and baking powder.
- Discuss the uses of neutralization reaction in class.
- Explain that alkalis have a bitter taste. Saliva is a weak alkali therefore it has no taste. Pour some sodium hydroxide into a test tube and put a blob of fat in it. Hold your thumb over the top and shake the test tube vigorously. Ask: What has happened to the fat? Explain that strong alkalis can dissolve fats. Dip a litmus paper and a pH paper in an alkali. Explain that alkalis turn litmus paper red and pH paper purple. Alkalis have a high pH value.
- Set up an electrolytic cell with dilute sodium hydroxide solution. Show the students the flow of the current through the alkali. Explain that alkalis are good conductors of electricity. Discuss the neutralization reaction between an acid and an alkali. Explain how indigestion, tooth decay, and insect bites can be treated by neutralization reactions.

Assessment
What is the pH of the following?
1) lemon juice ________________
2) washroom cleaner ________________
3) distilled water ________________
4) hair shampoo ________________
Reinforcement/homework
Exercise questions 4-6

Lesson plan 3

Students learning outcomes
Learn the term salt and its uses.

Materials
red cabbage, boiling water, lemon juice, vinegar, washing soda, baking soda solution, tomatoes.

Keywords
indicator, litmus, Universal Indicator, pH paper, salt, crystal, fertilizer

Overview
The teacher will describe the ways in which salts can be prepared and describe different indicators and their uses.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What is a salt?
2. In what form do we see salts?

Method:
- Explain that salts are solids that we see in the form of crystals. Discuss the properties of salts. Set up an electrolytic cell with a solution of sodium chloride (common salt). Explain that salt solutions are good conductors of electricity. Most salts occur naturally, but some salts are prepared in the laboratory, or in factories.
- Explain the reactions by which salts can be prepared.
- Explain the uses of salts.
- Discuss the various indicators that are used to find out whether a solution is acidic, alkaline, or neutral.
• Conduct in classroom:
  • Activity 3-4, page 55
  • Activity 5, page 58
  • Activity 6, page 59

Assessment
1. When an acid reacts with an alkali, a certain type of compound is formed. Complete the word equation for this type of reaction:
   \[ \text{acid} + \text{alkali} \rightarrow \]
2. The name of the reaction between an acid and an alkali is:
   i) combustion ii) neutralization iii) oxidation iv) reduction
3. Now complete these examples of this type of reaction:
   i. hydrochloric acid + sodium hydroxide →
   ii. sulphuric acid + potassium hydroxide →
4. Label the following diagram:

![Diagram]

Reinforcement/homework
Exercise questions 7-8
Lesson plan 1

Students learning outcomes
Learn about the force and pressure and its importance.

Materials
a rope, magnet, pins, balloon, bat, ball, toy car

Keywords
newton, square metre, pascal, pressure, force, area

Overview
The teacher will define force and pressure. They will state the formula for calculating pressure and explain the relation between force and pressure.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What causes more damage to a wooden floor, shoes with flat soles or high heels?
2. Can anyone define pressure?

Method:
- Describe force and then guide students towards the actual definition.
- Make a cloud on the blackboard using students’ responses about what forces can do.
- Explain that high heels can ruin carpets and punch holes in wooden floors. This is not just because of the strong downward force, but because this force is concentrated on such a small area that it produces strong pressure. Explain that scientists use the word pressure to describe how concentrated a force is.
- Explain the method of calculating pressure and the unit that pressure is measured in. Explain we calculate the force on an area if we know the pressure?
• Explain how force can be calculated by rearranging the pressure equation. Discuss the pressure of objects on different surfaces, and explain the applications of pressure.

• Explain different situation in daily life where forces are used so that students understand the forces operating in a range of situations. Ask the students to give ideas about the forces that are operating in each situation in turn and help them understand what is actually happening.

• Bring a toy and try to demonstrate a type of force that can be applied to push, pull, or create and change in the direction of an object. Explain start, stop, speed up, slow down, and change direction.

• Conduct in classroom:
  • Activity 1, page 62
  • Activity 2, page 63
  • Activity 3, page 64

**Assessment**

1. Choose the correct answer:
   i. Which of the following will create the greatest pressure on a surface?
      a. snowshoes  b. drawing pin  
      c. skis  d. the feet of a camel
   ii. The unit for force is the:
        a. kilogram  b. metre  c. joule  d. newton
   iii. The force of gravity pulling on an object is called its:
        a. height  b. mass  
        c. weight  d. temperature
   iv. What units do we use to measure pressure?
        a. newtons  b. metres  
        c. pascals  d. newton metres
   v. What pressure is created when a force of 64 N is applied over an area of 4 m²?
        a. 256 Pa  b. 16 Pa  
        c. 16 m²  d. 256 m²

2. Ali stands on the bathroom scales. The scales read 50 kg.
   a. What is Ali’s mass? ________________
   b. What is Ali’s weight? ________________

3. When Ali stands, the area of his feet in contact with the ground is 200cm².
   a. What pressure does Ali exert on the ground? ________________
b. When Ali stands on one foot, what effect does this have on the pressure he exerts on the ground? ________________

**Reinforcement/homework**
Exercise questions 1-3

**Lesson plan 2**

**Students learning outcomes**
Learn about pressure in our everyday life.

**Materials**
empty juice box, balloons, candle

**Keywords**
transmit, hydraulic machine, density, depth, weight, atmosphere, atmospheric pressure, compressed, fluid pressure, aerosol

**Overview**
The teacher will list the examples of where we experience pressure in our everyday life and explain how liquids exert pressure. She/he will explain that a fluid exerts pressure equally in all directions and explain how hydraulic machines work.

**Teaching methodology**

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

**Essential questions**
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. Do liquids exert pressure?
2. Why does a swimmer feel pressure in his ears?
3. If he goes deeper into the water, how will it affect the pressure?
4. What is blood pressure?

**Method:**
- Teacher can use magnets to show opposite poles of magnet attract and similar poles repel each other. Discuss with the students about the push or pull forces acting on an object.
• Teacher will drag heavy and light objects in front of the students like chair, table and let the students estimate the force required to lift several objects in the classroom.
• Students will be asked to blow a balloon to explain the gas pressure.
• Demonstrated to explain behaviour of gases under pressure. For e.g. the concept of behaviour of gases at high temperature.
• Teacher will demonstrate the hydraulics system with the help of a chart of hydraulic brake system. Teacher will bring a perfume bottle or any other spray bottle in the class to show the working of aerosol spray.
• Explain that liquids have two special features: they cannot be squashed, and if a liquid in a container is put under pressure, the pressure is transmitted equally to all parts of the liquid.
• Discuss hydraulic machines which use liquid pressure to transmit forces from one place to another. Most hydraulic machines are force magnifiers: they give out more force than is put in. This happens because the output piston is larger than the input piston.
• Explain that gravity is a force that pulls any liquid in a container downwards. A liquid under pressure pushes on every surface it touches. The pressure of a liquid increases with depth. The width or the shape of the container does not affect the pressure. Explain that pressure is affected by the density of the liquid. Explain the formula for calculating the pressure of liquids.
• Explain that the Earth’s atmosphere contains billions of tons of air. At sea level, the atmospheric pressure is equivalent to a force of about 100,000 newtons pushing on every square metre. Explain that in a gas the particles are continuously moving, so at any given time many of them are colliding with the sides of the container. They bounce off without losing any energy, and in doing so, each one exerts a small outward force on the wall. Because billions of particles are doing this each second, the force appears as constant pressure. Discuss the applications of atmospheric pressure and liquid pressure.
• Show an aerosol spray and explain the construction and working of an aerosol.
• Conduct in classroom:
  • Activity 4-6, page 62

**Assessment**

1. Write down the formula for calculating pressure.
2. Why is it an advantage for a camel to have big feet when it walks across desert sand?
3. Calculate the pressure exerted on the ground by each foot of a camel if it weighs 7000 N and each foot has an area of 600 cm².
4. Calculate the pressure exerted on the ground by each foot of a horse if it weighs 5000 N and each foot has an area of 125 cm².

5. Which animal would make the deepest footprints in sand, the horse or the camel?

6. Name a unit of pressure.

**Reinforcement/homework**

Exercise questions 4-6
Lesson plan 1

Students learning outcomes
Learn the S. I. units of different quantities.

Materials
pencil box, science book, a metre scale, a measuring tape

Keywords
matter, S.I units, MKS system, metre, kilogram, second

Overview
The teacher will explain what is meant by mass, volume, and time. She/he will explain the difference between mass and weight.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.

1. Do you have any idea of how long a metre is?
2. How long?
3. How big?

Method:
- Begin the lesson by explaining what measuring something means. Explain that long ago people had only inexact ideas about distance and time. For example, half an hour’s walk may mean very different distances for different people. Scientists make many kinds of measurements in the laboratory. It is only by making careful and accurate measurements that scientific work can be carried out. Since 1960, scientists have used SI units for all measurements. SI stands for System International, or the International System of Units.
• Bring different instruments to class or take the students to school lab to explain their uses as given in textbook.
• Discuss in class how they think scientific investigations take place. Explain the safety measures to be taken in a lab. Show the students a metre rule. Bring a piece of cloth in the class and ask them to measure it using hand spans to get a rough idea of how long a metre is?
• Conduct in classroom:
  • Activity 1-2, page 74

Assessment
1. What is meant by the term SI unit?
2. Why is it important to have SI units?
3. What are the SI units of:
   i) time
   ii) distance
4. Fill in the blanks to complete the statements:
   a. km is the symbol for ______________.
   b. To measure the volume of a liquid we use the unit____________.
   c. A balance is used to measure ____________.
   d. A measuring cylinder is used to measure ____________.
   e. A metre rule is used to measure ____________.

Reinforcement/homework
Exercise questions 1-2

Lesson plan 2
Students learning outcomes
Learn the use of different S. I. units.

Materials
measuring cylinders, scale, stopwatch, weighing balance

Keywords
meniscus, time, hour, minute, second, clock

Overview
The teacher will discuss the use of S.I unit in daily life and demonstrate the correct instruments for measuring mass, volume, and time. Students will record measurements of mass, volume, and time.
Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions

Before starting the lesson, ask some questions to explore background knowledge of students, e.g.

1. What is mass?
2. What is weight?
3. What is the difference between the two?
4. What is volume?
5. How can we measure the volume of a body?

Method:

- Ask the students to measure their copies or pencils and write measurement in their notebooks. Explain conversion of units.
- Ask students to make a chart of different lab instruments and their uses.
- Explain the difference between mass and weight. Weight is a force and is measured in Newton. Mass is the quantity of matter in a body. The mass of a body does not change, no matter where it is, but the weight can vary from place to place.
- The unit for measuring mass is the kilogram (kg). 1 kg = 1000 g
- The smaller units of mass are the gram and milligram.
- We often work with these smaller units in the laboratory.
- The instrument used to measure mass is called a balance.
- Discuss the different types of balance.
- Discuss the formula for finding the volume of regular solids: length x breadth x height.
- The volume of liquids is measured in litres (l). 1 litre = 1000 millilitres (ml)
- The instruments used for measuring the volume of liquids are: measuring cylinder, measuring flask, burette, pipette, etc.
- Bring four measuring cylinders in the class. Fill it with water and ask the students to measure the volumes. For reading the volume of a liquid accurately we have to read the bottom level of the meniscus. The eye must be level with it. To ensure that the liquid is level the cylinder must be upright when the reading is taken.
• Explain that in the past, sundials were used to tell the time. A sundial is the simplest clock. The sun casts a shadow on the face of the sundial. The movement of the shadow follows the apparent movement of the Sun. The position of the shadow on the scale gives the time.

• Show a clock and ask the students what do we measure with a clock?

• Ask three students to run from one to another corner of the class and note the time using stop watch.

• Explain the students to think what the world would be without clocks, watches, or calendars. Explain that stopwatches, watches, and clocks are used to measure time. A stopwatch has knobs or buttons to start, stop, and reset the digits. It has a large second’s hand.

• One full round of the hand measures 60 seconds.

• Electronic stopwatches can measure time intervals accurate to 0.01 second. They have digital display of time, which makes taking readings easier.

• Conduct in classroom:
  • Activity 3, page 75

Assessment
Choose the instrument you would use to measure each of the following distances:
30 cm ruler measuring tape metre ruler car milometer

i) The distance between Karachi and Quetta ________________________________

ii) The length of one of the school corridors ________________________________

iii) The size of your textbook ________________________________

iv) The size of your table ________________________________

Reinforcement/homework
Exercise questions 3-5
Lesson plan 1

Students learning outcomes
Learn the effect of heat on solid and liquids.

Materials
a candle and a torch, beaker, water, bits of paper or sawdust, burner or spirit lamp, a matchbox, a glass

Keywords
expansion, contraction

Overview
The teacher will explain the effect of heat on solids and explain the effect of heat on liquids. She/he will explain the effect of heat on gases and describe the effects of expansion and contraction in everyday life. She/he will identify the useful applications of expansion.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. How do we measure temperature of a body?
2. Why do gases diffuse faster at high temperature?

Method:
- Bring a candle and a torch to show the different sources of heat. Ask the students to rub hands to produce heat. If you heat ice, it melts, but it does not become hotter.
- Discuss the three states of matter and the behaviour of particles on heating. Explain that solids, liquids, and gases are made up of tiny particles which can attract each other. The particles are constantly moving.
- In a solid the particles attract each other strongly. Therefore the particles stay close together. They move by vibrating.
• In a liquid, the particles attract each other less strongly. The particles can move about as they vibrate. Liquids can flow.
• In a gas the particles attract each other very little. The particles move about very fast and quickly fill the container.
• As solids, liquids, and gases get hotter, the particles move faster. When the particles of a solid are heated, they begin to break the attraction they have between them. The solid may become a liquid. When a liquid is heated, the particles may break all the attractions between them. The liquid will then become a gas.
• A hot substance has more energy than a cold substance. Heat transfer is the flow of energy from a hot place to a colder one. The temperature stays at 0 degrees Celsius until all the ice has melted. The heat absorbed when a solid melts is called the latent heat of fusion: fusion means to melt, and latent means hidden.
• The effect of heat seems to be hidden because the temperature does not rise. In fact, the heat absorbed by the solid is used to pull the molecules apart, so that they are free to move around as a liquid.
• Every time that you put the kettle on to boil, heat energy is absorbed by the water. The temperature rises to 100 degrees Celsius, but no further. If you leave the kettle on the stove, the extra energy just turns more and more of the water into steam, but the temperature remains the same.
• The heat energy absorbed when a liquid changes into gas is called the latent heat of vaporization. The energy is needed to pull the molecules apart so that they can move around freely as a gas. Perform the experiment of relegation and discuss the effects of pressure on the melting point of a solid, such as ice. To explain expansion and contraction demonstrate. Freeze-thaw weathering will be explained with the help of cards showing steps of ice wedging.
• Conduct in classroom:
  • Activity 1 page 79
  • Activity 2, 3 page 80
  • Activity 4, 5, 6 page 81

**Assessment**

Write true or false:

i. The particles in a solid are packed close together.

ii. The particles in a gas are far apart.

iii. Liquids are easy to compress.

iv. Gases have a low density.

v. Gases are difficult to compress.

vi. Liquids and gases can flow.

vii. The particles in a solid vibrate.
Reinforcement/homework
Exercise questions 1-2

Lesson plan 2

Students learning outcomes
Learn the conversion of temperature reading from one scale to another.

Materials
A metallic bottle top, an ice cube, a tripod stand, a candle.

Keywords
expand, temperature, thermometer, vibrate

Overview
The teacher will explain why evaporation causes cooling and describe how the volume of a liquid changes when it solidifies. She/he will explain the different scales of temperatures and use the formulae to convert different temperature readings from one scale to another.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What is the difference between heat and temperature?
2. What will you see when a solid/ ice is heated?

Method
- Show different clippings of magazines or pictures from internet to show the effects and applications of expansion and contraction of solids. For e.g., show a picture of railway tracks or hanging wires from poles.
- Two strips of different coloured paper will be used to show a bimetallic strip and teacher will explain its use.
- Different types of thermometers will be brought to the class by the teacher and their differences will be explained. Demonstrate recording the freezing and boiling point
of water using different thermometers. Teacher will ask the students to practice conversion of different scales using formulae.

- Explain that expansion and contraction in a gas occurs in the same way as in solids and liquids. The difference in the expansion of gases is that the amount of expansion is much larger than that in a solid or a liquid. Discuss the ways in which the expansion of gases is useful.

- Conduct in classroom:
  - Activity 7–8, page 82
  - Activity 9, page 84

**Assessment**

1. What happens to the size of objects as they get hotter?
2. What happens to the size of objects as they get colder?
3. As the railway lines get hotter, what happens to the gaps in the track?
4. What would happen in hot weather if there were no gaps in the track?
5. In countries where there is very hot and very cold weather, should the gaps between the lengths of track be wider or narrower?

**Reinforcement/homework**

Exercise questions 3-5
Lenses

Lesson plan 1

Students learning outcomes
Learn about different types of lenses.

Materials
different types of lens, microscope, magnifying glass

Keywords
Classification, variety, groups, vertebrates, invertebrates, kingdom, feature

Overview
The teacher will identify a lens and describe the different types of lens. She/he will state the rules of refraction of rays by a lens and describe the formation of images by a convex and a concave lens.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
Show the students a magnifying glass. Tell them to read the words on the page of their books.
1. Why do the words look big?
2. Why do we use lens?

Method:
- The structure of human eye will be shown on a chart to the students and different parts and their functions will be discussed. A camera will be shown to the students and students will discuss the points of difference. An optician may be invited to the class to discuss about the defects of vision and importance of protection of eye or teacher will show a chart about the defects of vision. Teacher will show a leaf or onion cells through a microscope to the students.
• With the help of diagrams explain the paths of rays when they pass through a lens. Explain the formation of images of an object placed at various distances from the lens. Describe the kinds of images that will be formed. Explain the difference between real and virtual images. Help the students practice drawing refraction of rays through lenses.

• Describe a lens. With the help of real lenses and diagrams on the board, explain the types of lenses, and how light refracts when it passes through lenses. Hold a magnifying glass near a window. Focus a sharp image of the Sun on a sheet of paper. Explain that a clear image of an object is formed at a point where all the rays coming from the object come to a point (converge). This point is called the principal focus, and the distance between the image and the lens is called the focal length of the lens. Show the students how to calculate the focal length of a lens using an optical bench.

• Teacher will bring a magnifying glass and draw a ray diagram to show the formation of a virtual image and real image. Teacher will give ideas about to differentiate that a real image is an image which can be projected but virtual image cannot be measured. Teacher will explain the image produced by a lens on the brain considering that the light is travelling to the eye in a straight line. Teacher will keep a burning candle at different distances from a converging lens to demonstrate the formation of images, and students will observe the nature of the image formed on the screen.

• Conduct in classroom:
  • Activity 1, page 88

**Assessment**

1. Complete the diagram:
2. What type of lens is A?
3. What type of lens is B?

Reinforcement/homework
Exercise questions 1-2

Lesson plan 2

Students learning outcomes
Learn the uses of lenses in optical instruments.

Materials
spectacles, binoculars, camera, magnifying glass, camera

Keywords
eye, lens, iris, retina, light-sensitive cell, virtual image, optic nerve

Overview
The teacher will describe the use of lenses in optical instruments and describe the structure of the human eye. She/he will compare the eye to a camera and list some defects of vision.

Students will know the correction of poor eye-sight.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. Can you see distant objects without your glasses?
2. Does anyone in your family wear glasses?
3. Can you see in the dark?

Method:
- Hold a lens above the writing on this page. Look through the lens from the top and move the lens up and down until the writing is clear. Teacher will show converging lenses and show the image formation of a distant object for example a bird or a building seen through a lens bringing parallel rays from a distance to focus through a cylindrical lens. Students will be invited to draw a ray diagram to scale to show the formation of a real image.
• Draw the longitudinal section of the human eye, and describe its parts. Draw a section of a camera and explain the similarities and differences between the eye and the camera. Identify some students in the class who wear glasses. Discuss the use of spectacles and the defects of vision. Explain, with diagrams on the board, how corrective lenses can be used to help improve poor vision. Discuss the role of the iris and the pupil of the eye in adjusting to light and dark. Also explain the role of rods and cones in helping the eyes to get used to seeing in the dark. Discuss night vision.

• Show the students a microscope and explain its construction. Put a microscope slide under the objective lens and ask the students to observe the image. Explain that the combination of lenses in optical instruments helps us to see clear images of objects. Draw a section of the telescope and explain how images of distant objects can be seen through it. Explain that the image is upside down or inverted, but it does not matter when we are observing heavenly bodies.

**Assessment**

1. Label the following diagram:

2. Why is it important for the cornea of the eye to be transparent?

3. Name the two kinds of sensitive cell which are found in the retina.

4. The size of the pupil can be varied by the iris. What is the purpose of this?

5. Which part of the eye that sends impulses to the brain?

**Reinforcement/homework**

Exercise questions 3-5
Electricity in Action

Lesson plan 1

Students learning outcomes
Learn about the electricity and magnetism.

Materials
copper wire, glass rod, magnet, galvanometer, an iron wire, a candle, ice-cold water.

Keywords
Compass, magnetic field, electromagnetism, solenoid, generator, dynamo

Overview
The teacher will describe the different sources of electricity and explain the term electromagnetism. She/he will describe a dynamo and explain how electricity and magnetism are related.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. How is electricity generated at a power station?
2. How does it reach us?

Method:
- Students should be explained that the large-scale production of power in power stations basically uses two types of energy sources, the renewable and non-renewable type. Renewable sources are those which can be replaced easily like wind, water, solar, tidal, geothermal. Non-renewable sources are those which cannot be replaced in a short period of time once they are used up. These include all types of fossil fuels coal, oil, gas as well as nuclear fuel.
- Make a list of all the suggestions on the board. Wind a loop of wire on a nail. Remove the nail and attach the ends of the coil to a battery. Bring a magnetic
needle close to it. The needle will be deflected showing that there is a magnetic field around the coil. Explain that this type of coil is called an electromagnet or solenoid. If the number of turns of the coil is increased or if the current is increased, the electromagnet can be made stronger. Explain that when an electric current flows in a wire in a magnetic field, a force is produced which makes the wire move. This force is called the motor effect. The motor effect is used by scientists and engineers to build electric motors.

- Wind a loop of wire around a nail to make a coil. Remove the nail and attach the ends of the coil to a battery. Bring a magnetic needle close to the coil; the needle will be deflected showing that there is a magnetic field around the coil. Explain that this type of coil is called an electromagnet or a solenoid. If the number of turns of the coil is increased, or if the current is increased, the electromagnet will be stronger. Putting a piece of iron inside the coil makes the field even stronger. One end of the coil behaves like the North Pole and the other, the south pole of a magnet. Switching off the current destroys the magnetism. Explain if you had to build a stronger electromagnet, what would you do? How many turns of wire would you wind round it? What size of current would you use? Set up the circuit of the motor. Explain that when an electric current flows in a wire in a magnetic field, a force is produced which makes the wire move.

- Conduct in classroom:
  - Activity 1, page 97
  - Activity 2, page 98

**Assessment**

1. Name two unwanted forms of energy that result from wind turbines.
2. Explain why wind is a renewable energy source.
3. What are two advantages of wind turbines?
4. What are two disadvantages of wind turbines?

**Reinforcement/homework**

Exercise questions 1-2

**Lesson plan 2**

**Students learning outcomes**

Discover the uses of electrical appliances.

**Materials**

A zinc plate, a copper plate, two electric wires, diluted sulphuric acid (H2 SO4), a beaker, a bulb.
Keywords
Power station, energy source, wind turbine, hydroelectric power plant, solar energy, and transformer, Alternating current, direct current

Overview
The teacher will understand different types of cell and describe the motor effect and explain how the motor effect is used to make electric motors. She/he will define alternating current and explain how an alternating current and a direct current can be produced. She/he will identify electrical appliances which use alternating current or direct current.

Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What are transformers?
2. What is their role in transmitting electricity?

Method:
- Explain the method of electricity generation at a power station. When electricity is generated it has to be transmitted around the country using thick copper or aluminium cables which are hung on pylons or buried underground. Explain that these metals are very good conductors of electricity. The cables are thick to give low resistance.
- Explain that very high voltages are used when electrical energy has to be transmitted over long distances. Also, different uses require different voltages. Explain that it is the network which carries electrical energy around the country. It uses step-up and step-down transformers to increase or decrease the voltage.
- The small-scale electricity production is done through chemical means in dry cells and batteries and using mechanical means in domestic generators and dynamos. The difference between an alternating current and a direct current is also a very important concept which needs to be clearly understood. The students should be asked to sort the different devices in their surroundings that work using AC and DC as a warm up activity for this topic.
• Tell the students that they have just found out that electricity can be used to make magnets; the opposite is also true; magnets can be used to produce or generate electricity. It is quite easy to generate electricity in the laboratory. All you need is a U-shaped magnet and a loop of wire. Move the wire up and down between the poles of the magnet. To show that a current is flowing you have to connect a meter to the wire. It will give a tiny reading, but only while the wire is moving. To generate useful electricity you will need a long wire wound into a coil. Mount the coil on an axle. Place the coil between the poles of a magnet. Spin the coil steadily. This is the arrangement in a model generator. It uses the moving energy from a steam engine or a water turbine to spin the coil. When it is working, this generator can supply a steady current big enough to light a torch bulb. A power generator is much more complicated and much more powerful. It can generate enough electricity to supply a whole town.

• Spinning a coil between the poles of a fixed magnet is not the only way to generate electricity. Spinning a magnet inside a fixed coil generates electricity as well. The bicycle dynamo uses a spinning magnet. You have to supply energy to spin it. With a bicycle dynamo and a lamp you can change chemical energy in your food into light energy! Discuss some output components and their uses.

• When an electric current flows in a wire in a magnetic field, a force is produced. The force can make the wire move. This is sometimes called the motor effect. The motor effect has been used by engineers to build electrical motors which are so commonly used in small motors which move the tape in cassette players, to the powerful motors used to move heavy machines and trains, etc.

• A current can be produced when a wire is moved through a magnetic field. This is called the Dynamo effect. It is just the opposite of the motor effect.

• A current can also be generated or induced by moving a magnet towards or away from a coil of wire. The current is only induced when the magnet is moving.

• The size of the current can be increased by:
  a. moving the magnet faster
  b. using a stronger magnet
  c. using more turns of wire in the coil

• Conduct in classroom:
  • Activity 3, page 100
**Assessment**

1. Match the problems of electricity generation with the sources:

<table>
<thead>
<tr>
<th>Problems</th>
<th>Power generation sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are relatively expensive and do not work at night or in bad weather.</td>
<td>hydroelectric power plants</td>
</tr>
<tr>
<td>Do not need reservoirs to store water, and do not create pollution, but their construction costs are high.</td>
<td>using fossil fuels</td>
</tr>
<tr>
<td>Use a reservoir to store water, due to which lots of land is submerged; dams which are built to store water, displace people and destroy wild life; dam bursts can be disastrous.</td>
<td>solar panels</td>
</tr>
<tr>
<td>They are not renewable. They took millions of years to make, and at some point in time will run out. They can cause serious environmental problems.</td>
<td>wind turbines</td>
</tr>
</tbody>
</table>

**Reinforcement/homework**

Exercise questions 3-5

**Lesson plan 3**

**Students learning outcomes**

Learn the process of electricity generation at a power station.

**Materials**

A used cell, knife, chart showing power stations

**Keywords**

classification, variety, groups, vertebrates, invertebrates, kingdom, feature

**Overview**

The teacher will describe the process of electricity generation at a power station and discuss the problems of electricity generation. She/he will explain how electricity is distributed
Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. Where does electricity in our homes come from?
2. What do we use in a torch to light the bulb?
3. How does an electric clock work?

Method:
- The students can be asked to write an assignment on the advantages and disadvantages of using different sources of energy for the production of power on a large scale.
- Electronic systems all have the three basic components the input output and the processor unit. Different output devices like computer, watches, clocks, calculators, mobile phones are being used most commonly today in our daily life.
- In power stations fuel such as coal, gas, oil, or energy from a nuclear reactor is used to heat water and turn it into steam. The steam then turns turbines connected to a.c. generators.
- These are called alternators. They work on the same principle as the bicycle dynamo. The voltage is produced by a magnet spinning inside fixed coils of wire. The power station uses a spinning electromagnet. By changing the current in the electromagnet the output from the alternator can be accurately controlled without slowing the turbines. The current for the electromagnet comes from a small d.c. generator which is also driven by the turbines.
- Output components and their uses:
  a. Calculators: these devices use electronic circuits to solve mathematical problems quickly and accurately.
  b. Digital clocks: these devices use electronic timing circuits. These timers can be used in other devices.
  c. Central heating control units: these devices use programmable electronic circuits to allow easy control and are more reliable than mechanical switches.
  d. Computers: these devices are used for solving mathematical problems, business purposes and games.
e. Electronic organs: these devices use electronic circuits to produce musical notes and rhythms.

f. Satellite communications: these devices are used for international communications, military purposes, and satellite television.

- Conduct in classroom:
  - Activity 4, page 100

**Assessment**

1. Write the terms for these descriptions:
   i. the force produced when an electric current flows in a wire in a magnetic field
   ii. the current generated by a magnet moving near a coil of wire
   iii. the current produced when a wire is moved through a magnetic field
   iv. a device which uses electronic circuits to solve mathematical problems quickly and accurately
   v. a device that uses electronic timing circuits

2. The resistance of a piece of wire depends on several factors.
   i) Does the resistance of a piece of copper wire increase, decrease, or stay the same when its length increases?
      a. increase   b. decrease   c. stay the same
   ii) Does the resistance of a piece of copper wire increase, decrease, or stay the same when its diameter increases?
      a. increase   b. decrease   c. stay the same

**Reinforcement/homework**

Exercise questions 6-7
Lesson plan 1

Students learning outcomes
Learn about telecommunication and space.

Materials
pictures of solar system and astronauts

Keywords
Artificial satellite, aerial, radio telescope, space station, space shuttle

Overview
The teacher will define telecommunication and describe the various means of telecommunication. She/he will explain the kind of technology we use in everyday life and describe the uses of a television, a laser light, a computer, a nuclear reactor. The teacher will describe artificial satellites and list the functions of artificial satellites. She/he will be able to describe a rocket.

Teaching methodology

| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. What is solar system?
2. What is a satellite?
3. What is the natural satellite of the Earth?

Method:
- Explain how do we receive radio and television programs from other countries? Explain that artificial satellites are sent in space. They orbit the Earth. They carry aerials and machines which are used to send and receive signals.
- From where do artificial satellites get their supply of energy? Explain that satellites have solar panels that capture Sun energy, which is converted into electrical energy.
Discuss the various types of spacecraft and machines that are being used to explore space.

- Explain how do we receive telephone calls from far off countries? How do programs relay from a television station reach our television sets? Explain the transmission of sound and light waves in the form of electric signals to our TV sets, and how they are converted back into sound and light waves.

- Ask the students to observe the screen of a TV set with a magnifying glass. Explain that the coloured dots that they see on the screen are due to the coating of phosphor at the back of the screen. Phosphor glows when electrons are shot at it. Explain about laser light. Explain that laser light is a concentrated beam of light which can travel long distances. It can also travel in glass tubes called optical fibres. Optical fibres are being used instead of telephone cables. Explain working of a computer.

- Show the students the parts of a computer.
- Explain how a computer works.

**Assessment**

1. What are artificial satellites?
2. What are they used for?

**Reinforcement/homework**

List some uses of Robotic Spacecraft in:

a. Our daily life.
b. Space exploration.

**Lesson plan 2**

**Students learning outcomes**

Learn about space exploration and its importance.

**Materials**

binoculars, pictures of spacecraft

**Keywords**

space travel, rockets fuel, oxidizer, combustion chamber, astronaut, cosmonaut, space walking, life support system, mission control

**Overview**

The teacher will explain how a rocket is launched into space and describe an astronaut and the clothes he wears. She/he will explain how astronauts survive in space and discuss the benefits and problems of space exploration.
Teaching methodology

<table>
<thead>
<tr>
<th>Exploring knowledge through essential questions</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method/activity</td>
<td>25 min</td>
</tr>
<tr>
<td>Assessment</td>
<td>10 min</td>
</tr>
</tbody>
</table>

Essential questions
Before starting the lesson, ask some questions to explore background knowledge of students, e.g.
1. Can an aeroplane travel into space?
2. Why an aeroplane cannot travel into space?
3. What is a rocket?
4. How does a rocket travel in space?

Method:
- Ask students what they know about the solar system. Ask them the names of the planets and try to develop their interest in discussing the topic. Discuss the history of space exploration, if possible show pictures of first human who travelled in space.
- Explain different tools and telescopes used in space exploration. Start with a brief history of the telescope and the fact that the Italian scientist Galileo Galilei first developed a telescope in about the year 1600.
- Show a picture of an astronaut and discuss how astronauts look after themselves in space. Explain that only rockets can go into space because they carry their own supply of liquid fuel. They travel at a very fast speed to overcome the Earth’s gravity, and they orbit the Earth at the same velocity.
- Show the students pictures of spacecraft and astronauts. Explain that a spacecraft has its own life-support system, which provides food, air, and water to the astronauts.
- Ask: How do astronauts survive in space? Explain that the spacesuit that an astronaut wears keeps their pressure and temperature constant. Discuss the benefits generated by space technology, and the problems that have resulted from space exploration.
- Ask students to research about different space shuttles.
- Give different situations to students and ask them what they think astronauts might have done in such situations.
**Assessment**

1. Look carefully at these pictures of an astronaut in his space suit. Then answer the questions below.

   - Oxygen tank
   - Helmet
   - Outer covering
   - Temperature control
   - Gloves
   - Visor with Camera
   - Pressure gauge

   a. Which part of the space suit protects an astronaut’s face from flying dust and pieces of rock?
   b. How does the astronaut keep cool inside the space suit?
   c. How does the astronaut breathe in space?
   d. Why do you think there are lights attached to the astronaut’s helmet?
   e. Why do you think an astronaut wears a camera that sends pictures to the spacecraft and Mission Control?

**Reinforcement/homework**

Exercise questions 1-5
Answers to the exercise questions

Unit 1

1. The central nervous system consists of the brain and the spinal cord. The central nervous system is a system which receives information from the brain and coordinates and influences the activity of all parts of the bodies.

Cerebrum is made up of delicate layers of tissues. It is the principal part of the brain and occupies most of the upper part of the brain.

Cerebellum is made up of deep layers. It is smaller than the cerebrum and is located at the back, mostly underneath the cerebrum.

Medulla oblongata is located at the base of the brain, it connects the brain and spinal cord.

The Spinal Cord is a long tube which starts from the brain and passes down through the vertebral column. A network of nerves emerges from the spinal cord.

2. Humans perform different functions and tasks every day. All this is possible because of the amazing and complex nervous system of our body. Information about our surroundings is collected by receptor cells present in the sense organs.

3. Refer to the Students’ Book.

4.

<table>
<thead>
<tr>
<th>Name</th>
<th>structure</th>
<th>functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrum</td>
<td>It is made up of delicate layers of tissues. It is the principal part of</td>
<td>Its sensory areas receive impulses from the sensory organs, motor areas</td>
</tr>
<tr>
<td></td>
<td>the brain and occupies most of the upper part of the brain.</td>
<td>control muscle coordination and movement, and associated areas control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>thoughts, ideas, memory and conversation</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>It is made up of deep layers. It is smaller than the cerebrum and is</td>
<td>Controls muscular activity and balance; coordinates between the brain and</td>
</tr>
<tr>
<td></td>
<td>located at the back, mostly underneath the cerebrum.</td>
<td>the spinal cord.</td>
</tr>
<tr>
<td><strong>Medulla oblongata</strong></td>
<td>It is located at the base of the brain, it connects the brain and spinal cord.</td>
<td>Controls all involuntary functions like digestion, heartbeat, etc.</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>The Spinal Cord</strong></td>
<td>It is a long tube which starts from the brain and passes down through the vertebral column. A network of nerves emerges from the spinal cord.</td>
<td>These nerves connect all the parts of the body with the spinal cord, which is, in turn, connected to the brain.</td>
</tr>
</tbody>
</table>

5. Nerves. These are made up of cable-like bundles of nerve cells called neurons. Nerve cells receive and send messages between the body and the brain.

Sensory neurons: They send impulses from sensory receptors to inform the CNS of a stimulus. Sensory neurons have long dendrites and short axons.

Motor neurons: They send impulses from the CNS to the muscle, organ or gland they command to take action. Motor neurons have short dendrites and long axons.

6. The automatic responses of our body are called reflex actions. There are many actions which you do without consciously thinking about them. In general, the spinal cord sends these messages. Sometimes, the subconscious part of the brain takes part in making these decisions.

7. A voluntary action is an action which is in our control. We initiate it by your own conscious to perform actions like running, walking. The brain sends impulses from it to the muscles or glands through the spinal cord.

An involuntary action is an action which is not in our control. The spinal cord sends these messages. Sometimes, the subconscious part of the brain takes part in making these decisions.

8. The removal of urine is accomplished by the urinary tract, this is called excretion. The excretory system removes metabolic wastes from the body. In humans, this includes the removal of liquid nitrogenous waste in the form of urine, and the solid wastes especially from the breakdown of food.

9. Kidney not only functions as the excretory organ but also regulates water and salt balance in the body. Kidney makes sure that the concentration of the blood stays more or less constant. It is important because changes in the amount of water in the blood and tissue fluid can have adverse effects on body cells. If there is more water in the blood, then the water may move into the cells by osmosis causing them to swell up or perhaps even to burst. If the blood is too concentrated (with less water) water will move out of the cells causing them to shrink. In both cases cell’s metabolic activities are disturbed.

10. Refer to the Students’ Book.
11. Renal Stones: A kidney stone is a solid mass that forms from the crystals of calcium, magnesium, and uric acid, which separate from the urine and get deposited on the kidney walls.

Kidney Infection: a person’s kidneys may stop working properly due to kidney infection. This might be due to an infection in the kidneys. Complete failure of the kidneys allows urea and other waste products to accumulate up in the blood.

Diabetes: refer to the Students’ Book.

12. Kidney Dialysis: A patient whose kidneys are near to failure, is connected to a dialysis machine. The dialysis machine takes over the role of the kidneys and removes waste substances from the blood.

Kidney Transplant: kidney machines are not a permanent remedy, a better and long term solution for kidney failure is a kidney transplant.

13. Refer to the Students’ Book.

14. i. nervous system
   ii. cerebrum
   iii. central nervous system
   iv. kidneys
   v. nephrons

15. i. true
   ii. false
   iii. true
   iv. false
   v. false

Unit 2

1.

<table>
<thead>
<tr>
<th>Mitosis</th>
<th>Meiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell divide once</td>
<td>Cell divide twice</td>
</tr>
<tr>
<td>Parent cell produces two daughter cells</td>
<td>Parent cell produces four daughter cells</td>
</tr>
<tr>
<td>Daughter cells have the same number of chromosomes as the parent cell</td>
<td>Daughter cells have half number of chromosomes as the parent cell</td>
</tr>
<tr>
<td>Controls growth in living things</td>
<td>Controls genetic factors from parents to offspring</td>
</tr>
</tbody>
</table>

2. Refer to the Students’ Book.

Chromosomes are thread like structures in the nucleus which are made up of DNA (deoxyribonucleic acid).
The DNA consists of multiple tiny units known as genes. These contain all the information of an organism which are inherited from their parent cells, and a set of instructions for growth and development.

3. Heredity is the transfer of characteristics or traits from one generation to another or from parents to their offspring.
   Characteristics: long or short hair, black or brown eyes, short or tall body

4. Earlobe attached or detached, black or brown or coloured eyes.

5. Genetic Disorder:
   a. In haemophilia, the ability to control blood clotting is weakened.
   b. In muscular dystrophy, the muscles becomes weak and it becomes difficult for the person to move.
   c. Sickle cell anaemia is a genetic blood disorder in which the shape of the red blood cells is distorted.
   d. In Tay-sachs disease, blindness and muscle degeneration occur before death.
   e. In down syndrome, the offspring suffers physical and mental retardation

6. Refer to the Students’ Book.

7. i. Mitosis
   ii. Thread, DNA
   iii. Meiosis
   iv. Heredity

8. i. False
   ii. True
   iii. True
   iv. True
   v. False

**Unit 3**

1. Biotechnology is the use of living organism to make, or improve the quality of products for industrial and other purposes.

2. Bacteria grow and multiply quickly and they do not have a true nucleus instead it has one double strand of DNA in a ring shape. Bacteria are used by biotechnologists to introduce a new gene into an organism. Due to the simple structure of the bacteria makes it easy for scientists to change their genes, and then introduce them into an organism. See diagram in the Students’ Book for reference.

3. Fertilizers, soaps, detergents, and bioplastics.
4. Genetic modification can be used to produce crops that contain higher amounts of vitamins to improve their nutritional quality. Biotechnology is also used to alter the content of many oil crops, either to increase the amount of oil or to alter the types of oils they produce. Biotechnology could also be used to upgrade plants.

5. Healthcare: Genetically engineered plants and animals are used to produce medicines. Diabetes is a disorder in which the body’s blood glucose levels remain too low or too high. It can be treated by injecting insulin. Nowadays, most insulin is made by using genetically modified bacteria. Insulin is formed from the DNA of E. coli bacteria for this purpose.

Biofuels: A biofuel is a fuel made from animal or food waste, wood and alcohol. Vegetable oil or alcohol are used in cars, sometimes mixed with petrol. It is called gasohol. Methane, a natural gas is produced by fermentation. It is called biofuel.

Livestock: Biotechnology is used to increase the breeding in health of animals which help animals to produce more meat. Genetically engineered species of cattle give large quantities of milk. Hens lay more and larger eggs.

Food and Drink: Cheese and bread are biotechnological products. Yeast is used in baking bread. Which makes bread dough rise. This also improves its flavour and quality.

6. i. biotechnology
   ii. genetic engineering
   iii. Bacteria
   iv. GMOs
   v. Genetic Engineering

7. i. True
   ii. False
   iii. False
   iv. False
   v. True

Unit 4

1. i. Pollutants are unwanted substances harmful for plants and animals.
   ii. Air pollution: When the air is contaminated with harmful pollutants such as dust particles and gaseous chemicals we say that the air is polluted.
   Land pollution: When the land is contaminated with harmful pollutants such as garbage, chemicals and fertilisers, we say that the air is polluted.
   Water pollution: When the water is contaminated with harmful pollutants such as chemicals, garbage and other contamination we say that the air is polluted.
iii. It is the cutting down of trees in the forest to convert it to a non-forest use. Examples of deforestation include conversion of forests to farms, or to use for residential, commercial or industrial purposes.

Due to deforestation, the greenhouse gases in the atmosphere have increased, adding to global warming.

In the absence of trees, the soil is directly exposed to the Sun, making it dry. The flow of water is disrupted and leads to floods in some areas and droughts in others.

iv. The three ways are:
   - Plant a tree.
   - Go paperless.
   - Recycle and buy recycled products.

v. Carbon dioxide, methane, water vapours which are called greenhouse gases.

vi. Global warming can cause lots of destruction and damage to life on Earth. It can also cause changes in weather. Glaciers are melting much faster which cause flooding in some areas.

2.

<table>
<thead>
<tr>
<th>Problems</th>
<th>Causes</th>
<th>Effects</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid rain</td>
<td>Toxic gases</td>
<td>destroy forests, kill aquatic animals, and corrode the stone work of historical buildings</td>
<td>Use lead-free petrol in cars.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Keep vehicles in good condition so that they do not emit large amounts of smoke and gases in the air.</td>
</tr>
<tr>
<td>Global warming</td>
<td>greenhouse gases</td>
<td>Glaciers are melting much faster which cause flooding in some areas.</td>
<td>• Go paperless.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Recycle and buy recycled products.</td>
</tr>
</tbody>
</table>
Ozone depletion
chlorofluorocarbon (CFC)
Ozone layer is becoming thinner. Ultraviolet rays cause skin cancer, eye and lung diseases
Use lead-free petrol in cars.
• Keep vehicles in good condition so that they do not emit large amounts of smoke and gases in the air.

Greenhouse effect
greenhouse gases
Global warming. Glaciers are melting much faster which cause flooding in some areas.
Use lead-free petrol in cars.
• Keep vehicles in good condition so that they do not emit large amounts of smoke and gases in the air.

3. Gases such as carbon dioxide, sulphur dioxide and oxides of nitrogen are released into the air in large quantities by factories and motor vehicles. These gases dissolve in rainwater and form acid rain. Acid rain can destroy forests, kill aquatic animals, and corrode the stone work of historical buildings.

4. There are two types of natural resources:
   a. Renewable Resources: Renewable resources are water, air and plants. These are produced again.
   b. Non-renewable Resources: These are the resources which are difficult to produce again. Like fossil fuel, and minerals. We use fuel like, oil, gas or coal and due to an increase in human population, these uses are increasing day by day.

5. The following steps should be taken by each one of us:
   • Plant more trees.
   • Reuse, recycle, and reduce
   • Turn off electrical appliances when not in use.
   • Use public transport.
   • Use more renewable energy resources.

6. Refer to the Students’ Book.
7. Refer to the Students’ Book.
**Unit 5**

1. **i.** When elements are chemically combined and a new substance is formed, this process is called a chemical reaction. In a chemical reaction atoms are rearranged.

   **ii.** A subscript is a number which shows how many atoms of an element are in a molecule. A coefficient shows how many molecules there are of a particular chemical taking part in a chemical reaction.

   **iii.** According to the law of conservation of mass “mass can neither be created nor it is destroyed but it can be changed from one type to another type of substance in a chemical reaction.”

   \[ \text{Total mass of the reactant} = \text{Total mass of the product} \]

   **iv.**
   
   a. The reactions in which heat is absorbed are called endothermic reactions. Endothermic reactions take in energy from the surroundings.

   b. Exothermic reactions transfer energy to the surroundings. The energy is usually transferred as heat energy, causing the reaction mixture and its surroundings to become hotter.

   **v.** Refer to the Students’ Book.

2. **i.** Addition reaction

   **ii.** Displacement reaction

   **iii.** Double displacement reaction

   **iv.** Displacement reaction

3. **i.** magnesium + oxygen $\rightarrow$ magnesium oxide

   **ii.** sodium hydroxide + hydrochloric acid $\rightarrow$ sodium chloride + hydrogen

   **iii.** silver nitrate + sodium chloride $\rightarrow$ sodium nitrate + silver chloride

   **iv.** calcium oxide + water $\rightarrow$ calcium hydroxide

4. **i.** $\text{N}_2 + 2\text{O}_2 \rightarrow 2\text{NO}_2$

   **ii.** $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$

   **iii.** $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

   **iv.** $\text{Mg} + \text{FeSO}_4 \rightarrow \text{MgSO}_4 + \text{Fe}$

5. **i.** $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

   **ii.** $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$

   **iii.** $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$

   **iv.** $2\text{Li} + \text{O}_2 \rightarrow 2\text{Li}_2\text{O}$
Unit 6

1. i. They are sour in taste. They change the colour of the indicators. For instance, they turn the blue litmus paper red.
   ii. They are bitter in taste and have a soapy touch. They change red litmus paper blue.
   iii. Most of them are soluble in water. They melt and boil at very high temperatures.

2. i. 2,6,7,8,13
   ii. Salt solution is neutral. Acidic solution and alkaline solution can be coloured or colourless

3. Properties of acid: They are sour in taste. They change the colour of the indicators. For instance they turn the blue litmus paper red.
   Properties of alkalis: They are bitter in taste and have a soapy touch. They change red litmus paper blue.
   Properties of salts: Most of them are soluble in water. They melt and boil at very high temperatures.

4. i. True
   ii. False
   iii. True
   iv. False
   v. False
   vi. True

5. i. Lemons, oranges, vinegar
   ii. Watermelon, Apples, Tomatoes
   iii. Sour
   iv. Acid because it has sour taste
   v. Dark green
   vi. Neutralization reaction

6.

<table>
<thead>
<tr>
<th>Litmus</th>
<th>Soft drink</th>
<th>Nitric acid</th>
<th>Sodium hydroxide</th>
<th>Salt solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Blue</td>
<td>No change</td>
</tr>
<tr>
<td>Blue</td>
<td>Red</td>
<td>Red</td>
<td>Blue</td>
<td>No change</td>
</tr>
</tbody>
</table>
7.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Colour of universal indicator</th>
<th>pH</th>
<th>Type of solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft drink</td>
<td>orange</td>
<td>4</td>
<td>acidic</td>
</tr>
<tr>
<td>Soap solution</td>
<td>Dark green</td>
<td>8</td>
<td>alkaline</td>
</tr>
<tr>
<td>Milk</td>
<td>yellow</td>
<td>6</td>
<td>acidic</td>
</tr>
<tr>
<td>Water</td>
<td>Light green</td>
<td>7</td>
<td>neutral</td>
</tr>
<tr>
<td>Drain cleaner</td>
<td>Dark blue</td>
<td>13</td>
<td>alkaline</td>
</tr>
</tbody>
</table>

8. i. Acid + alkali $\rightarrow$ salt + water
   ii. acid + metal $\rightarrow$ salt + hydrogen
   iii. $\text{Ca(OH}_2\text{(aq)} + 2\text{NH}_4\text{Cl(aq)} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O(l)} + 2\text{NH}_3(s)$
   iv. $2\text{HNO}_3\text{(aq)} + \text{CaCO}_3 \rightarrow \text{Ca(NO}_3\text{)}_2\text{(aq)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$
   v. Hydrochloric acid + sodium hydroxide $\rightarrow$ sodium chloride + water


**Unit 7**

1. i. Force is a type of energy. Force can make an object move. Push and pull, stretch and throw are different forces.
   ii. An object thrown in the air always return to the ground due to gravity.
   iii. The pressure of the air is called atmospheric pressure. Atmospheric pressure is the highest near the sea level. At high altitudes air particles become less therefore, pressure is decreased.

Air pressure is measured with an instrument called barometer.

iv. There are two kinds of barometers:
   a. Mercury barometer: The mercury barometer is heavy because it is full of mercury.
   b. Aneroid barometer: The aneroid barometer is light and has no mercury in it. It is easier and more convenient to use. It consists of a flexible metallic box. When air pressure is exerted on the box, the needle on the dial moves to indicate the reading.

v. The pressure in the aerosol is higher than the atmospheric pressure. When the plunger of the aerosol spray is pressed the gas moves upward in spray form.

vi. At high temperature particles of gases collide more and pressure is increased.
2.  
   i.  \(200\text{N}/4\text{m}^2=50\text{N/m}^2\)  
   ii.  \(1000\text{Pa}\)
3.  
   i.  A container with 500 particles.  
   ii.  A balloon with 1000 particles  
   iii.  A container with 500 particles at 100ºC
4.  
   i.  False, the force which attracts objects to the Earth is called gravity.  
   ii.  False, we say work has been done when force is applied in one direction  
   iii.  False, the pressure in the aerosol is higher than the atmospheric pressure.  
   iv.  False, the higher the source of water, the greater is the pressure.  
   v.  True
5.  
   i.  Less  
   ii.  Pressure  
   iii.  Newton, N  
   iv.  Square meter, m\(^2\)
6.  
   i.  Camel walks easily on sand because camel has less pressure because of flat feet.  
   ii.  Hikers face difficulty in breathing at high altitudes because oxygen is less.  
   iii.  More force is required to push a heavy object because mass is more.
7.  Refer to the Students’ Book.

**Unit 8**

1.  
   a.  40 ml  
   b.  65 ml  
   c.  124 ml  
   d.  72ml
2.  Teacher supervision required.
3.  system international unit, S.I unit
4.  

<table>
<thead>
<tr>
<th>Physical quantity</th>
<th>S.I Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>second</td>
<td>s</td>
</tr>
<tr>
<td>Length</td>
<td>meter</td>
<td>m</td>
</tr>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>kg</td>
</tr>
<tr>
<td>Volume</td>
<td>litre</td>
<td>l</td>
</tr>
</tbody>
</table>
5.  a.  In order to observe the reading on the scale, your eye must be in correct position i.e. vertically above the reading. If the eye is not in the correct position then the error occurred is called Parallax error.  
   b.  When liquid is poured into a measuring cylinder, the liquid forms a curved surface on the top. This curved surface is known as a meniscus. Most liquids
curve downwards. To observe the reading on graduating cylinder accurately, the position of the eye must be at the same level as the meniscus. The meniscus of the mercury curves upward.

c. The prefixes are used to express smaller and bigger physical quantities. It is more convenient to express smaller quantities in small units.

6. a. A meter rule is one meter long graduated wooden stick. The meter rule is calibrated in centimetres and millimetres. It can measure the least value up to 0.1 cm or 0.01mm. To measure long distances like length and breadth of a park or field we use measuring tapes. Measuring tapes measure length in centimetres and meters.

b. It is a long narrow cylinder made up of glass or plastic. It is calibrated in ml. It comes in different sizes 10ml, 25ml, 50ml and 100 ml. A measuring cylinder is used to measure a volume of liquids. The least count of measuring cylinder is 0.5 ml.

7. a. Conical Flask: It is used to heat, store and mix liquids.

b. Volumetric Flask: It is used to contain a precise volume of liquid at a particular temperature. It is also used for preparing a standard solution with precise dilution.

c. Round bottom Flask: It is used to boil the liquids. Its narrow neck prevents splash exposures.

8. When liquid is poured into a measuring cylinder, the liquid forms a curved surface on the top. This curved surface is known as a meniscus. Most liquids curve downwards. To observe the reading on graduating cylinder accurately, the position of the eye must be at the same level as the meniscus. The meniscus of the mercury curves upward.

Unit 9

1. i. Refer to the Students’ Book.

   ii. Sources of Heat

      a. The Sun: The main source of heat energy is the Sun.

      b. Fire: Fire is produced by lightning and burning of fuels such as petroleum, natural gas and coal.

      c. Electricity: Electricity can be converted into heat energy.

      d. Friction: The heat produced by rubbing hands is due to friction. Sun

   iii. Heat is a form of energy. It is the energy that flows from a hot body to a cold body while temperature is the degree of hotness or coldness.
iv. Refer to the Students’ Book.

v. Refer to the Students’ Book.

vi. Objects expand when heated because particles move apart. Objects contract when cooled because particles come close to each other.

2. Materials expand on heating specially metals.

   Materials: A metal ring, a metal ball which cannot pass through the ring.

   Method: Heat the ring and try to pass the ball through the ring. Ball will pass through the ring because ring is expanded.

3. a. Convert 70°C into K  
   \[ 70°C + 273 = 343K \]
   b. Convert 250°C into °F  
   \[ (250 °C \times 9/5) + 32 = 482°F \]
   c. 30 K into °F  
   \[ 30K - 273 = -243°C \]
   \[ (-243 \times 9/5) + 32 = -405.4°F \]
   d. 200 K into °C  
   \[ 200K - 273 = -73K \]
   e. 150 °F into K  
   \[ 5/9 \times (150°F - 32) = 20°C \]
   \[ 20°C + 273 = 293K \]

4. Temperature is the degree of hotness or coldness. It is measured with a thermometer.

5. Teacher supervision required.

6. Bonding two metals with dissimilar thermal expansion coefficients can produce useful devices for detecting and measuring temperature changes.

7. 

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction</td>
<td>Takes place when objects cool because particles come close to each other</td>
</tr>
<tr>
<td>Bimetallic strip</td>
<td>It is made when two different metals are joined together</td>
</tr>
<tr>
<td>Temperature</td>
<td>Is the measure of hotness or coldness of an object</td>
</tr>
<tr>
<td>Heat energy</td>
<td>Flows from a hot body to a cold body</td>
</tr>
</tbody>
</table>

Unit 10

1. i. Centre of Curvature and Principal Axis: The line, P1 P2 joining C1 and C2 is called the principal axis.

   ii. Pole: The point where the principal axis meets the surface is called a pole.

   iii. Principal Axis: Centre of curvature is also called principal axis. The line, P1 P2 joining C1 and C2 is called the principal axis.

   iv. Refer to the Students’ Book.

2. Refer to the Students’ Book.
3. i. Concave lens: It is thinner in the middle and diverges (disperses) the light rays. It is also called a diverging lens. It causes a beam of parallel rays to diverge after refraction.

Convex lens: It is thicker in the middle and converges (concentrates) the light rays. It is also called converging lens. A convex lens bends light rays inward, which results in the object being perceived as larger or closer.

Refer to the Students’ Book for the diagrams.

ii. Refer to the Students’ Book.

iii.

<table>
<thead>
<tr>
<th>Human eye</th>
<th>Camera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual shape of the lens changed naturally to focus.</td>
<td>The lens is moved closer or farther to focus an image by a button.</td>
</tr>
<tr>
<td>The retina in a human eye is not uniformly sensitive.</td>
<td>A film in a camera is uniformly sensitive to light.</td>
</tr>
<tr>
<td>Image is made on a retina.</td>
<td>Image is formed on a film.</td>
</tr>
<tr>
<td>In a dark location the eye has more sensitivity than a camera.</td>
<td>In a bright light camera cannot properly capture the image which becomes blurred.</td>
</tr>
</tbody>
</table>

iv. Uses of Lenses

- A camera uses a lens to focus an image on photographic film.
- The magnifying lenses can enlarge the images.
- Lenses are used in spectacles and binoculars.
- Telescope is an optical device in which lens is used.
- The lenses are used in microscopes so that minute organisms can be seen.
- Lenses are used in the projector.

v. Refer to the Students’ Book.

4. i. Convex lens

ii. Convex lens

iii. Long-Sightedness: (Hyperopia)

iv. Short-Sightedness: (Myopia)

5. Refer to the Students’ Book.

6. Refer to the Students’ Book.

7. See above for answer.
8. a. Concave lens: It is thinner in the middle and diverges (disperses) the light rays.
   It is also called a diverging lens. It causes a beam of parallel rays to diverge after
   refraction.

   b. Convex lens: It is thicker in the middle and converges (concentrates) the light
   rays. It is also called converging lens. A convex lens bends light rays inward,
   which results in the object being perceived as larger or closer.

9. Refer to the Students’ Book.
10. Refer to the Students’ Book.
11. Refer to the Students’ Book.

Unit 11

1. i. Electricity can be produced by moving a magnet around a copper coil. A
   stronger current can be produced by increasing the rounds of coil or the speed
   with which the magnet is moved.

   ii. Coal, gas or petrol is burnt in power stations. The steam produced as a result of
   burning, is used to move the turbines which generate electricity.

   iii. Our main source of energy is the Sun. Many countries produce electricity using
   heat and light from the Sun. This is an easy, cheap and pollution-free method of
   producing electricity. Light energy from the Sun is collected, and converted into
   electricity with the help of solar cells.

   iv. Batteries and cells are the safest means of producing electricity through a
   chemical reaction.

   v. Nuclear energy is obtained by splitting the nucleus of an atom into parts. This
   process is called nuclear fission. Very high amount of heat is liberated during
   this process. This heat is used to produce steam which moves the turbines
   connected to electrical generators. This is how electricity is produced.

2. Refer to the Students’ Book.

3.

<table>
<thead>
<tr>
<th>Direct current (DC)</th>
<th>Alternating current (AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is an electric current which flows only</td>
<td>Is an electric current which periodically</td>
</tr>
<tr>
<td>in one direction.</td>
<td>reverses direction.</td>
</tr>
<tr>
<td>Some sources of DC power are dry cells,</td>
<td>It is the form of electrical energy that is</td>
</tr>
<tr>
<td>batteries, thermocouples, solar cells and</td>
<td>used when we plug kitchen appliances,</td>
</tr>
<tr>
<td>dynamos.</td>
<td>televisions.</td>
</tr>
</tbody>
</table>

4. Answer depends on the students.

5. i. Tarbela, Mangla and Warsak.

   ii. Solar
iii. Fission
iv. Karachi
v. Parallel

6. Dynamos: One simple example of a generator is the bicycle dynamo. The dynamo has a wheel that touches the back tyre. As the bicycle moves, the wheel turns the magnet inside a coil. This induces enough electricity to run the bicycle’s lights. The faster the bicycle moves, the greater the induced current and the brighter the lights. Refer to the Students’ Book for the diagram.

7. Problems of Generating Electricity:
   a. Thermal power stations waste more energy than they produce. Most energy is lost as heat energy during cooling the water and waste gases. In a typical coal burning power station only about 35% of the energy in its fuel is converted into electrical energy.
   b. Production of carbon dioxide and acid rain due to the burning of fossil fuels.
   c. Hot water from power stations when dumped into rivers or the sea cause an increase in the temperatures of water causing harm to the living organisms in it.
   d. Nuclear fuel if not disposed of carefully can also be extremely harmful to the ecosystems.

8. Any electronic system can be considered to consist of three parts:
   a. Input sensor
   b. Maintaining processor
   c. Output transducer

9.  
   a. AC can be changed to DC by an adopter that you use to power your battery. DC can be stored in batteries but AC cannot be stored.
   b. A converter is a device that changes alternating current to direct current or vice versa.
   c. A rectifier changing alternating current to direct current. Rectifier is use to recharge the batteries of mobile phones, iPods, digital cameras and other small devices.
   d. A power inverter does the opposite, changes the flow of the charge from direct current to alternating current.

Unit 12
1. i. Neil Armstrong
   ii. 1608, Galileo
   iii. Robotic space crafts
iv. America, Russia, Japan and Europe
v. football field

2.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957</td>
<td>the inception of space age</td>
</tr>
<tr>
<td>1958</td>
<td>the first U.S. satellite that went into space</td>
</tr>
<tr>
<td>1969</td>
<td>the exploration of the Moon</td>
</tr>
<tr>
<td>1990</td>
<td>five astronauts deployed a telescope into the Earth’s orbit</td>
</tr>
<tr>
<td>2000</td>
<td>the first piece of space station was launched into the Earth’s orbit</td>
</tr>
</tbody>
</table>

3. i. Spectroscope: is a machine or a vehicle designed to fly into space. The spacecraft is sent into space for different purposes including Earth observation, communication, planetary exploration, navigation and transportations of cargo and humans.

ii. Artificial satellite: When a robotic spacecraft is orbiting around any other object, it is called artificial satellite.

iii. Reflecting telescope: The light is analysed by breaking into its components, this technique is called spectroscopy. The scientist observed that every element responsible for a certain pattern or spectrum. This helps them to study the elements that make up the stars. A spectroscope is equipped with a camera to record velocities and to accurately measure the wavelengths of the spectral line.

4. Refer to the Students’ Book.

5. The spacecraft: is a machine or a vehicle designed to fly into space. The spacecraft is sent into space for different purposes including Earth observation, communication, planetary exploration, navigation and transportations of cargo and humans. The space shuttle: is a transport used to carry an astronaut into the space, and come back to the Earth and be re-launched into the space again. Each time the shuttle is launched, it is called a mission.

6. An international space station is made and used by collaboration of different countries.

7. The images which were captured by telescopes on the Earth were not clear. The images were distorted by the Earth’s atmosphere. To overcome this problem, in the 1940s an astronomer Lyman Spitzer was the first to propose the observatory above the position of the Earth. The images received from this observatory would be a lot sharper because it would be able to detect light from the stars, galaxies and other objects in space before the light got absorbed by the atmosphere. On April 25 1990,
five astronauts deployed a telescope into the Earth’s orbit roughly 380 miles (600 Km) above the Earth’s surface. This telescope is named as Hubble Telescope.

8. The spacecraft is a machine or a vehicle designed to fly into space. The spacecraft is sent into space for different purposes including Earth observation, communication, planetary exploration, navigation and transportations of cargo and humans. There are two types of spacecraft

a. Robotic Spacecraft: is less risky as it does not have any human. They are used to support scientific research. They collect data and can travel in most dangerous areas. Some robotic spacecraft are programmed and some can be controlled from the Earth. Voyager 1 and Voyager 2 are the example of robotic spacecraft, which was used to collect data from Mars and Jupiter. When a robotic spacecraft is orbiting around any other object, it is a called artificial satellite.

b. Manned Spacecraft: is designed to take a human crew into space. These spacecraft are designed more sophisticatedly. It has everything that is required for human survival. It has a built-in washroom, thermal control system, oxygen, food and water

9. Astronauts survive in space by:

a. Keeping Healthy.
b. Maintaining personal hygiene.
c. Eating nutritious meals
d. Getting enough sleep.
انسان کی تصویری کہا جاتا ہے (telescopes) جس میں استعمال کیا جاتا ہے (space exploration) اور غیر اور (tools) میں استعمال کیا گیا ہے (space shuttles) بالاتری کے خالی چیزوں (spacecrafts) میں استعمال کیا گیا ہے (astronauts) جو خاکی چیزوں کے خالی چیزوں کے بارے میں معلومات کروانے کیلئے استعمال کی جاتی ہیں۔
باب 11

بارضیں، طالبین کا شکار ہوئے اور ان کے دوران میں کھیالاتی کے درمیان روز مہم کہنے سے متعلق اپنے دکھائے۔

(cells) (microscope)

باب 12

طالبانے مین معلومات کا جائزہ ہے، جیب جھیل بندی کے خرابیوں سے متعلق پہنچ رکھنے کے کام کی خواتین

(explorer) (space exploration)
خیالات ہوئیں کریں، اور چھیپ ہوئیں میں ان کی مدر کیہے کہ درامز الیکٹرک ہو گے ہی۔

طلاب کے ساتھ ایک مہم یا ایک عمل ہو کر نئے دو وچلیلے (push) یا تباہیاد (pull) یا چکنیا (poles) کی قوته پر تباہیاد خیال کیتی۔ متناض بھی استعمال (similar) کرتے ہوئے دو نئے میکانیکس کے قطبین قطبیین کے خلاف قطبیین (poles) ایک دوسرے کی طرف خشک رکھتیں اور مشراب (push) قطبیین ایک دوسرے کو دور کرنا ہوئیں۔

طلاب کے ساتھ دو وچلیلے اور پینیی کچھ کیڑی، میز کھاکی اور مہم ہو کر طالب کا ہو امکانی کریں کہ مذہبی جماعت میں بکھرا ہوئیں مختلف ایک دوسرے کے لئے لوگ مختلف ہوں گے۔

گتنس کے دو نئے کریں کہ لوگ طالب سے چاہئے گا گا کھڑا ہوگا۔

دو ایک زرآتی مجوہی گو کریں کہ طرح غیر (behavioural) کو نئے کریں کہ لوگ سے چاہئے گا 6 اخبار دی جاگے گی۔

سرگرمی 7 کے مہم میں بہت سے لوگ تجارت رہے گی۔ دو گوں کے طرح غیر بھی اپنی دوسری سمت کے ترجمہ کیے گئے۔

ابھی دوقسم ہے کہ چپسی تجارت میں برکت ہے گا کہ لوگ کے مہم کے لئے کیسے ہی کھلا میں پہنچاہوں گا اس کی حد بات کی جا سکتا ہے۔

8 باب

کالا کی ہیں بیجی ہوئیں کہ طالب کے ساتھ دو وچلیلے کا خیال میں میں مستی کی تحقیق کے طرح کی جاائے گی۔ لیے میں اختیار کیے جاون گے واثق ہوئے ہی۔

قدمات کی ہوئیں۔

کالا کی مستی کی تحقیق کے ساتھ ساتھ میں لیے جاائے گے اور آن آبے کے استعمال کی مذہب کی تحقیق جنگی کا اصطلاح لکھا ہو گا واثق ہوئے۔

طلاب سے کہیں کریں کہ بہت اختیار کیا جائے گا اور کئی نئے کہ بیجی ہوئیں۔

اصولاً کتاب میں دیکھیں گا۔

اصولاً کتاب میں مین روندی ہوئے۔

اصولاً کتاب میں مین روندی ہوئے گیا تباور ہوئے گیا کہ سیم اور اجزے 3 اخبار ہوئے گیا۔

اصولاً کتاب میں مین روندی ہوئے گیا تباور ہوئے گیا اور سیم اور اجزے 3 اخبار ہوئے گیا۔

اصولاً کتاب میں مین روندی ہوئے گیا تباور ہوئے گیا اور سیم اور اجزے 3 اخبار ہوئے گیا۔

اصولاً کتاب میں مین روندی ہوئے گیا تباور ہوئے گیا اور سیم اور اجزے 3 اخبار ہوئے گیا۔

9 باب

حرارت کے مختلف واحد زراعتی (sources) کھلا کے لئے یہی کہ تجاویز کی میں اور تجارت کے لئے کر آپیں یہ طالب سے کہییں کہ حرارت پیدا کریں گے چاہئے کہ یہ کھلا کے لئے اپنی اپنی کھلا ہوئیں۔

حرارت کے مختلف واحد زراعتی (sources) کھلا کے لئے یہی کہ تجاویز کی میں اور تجارت کے لئے کر آپیں یہ طالب سے کہییں کہ حرارت پیدا کریں گے چاہئے کہ یہ کھلا کے لئے اپنی اپنی کھلا ہوئیں۔

حرارت کے مختلف واحد زراعتی (sources) کھلا کے لئے یہی کہ تجاویز کی میں اور تجارت کے لئے کر آپیں یہ طالب سے کہییں کہ حرارت پیدا کریں گے چاہئے کہ یہ کھلا کے لئے اپنی اپنی کھلا ہوئیں۔

حرارت کے مختلف واحد زراعتی (sources) کھلا کے لئے یہی کہ تجاویز کی میں اور تجارت کے لئے کر آپیں یہ طالب سے کہییں کہ حرارت پیدا کریں گے چاہئے کہ یہ کھلا کے لئے اپنی اپنی کھلا ہوئیں۔

حرارت کے مختلف واحد زراعتی (sources) کھلا کے لئے یہی کہ تجاویز کی میں اور تجارت کے لئے کر آپیں یہ طالب سے کہییں کہ حرارت پیدا کریں گے چاہئے کہ یہ کھلا کے لئے اپنی اپنی کھلا ہوئیں۔

حرارت کے مختلف واحد زراعتی (sources) کھلا کے لئے یہی کہ تجاویز کی میں اور تجارت کے لئے کر آپیں یہ طالب سے کہییں کہ حرارت پیدا کریں گے چاہئے کہ یہ کھلا کے لئے اپنی اپنی کھلا ہوئیں۔
(addition reaction)
\[ A + B \rightarrow AB \]

(decomposition reaction)
\[ AB \rightarrow A + B \]

(combustion reaction)
\[ A + BC \rightarrow AC + B \]

(neutralization reaction)
\[ AB + CD \rightarrow AD + CB \]

chemical reactions

6

baking powder (baking powder)

7

force (force)

clous (clous)

situations (situations)
باب 3

توضیحات

یہ باب کی بیانات کا بھی پہلوی سے ہے۔ کہا جاتا ہے کہ پندرح صدی خاتمہ میں جس کا آغاز ہورنر کی (genetic engineering) کا کہنا ہے، ہے کہ کہ توانائی کے ساتھ ہے۔

بیاہٹکنیکی نئے (biotechnological products) کی تصدیق کا نام ہے جس کا پہلا بار دنیا بھر کے لئے پہلا بارہ جوابی توانائی کے کی اجازت کا خواتین

باب 4

طلاب کے لئے پہلوی کا دو بیاہٹکنیکی پاکستان کے شکیل علاقے میں گئے ہیں۔ آپ انہیں سے پہلے کیزار خواہنہ کے لئے کہا جاتا ہے کہ اگر ایک دن بھی قابل ہو جاتا ہے (pollution)۔

پہلا بار، طالب کو آقا (global warming) کی تصدیق کا تبدیل کیا۔ ہے کہ جب کہ توانائی کا شبکہ کا آقا (acid rain) اور دیگر (global warming) کی تصدیق کا تبدیل کیا۔

گولاعرکنی کی تصدیق (natural resources) کی ایک بڑی لیاقت کا پھر پھیلنا ہے کہ اس کی تصدیق کا تبدیل کیا۔

باب 5

ابتدائی ایان اول گریم کے طور پر کا کا بھی نہ ہے۔

(physical and chemical changes) کی مختصر شکل ہو کر نے کا کامیاب

طلابے کے لئے اور کیکی نئی تبدیلی (law of conservation of mass) کے برابر پہلے کیکی نئی سماوے کا کامیاب

اس کے کہانسی کا مشاہدہ نہ ہے۔

طلاب لے کر آنے سے پہلے، اس جلی کے اور طالبے سے پہلوی کے بے (matchbox) کی ساخت کا کامیاب


Chapter 1

5 groups of stimuli are required to maintain a society as a unit. The stimuli (stimuli) are known as voluntary and involuntary actions. The voluntary actions are those that are under the control of the person, while the involuntary actions are those that occur automatically without conscious control.

Chapter 2

Human beings are classified into two main groups: genetic disorders and family tree. Genetic disorders include all diseases that are inherited, while the family tree includes all the relatives of a person. The chapter also discusses the process of meiosis and mitosis, which are essential for the reproduction of organisms.
تقوم نصاب برای جزء ساخت کی هکت عمیان (Assessment) که مطالعه‌ی جامعه‌ی کارکردی (tools) اور طریقی به کارکردن ضرورت بی‌نتیجه می‌باشد.

* شخصی
* تشریحی/شیوه‌ی عمل
* کارکردی کی جامعه‌ی (personal communication)
* ذائقه‌ی اپرا (self-assessment)

طلباً کی جامعه‌ی (Assessment) که مطالعه‌ی جامعه‌ی کارکردی (tools) اور طریقی به کارکردن ضرورت بی‌نتیجه می‌باشد.

ساخت کی هکت عمیان پد مشکل باید که لی توی نصاب برای جزء ساخت 2006 کا باب 8 سفر 65 سال 73 ملاحظه کنیم.
آیک فعال اور طالب علم میں کراکھ بحثیت کے لئے مفت مشتاق کرو تعلیم کار (شیفول) 

| سائنسی پہلے سے ممبوتو معلومات کو کی نگرانی کا ذریعہ بندی سوالات | 5 دقیقین |
| آموش ہوئے (learning) ذریعہ بندی کتب / مرکزی | 25 دقیقین |
| تیاری پر حساب ذریعہ جائیں | 10 دقیقین |

بر بر پر اک باندا تعلیمی انتظام کو کوئی جواب جمع کرنا یا جواب دینے کے لئے نبودھی تجویزات پر مشق کیا جا سکتا ہے، وہ کہ خصوصی تعلیمی جوابات دیگر گھنے ہوں گی - دیگر کو خصوصی تعلیمی جوابات کی جانب کو بھی اپنے ذائقے سے کام لیں بہت سے حالات ہیں اور یہ جوابات کی جانب پر یہ رسوم اور معلومات کی جانب کی کپتانی بھی ہے -

قوی نصاب بر اساس جزء سیاسی کے مطالعہ تدریسی کمیٹی کی عملیں

مؤثر دیباوی تدریسی کمیٹی کی عملیں میں مہم بر جزء دیہی سے (سائنسی کمیٹی کمیٹی کا جو کپتانی تعلم کہیں):

- مسائل اور پیش گذاری ہوئے (کوئری نویں)
- مسائل اور پیش گذاری ہوئے (کوئری نویں)
- عملی نظام اور تعلیمی کام (لیبرالیزری ڈوک)
- (problem based learning)
- پہلی معاہدہ، گروپ، اور افراد کی کام سے استفادہ
- خوویندی کی حکمت عملیہ (پیچیدا، لائنا اور مثالیہ)
- شوہریت
- طالب علم کے کام کی جگہ کی بھی اپنی کپتانی

سائنس کی تدریسی کمیٹی کا عملیہ پیش ہوئے اور جائزہ تعلیم کے لئے قوی نصاب بر اساس جزء سیاسی 2006 کا باب 7، صفحہ 55 اور 54، ملاحظے پرچم
تغليف التصميم في المقابل فيما يتعلق بخصوص معاونته اساتذة كرامة بمنحها مستوى اساتذة كرامة في تدريسهم.

كما يتمتع نهج التغليف بمزايا كبيرة، فقد يكون من خلاله مساعد على تطوير مهارات التدريس ونشر المعرفة في مجالات حديثة ومتقدمة، مما يحقق نتائج إبداعية و었습니다.

كما يتميز نهج التغليف بمزايا أخرى التي تساعد على تحسين جودة التعليم وزيادة مسارات النجاح.

وبالإضافة إلى ذلك، فإن نهج التغليف يتيح للمعلمون فرصة لتبادلك بالخبرات والتعرف على احتياجات الطلاب واحتياجاتهم، مما يحقق توازنًا في المصالح وتعزيز التعاون بين المعلم وطالب.

كما يتميز نهج التغليف بمزايا أخرى التي تساعد على تحسين جودة التعليم وزيادة مسارات النجاح.