

Teaching Guide

2

DISCOVERY

Geography for Secondary Classes

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Introduction

Geography is the study of the Earth, where human beings, animals, and plants live. Geography comes from two Greek words—*geo*, meaning the Earth and *graphein*, meaning to write or to map. Thus it is the study of the Earth, its physical features, its position in space and its movements in relation to the solar system. It is the study of the natural environment—climate, soils, vegetation, land, and water—and of human life and activity and their effect on the Earth. It is also the study of the Earth's physical features and its climate. We need to answer three questions about the Earth and its places: why, where, and how.

The study of geography teaches us why some locations are better for settlements, agriculture, and industries, and where and how changes have taken place in the Earth's landscapes and resources. As the world's population has grown by leaps and bounds, the Earth's natural resources have been exploited, causing environmental problems like pollution and climate change. We study the relationship between man and the natural environment, and the effects of natural hazards like cyclones, volcanic eruptions, earthquakes, and tsunamis.

The *Discovery* series for Classes 6 to 8 has been written with the aim of developing understanding and providing basic knowledge of geography. All topics have been covered in simple language and the content is supported by relevant maps, illustrations, diagrams, and tables. Additional and interesting information, related to the topics under study, is given in the margins. The chapters are divided into sections, each of which concludes with questions and activities to reinforce learning.

The *Discovery* series is designed to be supplemented with an atlas, as this reinforces the concepts taught and clearly illustrates the subject matter at hand. We recommend the *Oxford School Atlas for Pakistan*, which is a comprehensive atlas with an emphasis on the weather, relief, and population data for Pakistan.

This Teaching Guide is an ideal accompaniment to Student's Book 2. It contains detailed lesson plans, additional background information for the teachers, answers to the questions asked in the textbook, and supplemental worksheets which may be photocopied. It is a valuable resource which will enable the teacher to bring the subject matter to life and hopefully inculcate a lifelong understanding and appreciation of geography within the pupils.

Chapter 1

Physical state of the Earth

SECTION 1

THE INTERNAL STRUCTURE OF THE EARTH

Teacher's focus:

The Earth is a solid sphere made up of layers, just like an onion. The layers are called the crust, mantle, and core. The core is divided into two sub-layers, the inner core and outer core. Many geographers often take them to be two separate layers, and hence say that the Earth is made of four layers. These layers vary in thickness, composition, and constitution. Each layer has different characteristics.

The crust is the outermost layer of the Earth. It carries the oceans and continents. It is the thinnest of the four layers, made of massive pieces of thin rock, which are called plates. If you were to examine it closely, the crust would look like the cracked shell on a boiled egg.

The layer below the crust is the mantle. It is made of molten rock. The plates of the crust float on the mantle.

Below the mantle is the outer core, a molten, nearly-liquid layer. The heat and radioactive content found in this layer keep the rocks in a molten form. This layer is actually the centre of the Earth.

The inner core is the innermost layer and is a solid ball around which the outer core is wrapped.

Answer key

Questions and Activities

- The crust: The crust is the outermost part of the Earth. It comprises the continents and the ocean floor. Its thickness varies from 8 km to 40 km, being thickest where there are mountains and thinnest on the ocean floor where deep trenches exist. The crust is mainly formed of igneous rocks but there are significant proportions of metamorphic and sedimentary rock as well. On the basis of rock composition the crust is divided into continental crust and oceanic crust. The continental crust is thick and composed of granite, while the oceanic crust is thin and composed of basalt.

The mantle: Below the crust the second major layer is the mantle. The mantle is about 2900 km thick. Its temperature close to the crust is up to 1800°C. At increasing depth and closer to the core, it becomes as high as 2800°C. Due to these high temperatures, rock melts into magma which is thrown up in volcanic eruptions. The rock of the mantle resembles the magma which

is thrown up in volcanic eruptions. The rock of the mantle resembles the igneous rock called peridotite in which olivine is the main mineral. The mantle is divided into the lower mantle and the upper mantle, based on the differences in temperature and composition.

The core: Beneath the mantle another distinct layer is found called the core. It is located at the centre of the Earth. Scientists have estimated its total thickness to be 3486 km. The core is made up of two parts—a solid inner core and a liquid outer layer. The core is composed largely of two main minerals, iron and nickel. The temperature is estimated to be 6000°C, as hot as the Sun’s surface.

- ii. The continental crust is thick and composed of granite, while the oceanic crust is thin and composed of basalt.
- iii. Geologists use the term lithosphere to refer to the crust and the upper part of the mantle which is relatively cool with rocks in a solid state. The thickness of the lithosphere ranges from 60 to 150 km, and is thickest under the continents and thinnest under the ocean basin. Beneath the lithosphere, to a depth of 660 km, there is a layer of soft rock called the asthenosphere. The temperature of the asthenosphere is about 1400°C and scientists believe that the hard layer of the lithosphere slides over the soft layer of the asthenosphere.

- 2. i. crust ii. molten iii. granite
- iv. basalt v. mantle

Research

By studying:

- seismic waves called S waves and P waves
- rock structure and composition
- meteorites.

Famous geologists:

James Hutton, Alfred Wegener, Adam Sedgwick, William Smith, Marie Tharp

Lesson plan

No of lessons: 1

Duration: 40 minutes

Resources: Textbook pages 2–5, *Oxford School Atlas for Pakistan*

Teaching objective:

- to describe the physical structure and composition of the Earth

Learning outcomes:

Students should be able to:

- explain how the Earth was formed
- describe the different layers of the Earth
- discuss the composition of the Earth

Lesson 1

Introduction (5 minutes):

Bring an onion and a boiled egg with cracked shell to class. Use the onion to explain what the layers of the Earth would look like. Explain that there are not as many layers as the onion has but they surround the Earth just the way the onion layers surround its core.

Explanation (30 minutes):

Read and explain the text. Use the cracked eggshell to explain the concept of plates. Peel the shell to explain the thickness of the crust of the Earth, explaining that it is thin just like the shell.

Conclusion (5 minutes):

Sum up key points.

Classwork: Questions 1–2 page 5

Homework: Research task on page 5

SECTION 2

PLATE TECTONICS

Teacher's focus:

The Earth's crust is broken into eight massive pieces. Each piece is called a plate or tectonic plate. These plates lie on the mantle, which is the molten layer. The tectonic theory states that these plates are not stationary; they are constantly moving in different directions and at different speeds. Some plates are converging, i.e. they're moving towards, and colliding into each other; some are diverging, i.e. they're pulling away from each other. There are some that slide or lurch past each other and break free. In each of these events, a jolt is felt. This jolt is actually an earthquake which usually occurs along the edges of plates or fault lines. Faults are fractures or cracks in the Earth's crust. When the collision, breaking away, or lurching past is between an oceanic plate and a continental plate, the friction causes the rocks to melt and a volcanic eruption takes place. The oceanic plate which is heavier than the continental plate gets pushed down into the mantle. This is called subduction.

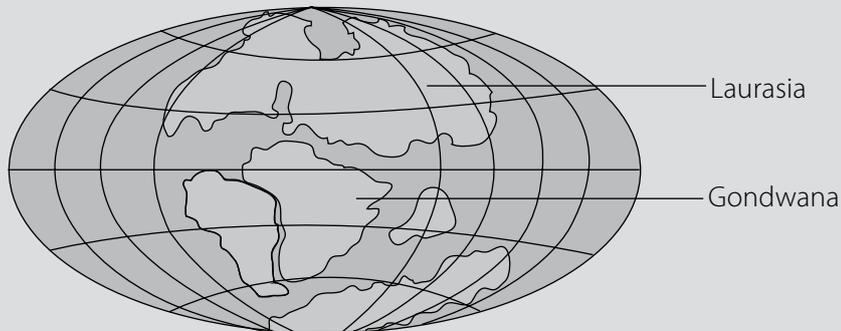
The Continental Drift theory states that millions of years ago, the continents were not in their present broken condition. Instead, there was one land mass called the supercontinent. Over hundreds of thousands of years, pieces began to break off and formed the present continents.

Answer key

Questions and Activities

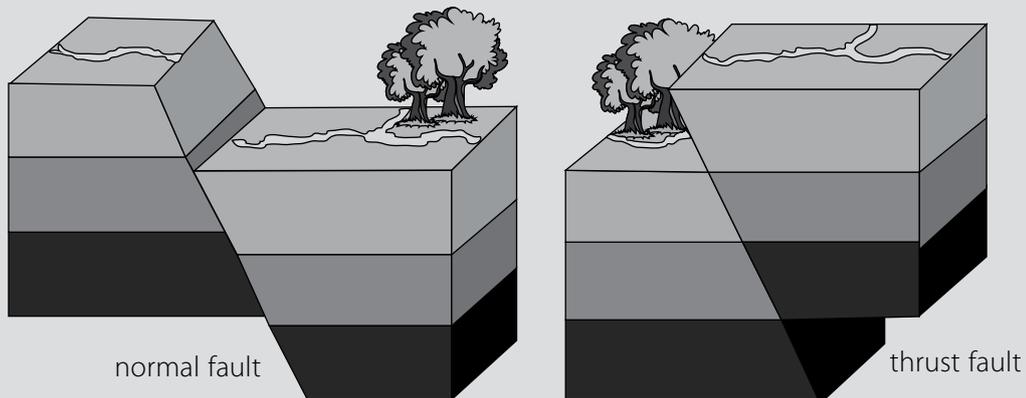
- 1 i. The lithosphere is not a single mass but is broken into numerous segments called tectonic plates which move over the asthenosphere.
- ii. The present locations and shapes of the continents are not the same as they were about 225 million years ago. At that time they were joined to each other in the form of single land mass called Pangaea (paan-ji-a), meaning supercontinent.

iii.



- iv. A fault is a fracture or crack in the Earth's crust.

v.



- 2 i. Pacific plate ii. fracture iii. the USA iv. Wegener

Lesson plan

No of lessons: 1

Duration: 40 minutes

Resources: Textbook pages 6–9, *Oxford School Atlas for Pakistan*

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Teaching objectives:

- to explain the tectonic theory and the cause and effect of the continental drift

Learning outcomes:

Students should be able to:

- explain the concept of plate tectonics
- locate the major tectonic plates on a map
- describe faults and their types

Lesson 1

Introduction (5 minutes):

Show students a film, photograph, or drawing of Pangaea. Compare it with the world map in the *Oxford School Atlas for Pakistan*. Explain the theory of plate tectonics.

Explanation (30 minutes):

Read and explain text. Clarify the difference between the theories of plate tectonics and continental drift. Stress on the concepts of plates, faults, tectonics, lithosphere, and asthenosphere. Make clear illustrations on the board for visual help.

Conclusion (5 minutes):

Recap key points. Ask questions to check understanding.

Classwork: Activity on page 9

Homework: Questions 1–2 on page 9

WORKSHEET 1

Date: _____

Name: _____

1. Choose the correct word to complete each of the sentences below.

- i. The outer part of the Earth where continents and ocean floor lie is composed of a solid layer of rocks called _____ (lithosphere, asthenosphere, hydrosphere).
- ii. This outermost part of the Earth overlies a weak soft layer of rocks called _____ (stratosphere, atmosphere, asthenosphere).
- iii. The Pacific Plate is the largest plate which is mostly located under the _____ (land, ocean, crust).
- iv. The lithospheric plates move slowly, generally a few _____ (metres, kilometres, centimetres) per year.
- v. The Theory of Plate Tectonics was developed in _____ (1965, 1955, 1915).
- vi. The theory states that all continents located at the present place and shape were not in the present form about _____ (125, 225, 325) million years ago.
- vii. The continents were joined to each other in the form of a single land mass called _____ (Pangaea, Hydrangea, Laurasia) meaning supercontinent.

2. Fill in the blanks.

- i. There are _____ major plates.
- ii. The lithosphere is not a _____ mass but broken into numerous segments called plates which move over the _____.
- iii. This super continent broke up around 200 million years ago into two major land masses _____ and _____.
- iv. The major movement of _____ plates generate earthquake, volcanic activity and _____ of large masses of rocks.

3. Answer the following questions. Use extra sheets, if required.

- i. Name the smaller plates.

ii. Which large plate includes an entire continent plus a large area of sea floor?

iii. What does the Theory of Plate Tectonics state?

iv. How does Wegener support his Theory of Continental Drift?

v. How are faults classified?

vi. Name and explain the three rock categories with diagrams.

SECTION 3

EARTHQUAKES AND TSUNAMIS

Teacher's focus:

The convergence and divergence of plates causes the rock to break and jolts to occur. These jolts are called earthquakes. Most earthquakes occur along faultlines or the edges of plates because this is where the jolt occurs. In an earthquake, waves of energy called seismic waves are given out. They travel like ripples causing tremors to be felt. The study of earthquakes is called seismology.

Earthquakes are measured on graphs called seismographs which have a series of waves showing the magnitude or power of seismic waves. These graphs are obtained by installing machines called seismometers. Seismometers are fixed into the ground near faults and monitored to observe any changes in rock activity in the crust.

Earthquakes cause most damage on or around faults, especially in areas where there is much construction. Such areas are called 'heavily built-up areas'. Damage caused by earthquakes includes loss of life and property, directly and indirectly. Water and gas pipes are fractured, electricity supply is disrupted, bridges can collapse, roads split open, crops are destroyed. Many people die as a result of shock. Rescue services may take a long time to reach affected areas.

Tsunami is a Japanese word that comes from the words '*tsu*' meaning harbour and '*nami*' meaning wave. It refers to a series of waves in the ocean bed that rise higher than normal and crash on to land, causing great destruction. A tsunami is created or born as a result of seismic energy released during an earthquake in the ocean or sea bed.

Tsunami affect coastal areas. They are also known as tidal waves because they resemble waves at high tides and are often deceptive. This is why predicting tsunamis is difficult. One cannot tell when or where a tsunami will take place. However once they have been created, tsunami warnings are issued to minimize damages. Areas which are prone to tsunamis are under monitoring by seismic departments.

Tsunami occur when an earthquake measures 7 or more on the Richter Scale. The focus is usually shallow, i.e. not too deep in the ground. The waves can rise to 18 m and more. Loss of life and property is direct and indirect. Tsunamis cause heavy floods.

Answer key

Questions and Activities

1.
 - i. Earthquakes are vibrations in the Earth's crust produced by the rapid release of energy. They occur as a result of the movements of these plates along faults, causing vibrations, breaking of rock, and the release of energy.
 - ii. Richter Scale

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iii. Vibrations that occur before the main quake are called foreshocks. Vibrations that occur after the main quake as the rocks settle down are called aftershocks. A long powerful wave created by an earthquake is called a tsunami or seismic wave. It occurs in the ocean bed.

iv. Earthquakes cause extensive loss of life and property, landslides, and deformation of land features. Examples of recent earthquakes:

In the 1964 Alaskan earthquake, the greatest damage to building structure was caused by landslides and the sinking of ground triggered by vibrations.

In 1976 in Tangshan, China, 240,000 people died as a result of an earthquake measuring 7.6 on the Richter Scale. Similarly, the 2003 earthquake in Iran killed 50,000 people.

The Muzaffarabad, (October 2005) earthquake in Pakistan killed 83,000 people and caused great damage to the infrastructure of the area.

2. i. seismology ii. 83,000 iii. sea iv. Pacific
v. epicentre

Research

A tsunami hit Japan on March 11, 2011. It was caused by an earthquake of magnitude 9, and its effects were felt around the world. It was one of the most devastating natural disasters that caused great loss of life and property, including nuclear leakage in Japan's Fukushima Daiichi Nuclear Power Plant.

The earthquake occurred in the sea floor 45 km east of Tohoku at a depth of 20 km below the Earth's surface, due to the collision of two tectonic plates: the Eurasian plate and the Pacific plate. It lasted for six minutes.

Due to a history of devastating earthquakes, Japan has an earthquake predicting system which had alerted people. Owing to this, a lot of damage to life and property was prevented.

Around 18,000 people died. The entire area was flooded as the tsunami hit Miyako and travelled 6 km inland as far as Sendai. Buildings and protections were destroyed. People died as a result of drowning.

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 10–14, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain to students the causes and effects of earthquakes and tsunamis
- to familiarize students with earthquake-prone areas and inform them about the greatest earthquakes of the world and earthquakes in Pakistan

Learning outcomes:

Students should be able to:

- describe the causes of earthquakes, their effects, and distribution
- list some of the great earthquakes of the world and Pakistan
- describe the causes and effects of a tsunami

Lesson 1

Introduction (5 minutes):

Gather information about the October 2008 earthquake in Pakistan, before the lesson. Write down what happened during the earthquake on the board. Discuss what happened. If the Internet is available, show them this BBC video or any other video to generate interest.

http://www.bbc.co.uk/science/earth/natural_disasters/earthquake#p00gtskq

<http://www.bbc.com/news/world-asia-pacific-12714255>

Provide a general overview of what the topic is about.

Explanation (30 minutes):

Read and explain the text, emphasizing the reasons for earthquakes and tsunamis. Talk about earthquake-prone areas and reasons for their being so.

Conclusion (5 minutes):

Sum up key points. Discuss with students how they would plan for safety if they were living in an earthquake-prone zone.

Lesson 2

Introduction (5 minutes):

Give instructions for the classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 page 14

Homework: Worksheet 2

WORKSHEET 2

Date: _____

Name: _____

1. Choose the correct answer.

- i. Earthquakes are vibrations in the Earth produced by the rapid release of _____ (energy, heat, pressure).
- ii. The scientific study of earthquakes is called _____ (seismology, geology, topography).
- iii. *Seismos* is a Greek word meaning _____ (waves, energy, earthquake).
- iv. Earthquakes occur when movement along faults causes vibration, breaking of rocks, and _____ (release, accumulation) of energy.
- v. The place below the Earth's surface where an earthquake occurs is called the _____ (seismic area, focus, fault) while the place right above on Earth's surface is called _____ (epicenter, focus, ground).
- vi. *Epi* means _____ (above, below, adjacent).
- vii. If the focus of the Earth is not deeper than about 100 km it is called _____ (shallow earthquake, tsunami, wave).
- viii. The intense vibration during the earthquake of October 8, 2005 in _____ (Kot Diji, Multan, Muzaffarabad) occurred for a few seconds.
- ix. Whenever an earthquake occurs, waves of energy or _____ (cosmic, seismic) waves are generated.
- x. The instrument or machine on which these waves are recorded is called _____ a (seismogram, seismometer, seismograph).
- xi. Today a refined Richter Scale is used worldwide to measure an earthquake's _____ (magnitude, damage, occurrence).
- xii. The Richter Scale is based upon the depth or _____ (amplitude, magnitude, multitude) of the largest wave recorded on the seismogram.
- xiii. The intensity of Muzaffarabad earthquake on the Richter Scale was _____ (8.2, 8.9, 9.2).

2. Fill in the blanks.

- i. Scientists who study earthquakes are called _____.

- ii. The most earthquake zone is the _____ which include countries like Japan, western Mexico, Philippines.
- iii. The other important belt is the _____ zone which spans Myanmar (Burma) to the Himalayan Range, Balochistan, Iran, Turkey and extends to the Mediterranean region.
- iv. An earthquake with a deep focus is called a _____ focus earthquake.
- v. The most recent tsunami struck _____ in March 2011.

3. Answer the following questions.

- i. Why are shallow earthquakes more destructive than deep earthquakes?

- ii. Make a list of all kinds of damages caused by earthquakes.

SECTION 4

VOLCANISM

Teacher's focus:

All tectonic plates bump or push into each other, pull away from each other, or slide past each other. Plates bumping or pushing into each other are called convergent plates. Plates that pull away from each other are called divergent plates. Whenever plates converge (push into each other) or diverge (pull away from each other), a jolt or earthquake is felt and heat energy is released. If continental and oceanic plates push into each other, something else occurs in addition to the earthquake and the generation of heat. The oceanic plate which is heavier gets pushed down. This process (where a heavy plate gets pushed down) is called subduction, and it occurs only when one of the plates (the oceanic plate) is heavier than the other plate (the continental crust). The heat released melts the rock. The basaltic molten rock eventually cools down and hardens, creating a new ocean floor and underwater volcanoes.

The oceanic crust has weak spots called hot spots. Lava oozes through these hot spots in the ocean floor. Accumulation, cooling, and hardening of lava through hot spots also forms cone-shaped underwater volcanic mountains. Many islands are the peaks of underwater volcanic mountains.

Answer key

Questions and Activities

1.
 - i. A volcano is a conical or dome-shaped landform formed by the flow of lava. The magma (molten rock from the Earth's interior) rises through a narrow, pipe-like feature called a vent. The vent is connected to the magma reservoir located beneath the surface of the Earth. When magma extrudes onto the surface, it is called lava. As a result of the cooling of lava, igneous rocks are formed. This process of volcanic activity is called volcanism.
 - ii. Diagram from book
 - iii. Shield volcanoes, composite volcanoes, and cinder cones
 - iv. Molten rock from the Earth's interior is called magma. When magma extrudes onto the surface, it is called lava.
 - v. Volcanic eruption is considered a serious environmental hazard. It causes death, forest fires, destruction of buildings, and changes in the weather; it can cause rain, thunder, and lightning. People and animals can be killed by the fast-moving lava; falling ash can make it difficult for them to breathe. They can also die from famine, fires, and earthquakes which can be related to volcanic activity. People can lose their possessions as volcanoes can destroy houses, roads, and fields. Flights get delayed and people get stranded.
 - vi. A volcano is considered active if there is some historical record of its eruption. If a volcano has not erupted in historical time and there is minor alteration in shape because of erosion, it is considered dormant, or sleeping. If a volcano has no historical record of eruption and its major portion has been eroded, leaving behind only a few identifying features like the volcanic neck or a caldera lake, it is called an extinct volcano.

- | | | | | | | |
|----|-----|--------|-----|--------|------|-------------|
| 2. | i. | vent | ii. | Hawaii | iii. | Mount Mayon |
| | iv. | 1100°C | v. | active | | |

Lesson plan

No of lessons: 1

Duration: 40 minutes

Resources: Textbook pages 15–18, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain to students the reasons and processes of the formation and eruption of volcanoes
- to familiarize students with the effects of volcanism, famous volcanoes, and volcanic regions of the world

Learning outcomes:

Students should be able to:

- explain volcanism
- describe types of volcanoes
- describe distribution of volcanoes in the world

Lesson 1

Introduction (5 minutes):

Show a video clip on volcanoes.

Explanation (30 minutes):

Read and explain text. Explain the formation of volcanoes, parts of a volcano, and the technical terms associated with volcanism. Use the *Oxford School Atlas for Pakistan* to locate the Ring of Fire and point it out to the students.

Conclusion (5 minutes):

Recap lesson. Ask questions.

Classwork: Questions 1–2, Activity questions 1 and 2 on page 18

Homework: Research question on page 18

WORKSHEET 3

Date: _____

Name: _____

1. Choose the correct answer.

- i. A volcano is a _____ (conical, square, elliptical) or dome-shaped landform built by eruption of lava.
- ii. The vent is connected to the _____ (surface, crater, magma reservoir) located beneath the Earth.
- iii. As a result of cooling of lava _____ (igneous, metamorphic, sedimentary) rocks are formed.
- iv. The process of volcanic activity is called _____ (seismic activity, volcanism, plate tectonics).
- v. At the opening portion of many volcanoes a steep-walled, cup-like depression called _____ (hollow, caldera, crater) is formed.
- vi. The largest volcano on Earth is _____ (Mount Etna, Mount Fuji, Mauna Loa) at Hawaii.
- vii. The Koh-e-Sultan and the _____ (Ras Koh, Margalla, Chaghai) Hill in the Balochistan province of Pakistan are examples of _____ (active, dormant, extinct) volcanoes.
- viii. There are more than _____ (250, 500, 750) active volcanoes in the world.
- ix. The Ring of Fire is located in the _____ (Atlantic Ocean, Mediterranean Sea, Pacific Ocean).

2. Answer the following questions. Use extra sheets, if required.

- i. How do volcanoes form?

- ii. What are caldera lakes? How are they formed?

- iii. Name all material that comes out in a volcanic eruption.

- iv. Name the two main regions of volcanic activity along with the names of countries.

Chapter 2

Denudation

SECTION 1

DENUATION AND WEATHERING

Teacher's focus:

Denudation is a natural process that results in drastic changes to the natural features found on the Earth's surface. These changes occur over varying lengths of time due to the forces of nature. Features that are removed or altered include land features, vegetation, habitation, etc.

The first of these forces is weathering. Weathering refers to the breakdown of rock due to wind, water, and changing temperatures in the atmosphere. Weathering is of three kinds: physical, chemical, and biological. All three processes are different but they all have the same result. As the name suggests, physical or mechanical weathering refers to the physical breakdown of rocks. Chemical weathering refers to the breakdown of rocks as a result of chemical reactions of water and air with minerals found in rocks. Biological weathering is wear and tear due to biological elements, such as plants that penetrate into rock and break them up from within.

Answer key

Questions and Activities

1.
 - i. Rocks exposed at the surface are affected by water, air, changing temperatures, and other environmental factors. The term weathering is applied to the combined action of all such processes which cause rocks to disintegrate physically and decompose chemically at or near the surface.
 - ii. There are three types of weathering: mechanical weathering, chemical weathering, biological weathering.

The following are the main processes in mechanical weathering: frost action, abrasion, pressure release or unloading, thermal expansion, salt crystallization.

Water penetrates rocks and when the temperature drops, it freezes and expands. This exerts pressure within the rock, causing it to develop cracks. This process is called frost wedging.

Oxygen, which is abundant in the atmosphere, acts as a chemical agent on rocks and minerals. For example, the rusting of iron is an important example of chemical weathering. Rocks like basalt and sandstone, which are rich in iron, minerals like hematite, which is red,

DISCOVERY 2

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- and limonite, which is yellow, react chemically with the oxygen and moisture in the air when they are exposed. This results in a reddish or yellow surface that is powdery and breaks up easily.
2.
 - i. thermal expansion
 - ii. unloading
 - iii. chemical
 - iv. chemical
 - v. break up

Lesson plan

No of lessons: 1

Duration: 40 minutes

Resources: Textbook pages 19–23, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain the concept of denudation
- to introduce the three kinds of denudation
- to explain the process of weathering

Learning outcomes:

Students should be able to:

- define weathering
- distinguish between different types of weathering
- describe the causes of weathering

Lesson 1

Introduction (5 minutes):

Begin the lesson by asking students if they have observed any neglected/unmaintained buildings or houses in a crumbling state or a shambles. Explain that the forces of weathering bring about wear and tear on the surfaces of buildings. Provide examples of weathering observed in daily life, such as rust. Introduce the lesson and its objectives and components.

Explanation (30 minutes):

Read and explain text. Discuss how the forces of weathering bring about wear and tear on the surfaces or exteriors of buildings. Explain that these forces also act upon landforms, causing changes in landscape as a result of weathering. Describe the different types of weathering, and explain why each of them occurs.

Conclusion (5 minutes):

Recap key points. Ask questions to check the level of understanding. Differentiate between kinds of weathering and causes of weathering so that the concept is clear.

Classwork: Questions 1 and 2 on page 23

Homework: Revise text. Do Worksheet 4.

WORKSHEET 4

Date: _____

Name: _____

1. Fill in the blanks.

- i. Rocks exposed at the _____ are affected by water, air, _____ and other environmental factors.
- ii. Water penetrates into rocks and when the temperature drops, it freezes and _____ which develops cracks and joints in rocks. This process is called _____.
- iii. Pressure release is a significant type of _____.
- iv. Rocks _____ due to heat and _____ when it cools down.
- v. Salt crystals also exert _____ in rocks and cause disintegration.
- vi. Water and carbon dioxide form _____ acid which dissolves the _____ carbonate in rocks like limestone.
- vii. Another cause of weathering is the growth of plants, like _____ and _____ on rocky surfaces, and plant roots which penetrate rocks and break them up.

2. Choose the correct answer.

- i. Mechanical weathering is also called _____ (physical, chemical, biological) weathering.
- ii. Water is a liquid which has a characteristic that when it freezes it _____ (smells, evaporates, expands).
- iii. In _____ (abrasion, traction, erosion) the surface is ground away by loose pieces of rocks when they are moved by river water, glaciers, and wind.
- iv. Cracks in rocks are called sheet _____ (faults, joints, plates).
- v. Thermal expansion is common in _____ (tropical deserts, polar regions, grasslands) where the day is very hot and the night is quite cool.
- vi. When _____ (saline, stagnant, acidic) solutions seep into rock cracks and joints, the water evaporates and salt crystals are left behind.
- vii. Oxygen acts as a _____ (chemical, reactionary, erosion) agent on rocks and minerals.
- viii. The rusting of _____ (copper, brass, iron) is an important example of chemical weathering.
- ix. The most effective agent of chemical weathering is _____ (water, oxygen, acid).

- x. The most important natural source of acid for rock weathering on the Earth's surface is dissolved _____ (oxygen, nitrogen, carbon dioxide) in water.
- xi. _____ (Decay, Abundance, Scarcity) of plants and animals matter may contribute to chemical weathering through the formation of carbon dioxide and carbonic acid.

3. Answer the following questions.

- i. In which parts of the world does frost wedging take place?

- ii. Explain salt crystallization.

SECTION 2

MASS WASTING

Teacher's focus:

Mass wasting is another important natural process that brings about wear and tear, or change in landscapes. It occurs as a result of the force of gravity over a period of many years. Mass wasting is often expedited by forces of nature as well. It always takes place on slopes and inclines. It is triggered by factors such as a change in the steepness of a slope, increased amount of water, loss of vegetation and the effects of weathering (weakening and breakdown) on mountains, cliffs, and rock surfaces.

When any of these factors are present, they cause the force of gravity to become greater than the force of resistance acting on slopes. When this happens, mass wasting takes place at different speeds, regulated by these very factors. On the basis of speed, mass weathering is categorized into types: creeps, slides, and flows.

Answer key

Questions and Activities

1.
 - i. Mass wasting is a combination of several processes in which large blocks of rock, rock fragments, rock debris, or unconsolidated rock materials and soil move downhill due to the force of gravity.
 - ii. The main controlling factors are gravity and water.
 - iii. When a block of bedrock breaks off and falls freely, or bounces down a cliff it is called rock fall. This commonly occurs near the shoreline when waves undercut the cliff, causing the mass of rock above to fall. Similarly, rock avalanches take place where the slopes are too steep along river channels, or in the construction of highways, dams, or other projects. A rock slide is the rapid sliding of a mass of bedrock along an inclined surface.
 - iv. A mudflow is a flowing mixture of debris and water, usually moving down a channel, such as in streams or flash floods. Mudflows are common during torrential rains and flash floods which destroy roads, crops, and property, and kill humans and animals.
 - v. Mass wasting can be completely prevented or its rate can be slowed by taking important measures. Correct engineering methods can be followed during construction on hillsides and mountain slopes. Retaining walls should be built to control rock falls and rockslides. The removal of vegetation and cutting of forests, particularly on the slopes of mountains and hills, should be avoided. Tree roots consolidate the soil and prevent debris from landslides, and also help the soil to absorb rainwater that would otherwise flow downhill carrying away the soil. Slopes along the roads can be pitched with stones to avoid mass wasting.
2.
 - i. creep
 - ii. earthflow
 - iii. construction
 - iv. landslides
 - v. mudflows

Lesson plan

No of lessons: 1

Duration: 40 minutes

Resources: Textbook pages 24–27, *Oxford School Atlas for Pakistan*

Teaching objective:

- to explain to students the concept and process of mass wasting as a form of weathering

Learning outcomes:

Students should be able to:

- define mass wasting
- describe the causes and impact of mass wasting

Lesson 1

Introduction (5 minutes):

Talk about mass wasting as another important process and provide a brief summary of what the lesson is about. Please elaborate.

Explanation (30 minutes):

Read and explain text. Explain the different terms used, i.e. debris, rock debris, unconsolidated rock, soil creep, landslide, rock fall, etc. Differentiate between the causes/factors of mass wasting (gravity and water), basis of classification of mass wasting (pace of movement, type of materials, and nature of movement), nature of movement of materials (flow, slide, or fall) and common types of mass wasting processes (creep, fall, and slide).

Conclusion (5 minutes)

Recap key points. Ask questions to check understanding. Conduct activity given in textbook.

Classwork: Questions 1– 2 on page 27

Homework: Read text

WORKSHEET 5

Date: _____

Name: _____

1. Choose the correct answer.

- i. Mass wasting includes very slow movement called soil _____ (flow, fall, creep).
- ii. The mass and angle of the _____ (mountain, slope, debris) both affect the force of gravity.
- iii. When debris is _____ (dry, arid, saturated) it becomes heavier and more likely to flow _____ (upward, sideways, downward).

2. Answer the following questions. Use extra sheets, if required.

i. On what basis is mass wasting classified?

ii. When does most mass wasting take place?

iii. What factors affect the movement of material in mass wasting?

iv. What are the most common types of mass wasting? Explain each type in detail.

SECTION 3

EROSION

Teacher's focus:

Erosion is a natural process in which material is picked up from its original place by agents of erosion—water, wind, or ice. Erosion changes the landscape of a place. In simple words, erosion is the process that breaks down landforms such as mountains, cliffs, or rock surfaces. These are broken down into smaller components and result in a change of landscape. These changes do not occur overnight; they are brought about over a number of years.

The agents of erosion are very powerful. They work on land surfaces and break down components sometimes to their smallest possible form. For example, some cliff surfaces may be reduced to sand as a result of the action of water and wind. Chunks of rocks from mountains are broken off in the form of boulders due to the long-term action of wind, water, or ice.

All agents of erosion work in a similar pattern. They first pick up or erode material from a weak and weathered area where their own force is the strongest. Then they transport this material or load with their flow and direction, to new places. Finally they drop or deposit the load at the place where they lose energy or come across any obstacle that prevents them from going any further.

Answer key

Questions and Activities

1.
 - i. Erosion is the process by which weathered rocks and debris are removed. Types of erosion are: erosion by moving water, erosion by moving ice, erosion by wind, and erosion by sea waves.
 - ii. Erosion is a natural geological process which not only creates new landforms but sometimes also creates problems for humans. The powerful wind erodes and transports fertile top soil, making agricultural land infertile. Unwise land use by humans also results in soil erosion. Deforestation and overgrazing by animals triggers the erosion of fertile soil. Overuse of agricultural land reduces its fertility. The loss of agricultural land along riverbanks due to river erosion is a common problem in Pakistan.
 - iii. Glaciers, moving masses of ice, are important agents of erosion. Broken pieces of rock are frozen into the base of a moving glacier. When heavy glaciers move these rocks, they polish or grind the surface and make long, deep scratches, called grooves or striations, on the rock surface.
 - iv. Erosion can affect land adversely and turn fertile land into lifeless terrain. Some steps that can be taken to minimize its effects are:

Planting ground cover and trees: these will hold the soil together with their roots and prevent it from being washed away by rainwater. Barriers like rock piles can be erected to protect against further land erosion. Tall trees can be planted to act as wind breaks.

2.
 - i. striations
 - ii. wind
 - iii. wind
 - iv. vegetation
 - v. acids

Lesson plan

No of lessons: 1

Duration: 40 minutes

Resources: Textbook pages 28–30, *Oxford School Atlas for Pakistan*

Teaching objective:

- to explain the meaning, process, agents, and impact of erosion

Learning outcomes:

Students should be able to:

- define erosion
- describe the agents of erosion
- describe the impact of erosion

Lesson 1

Introduction (5 minutes):

Begin the lesson with the definition of erosion. Summarize the highlights of the lesson in order to give the students an overview.

Explanation (30 minutes):

Read and explain text.

Conclusion (5 minutes):

Recap main points. Ask questions to check understanding.

Classwork: Questions 1–2 on page 30

Homework: Read and revise text. Do Worksheet 6.

WORKSHEET 6

Date: _____

Name: _____

1. Choose the correct answer.

- i. The running _____ (water, wind, glaciers) on ground surface or in streams has a force to erode rocks and sediments.
- ii. The erosive process that is usually most effective on a rocky stream bed is _____ (traction, dissolving, abrasion).
- iii. Abrasion is the grinding away of the stream channel by _____ (friction, erosion, attrition).
- iv. The fall of water from _____ (mountains, lowlands, height) provides a powerful force which erodes rocks and sediment.
- v. Wind erosion is common in regions with little or no _____ (heat, water, vegetation).
- vi. In deserts, the action of the wind creates _____ (sand blasts, deflation, sand dunes).

2. Answer the following questions. Use extra sheets, if required.

- i. Name the agents of erosion.

- ii. Explain in detail the work of each agent.

- iii. What do you think would happen to landscapes if there was no erosion? Justify your answer with supporting arguments.

Chapter 3

The atmosphere—an introduction

SECTION 1

THE ATMOSPHERE

Teacher's focus:

The atmosphere is a protective layer, in and around the Earth. Its purpose is to protect the Earth from the harmful rays of the Sun. Sunlight and solar radiation are beneficial for the Earth but only if they reach the Earth in a filtered form. The layers of the atmosphere are the filters.

Scientists and geographers have classified the atmosphere into different parts on the basis of certain characteristics. The first broad division is done on the basis of the distribution of gases. The first or lowest part of the atmosphere till 80 km beyond the Earth's surface, where the distribution even, is called the homosphere. The part where the distribution of gases is uneven is the heterosphere. It extends beyond 80 km.

The main layers of the atmosphere are the troposphere, stratosphere, mesosphere, and thermosphere. The exosphere is also considered a layer. It is the last of the layers and merges into planetary space. Each of these layers has unique qualities.

Answer key

Questions and Activities

1.
 - i. The Earth is surrounded by a huge mass of air called the atmosphere. The atmosphere is located outside the Earth but it is considered an important part of the Earth's physical environment. It provides oxygen, which is essential for life. It maintains the temperature balance on Earth and protects the Earth from the excessive heat of the Sun and dangerous rays such as ultraviolet rays. Clouds form in the atmosphere, bringing rain and snow, which are sources of water on the Earth's surface.
 - ii. The atmosphere provides oxygen which is essential for life. The atmosphere maintains a temperature balance for the Earth and protects the Earth from excessive heat of the Sun and dangerous rays like ultraviolet rays. Clouds form in the atmosphere which bring rain and snow which are the ultimate sources of water on the Earth's surface.

iii.

Gases	Percentage by volume
nitrogen	78.084
oxygen	20.946
argon	0.934
carbon dioxide	0.0325
neon	0.00182
helium	0.000524
methane	0.00015
krypton	0.000114
hydrogen	0.00005

iv. It is a heat absorber and affects temperature on the Earth.

v. The troposphere: The troposphere is the lower layer in which we live, where temperature decreases with an increase in height. The thickness of the troposphere is not the same everywhere: it varies with latitude and the season. On average the temperature drop continues to a height of about 12 km. The troposphere is a very important layer for the Earth's surface because all atmospheric processes like the formation of clouds, the generation of wind and storms, etc. take place in the troposphere. The troposphere constitutes the major part of the atmosphere by volume. The stratosphere: The layer immediately above the troposphere is called the stratosphere. This layer is different from the troposphere because the temperature pattern is the opposite: the temperature increases with increasing height. The upper limit of this layer is up to 50 km. The stratosphere is the layer where ozone, the protective layer that shields life on Earth from Sun's harmful ultraviolet radiation, forms. This is the layer where jet planes fly. The mesosphere: The third layer is called the mesosphere. It extends from 50 to 80 km above the Earth's surface. In this layer the temperature again decreases with increasing altitude. This is the layer where meteors falling to Earth burn up, leaving fiery trails in the sky. The thermosphere: Beyond 80 km the topmost layer is called the thermosphere. This layer contains only a tiny mass of atmosphere. In this layer the temperature again rises. Its exact height is not known but approximately 10,000 km is considered to be the upper limit. The temperature is very high in this layer: it continues to rise up to 1000°C.

2. i. water vapour ii. 99 iii. 0.0325 iv. 78.084 per cent
v. stratosphere vi. mesosphere

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 31–35, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain the purpose, composition, and structure of the atmosphere
- to create awareness about the proportion and importance of the gases present in the atmosphere, and their contribution to life on Earth
- to describe the layers of atmosphere
- to identify the basic characteristics of each layer of the atmosphere

Learning outcomes:

Students should be able to:

- describe the origin of the atmosphere
- describe the composition of the atmosphere
- discuss the significance of important gases for life on the Earth
- describe the layers of the atmosphere
- identify the basic characteristics of each layer of the atmosphere

Lesson 1

Introduction (5 minutes):

Introduce the idea of the atmosphere as a protective layer around the Earth. In order to make the concept clearer, use a ball as a model to represent the Earth and wrap it in a polythene bag. Explain to the students that the atmosphere is represented by this bag, which acts as a protective layer.

Explanation (30 minutes):

Read and explain the text. Discuss the purpose of the atmosphere as protection for the Earth. Emphasize the proportion and purpose of the gases. Draw the diagram of the layers on the board. Divide them into homosphere and heterosphere. Mark the four layers and write their characteristics. Alternately, make a chart with all the information and use as visual aid to explain the layers and their position and characteristics. Clarify the difference between the divisions of homosphere and heterosphere, and troposphere, stratosphere, mesosphere, and thermosphere.

Conclusion (5 minutes):

Recap key points. Ask questions to check understanding. Recap lesson.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1– 2 on page 35

Homework: Read and revise text. Do Worksheet 7.

WORKSHEET 7

Date: _____

Name: _____

1. Choose the correct answer.

- i. Our Earth is surrounded by a huge mass of air, called _____ (atmosphere, biosphere, hydrosphere).
- ii. The atmosphere provides _____ (carbon dioxide, oxygen, argon) which is essential for life.
- iii. The gases nitrogen and oxygen, make up _____ (99, 78, 21) per cent of the volume of clean, dry air.
- iv. In the late eighteenth century _____ (kites, balloons, wind vanes) were used to investigate the composition and properties of the atmosphere.
- v. Water vapour and dust particles play an important role in _____ (ozone, dust, cloud) formation.

2. Complete the following.

- i. The envelope of air that surrounds our planet is _____.
- ii. Water vapour also absorbs heat energy and dust particles which _____.
- iii. The atmosphere is located outside the Earth but it is considered _____.
- iv. An increase in its quantity in the atmosphere takes place through _____.

3. Fill in the blanks.

- i. In 1752, Benjamin Franklin, used a kite to explore the _____.
- ii. The envelope of air that surrounds our planet is a mixture of many _____, dust particles, and _____.
- iii. In the remaining one per cent, _____ accounts for 0.93 per cent of the gases.
- iv. Carbon dioxide is present in only _____ quantities but it is nevertheless an important constituent of air.
- v. An increase in the amount of carbon dioxide in the atmosphere takes place through _____ pollution and burning of _____.

4. Answer the following questions.

i. What is the significance of ozone, water vapour, and dust in the atmosphere?

ii. How is nitrogen added to and removed from the atmosphere and what are its effects?

SECTION 2

WEATHER AND CLIMATE

Teacher's focus:

Weather and climate are determined by changes in the atmosphere. The elements of weather include temperature, precipitation, humidity, and air pressure. These changes occur in the troposphere and bring about weather changes. Weather refers to the atmospheric changes at a particular point of time and is a short-term change. It can fluctuate on an hourly, daily, weekly, or monthly basis. Climate, on the other hand, refers to the general weather or atmospheric changes of a place as observed over a long period of time, usually 30 years. It is taken to be the general or characteristic weather of a place.

Answer key

Questions and Activities

1.
 - i. The conditions in the atmosphere created by variations in temperature, humidity, rainfall, wind speed, etc.
 - ii. Weather is defined as the condition of the temperature, rainfall, air pressure, humidity, etc. in any place at a given time. Climate is the average weather conditions of a place, usually based on the yearly weather conditions observed over a period of 30 years.
 - iii. Climate change refers to changes in the average temperature of the Earth. It is not a new phenomenon. It affects the temperatures on Earth, which in turn affects all life forms.
 - iv. Global warming is the biggest environmental issue for the world today. Greenhouse gases such as carbon dioxide and methane, absorb heat that would otherwise escape from the Earth, thus raising the temperature on Earth. Scientists believe that excessive release of carbon dioxide by burning fossil fuels (coal, natural gas, and petroleum), the emission of carbon dioxide from industries, etc. are the main causes of global warming. Scientists warn that one of the possible impacts of global warming is the melting of the glaciers which are the major stores of fresh water on Earth. As a result, sea levels will rise globally. It has been estimated that during the last century the sea level rose by between 10 and 25 cm. Some estimates suggest that by the end of the twenty-first century the sea level will have risen by up to 50 cm. As a result, coastal areas and many islands would be submerged. Global warming will also increase the rate of evaporation. As a result there will be more rains, increasing the risk of flooding.
 - v. Diagram on page 37 of the book.
2.
 - i. carbon dioxide
 - ii. 0.6°C
 - iii. rainfall

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 36–39, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain weather and climate as phenomena of the atmosphere
- to introduce the elements of weather

Learning outcomes:

Students should be able to:

- differentiate between weather and climate
- identify the basic elements of weather

Lesson 1

Introduction (5 minutes):

Ask students questions to see what they remember from previous classes. Revise the basic concepts regarding weather and climate. Talk about general climatic conditions of their city, and the weather of that day.

Explanation (30 minutes):

Read and explain text. Discuss the link between weather and climate in the atmosphere and make the connection with the elements of weather and climate. Clarify the difference between weather and climate by telling them that on a particular date in different years, the weather might not be the same, i.e. if it rained on August 1, 2013 in Karachi, it may or may not rain on August 1, 2014. However June, July, and August will always be the monsoon season for Karachi. Explain each element in detail.

Conclusion (5 minutes):

Recap key points. Give a brief overview of the next section. Make the relevant connections.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks

Written work (35 minutes):

Classwork: Questions 1– 2 on page 39

Homework: Poster activity on page 39

WORKSHEET 8

Date: _____

Name: _____

1. Choose the correct answer.

- i. The atmospheric condition of a place on a specific time is called _____ (weather, climate, elements of weather).
- ii. Atmospheric condition is determined with the measurements of _____ (elements, variations, kind) of weather.
- iii. Weather is defined as a condition of temperature, rainfall, pressure, and humidity, etc. at any place at a _____ (given, yearly, annual) time.
- iv. Climate is the average weather condition of a place as observed for _____ (10, 20, 30) years.
- v. _____ (Scientists, Geographers, Meteorologists) study weather and climate.
- vi. Weather predictions are called _____ (forecasts, information, podcasts).

2. Answer the following questions.

- i. What is humidity?

- ii. Explain the work of meteorologists.

- iii. What is the most important responsibility of meteorologists?

- iv. Who may need weather data?

- v. Why is this data important for them?

SECTION 3

OZONE DEPLETION

Teacher's focus:

Ozone depletion is a growing cause of concern in our times. CFCs are used in aerosol sprays and the use of aerosol sprays is increasing at the global level. Insecticides, pesticides, varnishes, etc. in aerosol sprays are being consumed in great volumes and it is speeding up ozone depletion. Ozone is an atmospheric layer that filters out the harmful ultraviolet rays of the Sun. The depleted ozone layer has led to an increase in health issues like skin cancers and other skin problems, allergies, etc.

Answer key

Questions and Activities

1.
 - i. Ozone is a form of oxygen that combines three oxygen atoms into each molecule (O_3). The presence of the ozone layer in our atmosphere is crucial because it absorbs the harmful ultraviolet rays of the Sun. If it was not for ozone, the ultraviolet rays would reach the surface of our planet, making it uninhabitable.
 - ii. Ozone is not the same as the oxygen we breathe, which has two atoms per molecule (O_2).
 - iii. CFCs are stable, nonflammable, low in toxicity, and inexpensive to produce.
 - iv. The loss of ozone in the atmosphere is a result of human activities that pollute the environment. The amount of CFCs in the atmosphere, which is the main cause of ozone depletion, has been increasing day by day.

Always unplug electronic appliances when they are not in use as they emit CFCs. Refrigerators made before 1995 use refrigerant made from CFCs and are a major contributor to CFCs in the air. These must be replaced with modern ones. The old ones should be disposed of properly. Air conditioners made before 1994 used a CFC called freon. These may no longer be in use, but the present day air conditioners too use chemicals called HCFCs. Although these are not as harmful to the ozone layer as CFCs, they too contribute to its depletion. Therefore, air conditioning should be used as little as possible. The cleaning products used in our homes contain toxic chemicals that affect the ozone layer. These should be replaced with eco-friendly and natural cleaning products. Nitrous oxide, which is quite commonly used, has been found to be more harmful to the ozone layer than CFCs. Unfortunately, governments have not taken notice of this yet. It is used in medical procedures, to increase the output of car engines, and in the food industry, among other uses. The number of cars on the roads should be reduced and people should be encouraged to walk, or use bicycles or public transport. Car exhaust creates smog which is very bad for the ozone layer.

2.
 - i. CFCs
 - ii. nitrous oxide
 - iii. Antarctica
 - iv. stratosphere
 - v. freon

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 40–42, *Oxford School Atlas Pakistan*

Teaching objective:

- to make students aware of the damage being caused to the ozone layer and the outcomes of this damage

Learning outcomes:

Students should be able to:

- describe the ozone layer and explain why it is important for us
- explain the causes of ozone depletion

Lesson 1

Introduction (5 minutes):

Show students the model Earth in the plastic bag used in previous lessons. Hold it near a heat source like a candle. Observe what happens to the plastic. Tell students that increasing temperatures on the Earth are causing a similar problem in the ozone layer.

Explanation (30 minutes):

Read and explain the text. Talk about the dangers of ozone depletion and make a list of all irresponsible human activities that contribute to ozone depletion. Ask students to provide their suggestions for saving the ozone layer. Facilitate discussion by providing one, or two hints, for example, car pooling, cycling or walking short distances instead of taking a car, etc.

Conclusion (5 minutes):

Recap key points of lesson. Make a list of student suggestions on the board.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks

Written work (35 minutes):

Classwork: Questions 1–2 on page 42

Homework: Preparation for Activity questions on page 42

WORKSHEET 9

Date: _____

Name: _____

1. Choose the correct answer.

- i. Ozone is a form of oxygen that combines _____ (one, two, three) oxygen atoms into each molecule.
- ii. Ozone is concentrated in the _____ (thermosphere, mesosphere, stratosphere) between 10 and 50 km.
- iii. Ozone absorbs the harmful _____ (infrared, ultraviolet, cosmic) rays of the Sun.
- iv. The amount of _____ (CFCs, generators, petrol) has been increasing day by day which is the main cause of depleting ozone.
- v. CFCs are used in _____ (aerosol sprays, fossil fuels, carbon emissions).

2. Answer the following questions.

- i. What is the difference between O_2 and O_3 ?

- ii. What are the positive and negative qualities of chlorofluorocarbons?

- iii. When and by whom was the idea of ozone depletion first presented?

- iv. How and when was damage to the ozone layer detected?

Chapter 4

Atmospheric temperature

SECTION 1

TEMPERATURE AND ITS MEASUREMENT

Teacher's focus:

The Sun is our only source of heat and light. When we talk about temperature we are referring to the degree of the heat of the Sun, or heat received from the Sun as rays. This is called solar radiation, and the Earth's surface absorbs the heat received. Without sunlight, the Earth would have been a cold, gloomy place. The amount of heat received at any point on the Earth depends on the Earth's position during revolution. Rotation, which causes day and night, also causes sunlight to reach different parts of the Earth at different times.

Temperature is measured with an instrument called thermometer. There are two scales used for measuring temperature: the Fahrenheit and Celsius scales, named after their inventors. The highest recorded temperature for a given period is called maximum temperature and the lowest recorded temperature is called minimum temperature.

Answer key

Questions and Activities

1.
 - i. Atmospheric temperature means the degree of hotness of air.
 - ii. In a common thermometer, mercury or alcohol is used as the liquid. When heated, the liquid expands more quickly than the glass and, when cooled, it contracts more quickly than the glass. Because of this relative expansion and contraction, the length of the column of liquid in the glass indicates the temperature of the surrounding area.
 - iii. Anders Celsius, a Swedish astronomer, devised a decimal scale on which the melting point of ice was set at 0 degrees and the boiling point of water at 100 degrees. Gabriel Daniel Fahrenheit, a German physicist, devised the temperature scale that bears his name. He constructed a mercury thermometer on which the zero point was the lowest that he could attain with a mixture of ice, water, and common salt. For his second fixed point he chose the human body temperature, i.e. 96 degrees. On this scale he determined that the melting point of ice was 32 degrees and the boiling point of water was 212 degrees.

- iv. In 1714, Gabriel Daniel Fahrenheit, a German physicist, devised the temperature scale that bears his name. He constructed a mercury thermometer on which the zero point was the lowest that he could attain with a mixture of ice, water, and common salt. For his second fixed point he chose the human body temperature, i.e. 96 degrees. On this scale he determined that the melting point of ice was 32 degrees and the boiling point of water was 212 degrees. As the thermometer improved, the human body temperature was later shown to be 98.6 degrees Fahrenheit. In 1742, twenty-eight years after Fahrenheit invented his scale, Anders Celsius, a Swedish astronomer, devised a decimal scale on which the melting point of ice was set at 0 degrees and the boiling point of water at 100 degrees. For many years it was called the centigrade scale, but it is now known as the Celsius scale. Since the interval between the melting point and the boiling point of water is 100 degrees on the Celsius scale and 180 degrees on the Fahrenheit scale, formulae have been devised to convert from the Celsius scale to Fahrenheit, and from the Fahrenheit scale to Celsius.
- v. To obtain a meaningful temperature reading, thermometers must be shaded from direct sunlight and shielded from radiating surfaces such as buildings and the ground. For this reason, thermometers are mounted in a white shelter box that has louvered sides that permit free movement of the surrounding air. The shelter box is mounted about 1 m above the ground and far away from buildings.
2. i. Sweden ii. 180 iii. 98.6 iv. temperature
v. atmosphere vi. 1

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 43–46, *Oxford School Atlas for Pakistan*

Teaching objective:

- to explain to students the definition of atmospheric temperature and its measurements

Learning outcomes:

Students should be able to:

- define atmospheric temperature
- describe scales of temperature measurements

Lesson 1

Introduction (5 minutes):

Review previous lessons in order to revise atmospheric temperature and its measurement. Bring a thermometer to school and ask students if they know its purpose. Explain the concept of temperature and how it is measured using a thermometer.

DISCOVERY 2

Teaching Guide

Explanation (30 minutes):

Read and explain text. Discuss the Sun as the Earth's only source of heat and light, what causes temperature variations, and measurement and the scales of temperature.

Conclusion (5 minutes):

Recap key points. Make students do conversion exercises from Celsius to Fahrenheit and vice versa. Clarify the difference between Celsius, Centigrade, and Fahrenheit.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks

Written work (35 minutes):

Classwork: Questions 1–2 on page 46

Homework: Read and revise text.

WORKSHEET 10

Date: _____

Name: _____

1. Choose the correct answer.

- i. Temperature is defined as the degree of _____ (hotness, coolness, pressure).
- ii. Atmospheric temperature means the degree of hotness of the _____ (air, Sun, Earth).
- iii. The Sun is the source of _____ (energy, reflection, ozone) for heating our atmosphere.
- iv. The surface temperature of the Sun is about _____ (4000°C, 6000°C, 8000°C).
- v. The heat of the Sun is called _____ (solar radiation, insolation, solar plexus).
- vi. In the common thermometer, _____ (aluminium, copper, mercury) or alcohol are used as the liquid.
- vii. Temperature is represented in _____ (quantitative, abstract, qualitative) measurements which need scales.
- viii. For many years the Celsius scale was called _____ (centigrade, isotherm, measuring) scale.
- ix. The interval between the melting point of ice and the boiling point of water is _____ (0, 100, 180) degrees on the Celsius scale and _____ (120, 160, 180) degrees on the Fahrenheit scale.
- x. Gabriel Daniel Fahrenheit was a German _____ (astronomer, physicist, meteorologist).

2. Answer the following questions. Use extra sheets, if required.

- i. What does the atmosphere of the Earth do?

- ii. What is so interesting about the Fahrenheit and Celsius scales?

- iii. What is the purpose of the thermometer?

- iv. What factors control the accuracy of a reading on the thermometer?

SECTION 2

INSOLATION

Teacher's focus:

Insolation refers to the phenomenon of solar radiation when it reaches the surface of the Earth. It is considered to be the Earth's heat regulator. These rays of heat energy go through three processes: scattering, reflection, and absorption, and regulate the quantity of heat reaching the Earth. There are a number of factors that determine all three processes and hence the amount of heat on the Earth.

Answer key

Questions and Activities

1.
 - i. Insolation is the incoming solar radiation that enters the atmosphere, a considerable amount of which reaches the Earth's surface.
 - ii. Insolation is the incoming solar radiation that enters the atmosphere. The Sun's interior is the source of generating solar energy. Its surface temperature is about 6000°C. It emits energy in the form of electromagnetic radiation. Although the atmosphere is largely transparent to incoming solar radiation, only about 25 per cent reaches directly the Earth's surface. The remaining is treated by three processes of scattering, reflection, and absorption. Solar radiation travels in a straight line. When it collides with the dust and salt particles it changes its direction called scattering. About 30 per cent of the solar energy reaching the outer atmosphere is reflected back to space. The surface of the Earth that reflects solar energy is called the albedo. On white surfaces, the albedo is high and on dark surfaces, the albedo is low. The atmosphere is a good absorber of heat. The ozone layer absorbs the ultraviolet rays of Sun. The 20 per cent of incoming solar radiation is absorbed by clouds. When water absorbs heat energy it returns this heat in the form of vapour through the process of convection. Similarly when land is heated up it radiates heat in the form of long wave radiation. Water vapour and carbon dioxide in the air are the main absorbers of the Earth's radiation and cause of the heating of atmosphere.
 - iii. The amount of incoming solar radiation at any place varies during 24 hours. The rotation of the Earth on its axis determines the daily cycle of insolation. The surface of the Earth starts receiving incoming solar energy when the Sun rises and it is at its peak at 12 noon. Insolation declines and it becomes zero when the Sun sets.
 - iv. The amount of insolation the Earth receives at any point in time depends on the current season and the latitude of the area. It depends on the position of the Earth in relation to the Sun. Students should refer to solstices and equinoxes in their answer.
 - v. The factors are: the angle at which the Sun's rays fall on Earth, the duration of daytime, and the presence or absence of clouds.
2.
 - i. temperature
 - ii. Equator
 - iii. absorber
 - iv. ultraviolet
 - v. 20

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 47–50, *Oxford School Atlas for Pakistan*

Teaching objective:

- to make students aware of the concept of insolation and how the Earth's surface and atmosphere are heated

Learning outcomes:

Students should be able to:

- define insolation
- explain how the Earth and the atmosphere are heated

Lesson 1

Introduction (5 minutes):

Recap the previous lesson on atmospheric temperature. Discuss the Sun as the Earth's only source of heat. Ask students if they know how and why the Sun's heat energy gets transferred to the Earth. While some of it is absorbed, some is scattered, and the rest is reflected back. It's a good thing that this happens because the Sun's rays are so strong they would burn the Earth down if all of them were absorbed.

Explanation (30 minutes):

Read and explain text. Clarify key concepts such as the energy of the Sun, the transfer of heat energy, and scattering, reflection, and absorption. Draw the diagram on page 47 of the Book to explain this.

Conclusion (5 minutes):

Sum up key points on the board. Ask questions to check whether students have understood or not.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks

Written work (35 minutes):

Classwork: Questions 1–2 on page 50

Homework: Read and revise text.

WORKSHEET 11

Date: _____

Name: _____

1. Choose the correct answer.

- i. Insolation refers to the incoming solar radiation that enters the _____ (atmosphere, hydrosphere, troposphere) and reaches the Earth's surface.
- ii. The Sun is the source of _____ (heat and energy, power, ozone layer) for Earth.
- iii. The Sun's _____ (rays, interior, radiation) is the source generating solar energy.
- iv. The surface temperature of the sun is about _____ (9000, 6000, 12000)°C.
- v. The Sun emits energy in the form of _____ (electromagnetic, kinetic, potential) radiation.
- vi. The amount of solar energy reflected back from the Earth's surface is called _____ (albedo, ozone, stratosphere).
- vii. When water absorbs heat energy it returns this heat in the form of vapour through the process of _____ (convection, radiation, evaporation).
- viii. The place where the sunrays strike _____ (diagonally, horizontally, vertically) receives more heat energy than the place where the rays strike obliquely.
- ix. Insolation declines and becomes zero when the Sun _____ (rises, sets, is overhead) at the Equator.
- x. The Equator receives _____ the (highest, lowest) amount of insolation and the Poles receive _____ the (highest, lowest) amount of insolation in a year.

2. Fill in the blanks.

- i. The incoming solar radiation that enters the atmosphere is called _____.
- ii. The term 'insolation' has been invented by combining the words _____.
- iii. Changing of direction is known as _____.
- iv. _____ per cent of incoming solar radiation is absorbed by clouds.
- v. When land heats up it radiates heat in the form of _____.
- vi. Insolation is high when the sky is _____.

SECTION 3

DISTRIBUTION OF TEMPERATURE

Teacher's focus:

The study of temperature distribution is carried out from two perspectives—vertical distribution and horizontal distribution. Vertical distribution refers to the temperatures of the layers of atmosphere. It is called vertical distribution because the layers of the atmosphere are one above the other. Temperatures are different at all four layers. Horizontal distribution refers to the distribution of temperature on a latitudinal or horizontal basis. It is affected or regulated by the latitude of a place, its altitude, oceanic currents, and the difference between the heating and cooling of the land and oceans. Distribution of temperature is measured or recorded with isotherms. Isotherms are curved lines like contour lines. They mark or connect places with the same temperature.

Answer key

Questions and Activities

1.
 - i. Temperature in the troposphere declines with increasing height because the atmosphere is heated by the Earth's radiation. Therefore air near the surface is warmer than the air at a distance from it.
 - ii. An isotherm is a line which represents areas of the equal values of temperature.
 - iii. Latitude, altitude, land and water contrast, oceanic currents.
2.
 - i. is constant
 - ii. 6.5
 - iii. lower
 - iv. coastal
 - v. isotherms

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 51–55, *Oxford School Atlas for Pakistan*

Teaching objective:

- to make students aware of temperature distribution, its measurement, and the use of isotherms

Learning outcomes:

Students should be able to:

- describe vertical distribution of temperature
- describe horizontal distribution of temperature
- define isotherm and explain the purpose of isothermal maps

Lesson 1

Introduction (5 minutes):

Define temperature distribution. Ask students if they can guess the factors on which this distribution is based. Give hints.

Explanation (30 minutes):

Read and explain text. Compare vertical and horizontal distribution by making a comparison column on the board. Explain isotherms. Use the *Oxford School Atlas for Pakistan* to show isotherms.

Conclusion (5 minutes):

Recap lesson. Ask questions to check understanding.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on pages 54–55

Homework: Read and revise text. Worksheet 12.

WORKSHEET 12

Date: _____

Name: _____

1. Choose the correct answer.

- i. On the basis of vertical temperature variation, the atmosphere is divided into _____ (four, three, five) main layers.
- ii. The bottom layer where temperature _____ (decreases, increases, remains unchanged) with increase in height is called _____ (troposphere, hydrosphere, mesosphere).
- iii. Temperature decrease continues to an average height of approximately _____ (12, 13, 15) km.
- iv. Mountains have lower temperature than plains because of _____ (altitude, pressure, humidity).
- v. Air temperature _____ (rises, drops, remains constant) with increasing height.
- vi. The rate of decrease is called _____ (pulse, falling, lapse) rate which is generally 6.5°C per kilometre.
- vii. Land becomes (warmer, cooler) faster and cools rapidly as compared to _____ (mountains, plains, seas, and oceans).
- viii. Oceanic currents are movements of _____ (air, wind, water) in particular directions.
- ix. One of the characteristics of isotherms is that they do not _____ (affect, cross, locate) each other.

2. Answer the following questions.

- i. What are tropopause, stratopause, mesopause, and thermopause?

- ii. Describe the controlling factors of horizontal distribution of temperature.

iii. Why is temperature at the lower part of stratosphere warmer than the upper part?

iv. Why are there latitudinal variations in temperature?

v. How do meteorologists study the distribution of temperature?

vi. What is the purpose of isothermal maps?

Chapter 5

Atmospheric pressure and wind

SECTION 1

PRESSURE AND ITS MEASUREMENT

Teacher's focus:

Atmospheric pressure is the pressure of all the gases in the atmosphere that is exerted on a unit area. It is measured with a barometer. Hot air is lighter than cold air and rises. As the altitude increases, the pressure decreases because the hot air has risen and thinned out, and it contains less oxygen than it did at sea level. This is why mountain climbers often experience shortness of breath and carry oxygen cylinders with them. Cold air is heavier and sinks to the bottom of the atmosphere. The atmospheric pressure in places at sea-level is greater than at high altitudes because air contains more oxygen, making it denser and heavier. Changing atmospheric pressure gives rise to the system of winds.

Answer key

Questions and Activities

1.
 - i. Atmospheric pressure is the total weight of the atmosphere (gases and vapours) pressing down on the surface of the Earth.
 - ii. Atmospheric pressure is measured with an instrument called barometer. The most common barometer is the mercury barometer.
2.
 - i. mercury
 - ii. air
 - iii. decreases
 - iv. isobars
 - v. Torricelli

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 57–58, *Oxford School Atlas for Pakistan*

DISCOVERY 2

Teaching Guide

Teaching objective:

- to explain to students the concept of atmospheric pressure, and its measurement and causes

Learning outcomes:

Students should be able to:

- explain air pressure
- describe how air pressure decreases with increasing height

Lesson 1

Introduction (5 minutes):

Explain the key concept that air in the atmosphere exerts pressure. Illustrate the idea by bringing some balloons to class and filling one or two balloons with air, without tying the knot and then releasing them. The balloons will move around very fast before deflating. Ask the students if they can think why the balloons circled around till they had air and then fell down. Link the discussion to the concept of air pressure.

Explanation (30 minutes):

Read and explain text.

Conclusion (5 minutes):

Recap main points of lesson.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks

Written work (35 minutes):

Classwork: Questions 1–2 on page 58

Homework: Read and revise text. Do Worksheet 13.

WORKSHEET 13

Date: _____

Name: _____

1. Pick the correct answer.

- i. Pressure can be defined as:
 - a. force that applies on a unit area.
 - b. force that applies on the Earth.
 - c. force that is found on mountains.
- ii. Atmospheric pressure is:
 - a. the pressure at sea level or on mountains.
 - b. total weight of the atmosphere.
 - c. the weight of wind.
- iii. At sea level generally a column of atmosphere exerts an average pressure of about:
 - a. 1.055 kg per sq cm
 - b. 0.914 kg per sq cm
 - c. 0.8437 kg per sq cm
- iv. Air that is cooled at the bottom will:
 - a. rise and decrease pressure.
 - b. sink and increase pressure.
 - c. remain unchanged.
- v. Warming will cause the air to:
 - a. rise and thus lower the pressure.
 - b. sink and increase pressure.
 - c. remain unchanged.

2. Look at the figure and answer the questions.

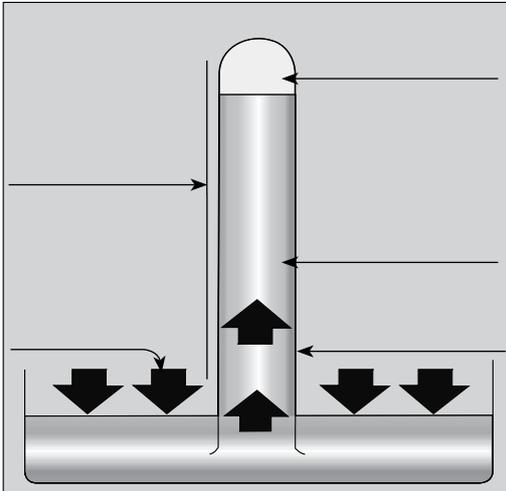


Fig 1



Fig 2

- i. Name both the instruments in figures 1 and 2.

- ii. Label the parts of the instrument in Figure 1.

- iii. Explain the working of both instruments.

SECTION 2

GLOBAL DISTRIBUTION OF AIR PRESSURE

Teacher's focus:

Air pressure depends on altitude and also on temperature. As discussed in the earlier chapters, latitudes determine different climatic zones. The Equator, the Tropics, and the Poles have unique climates because of the position and duration of the overhead Sun throughout the year, which means that there are unequal temperatures on the surface of the Earth. Warm air is lighter than cold air and it rises. On the other hand, cold air is heavier and sinks to the bottom. As a result, convection currents are created which in turn form high and low pressure zones. This is how a system of winds is created.

Answer key

Questions and Activities

1.
 - i. Equatorial low pressure, sub tropical high pressure in the northern hemisphere, sub tropical low pressure in the southern hemisphere, sub polar low pressure in the northern hemisphere, sub polar low pressure in the southern hemisphere, north polar high pressure, south polar high pressure
 - ii. Hot air from the Equator moves upwards and as a result air pressure declines and creates a low pressure zone at the Equator. The Poles are regions of low temperature. Cool air condenses and moves downward. Therefore high pressure develops at both the North Pole and South Pole.
2.
 - i. low
 - ii. summer
 - iii. summer
 - iv. low

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 59–61, *Oxford School Atlas for Pakistan*

Teaching objective:

- To make students aware of how different pressure system belts are created as a result of uneven atmospheric pressure

Learning outcomes:

Students should be able to:

- explain how and why pressure belts are created
- discuss air pressure belts on the globe
- describe isobars

Lesson 1

Introduction (5 minutes):

Recall and revise previous lesson, paying attention to the climatic zones with their readings and climate. Link uneven temperatures to uneven pressure zones.

Explanation (30 minutes):

Read and explain text. Discuss the concept of pressure belts, how they are created, and their impact. Explain isobars and compare to isotherms and contour lines. Use *Oxford School Atlas for Pakistan* to find out pressure zones.

Conclusion (5 minutes):

Recap key points. Ask questions to ascertain level of understanding.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 61

Homework: Activity on page 61

WORKSHEET 14

Date: _____

Name: _____

1. Choose the correct answer.

- i. When air is heated it expands, causing _____ (increase/decrease) in pressure.
- ii. The Equator is the region of _____ (high/low) temperature.
- iii. Hot air over the Equator moves _____ (downward/upward).
- iv. The surface of the Earth is not _____ (uniform/different).
- v. Atmospheric pressure of different places is shown on a map with _____ (isobars, isotherms) which are drawn on pressure values.
- vi. In the Southern Hemisphere, the temperature over land is _____ (lower/higher) than over the ocean.

2. Answer the following questions.

- i. What happens when movement of air takes place from high pressure to low pressure areas?

- ii. Although temperature is also relatively high in the subtropical regions, high pressure develops in this region. Why?

- iii. What factors affect global air pressure?

- iv. Describe isobars.

SECTION 3

THE PLANETARY WIND SYSTEM

Teacher's focus:

As we know, atmospheric pressure is affected by latitude and temperature. Due to the Earth's uneven tilt, bulge, and rotation, there is uneven solar radiation (heat from the Sun). The temperature is the highest at the Equator, cooler near the Tropics, and the coldest at the Poles. Ocean surfaces also get heated up during the day. Owing to these temperature changes, high and low pressure zones are created, giving rise to convection currents. These currents create a system of winds over land and sea, known as the Planetary Wind System.

The Planetary Wind System simply refers to the system of winds that develops as a result of varying pressure patterns, tilt, and rotation of the Earth. These winds blow towards and from certain directions, and have been given special names based on their characteristics and region. Geographers believe that the wind system of the Pacific is a typical model of the Planetary Wind System. No other region has such a perfect wind system.

Answer key

Questions and Activities

1.
 - i. Air moves from areas of high pressure to areas of low pressure. Therefore if the pressure values of two places are the same, no wind is generated but when at one place, the pressure declines, wind is generated from high pressure to low pressure. This slope is called pressure gradient force.
 - ii. Winds in the middle latitudes, between 30 and 60 degrees latitude, blowing from the high pressure area in the horse latitudes towards the Poles. These prevailing winds blow from the west to the east. Global winds: winds that circulate around the Earth in set patterns; Seasonal winds: winds that generate in particular seasons.
 - iii. Land and sea breezes generate as a result of the temperature difference between the land and sea. During the day, land becomes hotter than the sea. Therefore the air on land is lifted up and low pressure develops over land. On the other hand, the temperature of the sea is relatively low and high pressure prevails over the sea. As a result in the afternoon, wind generates from sea to land which is called sea breeze. Due to this relatively cool and moist wind, the weather of coastal places becomes pleasant in the afternoon, particularly near the shoreline. Late at night, the land cools down due to the release of the Earth's radiation. Therefore the temperature of land is lower than that of the sea. As a result, high pressure develops over land and low pressure develops over sea. Wind that generates from land to sea is called land breeze.
 - iv. Due to the Coriolis Effect, air is deflected to the right in the northern hemisphere, and is deflected to the left in the southern hemisphere.
 - v. Types of winds: local wind, land and sea breezes, mountain and valley breezes; other local winds.
2.
 - i. local
 - ii. monsoon
 - iii. right, left
 - iv. friction
 - v. rains

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 62–66, *Oxford School Atlas for Pakistan*

Teaching objective:

- to make students aware of the wind system on Earth, how it works, its controlling factors, and its effects

Learning outcomes:

Students should be able to:

- describe the wind system
- explain the controlling factors of the wind

Lesson 1

Introduction (5 minutes):

Write down different words for different speeds of wind on the board—wind, breeze, gale, hurricane, etc. with their meanings. Ask students if they have noticed what happens to tree tops in the wind. Discuss what happens when the regulator of a fan is adjusted to different speeds and link the discussion to the Earth's wind system.

Explanation (30 minutes):

Read and explain text.

Conclusion (5 minutes):

Recap key concepts. Ask questions to check understanding.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 66

Homework: Read and revise text. Do Worksheet 15.

WORKSHEET 15

Date: _____

Name: _____

1. Select the correct answer.

- i. The movement of air is similar to the movement of _____ (water, pressure, temperature).
- ii. The movement of _____ (water, wind, air) takes place from high pressure areas to low pressure areas.
- iii. The movement of oceanic water is called _____ (quakes, currents).
- iv. The tropical easterlies are also called _____ (hot winds, westerlies, trade winds) by old local navigators.
- v. The most important local wind is the _____ (Chinook, monsoon, Foehn) wind.
- vi. The word monsoon is an Arabic word which means _____ (season, wind, rain).
- vii. If pressure values of two places are the same _____ (no, strong, mild) wind generates, but when at one place pressure declines wind generates from high pressure area to low pressure area.
- viii. The planetary or global wind pattern is related to _____ (global atmosphere, global temperature, global pressure belts).
- ix. Because of the Coriolis force wind is deflected to the _____ (left, right, centre) in the Southern Hemisphere.

2. Answer the following questions. Use extra sheets, if required.

- i. Explain the difference between wind and air current.

- ii. Name the controlling factors of wind. Explain these factors in detail.

iii. What are seasonal winds? Name some seasonal winds.

iv. Explain the system of monsoon winds.

v. Why is low pressure created over mountains and high pressure over valleys?

3. Give one word answer for each of the following:

- i. Dry winds in the eastern slopes of Rocky mountains: _____
- ii. In the Alps region, Chinook wind is called: _____
- iii. Wind which generates when a body of cool air falls from a mountain top due to gravity and flows over a plain where it drops the temperature suddenly: _____
- iv. The province from which Karachi gets its winds in winter: _____
- v. In France the most famous wind that comes from the Alps: _____

SECTION 4

CYCLONES

Teacher's focus:

Cyclones are high speed, water-bearing winds that bring great devastation. They are circular, spiralling, or rotating winds that can reach speeds of 200 kph or more. In the Northern Hemisphere, these winds blow in an anticlockwise direction and are known as cyclones or cyclonic winds; in the Southern Hemisphere they blow clockwise and are known as anti-cyclones or anti-cyclonic winds. As cyclonic winds blow, an area of low pressure, called the eye, is created in the centre. This eye is the calmest part of the cyclone.

Cyclonic winds are created over oceans as a result of evaporation and low pressures. They have different names in different areas. They are broadly divided into tropical and temperate cyclones. Tornadoes and hurricanes are also devastating cyclonic winds.

Answer key

Questions and Activities

1.
 - i. Tropical cyclones form in the tropical seas and oceans. The region of the formation of tropical cyclones is between 20 degree north and south of the Equator. They form away from the Equator, where the Coriolis force is weak. Therefore generally, no tropical storms form between 5 degrees north and south of the Equator.
 - ii. Temperate cyclones form in the middle latitudes or temperate region, located at roughly 35 degree to 55 degree latitudes. These cyclones form as a result of two different air masses which cover areas of hundreds and thousands of sq km, having different temperature and moisture characteristics. When the dry, cool polar continental air mass moves southward and collides with warm moist tropical maritime air mass, a division line called front is formed.
 - iii. Tornadoes are local storms of short duration and are the most destructive natural force. In the United States, tornadoes are popularly called twisters. Tornadoes travel on land and the area where they pass is completely destroyed. Intense low pressure develops at the centre of a tornado, while winds rotate around it and a vacuum is created at the centre. The wind speed reaches up to 650 kph or more. When the dry, cool polar continental air mass moves southwards and collides with a warm, moist tropical air mass, a division line called a front is formed. Therefore temperate cyclones are also called frontal cyclones. They form as a result of the movements of warm and cold fronts.
2.
 - i. hurricane
 - ii. Bangladesh
 - iii. 200
 - iv. 20
 - v. frontal

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 67–70, *Oxford School Atlas for Pakistan*

Teaching objective:

- to make students aware of the causes and effects of cyclones

Learning outcomes:

Students should be able to:

- define a cyclone
- describe a tropical cyclone and its stages of development
- explain the devastating effects of cyclones

Lesson 1

Introduction (5 minutes):

Talk about natural disasters. If possible, try and show video clips that demonstrate the nature of a cyclone. Ask students if they have heard stories from cyclone survivors or witnessed one.

Explanation (30 minutes):

Read and explain the text. Explain the causes for cyclones. Discuss the different types of cyclones with details of how each kind is formed. Differentiate between each kind. Make a list of damages that can be caused by cyclones.

Conclusion (5 minutes)

Recap key points of the lesson by summing them up.

Lesson 2

Introduction (5 minutes):

Give instructions for classwork tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 70

WORKSHEET 16

Date: _____

Name: _____

1. Choose the correct answer.

- i. Meteorologists define _____ (cyclones, tsunamis, Chinooks) as low pressure areas.
- ii. Cyclones are severe storms in which wind speed reaches up to _____ (500, 100, 200) km per hour.
- iii. Tornado is also a severe type of cyclonic form that generates on _____ (land, oceans, water surfaces).
- iv. Tropical cyclones form in the _____ (Equatorial, polar, tropical) seas and oceans.
- v. In East Asian Pacific Ocean cyclones are called _____ (hurricanes, willy willy, typhoon)
- vi. In the seas of Australia and New Zealand tropical cyclones are identified as _____ (willy willy, twister, tornado).
- vii. Dark clouds called _____ (cumulonimbus, cirrus, cumulus) form because of the vertical movement of air and cause heavy rain.
- viii. The centre of storm is calm and is called the _____ (nucleus, eye, pin) of the cyclone.
- ix. Whenever tropical cyclones reach the coast they _____ (lose, gain) their energy. This is the (decay, regeneration, turning) stage of the tropical cyclone.
- x. The decay stage of temperate cyclones is called _____ (occlusion, occasion, collision).

2. Answer the following questions. Use extra sheets, if required.

- i. Explain the formation of tropical cyclones.
- ii. What kind of damage do tropical cyclones cause?
- iii. Name the countries most affected by tropical cyclones.
- iv. Explain the formation of temperate cyclones.
- v. What are tornadoes? How are they formed?
- vi. How have tornadoes affected USA?

Chapter 6

Atmospheric humidity and precipitation

SECTION 1

HUMIDITY IN THE ATMOSPHERE

Teacher's focus:

Evaporation is a process through which liquids change into a gaseous state as a result of high temperatures. The atmosphere contains water in a gaseous state, which is known as water vapour. Water vapour is formed when water present on the surface of the Earth heats up and evaporation takes place. Water vapour is warm, lighter than air, and rises into the atmosphere. Humidity is the amount of water vapour present in the atmosphere. Higher temperatures lead to a higher rate of evaporation, which in turn releases more water vapour into the atmosphere, thus increasing humidity. Humidity is the key indicator of precipitation.

It is measured as:

- specific humidity
- relative humidity
- absolute humidity

Specific humidity compares the weight of water vapour to the weight of specific mass of air. Relative humidity compares the amount of humidity present in the atmosphere to the maximum amount the atmosphere can hold. Absolute humidity compares the weight of water vapour to a specific volume (not weight) of air.

Answer key

Questions and Activities

- i. The changing of matter from solid state directly to a gaseous state is called sublimation. In nature, snow (solid state) changes into water vapour (gaseous state) directly. This is an example of sublimation.
 - ii. Humidity is measured and expressed in three ways: absolute humidity, specific humidity, and relative humidity. Absolute humidity is the weight of water vapour in a given volume of air. Specific humidity is the weight of water vapour per weight of a given mass of air, including the water vapour. Relative humidity is the ratio of the amount of water vapour in

DISCOVERY 2

Teaching Guide

- the air and the capacity of the air to hold it.
- iii. Humidity is measured using an instrument called a hygrometer.
2. i. specific humidity ii. humidity iii. decreases iv. factories
v. evaporation

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 72–73, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain to students what humidity is and its importance in the atmosphere
- to make students aware of the kinds of humidity and their measurements

Learning outcomes:

Students should be able to:

- explain what is meant by humidity
- explain the importance of humidity in the atmosphere
- discuss the kinds of humidity and their measurements

Lesson 1

Introduction (5 minutes):

Ask students if they experience a sticky and clammy feeling and increased sweating during the summer. Explain that it is due to water vapour in the atmosphere and the quantity of water vapour in the atmosphere depends upon evaporation.

Explanation (30 minutes):

Read and explain text. Explain the concept of humidity, the quantity of water vapour in the atmosphere and the factors that regulate this quantity. Tell them about the different kinds of humidity and how they are measured.

Conclusion (5 minutes):

Recap the lesson by highlighting key points. Ask questions.

Lesson 2

Introduction (5 minutes):

Instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1 and 2 on page 73

Homework: Read and revise text.

WORKSHEET 17

Date: _____

Name: _____

1. State whether True or False.

- i. Humidity is a general term used to describe the amount of water vapour or moisture in the atmosphere.
- ii. Water vapour is a white gas that mixes freely with the other gases in the atmosphere.
- iii. Absolute humidity is generally used in factories or in engineering works to measure amounts of moisture.
- iv. Specific humidity is not affected by changes in pressure or temperature.
- v. The term which is most commonly used to describe the moisture content of air is specific humidity.
- vi. Relative humidity is usually expressed as a percentage.
- vii. Hot air has a lesser capacity to hold vapour than cold air.
- viii. With an increase in temperature, the relative humidity decreases.
- ix. If the amount of water vapour increases, relative humidity decreases.
- x. Humidity is measured with an instrument called a hygrometer.

2. Answer the following questions. Use extra sheets.

- i. What is the chief characteristic of water vapour? How is it helpful?
- ii. What is evaporation?
- iii. What is latent energy?
- iv. Apart from evaporation, by which other process can water vapour form?

SECTION 2

CONDENSATION AND CLOUDS

Teacher's focus:

Condensation is the process through which water vapour (gaseous form) in the atmosphere cools down to form water droplets (liquid form). It is the opposite of evaporation. Water vapour in the atmosphere is actually water that has evaporated from surface of the ocean, sea, and other water bodies. . Because it is light, water vapour rises up into the atmosphere and as it condenses, it collects as water droplets. Humidity is the amount of water vapour in the atmosphere. The higher the temperature, the greater is the rate of evaporation and humidity. A greater rate of humidity means more condensation in the atmosphere. Millions of condensed water droplets collect to form clouds. When the atmosphere is completely saturated with water, i.e. the clouds cannot hold any more water, the water falls back to Earth as precipitation—rain, snow, hail, sleet.

Evaporation, condensation, and precipitation are parts of the water cycle; this means that water in the atmosphere is never lost as it keeps moving from land and water surfaces to the sky and back.

There are different kinds of clouds. Their classification is based on their appearance or description, formation, and purpose.

Answer key

Questions and Activities

1.
 - i. Condensation is the conversion of water vapour into tiny water droplets.
 - ii. Three types of clouds can be recognized on the basis of their shapes:
Cirrus: Cirrus clouds are high clouds. They have a feathery appearance.
Cumulus: The cumulus forms a globular structure like a dome. Such clouds are frequently described as having a cauliflower-like structure.
Stratus: The stratus clouds are described as sheets or layers that cover much or all of the sky.
Apart from these three basic forms, all other clouds are formed by a combination of these clouds, such as cirrocumulus, cirrostratus, stratocumulus, etc. These clouds are also classified on the basis of height as high clouds (above 6000 m), middle clouds (2000 m to 6000 m), and low clouds (below 2000 m). Cirrus, cirrocumulus, and stratus are high clouds. Altocumulus and altostratus are middle clouds. Stratocumulus, stratus, and nimbostratus are low clouds. Another type of cloud which forms vertically, is called cumulonimbus. These are dark clouds and indicate heavy rain, while cirrus and cumulus indicate fair weather conditions.
 - iii. Fog is another form of condensation. It is simply called surface cloud because it is commonly observed a few metres above the ground. In other words, fog is defined as a cloud with its base at or very near the ground. It is common in winter.

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2. i. frost ii. hail iii. weather iv. troposphere
v. smog.

3.

Name	Height	High, Middle, Low
altocumulus and altostratus	2000 m to 6000 m	middle clouds
stratocumulus, stratus, and nimbostratus	below 2000 m	low clouds
cirrus, cirrocumulus, and cirrostratus	above 6000 m	high clouds

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 74–77, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to make students aware of the concept of condensation
- to highlight the difference between condensation and evaporation
- to illustrate the link between condensation and cloud formation

Learning outcomes:

Students will be able to:

- explain the process of condensation
- explain the difference between condensation and evaporation
- explain the link between condensation and cloud formation
- state the importance of condensation

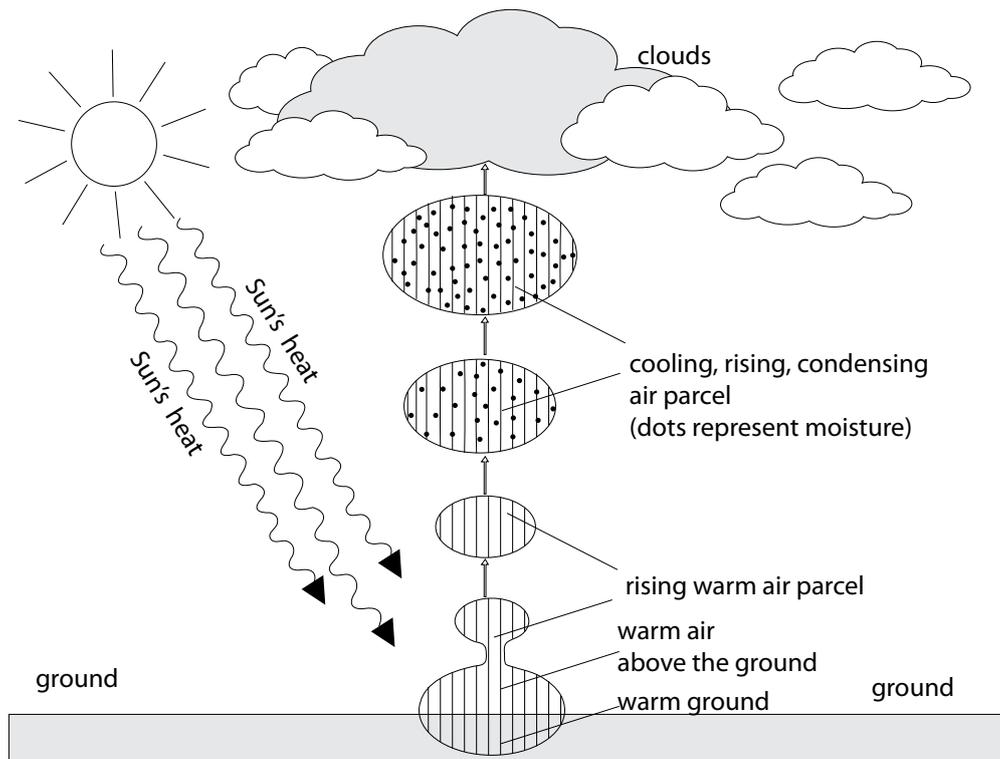
Lesson 1

Introduction (10 minutes)

Pour water on a towel or sponge, little by little, and then wet it completely. Squeeze out the water. Briefly explain condensation, cloud formation, and precipitation using the three steps of the experiment.

Ask students if they have noticed/observed/seen the following: dew collecting on cars and flowers in the morning, moist chairs at weddings or other outdoor functions at night. Also ask if they have noticed water droplets outside a bottle/glass of cold water or a cold drink, and how it starts trickling down if left out for a long time. Ask them if they know why that happens. Explain that the water vapour in the atmosphere condenses into dew.

Use this diagram to explain cloud formation.



Explanation (25 minutes):

Read and explain text. Explain how water vapour condenses in the atmosphere, leading to cloud formation and precipitation.

Conclusion (5 minutes):

Recap key points. Ask questions to check understanding.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–3 on page 77

Homework: Read and revise text. Do Worksheet 18.

WORKSHEET 18

Date: _____

Name: _____

1. Choose the correct answer.

- i. Condensation is the conversion of water vapour into tiny water _____ (droplets, cycle, table).
- ii. The result of _____ (evaporation, precipitation, condensation) may appear in the form of dew, fog, or clouds.
- iii. Condensation starts when the air is _____ (hot, cold, saturated).
- iv. A type of cloud which forms vertically, is called _____ (stratus, cirrocumulus, cumulonimbus).
- v. Cumulonimbus are dark clouds and indicate _____ (heavy rain, drought, heavy snowfall).
- vi. Cirrus and cumulus indicate _____ (cloudy, sunny, fair) weather conditions.

2. Answer the following questions. Use extra sheets.

- i. Why does air become saturated? What happens as a result of this saturation?
- ii. Explain the levels at which saturation takes place.
- iii. Name and explain the forms of condensation.

SECTION 3

PRECIPITATION AND ITS TYPES

Teacher's focus:

Precipitation is the process by which water falls back to the Earth in the form of rain, snow, or hail. Water that evaporates from land and water surfaces due to high temperatures condenses in the atmosphere, where temperatures are cooler. The warm air rises and water vapour cools down, creating water droplets. Millions of these droplets join and form clouds. As clouds form, they keep collecting water droplets till such time that they cannot collect any more. Eventually it comes back to the ground in the form of rain, snow, drizzle, glaze, sleet, or hail.

The kind of precipitation that occurs depends on the atmospheric temperature, pressure, and altitude of a place. Temperature and pressure decrease with altitude. The size of water droplets also affects precipitation, as the smaller the droplets, the lesser the precipitation.

Answer key

Questions and Activities

1.
 - i. The word precipitation is used for both rainfall and snowfall.
 - ii. Sleet is a winter phenomenon and refers to the fall of small particles of ice. Sleet is also called ice pellets. Sleet occurs when snow falls through a warmer layer of air and melts. Some of it refreezes and forms pellets. Sleet can also be a mixture of rain and ice pellets.
Glaze is also called freezing rain. It occurs when rain falls on a surface that has a temperature below freezing. The rain freezes on contact, gradually building up a layer of ice.
Hailstones are small balls of ice. Hail forms in the dark cumulonimbus clouds. A large hailstone may be upto 5 cm in diameter.
Drizzle is often called mist. It is made up of very small water droplets which appear to float in the air. It forms in low clouds like stratus clouds.
In all areas except the warm tropical and equatorial regions, precipitation forms initially in the form of ice crystal. When they are close to the ground, and if the temperature is high enough, they melt and fall in the form of large water droplets called rain. If the temperature at the lower level is below freezing point, ice crystals called snow fall on the surface of the ground.
 - iii. The circulation of winds like the monsoon winds in particular regions, and the development of fronts also cause heavy rainfall. In South Asia, India, Bangladesh, Pakistan, etc. rainfall mainly occurs in the summer season because of the summer monsoon winds called the south-west trade winds.
 - iv. It is simply an open container in which rain water accumulates and is measured either in millimetres, centimetres, or inches. However, an international standard has been used to design rain gauges. To measure the amount of snowfall a ratio of snow and water is used

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- which is generally 10 units of snow is equal to 1 unit of water. This means that for every 10 cm of snow, precipitation is 1 cm.
2.
 - i. precipitation
 - ii. pellets
 - iii. 2.5
 - iv. rain gauge
 - v. Cherrapunji

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 78–81, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to highlight the effects and importance of precipitation
- to make students aware of the concept and types of precipitation

Learning outcomes:

Students should be able to:

- explain the concept and types of precipitation
- discuss the effects and importance of precipitation

Lesson 1

Introduction (5 minutes):

Recap previous lesson. Explain the meaning of precipitation and write down the different kinds of precipitation on the board. Ask students what kind of precipitation they have seen, i.e. rain, snow, hail, etc.

A small experiment can also be conducted to make the lesson more interesting. Containers (glass, bowl, cup, etc.) filled with water can be kept in the classroom, with Container A left open and Container B covered with a transparent plastic bag. The transparent bag represents the atmosphere. Observe that the water level in Container A will decrease as water will evaporate. The plastic bag over Container B will have water droplets, and those will eventually fall back into the container. This will explain evaporation and condensation, and how water falls back to Earth.

Explanation (30 minutes):

Read and explain text. Make the connection to the previous lesson and discuss why precipitation occurs. Explain the kinds and clarify how each type occurs. Differentiate between them.

Conclusion (5 minutes):

Summarize key points.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 81

Homework: Read and revise text. Do Worksheet 19.

WORKSHEET 19

Date: _____

Name: _____

1. State whether True or False.

- i. The word precipitation is used for both rainfall and snowfall.
- ii. Clouds produce precipitation.
- iii. All clouds contain water and all clouds produce precipitation.
- iv. Rain and snow are the two most uncommon forms of precipitation.
- v. Sleet can never be a mixture of rain and ice pellets.
- vi. Sleet occurs only during the winter, while hail may fall at any time of the year.
- vii. A large hailstone may be 15 cm in diameter.
- viii. In all areas except the warm tropical and equatorial regions, precipitation forms initially in the form of ice crystal.
- ix. Precipitation on the Earth's surface is not uniform.
- x. Some areas of the world are extremely wet while other areas are extremely dry and have desert-like characteristics.

2. Complete the following statements.

- i. The highest rainfall in the world was recorded at _____.
- ii. Subtropical deserts include _____.
- iii. Some of these subtropical deserts have total annual rainfall of _____.
- iv. Hail forms in _____.
- v. Drizzle is often called _____.

3. Differentiate between:

- i. Mist and drizzle

- ii. Sleet and glaze

Chapter 7

Agriculture

SECTION 1

TYPES OF FARMING

Teacher's focus:

Agriculture is considered to be a life sustaining occupation in every country. No matter how highly industrialized or technologically advanced a nation becomes, it will always be dependent on agriculture, which provides us with food. Food is a basic need for all forms of life. Agricultural products are also the raw material for many industries. Such industries are called agro-based industries. Sugar mills, cotton and silk mills, jute and rubber factories, and tobacco, tea and coffee industries are examples of industries that depend on agricultural products. Components of agriculture include growing crops, cattle and dairy farming, fish breeding, and sheep shearing. Out of all these, growing crops is the most important component as all others are dependent on it.

There are different kinds of farming. The choice of each kind depends upon the climate, terrain, need and nature of crops and factors available for producing crops.

Answer key

Questions and Activities

1.
 - i. It is a type of farming in which farmers grow crops only for themselves and their families.
 - ii. Selling surplus crops for local markets and exports is called commercial farming.
 - iii. Agricultural land is the most important natural resource in the world since it is a means of providing food and clothing for the human population of the world. It is an important source of raw materials for industries like textiles, food processing, leather, and rubber. Agriculture provides employment for the rural population of the world. Agriculture is the backbone of the economies of the world's less-developed countries.
 - iv. It includes cultivation as well as animal rearing such as cattle farming, and poultry farming.
 - v. People live in different countries which vary in terms of their physical characteristics such as relief, climate, vegetation, and social, economic, and technological development.
2.

i. economies	ii. monsoon	iii. steppes	iv. cash
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3.

i. True	ii. True	iii. False	iv. True	v. False
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Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 82–86, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to make students aware of the importance of agriculture
- to explain the different kinds of farming

Teaching outcomes:

Students should be able to:

- discuss the importance of agriculture
- describe major types of farming

Lesson 1

Introduction (5 minutes):

Ask students if they have seen farms and agricultural fields, and what they have observed. Discuss what would happen if there was no agriculture and how agriculture is one of the oldest known professions. Write down relevant and important points on the board.

Explanation (30 minutes):

Read and explain text. Focus on the importance of agriculture and how agriculture-based countries contribute to the global economy. Explain the different kinds of farming.

Conclusion (5 minutes):

Explain that even if an economy is highly industrialized, it cannot manufacture goods without agricultural crops. Even industrial/commercial products, such as chips or biscuits cannot be manufactured without food crops. Recap the main points of lesson.

Lesson 2:

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 86

Homework: Read and revise text and complete Question 3 on page 86

WORKSHEET 20

Date: _____

Name: _____

1. Choose the correct answer.

- i. Agricultural _____ (produce, countries, land) is an important global resource which provides food and clothing to the human population of the world.
- ii. Shifting cultivation is a primitive type of _____ (subsistence, intensive, extensive) farming.
- iii. Subsistence farming is common in the _____ (river, mountainous, forest) regions of Southeast Asia, Central Africa, and Amazon region.
- iv. Market gardening is a common example of _____ (subsistence, cattle, intensive) farming in European countries.
- v. Temperate grasslands in Russia, Ukraine, and Kazakhstan are called _____ (steppes, pampas, prairies).

2. Answer the following questions. Use extra sheets.

- i. What is agriculture? What does it include?
- ii. Why are industries and trade dependent on agriculture?
- iii. Why do agricultural practices vary all over the world?
- iv. Name the most common kinds of farming.
- v. What is intensive subsistence farming?
- vi. Explain the difference between mixed farming, livestock ranching and dairy farming.

3. Write the name of the correct type of farming next to the description:

- i. Farmers grow crops only for themselves and there are no surplus crops. _____
- ii. Farming that needs high inputs of money or labour per unit of land for a high yield.

- iii. Type of farming in which inputs per unit of land are low, it covers a large area and cereals are grown. _____
- iv. A kind of farming is practised in the monsoon lands of Asia, like Pakistan, India, etc.

- v. Commercial agriculture practised in the tropical lands of Southeast Asia, Africa and Central and South America. Farms are unusually large, generally one cash crop is grown. _____

SECTION 2

AGRICULTURE IN PAKISTAN

Teacher's focus:

Pakistan is largely an agricultural country. There has been no significant scientific development or technological advancements in agricultural practices and the farmers of Pakistan use traditional farming methods. However these methods are still very reliable and effective to a great extent.

Water is a vital component of agriculture and Pakistan depends on water from the Indus and its tributaries for irrigation. This is called irrigated agriculture, and it allows a variety of crops to be grown throughout the year. In dry and arid regions like the Thar Desert and parts of Khyber Pakhtunkhwa and Balochistan where river water cannot be channelized and farmers depend on rainfall, few hardy crops can be grown at certain times of the year. This is called rain-fed agriculture.

The main crops of Pakistan are wheat, rice, sugarcane, cotton, pulses, and a variety of fruit and vegetables. Date farming is also being practised in some parts of Pakistan.

Answer key

Questions and Activities

1.
 - i. Wheat is the staple food of the country and dominates all other crops in terms of cultivated area and production.
 - ii. Northeastern Punjab: Sialkot, Gujranwala, Sheikhupura, Narowal, Hafizabad Districts. Sindh: Larkana, Shikarpur, Jacobabad, Badin, Thatta. Balochistan: Nasirabad and Jaffarabad Districts.
 - iii. Cotton is the main cash crop in Pakistan. Cotton is mainly consumed in making cotton yarn and cloth. Cotton and its products like yarn, cloth, garments have the leading share of the total export of Pakistan.
 - iv. Canals, tube wells, and karez are the main sources of irrigation in Pakistan.
 - v. Pakistan produces four tropical fruits, namely citrus fruits, mangoes, bananas, and dates. Punjab is the leading producer of citrus fruits which account for 99 per cent of the total fruit production in this province. Balochistan produces 75 per cent of dates. Punjab produces 52 per cent of mangoes, while Sindh produces 47 per cent of the total mango production. Sindh is the leading producer of bananas which account for 90 per cent of the total production.
 - vi. Fruits like apples, apricots, almonds, and grapes are called temperate fruits. In Pakistan most of them are grown in the highlands of Balochistan, in Kalat, Ziarat, and Zhob, and in Khyber Pakhtunkhwa in Mansehra, Dir, Swat, and Chitral.
 - vii. Agriculture is the backbone of the economy as it is the major contributor to the national income.

- viii. The windmill was invented by the Arabs as early as 644 CE. It was used to pump water for irrigation. Fertilizers to enrich the soil were introduced by the Arabs in 1000 CE.
2. i. Punjab ii. Punjab iii. 40 iv. bananas
v. cropping
3. i. True ii. True iii. False iv. False v. True
vi. False vii. True

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 87–96, *Oxford School Atlas for Pakistan*

Teaching objective:

- to make students aware of agriculture, agricultural practices, and crops typical to Pakistan

Teaching outcomes:

Students should be able to:

- describe Pakistan's agricultural system and its uniqueness
- describe irrigated and rain-fed agriculture in Pakistan
- name the major crops of Pakistan

Lesson 1

Introduction (5 minutes):

Discuss the Indus River system with students. Trace its route on the map in the *Oxford School Atlas for Pakistan*. Ask students what they think happens in places where river water cannot be diverted. Talk about different crops and how different crops have varying water needs.

Explanation (30 minutes):

Read and explain text. Focus on the concepts of irrigated and rain-fed agriculture, and the nature and importance of crops grown in Pakistan. Make a column on the board and write the salient features of irrigated agriculture on one side and rain-fed agriculture on the other. Compare the two.

Conclusion (5 minutes):

Recap key points. Ask questions to gauge understanding.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–3 on page 95

Homework: Read and revise text. Research activity on page 96

WORKSHEET 21

Date: _____

Name: _____

1. Choose the correct answer.

- i. Pakistan is an _____ (agricultural, mining, industrial) country.
- ii. Agriculture employees about _____ (50, 40, 68) per cent of the total labour force.
- iii. The area under _____ (wheat, rice, millet) cultivation has increased from 4 million hectares in 1947–48 to 9 million hectares in 2010.
- iv. About _____ (60, 75, 90) per cent of wheat area is irrigated.
- v. The plains of _____ (Swat, Jhelum, Indus) rivers dominate the wheat area.
- vi. _____ (Basmati, Irri, Brown) rice is mostly exported to the Middle East.
- vii. Pakistan has the fourth largest _____ (cotton, rice, wheat) acreage and production in the world.
- viii. About 40 per cent of tomatoes come from _____ (Punjab, Sindh, Khyber Pukhtunkhwa).
- ix. Punjab produces 80 per cent of total _____ (tomato, potato, millet) production.
- x. Temperate fruits grow in _____ (mild, warm, cool) temperature climates.
- xi. Fruits like apples, apricots, almonds, and grapes are grown in the highlands of _____ (Sindh, Khyber Pukhtunkhwa, Balochistan)

2. Fill in the blanks.

- i. More than 90 per cent of rice is grown in _____ and _____ provinces.
- ii. Rice needs a _____ climate which does not exist in Pakistan.
- iii. The two main regions where rice is grown are _____-irrigated areas.
- iv. The area under fruit cultivation in Pakistan is about _____ per cent of the total cultivated area.
- v. Sindh produces 80 per cent of _____ and 40 per cent of _____.

3. Answer the following questions.

i. Name the regions where wheat, sugar cane, cotton, and rice are grown.

ii. On the given map of Pakistan, shade the following:



- a. wheat growing areas, brown
- b. sugarcane growing areas, green
- c. cotton growing areas, blue
- d. rice growing areas, yellow

4. Briefly answer the following questions. Use extra sheets, if required.

i. What is the contribution of agriculture to Pakistan's economy?

ii. Comment on the traditional and modern farming equipment, methods, and developments in Pakistani agriculture.

iii. Name the two kinds of agriculture practised in Pakistan.

iv. On what basis have these two kinds of agriculture been categorized? Explain both types with the reasons.

v. What is mountain agriculture?

vi. What are the cropping seasons of Pakistan called?

vii. List the main crops of Pakistan with the seasons they grow in.

viii. Briefly explain the nature and purpose of the major crops (excluding fruits and vegetables) of Pakistan.

ix. Explain what is meant by livestock farming. Why is it important?

SECTION 3

IRRIGATION SYSTEM OF PAKISTAN

Teacher's focus:

Irrigation refers to the system of supply of water to farms and fields for agricultural purposes. Not all agricultural land is located near rivers or other fresh water bodies. For this reason, water has to be diverted or brought to agricultural fields in such areas. The method of bringing water depends upon the terrain and climate of a place. The economy of a country also determines the availability of latest and effective methods of irrigation to the farmers.

Pakistan has a unique irrigation system. The River Indus and its tributaries ensure a consistent water supply through a network of canals, dams, and reservoirs. The tubewell, karez, and shaduf systems are helpful in pumping sweet groundwater.

Answer key

Questions and Activities

1.
 - i. Irrigation is necessary for Pakistan because the country does not receive enough rain to satisfy the needs of agriculture.
 - ii. Dams are built on rivers. They have water reservoirs used for storing water. Canals are also taken out from dams. Canals are seasonal and perennial. Seasonal canals provide water to crop for one season like rice canal in Larkana provides water only for *kharif* crops. Perennial canals provide water for both *rabi* and *kharif* crops.
 - iii. Karez is a water tunnel. The karez system is an old method of irrigation. In Pakistan. It is only practiced in Balochistan. In Iran it is called qanat. It starts from the base of a hill or mountain where ground water is present. It runs for 1 or 2 km or sometimes more underground before it emerges on the surface The source well is called mother well while other wells are called shafts. Recently the karez has begun to be replaced by wells.
 - iv. The problems faced by Pakistan in agriculture are both man-made and natural. Aridity, rugged topography, infertile soil, and soil erosion are some of the natural problems. Waterlogging, salinity, lack of mechanization, poor water distribution, and pests are some of the man-made problems.
 - v. The different methods of irrigation are lift irrigation, tube wells, canals, and karez.
2.
 - i. canals ii. karez iii. low and unreliable iv. semi-arid
 - v. canal

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 97–102, *Oxford School Atlas for Pakistan*

Teaching objective:

- to familiarize students with the irrigation system of Pakistan

Teaching outcomes:

Students should be able to:

- describe the irrigation system and methods of irrigation practised in Pakistan
- discuss the importance of irrigation in Pakistan

Lesson 1

Introduction (5 minutes):

Collect pictures or prepare diagrams of all the methods of irrigation. Display them on class boards and briefly summarize the content of the lesson using the images as support.

Explanation (30 minutes):

Read and explain text. Highlight key points of each method. Compare the various types.

Conclusion (5 minutes):

Summarize the key points of the topic and write them on the board. Highlight the differences and similarities between the various methods.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 102

Homework: Read and revise text. Do Worksheet 22.

WORKSHEET 22

Date: _____

Name: _____

1. Choose the correct answer.

- i. The oldest method of irrigation in Pakistan is _____ (lift, karez, tubewell) irrigation.
- ii. Pakistan is a country where rainfall is _____ (low, high) and highly variable.
- iii. Because of the _____ (abundance, saltiness, scarcity) of water, both rivers and underground sweet water are used for irrigation.
- iv. Canals, tube wells, wells, karez, and diversion canals or channels are means of _____ (irrigation, removing salinity, preventing waterlogging) in Pakistan.
- v. Karez is a water _____ (path, reservoir, tunnel).
- vi. In Iran, karez is called _____ (*dhenkli, shaduf, qanat*).
- vii. Canals irrigate about _____ (88, 78, 68) per cent of the total irrigated land.
- viii. Seasonal _____ (*shadufs, canals, rivers*) provide water to crops for one season.
- ix. Pakistan is not _____ (self-sufficient, dependent, reliable) in producing food resources.
- x. Unlined canals are the main cause of _____ (waterlogging, salinity, plant diseases).

2. Answer the following questions. Use extra sheets, if required.

- i. Why does Pakistan's agriculture depend on irrigation?

- ii. a) Explain lift irrigation.

- b) Where in Pakistan is lift irrigation practised?

- c) Explain tube well irrigation.

- iii. Make a list of the problems faced by Pakistan's agriculture.

3. State whether True or False.

- i. Most of Balochistan as well as parts of Khyber Pukhtunkhwa have a flat terrain.
- ii. Among the natural problems of agriculture, aridity is the main threat to agriculture.
- iii. In a tube well, the source well is called mother well while other wells are called shafts.
- iv. Sukkur, Guddu, and Kotri have dams.
- v. Crops can be easily cultivated without soil cover.
- vi. Pakistan is fortunate that it has fertile alluvial soil, deposited by the Indus River in the vast areas of its plains.
- vii. Tractors, combines, threshers are machines used in agriculture.

Chapter 8

Mining and power

SECTION 1

MINING AS AN EXTRACTIVE INDUSTRY

Teacher's focus:

A country's wealth consists of its man-made and natural resources. Natural resources consist of geographical factors and physical features such as flat, fertile land, river system, climate, etc., all of which facilitate agriculture. The presence of minerals as a natural resource also adds to the wealth of a nation. Minerals are found underground as ore, which is their raw form. The process of obtaining or extracting mineral ore is called mining. After ore is extracted from the ground, it is sent for processing.

There are five kinds of mining processes. Any of these processes can be used for extracting ore. The selection depends on the nature and location (including depth) of the ore. The five typical methods are:

- hand panning
- adit tunnel
- shaft tunnel
- open pit
- mining

Not all minerals can be mined. The time, money, and effort spent on mining have to be worth the returns.

Answer key

Questions and Activities

- Minerals that are deposited at a shallow depth can be extracted through the open-pit method, in which a pit or burrow is dug. Mining takes place after removing the overburdens like rocks, debris, or water. In Pakistan, limestone, chromite, and copper are mined in this manner.
 - The location of mineral deposits is an important factor to be considered before mining is undertaken. It may not be cost effective to invest in mining in marshy areas, dense forests, and deserts. These areas may be difficult to access and huge costs may be incurred in transporting heavy machinery and personnel. In such cases, mining is not carried out in spite of known deposits.

- iii. Deeply-deposited minerals are difficult to extract. For this a shaft has to be bored from the surface downwards to reach the mineral. Mining takes place through this shaft.
2.
 - i. non-metallic

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 103–107, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to make students aware of the concept and importance of mining
- to familiarize students with the mining process and the conditions under which mining can be carried out
- to explain the classification of minerals into different groups

Learning outcomes:

Students should be able to:

- explain the importance of mining and minerals
- describe the mining process
- discuss the conditions under which mining can be carried out

Lesson 1

Introduction (5 minutes):

Ask students if they know where gold, marble, salt, iron, etc. are found, or how we get them. Ask them if they can think why gold is so expensive. Introduce the concept of minerals and mining.

Explanation (30 minutes):

Read and explain text. Explain keywords like mining, extraction, ore, cost effective, and overburden. Write down names of all the processes of mining on the board and differentiate between each process. Discuss why mining is important and why it can be unsustainable at times.

Conclusion (5 minutes):

Recap main points. Write the names of mineral groups on the board and ask students if they can come up with more names.

Lesson 2

Introduction (5 minutes):

Give instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 107

Homework: Read and revise text. Do Worksheet 23 at home.

WORKSHEET 23

Date: _____

Name: _____

1. Explain the following words:

i. cost effective

ii. mining

iii. extract

iv. overburden

v. ore

2. Answer the following questions.

i. What mineral was used by people of earliest times?

ii. What kind of an industry is mining? Why is mining important?

iii. How are minerals obtained?

iv. Why is mining an important economic activity?

3. Name the techniques for mining the following minerals.

i. coal and salt _____

ii. grains of gold and other precious minerals _____

iii. oil and gas _____

iv. limestone, chromite, and copper and other minerals at shallow depth _____

v. gold, silver, copper, and other precious metals in hard underground rock

SECTION 2

IMPORTANT MINERALS AND POWER RESOURCES OF PAKISTAN

Teacher's focus:

Pakistan is a country that has been blessed with a variety and abundance of natural resources. Minerals are one of Pakistan's numerous treasures, and Pakistan is famous for its fine marble and onyx, making Pakistan's marble industry one of the finest in the world. The Gilgit-Baltistan area produces gemstones like ruby, emerald, opal, jade, and amethyst. Gas deposits are found in Sui, Balochistan. Coalmines have been discovered in Lakhra, Sindh. Salt mines are found in Khewra and the Salt Range. Other key minerals include gypsum, chromite, soapstone, clay, and limestone. Besides these, a large variety of lesser important minerals are found all over Pakistan.

Mineral deposits are very important for Pakistan's economy and progress. Coal and gas deposits provide fuel to power plants and many other industries, in addition to houses.

Answer key

Questions and Activities

1.
 - i. Chromite in Muslim Bagh, Balochistan; iron ore in Kalabagh, and copper, in Saindak, Balochistan
 - ii. Limestone in Potwar Plateau, Pezu in Dera Ismail Khan, Zindapir in Dera Ghazi Khan, Ganjo Takkar in Hyderabad, and Rohri Hill, Makli Hill, and Pir Mangho in Karachi
Barite: Khuzdar, and Kundi in Balochistan and some other locations
Salt: the Salt Range
Marble: in Mullagori in Khyber Agency, Ghundai Tarko in Mardan, and Chagai in Balochistan
Coal: Punjab, in the Salt Range at Makarwal; in Balochistan, at Khost-Sharig-Harnai, Sor Range, and Mach; in Sindh, at Lakhra, and the Jhimpir-Meting area
China clay and soapstone: Shah Dari in Swat and soapstone from Sherwan, Abbottabad
 - iii. Oil, gas, hydroelectricity, and coal are the main sources of energy in Pakistan. In addition to these, and to a lesser degree, resources like LPG (Liquified Petroleum Gas), CNG (Compressed Natural Gas), and nuclear energy are also used. Solar power and biogas are also gradually being introduced as sources of energy.
2.
 - i. Sui
 - ii. 1974

Lesson plan

No of lessons: 3

Duration: 40 minutes each

Resources: Textbook pages 108–115, *Oxford School Atlas for Pakistan*

Teaching objective:

- to make students aware of Pakistan's mineral and energy resources

Learning outcomes:

Students should be able to:

- name the types of minerals found in Pakistan and their key regions
- name the types of power and energy resources of Pakistan and their key regions

Lesson 1

Introduction (5 minutes):

Make columns on the board and write the names of Pakistan's metallic and non-metallic minerals (with the regions they are found in). Locate these regions on the map of Pakistan in the *Oxford School Atlas for Pakistan*.

Explanation (30 minutes):

Read and explain text. Focus on the nature, use, and location of each kind of mineral deposit.

Conclusion (5 minutes):

Recap key points. Use Activity questions involving maps, as a concluding activity.

Lesson 2

Introduction (5 minutes):

Explain to students what power resources are. Talk about the importance of electricity as a power resource. Ask students to think of alternative energy resources and how energy/power can be generated using such resources.

Explanation (30 minutes):

Read and explain text. Focus on the nature, use, and location of each kind of energy source.

Conclusion (5 minutes):

Recap key points.

Lesson 3

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 115

Homework: Read and revise text. Do Worksheet 24.

WORKSHEET 24

Date: _____

Name: _____

1. Complete the table.

Name of mineral	Category	Found/mined in	Uses
Salt			
Marble			
Coal			
Limestone			

Chromite			
China clay and soapstone			
Barite			

2. State whether True or False.

- i. Pakistan has enormous deposits of non-metallic minerals like rock salt, limestone, marble, gypsum, soapstone, china clay, fire clay, barite, etc.
- ii. Chromite is the only metallic ore mined on a commercial scale.
- iii. The coal deposits of Pakistan are generally of a high quality.
- iv. The Pakistani coal contains a high percentage of carbon and a high percentage of impurities like sulphur and ash.
- v. The thermal electricity plant at Lakhra, Sindh, uses coal as fuel.
- vi. Oil, gas, hydroelectricity, and coal are the main sources of energy in Pakistan.
- vii. Solar power and biogas have been rejected as sources of energy.

Chapter 9

Industry

SECTION 1

TYPES OF INDUSTRIES

Teacher's focus:

An industry is a unit or a collection of units that convert raw material into finished goods for consumers. The term refers to all activities, material, processes, places, and movements involved in the production of goods in exchange for money or services.

Raw material is either used to manufacture totally new products or it is further processed into refined goods. Industrialised nations are considered to be highly developed nations as they can process indigenous products for themselves as well as earn foreign exchange by exporting the surplus. It decreases dependence on other nations. For any nation, industries are important because they increase the self-sufficiency of a nation and its ability to sustain itself, thereby decreasing its dependency on other countries. Industries bring in foreign exchange, provide employment, and utilize resources as raw material.

However, the negative consequences of industrialization is the opportunity cost of using agricultural land and other resources, increased pollution, and increased costs.

Several factors come into play for the smooth regulation of industries. The availability of raw material, capital, sufficient power to run industrial machinery, cheap and skilled labour, transport and infrastructure, industry-friendly government policies, and a steady market are all extremely important. In the absence of one or more, industries can suffer greatly.

Answer key

Questions and Activities

1.
 - i. In processing industries, raw materials are changed and made suitable for use by manufacturing industries.
 - ii.
 - a. availability of raw materials
 - b. availability of electricity
 - c. distance from the market
 - d. transport costs

- e. availability of labour
 - f. capital
 - g. government policies
2. i. processing ii. market iii. production iv. seeds
- v. ore

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 117–120, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain the importance of industries
- to describe the different kinds of industries
- to discuss the factors that affect industrial production

Learning outcomes:

Students should be able to:

- describe different kinds of industries
- explain the importance of industry for a nation
- discuss the factors that support industries

Lesson 1

Introduction (5 minutes):

Talk to students about goods they consume in their daily lives, such as clothes, shoes, bags, sugar, tea, etc. Explain that all of these goods have to undergo certain processes before they are available at shops. Introduce the keywords manufacturing, factories, and industries.

Explanation (30 minutes)

Read and explain text. Explain the meaning of industry, raw material, and key concepts such as production. Emphasize the importance of industries for the growth and development of countries. Ask students what they know about industries and factories in Pakistan. After studying the agriculture of Pakistan in previous chapters, ask what they think about the kind of raw materials Pakistani factories would utilize? Discuss the different kinds of industries and clarify the difference between manufacturing and processing. Write down the factors affecting industries on the board. Ask students how they think each factor contributes to the promotion of industry.

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Conclusion (5 minutes):

Sum up key points. Discuss with the students the advantages and disadvantages of industries.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 120

Homework: Read and revise text. Complete Worksheet 25.

WORKSHEET 25

Date: _____

Name: _____

1. Explain the importance of each of the factors supporting industry. Use extra sheets, if required.

i. availability of raw materials

ii. availability of electricity

iii. market demand

iv. availability and cost of transport

v. availability of labour

vi. capital

vii. the Government

SECTION 2

MAJOR INDUSTRIES OF PAKISTAN

Teacher's focus:

Pakistan is a developing nation and requires industrial growth to bring about economic progress and development, as manufacturing and processing increases our self-sufficiency and the surplus is exported to earn foreign exchange. Our country has an abundance of natural resources, and many of the factors necessary for the successful growth of industries are present, such as land, water, raw material, capital, skilled and unskilled labour, etc. However, they are not being used to their potential. The law and order situation in the country is precarious, and the rapid changes in government policies and the taxation system are hampering opportunities for industrial growth. Pakistan's chief industries include cotton and cotton textiles, sports goods, sugar, surgical equipment, automobiles, and cement. These industries fall into one of three categories: large scale, medium scale, and small scale or cottage industries. This division is based on three things: a) the amount of investment, b) technology, and c) number and skill of labour needed to set up and run them. Each of these industries is vital for bringing prosperity to Pakistan.

Answer key

Questions and Activities

1.
 - i. In large-scale industries, there is no restriction on the amount of capital or the number of people employed. Steel industry, cement industry, sugar industry, fertilizer industry, automobile industry, electronic goods industry, textiles, and heavy engineering are examples of large-scale industries. An industry that has an investment of up to Rs 10 million in addition to the amount taken on loan, and the value of the land and buildings is called a small-scale industry. This type of industry hires up to 20 labourers. Flour mills, rice husking mills, and printing presses come under this category.
 - ii. Cottage industries are also called home-based industries. These are a kind of small scale industry that are run from houses with little or no capital. Most cottage industries are family run units for earning extra income to support households. Cottage industries are usually found in rural areas and villages.
 - iii. Pakistan produces the world's finest quality cotton. Cotton yarn and cotton textiles and other products are in demand all over the world. Exports bring about revenue in foreign exchange.
2.
 - i. textile
 - ii. Karachi
 - iii. looms
 - iv. limestone and gypsum
 - v. bagasse

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 121–125, *Oxford School Atlas for Pakistan*

Teaching objective:

- to make students aware of the major industries of Pakistan and their contribution to the nation

Learning outcome:

- Students should be able name the major industries of Pakistan, give their location, and discuss their contribution to Pakistan's economy and development

Lesson 1

Introduction (5 minutes):

Find out what kinds of factories or manufacturing/processing units or cottage industries are present in your area. Tell students what products their city is famous for. Reinforce the concepts of industries taught in the previous lesson.

Explanation (30 minutes)

Read and explain text. Focus on the importance of industries for Pakistan. Discuss the reasons for categorizing industries and go over each type of industry and its importance.

Conclusion (5 minutes):

Revise key concepts. Ask questions to check understanding.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 125

Homework: Read and revise text. Complete Worksheet 26.

WORKSHEET 26

Date: _____

Name: _____

1. State whether True or False

- i. At the time of the creation of Pakistan, the country had a weak industrial base.
- ii. The decades of 1950s and 1960s were the worst for industrial growth in the country.
- iii. The number of cement industries has decreased over the years from five in 1947 to thirty-one in 2010-11, making Pakistan one of the lowest producers of cement in the world.
- iv. Sugar cane is bulky and cannot be stored.
- v. Textile industry includes cotton, woollen, art silk, and jute textile mills.
- vi. The cotton textile industry is the smallest in Pakistan.

2. Answer the following questions. Use extra sheets, if required.

- i. Why are cottage industries referred to as the informal sector of the industry?

- ii. Give examples of some large scale industries.

- iii. What industries does the textile sector include?

- iv. Why are cement industries located close to limestone regions?

- v. "Despite the fact that sugar cane is one of the major crops of Pakistan, the country is not self-sufficient in sugar production." Find out why.

Chapter 10

Trade

SECTION 1

BEGINNING OF TRADE

Teacher's focus:

Trade simply means the buying and selling (exchange) of ready-made goods and services in a market. Trading done in one's own country is called domestic or local trade. Trading with other countries is called foreign trade.

Trading is useful because it conserves precious time and resources, and prevents the duplication of goods that are already present in the market. It enables nations, individuals, and communities to raise their standards of living, by providing buying opportunities for those who do not have enough resources for production themselves.

Foreign trade consists of buying or importing goods from other countries, and selling or exporting domestic output. Not all countries are self-sufficient, and they are not always able to produce everything they need, which is why all countries of the world are dependent on each other for trade. Exports are a source of revenue, and facilitate industrial growth in a country. Imports cause foreign exchange to flow out of the country. However, imports are beneficial when it comes to acquiring commodities like oil and technology or bringing in trained professionals for creating more business opportunities. The difference between the value of exports and imports is known as the balance of payments. If the exports are greater in value a country is said to have a favourable balance. If the imports are greater in value, the balance is said to be in deficit, which is not good for the economy of a country.

Local and foreign trade is dependent on many factors: location, transportation, expertise, government rules and trade policies, and favourable diplomatic relations between countries.

Answer key

Questions and Activities

1.
 - i. Buying and selling of goods in a market
 - ii. Export: selling surplus goods to other countries
Import: buying required goods from other countries
 - iii. Different environments, different stages of economic development, differences in people's

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- tastes, preferences, choices, different political situations and government policies
- iv. Economic sanctions may be imposed by western powers or the UNO on countries if they do not have a democratic government or have problems of human rights violations, or are found to be supporting terrorism.
 - v. It means that the gap between the value of exports and imports should be controlled.
2. i. supply ii. Export iii. teak iv. oil

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 127–131, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to make students aware of the importance of trade
- to explain to students the various kinds of trade

Learning outcomes:

Students should be able to:

- explain why countries trade
- discuss the various kinds of trades and their impact on a country's growth and progress

Lesson 1

Introduction (5 minutes):

Explain the concept of trade to students by using everyday examples, such as buying and selling objects from shops. Expand upon this idea and explain that just as students buy objects they need from shops, countries also buy the goods and services they require, from other countries. Ask students if they can think of reasons why trading is helpful to them.

Explanation (30 minutes):

Read and explain text. Focus on the difference between domestic and foreign trade and the benefits of each. Discuss what factors affect each and how.

Conclusion (5 minutes):

Recap main points.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 131

Homework: Read and revise text. Do the activity on page 131.

WORKSHEET 27

Date: _____

Name: _____

1. Answer the following questions.

i. Why do countries make an effort to increase their exports?

ii. Who do governments impose duties?

iii. Name some international trade organizations.

iv. Explain the terms 'free trade' and 'quota'. What is their importance in foreign or international trade?

2. State whether True or False.

- i. Ninety-five per cent of Nigeria's earnings come from oil. _____
- ii. Pakistan produces surplus cotton and manufactured goods made of cotton. _____
- iii. Seventy-five per cent of Botswana's earnings come from pineapple exports. _____
- iv. Competition in the international market develops specialization. _____
- v. Wood for pulp comes from the temperate coniferous forests regions. _____

SECTION 2

MAJOR IMPORTS AND EXPORTS OF PAKISTAN

Teacher's focus:

Pakistan's trade includes both domestic and foreign trade. As a nation, Pakistan is dependent on other countries for products like oil, technology, etc. It is also dependent on technology for setting up industries like automobiles. Pakistan also earns foreign exchange through exports of cotton and cotton textiles, sugar, mangoes, rice, wheat, dates, etc but it is not enough to bring a favourable balance of payments position to it. In addition heavy international borrowing and loans remain unpaid with heavy interest amounts remaining due. This adds to the financial burden because whatever is earned is paid off to the lenders. Pakistan's imports and exports also suffer because of the prevailing law and order situation and irregularities in trade policies. Natural disasters like floods cause widespread destruction, affecting export crops and agro-based industries.

Answer key

Questions and Activities

1.
 - i. Major export commodities: cotton yarn, cotton cloth, cotton textiles and related products like hosiery bed linen; exported to countries like Japan, the USA, the UK, France, and Germany. Raw cotton is exported to Japan, the UK and other EEC countries, and the Middle East.
 - ii. Main source of earning foreign exchange.
2.
 - i. imports
 - ii. Petroleum

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 132–135, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain the trading position of Pakistan
- to list the Pakistan's major exports and imports
- to discuss the factors affecting Pakistan's foreign trade

Learning outcomes:

Students should be able to:

- explain the position of international trade between Pakistan and other countries
- name Pakistan's major imports and exports

Lesson 1

Introduction (5 minutes):

Ask students to observe objects around them, and try to guess how many things around them are made in their country or city and how many are imported. What is the difference between the two?

Explanation (30 minutes):

Read and explain text. Clarify the reasons for international trade. Talk about the factors that regulate international trade. Talk about how spending as individuals and as a nation affects the balance of payments.

Conclusion (5 minutes):

Ask for suggestions for bringing an improvement in Pakistan's trade deficits. Write out a list of things that students think should be imported and exported.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 135

Homework: Read and revise text. Do the research task given on page 135.

WORKSHEET 28

Date: _____

Name: _____

1. Answer the following questions:

i. Why does Pakistan import wheat, sugar, and pulses despite being an agricultural country?

ii. When did Pakistan have a favourable trade balance?

iii. How is a shortfall in international trade met?

iv. Name the major trade partners of Pakistan with their shares.

v. What goods come in the following categories and in what percentage?

a) primary products

b) other manufactured goods

2. Complete the following statements.

i. Pakistan did not have to import tea until _____.

ii. Textiles have a major share in the _____.

Chapter 11

Transport

SECTION 1

MEANS OF TRANSPORT

Teacher's focus:

Transport and communication are vital for the trade and development of any country. An effective transport system will ensure the transfer of people and goods in the most efficient manner, at the cheapest rates, in the shortest possible time. Trade and businesses, industries, services, etc all depend upon labour, and industries need raw material. Finished products need to reach the consumer through markets. Exports and imports have to reach their destinations. None of these targets can be achieved without transport and an effective transportation system.

There are three basic categories of transport—land, water, and air. Means of land transport include cars, buses, trucks and lorries, trains, motorcycles, vans, etc. Water transport includes boats, ships, launches, and barges. Air transport includes aeroplanes and helicopters. The number of passengers, nature of cargo, and geographical locations determine the means of transport that is taken by people.

Answer key

Questions and Activities

1.
 - i. Transport provides a link between producers and consumers. Farmers grow crops and transport is required to move these crops to the markets. Similarly, industries use raw materials and transport is required to transfer these raw materials to the factories. More transport is needed to move the finished goods to the markets. The rapid movement of people over long distances has become possible only because of advanced modes of transport like bullet trains and aeroplanes. Mass transit systems within cities make it possible for workers to commute to their workplaces and back.
 - ii. Buses, trucks, and cars are major users of roads and are used to carry passengers and goods. Flexibility of routes is a great advantage which the roads enjoy over the railways. Door to door service is possible only by road.
 - iii. Sea transport not only links countries directly, but is also the cheapest means of transport. It can carry passengers and cargo both. It is the best means of transportation between countries not connected by land.

- iv. Refrigerated vehicles have been developed to carry vegetables, fruit, meat, and fish, and tankers are used to transport liquids like oil and milk.
 - v. Autobahns in Germany, autoroutes in France, autostrada in Italy, and motorways in the UK and Australia.
 - vi. The River Elbe, River Rhine, River Rhone, and River Danube are the main navigable rivers of Europe.
2. i. Volga ii. Russia iii. bullock iv. highways
v. junctions

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 136–141, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to explain to students the importance of a well-connected transport network
- to make students aware of the different means of transport

Learning outcomes:

Students should be able to:

- explain the need and importance of transport
- describe different means of transport and their purpose

Lesson 1

Introduction (5 minutes):

Ask students about places (within and outside their city) they have visited—ask them about the means of transport they used, and the reason for using it. Bring up questions like what would happen if there was no transport available and they had to walk for miles—how would a person’s business or job or other work suffer?

Explanation (30 minutes):

Read and explain text. Focus on the importance of transport in all aspects of life. Elaborate on the reasons for choosing different means of transport for different purposes. Compare the time and cost effectiveness of each.

Conclusion (5 minutes):

Recap key points. Ask questions to check understanding.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes)

Classwork: Questions 1–2 on page 141. Activity on page 141.

Homework: Read and revise text. Do Worksheet 28.

WORKSHEET 29

Date: _____

Name: _____

1. Fill in the blanks.

- i. Transport provides a link between _____ and _____.
- ii. All modern means of transport need a basic _____ in order to operate efficiently.
- iii. The first roads were constructed by the _____.
- iv. Long tunnels have been constructed through _____ to make travel easy.
- v. Rivers, lakes, and canals are the channels of _____ waterways.
- vi. _____ is a great continent of inland waterways.
- vii. A _____ is free to enter any port.

2. Answer the questions.

- i. What is the difference between ocean liners, cargo liners, and tramp steamers?

- ii. Name some navigable rivers of the world.

- iii. Why are railways usually state owned?

3. Choose the correct answer to complete each of the sentences below.

- i. The most industrialized and commercialized regions of the world have the highest _____ (levels, mileages, relief) of roads.
- ii. The USA accounts for _____ (10, 30, 50) per cent of the world's road mileage.
- iii. Railways are a very important form of _____ (inland, surface, air) transport.
- iv. The distribution of railways shows a similar pattern to that of _____ (airports, ports, roads).

SECTION 2

TRANSPORT NETWORKS OF PAKISTAN

Teacher's focus:

Pakistan's geographical location is well-suited for all three kinds of transport—land, air, and sea.

Railways, roads (including motorways and highways), flyovers, bridges, and underpasses facilitate land transport. Pakistan is home to many international airports. The Quaid-e-Azam International Airport in Karachi is comparable to any major international airport of the world. Work is still being done on improving existing networks. Karachi Port, Port Qasim, and Gwadar Port are Pakistan's three ports, and handle the nation's trade activities.

Answer key**Questions and Activities**

1.
 - i.
 - a. Karachi-Lahore-Peshawar
 - b. Karachi-Dera Ghazi Khan-Peshawar
 - c. Karachi-Quetta
 - d. Quetta-Lahore-Peshawar
 - ii. The major types of roads in Pakistan link small towns and villages to large cities. They provide quick transport between major cities for goods as well as passengers. They serve regional markets.
 - iii. Pakistan Railways extends its services to the borders of two foreign countries. One runs from Lahore to Wagah on the border with India, and the other runs from Quetta to Zahedan on the border with Iran.
 - iv.
 - village roads
 - district roads
 - motorways
 - highways
 - v. In 1955 the government formed a national airline company called Pakistan International Airlines (PIA).
2.
 - i. Balochistan
 - ii. Khunjerab
 - iii. transport
 - iv. poor
 - v. hinterland

Lesson plan

No of lessons: 2

Duration: 40 minutes each

Resources: Textbook pages 142–148, *Oxford School Atlas for Pakistan*

Teaching objectives:

- to make students aware of the importance of the transport networks for Pakistan's social and economic well-being
- to discuss the condition of Pakistan's transport networks

Learning outcomes:

Students should be able to:

- identify Pakistan's transport networks
- explain the need for developing these networks

Lesson 1

Introduction (10 minutes):

Begin the lesson with an activity. Using the *Oxford School Atlas for Pakistan*, trace out land, sea, and water routes that connect Pakistan to other countries of the world. Identify rail routes, roads, coastal areas, and airports, etc.

Explanation (25 minutes):

Read and explain text. Talk about the different transportation networks that exist in Pakistan and when they were formed. Compare the existing conditions with conditions at the time of formation. Discuss how the conditions changed over time and identify the problems, asking students for suggestions for resolving issues.

Conclusion (5 minutes):

Recap lesson by summing up key points. Ask questions to check understanding.

Lesson 2

Introduction (5 minutes):

Provide instructions for classwork and homework tasks.

Written work (35 minutes):

Classwork: Questions 1–2 on page 147

Homework: Read and revise text. Do the Activity on page 148.

WORKSHEET 30

Date: _____

Name: _____

1. State whether True or False.

- i. The economic development of a country is closely linked to its transport network.
- ii. The transport systems in developed countries are less advanced than those in developing countries.
- iii. The transport network in Pakistan is still excellent and does not need further development.
- iv. In 1947, the only airline operating in Pakistan was the small Orient Airways.
- v. PIA does not link Pakistan with other countries.
- vi. Karachi Port is a natural harbour protected by the island of Manora.
- vii. Gwadar Port serves the whole of Pakistan and also Afghanistan.

2. Answer the following questions. Use extra sheets, if required.

- i. a. What two problems does Pakistan Railways face?

- b. What has happened as a result of these problems?

- c. Why do all railway routes start from Karachi?

Answer key for worksheets

Worksheet 1

1.
 - i. lithosphere
 - ii. asthenosphere
 - iii. ocean
 - iv. centimetres
 - v. 1915
 - vi. 225
 - vii. Pangaea
2.
 - i. seven
 - ii. single, asthenosphere
 - iii. Laurasia, Gondwana
 - iv. tectonic, deformation
3.
 - i. The Caribbean plate, the Nazca plate, the Philippine plate, and the Arabian plate
 - ii. The South American plate
 - iii. The theory states that the present locations and shapes of the continents are not the same as they were about 225 million years ago. At that time they were joined to each other in the form of single land mass called Pangaea meaning supercontinent. This supercontinent broke up around 200 million years ago into two major land masses, Laurasia and Gondwana. Laurasia drifted northwards and broke up further into North America and Eurasia (Europe and Asia). Similarly, the southern land mass, Gondwana, broke up into South America, Africa, Antarctica, Australia, and India.
 - iv. Through several pieces of evidence including the matching shapes of the continents, types of rock, and fossils.
 - v. Faults can be broadly classified into three major categories on the basis of rock movements.
 - vi. Dip-slip faults: If movements of rocks are vertical or inclined, they are categorized as dip-slip faults. Movement along dip-slip faults can be either up or down the fault plane. Because of their different movements they are further recognized as normal faults, reverse faults, and thrust faults. Strike-slip faults: If movements of rocks are horizontal and displacements occur opposite each other, they are known as strike-slip faults. The San Andreas fault in the USA is an example of this type of fault. Oblique-slip faults: When faults have both vertical and horizontal movement, they are called oblique-slip faults.

Worksheet 2

1.
 - i. energy
 - ii. seismology
 - iii. earthquake
 - iv. release
 - v. focus, epicentre
 - vi. above
 - vii. shallow earthquake
 - viii. Muzaffarabad
 - ix. seismic
 - x. seismometer
 - xi. magnitude
 - xii. amplitude
 - xiii. 8.2
2.
 - i. seismologists.
 - ii. the Pacific ocean belt
 - iii. Mediterranean and trans-Asiatic
 - iv. deep
 - v. Japan
3.
 - i. Shallow earthquakes are generally more destructive than deep focus earthquakes because of the shorter distance between the source of energy and the Earth's surface.
 - ii. Extensive loss of life and property, landslides, deformation of land features, fires, damages to building, damage to buildings and infrastructure.

Worksheet 3

1.
 - i. conical
 - ii. magma reservoir
 - iii. igneous
 - iv. volcanism
 - v. crater
 - vi. Mauna Loa
 - vii. extinct
 - viii. 500
 - ix. Pacific Ocean
2.
 - i. A volcano is a conical or dome-shaped landform formed by the flow of lava. The magma (molten rock from the Earth's interior) rises through a narrow, pipe-like feature called a vent. The vent is connected to the magma reservoir located beneath the surface of the Earth. When magma extrudes onto the surface, it is called lava. As a result of the cooling of lava, igneous rocks are formed. This process of volcanic activity is called volcanism.
 - ii. At the opening of many volcanoes there is a steep-walled, cup-like depression called a crater. Due to the violent eruption of volcanic material, the walls of the crater collapse with the passage of time and a large depression is formed, known as a caldera. If volcanic eruption has not taken place for a long period, a caldera may become filled by rainwater, and converted into a caldera lake.
 - iii. Lava, solid rock, fragments including ash and dust, and toxic gases like sulphur dioxide, carbon dioxide, and carbon monoxide.
 - iv. The Ring of Fire in the Pacific Ocean, which includes Japan, the Philippines, Indonesia, Hawaii, Mexico, Peru, and Chile, is an important area of active volcanoes. The Mediterranean region, which includes countries of Southern Europe, is another important region.

Worksheet 4

1.
 - i. surface, environmental
 - ii. freezes, frost wedging
 - iii. weathering
 - iv. expand, contract
 - v. pressure
 - vi. carbonic, calcium
 - vii. moss, lichen
2.
 - i. physical
 - ii. expands
 - iii. abrasion
 - iv. joints
 - v. tropical deserts
 - vi. saline
 - vii. reactionary
 - viii. iron
 - ix. acid
 - x. oxygen
 - xi. decay
3.
 - i. The United Kingdom, France, the USA, Canada, and Norway, and the mountains of Pakistan's Northern Areas
 - ii. When saline (salty) solutions seep into rock cracks and joints and then evaporate, salt crystals are formed. Salt crystals also exert pressure in rocks and cause disintegration.

Worksheet 5

1.
 - i. creep
 - ii. slope
 - iii. saturated, downward
2.
 - i. The pace of movement, type of materials, and nature of the movement.
 - ii. During rainfall or when ice melts.
 - iii. Gravity and water
 - iv. Creep: Creep is the very slow, down-slope movement of solid or loose debris. It can also take place along almost-horizontal slopes. The rate of movement is usually less than one cm per year and can be detected only by observation of objects. Debris flow: Debris flow is a type of mass wasting movement that takes place in fluid form; water is the main agent of such movement. The common varieties are earthflow, mudflow, and debris avalanches. In an earthflow, debris moves down-slope as a fluid; the process can be slow or rapid. Earthflows usually occur on hillsides that have a thick cover of debris, often after heavy rains that saturate the soil. A mudflow is a flowing mixture of debris and water, usually moving down a channel, such as in streams or flash floods. In the coastal areas of

Balochistan, mudflows are common during torrential rains and flash floods which destroy roads, crops, and property, and kill humans and animals. An example is the 2007 flooding following heavy rains, which affected thousands of people and caused the loss of billions of rupees worth of crops, property, and roads in the Kech and Las Bela districts of Balochistan. The fastest type of debris flow is a debris avalanche. Rock falls and rock slides: Rock falls and rock slides are the other forms of mass wasting. When a block of bedrock breaks off and falls freely, or bounces down a cliff it is called rock fall. This commonly occurs near the shoreline when waves undercut the cliff, causing the mass of rock above to fall. Similarly, rock avalanches take place where the slopes are too steep along river channels, or in the construction of highways, dams, or other projects. A rock slide is the rapid sliding of a mass of bedrock along an inclined surface. An example is the disastrous landslide that took place in Italy in 1963 when a huge mass of limestone bedrock broke and slid into a large reservoir, creating a giant wave that overtopped the dam. 3000 people were killed as a result of that flash flood.

Worksheet 6

1.
 - i. water
 - ii. abrasion
 - iii. friction, height
 - iv. vegetation
 - v. sand dunes
2.
 - i. Wind, water, ice
 - ii. Erosion by running water: Running water on the ground surface or in streams has the force to erode rock and sediment. The erosive process that is usually most effective on a rocky stream bed is abrasion, the grinding away of the stream channel by friction. The fall of water from height provides a powerful force which erodes rocks and sediment and channels of streams are formed due to this erosion. Erosion by sea waves: On seashores, waves are a powerful eroding agent as they wear away rocky surfaces over a period of time. Waves erode the lower rocks of cliffs by undercutting. Erosion by moving ice: Glaciers, moving masses of ice, are important agents of erosion. Broken pieces of rock are frozen into the base of a moving glacier. When heavy glaciers move these rocks, they polish or grind the surface and make long, deep scratches, called grooves or striations, on the rock surface. Erosion by wind: Wind erosion is common in regions with little or no vegetation. Heavy dust storms are one example of wind action. Deflation is an important process of wind erosion in which the wind scoops away light particles like clay, silt, and sand, and develops a depression called a blowout. In deserts, the action of the wind creates sand dunes. Sand blasting is the action of forceful wind erosion in the desert regions of the world.
 - iii. Open question. Mark on basis of sensibility of answer with reference to text.

Worksheet 7

1.
 - i. atmosphere
 - ii. oxygen
 - iii. 99
 - iv. balloons
 - v. cloud
2.
 - i. a mixture of gases, dust particles, and water vapour.
 - ii. reflect a significant amount of solar heat back into space.
 - iii. an important part of the Earth's physical environment.
 - iv. industrial pollution and the burning of fossil fuels (natural gas, petroleum, and coal).
3.
 - i. atmosphere
 - ii. gases, water vapour.
 - iii. argon
 - iv. minute
 - v. industrial, fossil fuel
4.
 - i. Water vapour, ozone, and dust particles are also components of the atmosphere. Ozone is a layer of molecular oxygen in the upper atmosphere which absorbs dangerous ultraviolet rays. Water vapour and dust particles play an important role in cloud formation. Water vapour also absorbs heat energy and dust particles which reflect a significant amount of solar heat back into space.

DISCOVERY 2

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- ii. Nitrogen is constantly being added to the atmosphere as plants and animals decay. It is also constantly being removed by living organisms and by rain and snow so that there is a perfect balance between the amounts of nitrogen and oxygen in the atmosphere.

Worksheet 8

1.
 - i. weather
 - ii. elements
 - iii. given
 - iv. 30
 - v. Meteorologists
 - vi. forecasts
2.
 - i. Humidity is the amount of water vapour in the air. The hotter the air, the more water vapour it can hold.
 - ii. Meteorologists record weather data (temperature, rainfall, humidity, air pressure, cloud condition, etc.) on a daily basis using different instruments and weather satellites. On the basis of these weather data they also predict the weather conditions for the next twenty-four hours: this is called weather forecasting.
 - iii. The most important work of meteorologists is to inform us about extreme weather.
 - iv. Weather data are used by fishermen, navigators, aircraft pilots, and ordinary people.
 - v. In order to remain safe from the effects of bad weather. Fishermen can drown, navigators can lose their way, aircraft pilots can lose control over aircraft and crash, and the lives of ordinary people can be affected.

Worksheet 9

1.
 - i. three
 - ii. stratosphere
 - iii. ultraviolet
 - iv. CFCs
 - v. aerosol sprays
2.
 - i. Ozone is a form of oxygen that combines three oxygen atoms into each molecule (O_3). The oxygen we breathe has two atoms per molecule (O_2).
 - ii. They are stable, nonflammable, low in toxicity, and inexpensive to produce. It was later discovered that one chlorine atom can destroy over 100,000 ozone molecules.
 - iii. The idea of ozone depletion was first presented in 1974 by two researchers, F. Sherwood Rowland and Mario Molino.
 - iv. Scientists took serious notice in October 1995 when they identified, through satellite images, a hole in the ozone layer over Antarctica called the ozone hole.

Worksheet 10

1.
 - i. hotness
 - ii. Earth
 - iii. energy
 - iv. $6000^{\circ}C$
 - v. solar radiation
 - vi. mercury
 - vii. quantitative
 - viii. Centigrade
 - ix. 100, 180
 - x. physicist
2.
 - i. It absorbs the Earth's heat.
 - ii. It is interesting to note that Fahrenheit and Celsius are equal at -40 degrees.
 - iii. Measure the minimum and maximum temperature of a place
 - iv. The accurate measurement of air temperature depends not only on the care with which the thermometer is constructed, but also upon its proper placement. To obtain a meaningful temperature reading, thermometers must be shaded from direct sunlight and shielded from radiating surfaces such as buildings and the ground.

Worksheet 11

1. i. atmosphere ii. heat and energy iii. interior
iv. 6000 v. electromagnetic vi. albedo
vii. convection viii. vertically ix. sets x. highest, lowest
2. i. incoming ii. incident, solar, and radiation iii. scattering
iv. 20 v. radiation vi. clear

Worksheet 12

1. i. four ii. remains unchanged, troposphere, iii. 12
iv. altitude v. drops vi. lapse vii. warmer, seas and oceans
viii. water ix. cross
2. i. In the bottom layer, the troposphere, the temperature decreases with an increase in height. It decreases at the average rate of 6.5°C per km. This is because the surface of the Earth heats up due to radiation and the air close to the surface is warmer than that farther away from it. The temperature decrease continues to an average height of approximately 12 km. At this height the temperature remains constant for a few kilometres, in the segment called tropopause. In the next layer, the stratosphere, the temperature begins to rise. This is because of the presence of the ozone layer (at about 15 to 30 km) which absorbs ultraviolet rays. As a result, the temperature in the lower part of the stratosphere is higher than in the upper part. At the height of 50 km, in the segment called the stratopause, the temperature once again becomes constant. In the third layer, the mesosphere, the temperature again decreases up as far as 80 km. It becomes constant in the segment called the mesopause. Next to the mesopause, in the thermosphere, there is an extreme rise in temperature to over 1000°C. This is due to the absorption of the Sun's energy by atoms of oxygen, nitrogen, hydrogen, and helium which become electrically charged.
- ii. **Latitude:** air temperature varies with latitude. The Equator and Tropics have high temperatures while temperatures are low in the Polar Regions. These latitudinal variations are mainly due to the angle of the Sun's rays and tilt of the Earth with reference to the Sun's rays. **Altitude:** temperatures are lower in mountains than on plains. This is because the air temperature drops with increasing height. The rate of decrease is called the lapse rate, which is generally 6.5°C per kilometre. For this reason, Mount Kilimanjaro (in Kenya) is covered with snow although it is located on the Equator. Similarly, in the case of Islamabad and Murree, though located on almost the same latitude, summers are hot in the former while they are cooler in the latter. This is because of the difference in height: Islamabad is located at a height of about 600 m above sea level while Murree is located at a height of 2100 m above sea level. **Contrast between land and water:** because of the different molecular structures of solids and liquids, land (solid) becomes warm faster and cools more rapidly than bodies of water (seas and oceans) which warm and cool slowly. Therefore, in summer the temperature over the land is higher than that over the seas and oceans. It is the opposite in winter when the land is cooler than the seas and oceans. This contrasting characteristic of land and water affects the temperatures of places located near the sea and those away from it. **Oceanic currents:** oceanic currents are movements of water in particular directions. These movements of water take place vertically and horizontally. Oceanic currents cause the transfer of warm equatorial and tropical waters towards the cold Polar oceans. Similarly, they transfer cold waters from the Polar oceans to the tropical oceans. Such movements of ocean waters change the temperature and the rate of evaporation in the oceans. This has an effect on the weather and climate of coastal areas.

DISCOVERY 2

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- iii. This is because of the presence of the ozone layer (at about 15 to 30 km) which absorbs ultraviolet rays. As a result, the temperature in the lower part of the stratosphere is higher than in the upper part.
- iv. Latitudinal variations are mainly due to the angle of the Sun's rays and tilt of the Earth with reference to the Sun's rays.
- v. Meteorologists study the distribution of temperature by plotting isotherms.
- vi. Isothermal maps are helpful in understanding the changing temperature patterns and controlling factors of temperature. On most isothermal maps, all temperatures have been reduced to sea level and the effect of altitude is eliminated. One of the characteristics of isotherms is that they do not cross each other.

Worksheet 13

1.
 - i.
 - a. force that applies on any unit area
 - ii. b. total weight of the atmosphere
 - iii.
 - a. 1.055 kg per sq cm
 - iv. b. sink and increase pressure
 - v.
 - a. rise and thus lower the pressure.
2.
 - i. Fig 1 mercury barometer Fig 2 aneroid barometer
 - ii. vacuum, mercury, glass tube, atmospheric pressure, height
 - iii. Atmospheric pressure is measured with an instrument called barometer. The most common barometer is mercury barometer. The modern mercury barometer is not very different from the simple original barometer, invented by Torricelli in 1643. This first barometer was merely a glass tube with a vacuum in it, closed at one end. The open end was placed in a dish of mercury. As normal air pressure was exerted on the mercury surface, a column was forced up the tube to a height of roughly 76 cm at sea level. Variations in pressure caused changes in this height. A more convenient but somewhat less accurate barometer is the aneroid (without liquid) barometer. It is a small metal diaphragm with a partial vacuum inside. As the outside air pressure drops, the sides bulge outward. This movement is shown on a dial that indicates the pressure change.

Worksheet 14

1.
 - i. decrease
 - ii. high
 - iii. upward
 - iv. uniform
 - v. isobars
 - vi. lower
2.
 - i. When the movement of air takes place from high pressure areas (more concentration of gases) to low pressure areas, high pressure becomes low pressure and low pressure becomes high pressure. These two factors form the global pattern pressure belts.
 - ii. It is because of the movement of the hot air of equatorial region which moves upward and then moves toward subtropical latitudes. At the upper level the air becomes cool and dense, and moves downward. Because of the addition of this air, the subtropical regions both in northern and southern hemisphere have high pressure. Similarly because of the movement of air, two subpolar (60 to 65 latitudes) low pressures develop in each hemisphere.
 - iii. Land and ocean contrast, the factor of ocean currents, and circulation of wind affect global air pressure.
 - iv. Isobars are lines which join places having equal values. Generally when isobars are drawn values of atmospheric pressure are reduced to sea level. Isobars are essential element of weather maps which are used by meteorologists for daily forecasting of rain, storms, etc. On the atmospheric pressure maps isobars are in circular or semicircular shape called cells, and disconnected lines, and curves are called belts. These cells determine the high pressure and low pressure areas.

Worksheet 15

1.
 - i. water
 - ii. air
 - iii. currents
 - iv. trade winds
 - v. monsoon
 - vi. season
 - vii. no
 - viii. global pressure belts
 - ix. west
2.
 - i. Horizontal movement of air is called wind while vertical movement of air is called air current.
 - ii. The three main factors which affect the velocity and direction of wind are the pressure gradient force, Coriolis force, and friction.

Pressure gradient force: air moves like the flow of water from high level to low level. Therefore if pressure values of two places are same, no wind generates but when at one place pressure declines wind generates from high pressure to low pressure. This slope is called pressure gradient force. The pressure gradient force not only determines the velocity, but also the direction of wind and changes its speed and direction with the changes of atmospheric pressure and development of low and high pressure cells. **Coriolis force:** the other important force that affects the direction of wind is called the coriolis force. This force generates because of the rotation of the Earth and it is zero at the Equator and increases away from it. The force applies on any free moving body including air. Therefore when a parcel of air moves northward it is deflected rightward or eastward because of the influence of this force while in the southern hemisphere parcel of air is deflected towards leftward or eastward. **Friction:** it is a common observation that along the shoreline, the speed of the wind is higher than in the area surrounded by high rise buildings or a forest. Barriers, whether natural or man-made affect the speed and direction of wind through a force called friction. Mountains, hills, forests, buildings are elements that create friction.

- iii. Seasonal winds are types of winds which generate in particular seasons or in specific months and affect the weather and climate of large areas where they exist. The most important of these are the monsoon winds. There are also trade winds.
 - iv. The monsoon winds are actually tropical easterlies. The monsoon winds are of two types. One is called the south west trade wind which brings summer rainfall particularly in South Asia (India, Bangladesh, Pakistan, Sri Lanka, Nepal, Bhutan, and Maldives). The summer monsoon winds also cause rainfall in East Asia (China, Myanmar, Malaysia, Cambodia, etc). The south west monsoon winds are actually tropical easterlies of the southern hemisphere, which move towards the Equator. After crossing it, they change their direction due to the Coriolis force in the northern hemisphere and move from west to east. Because of its original source, it is called south west trade wind. It travels over vast ocean surfaces; therefore it has copious moisture which causes the occurrence of heavy rain. The summer monsoon also brings rainfall and causes the movement of tropical storms in the tropical areas of Central America, North America, Asia and the Pacific islands. The winter monsoon, of north-east trade winds, is relatively dry because it travels mostly over continents.
 - v. In the mountain areas when the Sun rises, due to the angle of the Sun's rays, mountains receive heat energy before the valleys do. As a result, low pressure develops over mountains and high pressure in the valleys.
3.
 - i. Chinook
 - ii. Foehn
 - iii. Katabatic
 - iv. Balochistan
 - v. Mistral

Worksheet 16

1.
 - i. cyclones
 - ii. 200
 - iii. land
 - iv. tropical
 - v. typhoon
 - vi. willy willy
 - vii. cumulonimbus
 - viii. eye
 - ix. lose, decay
 - x. occlusion

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2.
 - i. Tropical cyclones form when the sea temperature rises up to 27°C. Water evaporates and provides latent heat to the spinning wind which increases its speed to 200 kph. Because of the movement of the wind over the ocean it forms a wall of water. The average diameter of tropical cyclones is about 600 km. Atmospheric pressure at the centre is low, for example 950 mb while outer edge has high pressure, for example 1015 mb. The vertical movement of air causes dark clouds called cumulonimbus to form, which cause heavy rain. The centre of storm is calm, and it is called the eye of the cyclone, which is usually 20 km in diameter. Whenever tropical cyclones reach the coast they lose their energy. This is the decay stage of a tropical cyclone.
 - ii. Damage caused by tropical cyclones can be divided into three categories: wind damage, storm surge, and inland freshwater flooding.
 - iii. The coastal area of Bangladesh is one of the most seriously affected regions of the world. In 1970, about 200,000 people died due to tropical cyclones. This is considered one of the worst natural disasters of modern times. The coastal belt of India is also affected by tropical cyclones. The chance of the occurrence of tropical cyclones in the coastal area of Pakistan is rare. However coastal areas of Karachi, Thatta, Badin are affected in the form of high velocity wind and rain. Similarly in the USA and Mexico, hurricanes cause severe damages in the coastal regions every year. Occurrence of typhoons is common in the east Pacific and causes severe destruction in China, Vietnam, Thailand, etc.
 - iv. Temperate cyclones form in the middle latitudes, at roughly 35 degree to 55 degree latitudes. These cyclones form as a result of two different air masses which cover areas of hundreds and thousands of sq km, having different temperature and moisture characteristics. When the dry cool polar continental air mass moves southward and collides with warm moist tropical maritime air mass, a division line called front is formed. Therefore temperate cyclones are also called frontal cyclones. They form as a result of the movement of warm and cold front. Temperate cyclones form when the warm front and the cold front form, moving side by side. In the mature stage, warm air lies between the cold and warm front and moves upward to form dense clouds and give rain. As the two fronts reach near each other, two bodies of cold air meet and warm air is completely uplifted. This is called occlusion. The occlusion is the decay stage of temperate cyclones. Temperate cyclones are less severe than tropical storms but they cause heavy rainfall in middle latitude countries like France, USA, UK, Russia, etc.
 - v. Tornadoes are local storms of short duration. It is the most destructive natural force. In United States, tornadoes are popularly called twisters. A tornado travels on land and the area where it passes is completely destroyed. Intense low pressure develops at the center while winds rotate around it and create a vacuum at the centre. The wind reaches speeds of 650 kph or more. The formation of tornadoes is linked with that of hurricanes. When hurricanes reach the land, they join the already spinning winds developed on land as a result of central low pressure. A funnel cloud forms, which touches the ground and moves with high velocity wind.
 - vi. About 700 tornadoes are reported each year in the United States. Tornadoes struck an area stretching from Canada to Georgia (USA). In 1974 a tornado killed 300 people in Georgia, USA.

Worksheet 17

1.

i. True	ii. False	iii. True	iv. True
v. False	vi. True	vii. False	viii. True
ix. False	x. True		
2.
 - i. Water vapour changes into different states of matter, i.e. solid, liquid, and gas, with changes in temperature and pressure. Because of this characteristic, the water of the oceans easily converts into vapour and is added to the atmosphere.

- ii. The process of converting a liquid into vapour is called evaporation.
- iii. The energy that is stored in water vapour is called latent energy, meaning hidden or stored heat.
- iv. Water vapour in the air also forms as a result of the direct conversion of matter from a solid to a gas. The conversion of ice (solid state) to vapour (gas state), without melting is called sublimation. In the sublimation process a total of 680 calories are used up.

Worksheet 18

1. i. droplets ii. condensation iii. saturated iv. cumulonimbus
v. heavy rain vi. fair
2. i. Air may be saturated either because it has become cool or because of the addition of more water vapour. This reduces its (water) holding capacity.
ii. Air could become saturated either at the lower level or at the higher level, depending upon the temperature and moisture characteristics of the air. If the air moves upwards and its temperature is higher than that of the surrounding air, it goes upwards, like the vertical movement of smoke. This air is called unstable air. It is an important aspect of condensation because we know that temperature decreases with height. Therefore this air becomes cool and saturated at a certain height where the temperature is low. When air becomes saturated, condensation starts.
iii. Clouds, fog, and dew

Worksheet 19

1. i. True ii. True iii. False iv. False
v. False vi. True vii. False viii. True
ix. True x. True
2. i. Cherrapunji, India, i.e about 11,000 mm annually
ii. Sahara, Rab-ul-Khali, Thar
iii. less than 12.7 mm, for example, Nokundi in Pakistan
iv. the dark cumulonimbus clouds.
v. mist
3. i. Drizzle is often called mist. It is made up of very small water droplets which appear to float in the air. It forms in low clouds like stratus clouds.
ii. Sleet is a winter phenomenon and refers to the fall of small particles of ice. Sleet is also called ice pellets. Sleet occurs when snow falls through a warmer layer of air and melts. Some of it refreezes and forms pellets. Sleet can also be a mixture of rain and ice pellets. Glaze is also called freezing rain. It occurs when rain falls on a surface that has a temperature below freezing. The rain freezes on contact, gradually building up a layer of ice.

Worksheet 20

1. i. land ii. subsistence iii. forest iv. intensive v. steppes
2. i. Agriculture is the most fundamental form of human activity which includes not only cultivation of crops but also animal rearing like cattle farming, poultry farming, etc.
ii. Agriculture is an important source of raw material for industries like textile, food processing, leather, and rubber. Agriculture provides employment to the rural population of the world. The share of agricultural products in the international trade is still impressive. Agriculture is the backbone of the economy of less developed countries.

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- iii. People live in different countries which differ in terms of their physical characteristics like relief, climate, vegetation and social, economical and technological characteristics. Consequently various types of agriculture are practised in different parts of the world.
 - iv. subsistence farming, intensive farming, extensive farming, mixed farming, plantation farming, dairy farming
 - v. In developing countries like Pakistan, India, China, a high yield of crop is obtained by intensive use of labour. However, this method of farming is traditional and there is no surplus production. In this region population density is very high. Therefore every inch of land is tried to be intensively cultivated.
 - vi. **Mixed farming:** mixed farming refers to a type of agriculture in which both crop production and animal rearing are important. It is practised in the USA, Central Mexico, Southern Brazil, South Africa, Western Europe, and Central Russia. In some areas both crops and animals are raised for commercial purposes, while in other areas they are locally consumed. **Livestock ranching:** in the grasslands, cattle are raised commercially on huge ranches. Livestock ranching is common in USA, Australia, New Zealand, Canada, Mexico, Kazakhstan, etc. **Dairy farming:** products made from milk are called dairy products, and cattle and livestock are an important source of dairy products like milk, butter, cheese, ghee (clarified butter), curd, etc. Raising cattle for the purpose of producing dairy products is called dairy farming. In developing countries dairy farms are small and most of the dairy products are consumed by farmers or by local population. In developed countries like Australia, USA, and Canada, large dairy farms are developed for commercial purposes and their products are sold all over the world.
3. i. subsistence ii. intensive iii. extensive farming
iv. intensive subsistence v. plantation

Worksheet 21

1. i. agricultural ii. 40 iii. wheat iv. 90
v. Indus vi. Basmati vii. cotton viii. Khyber Pukhtunkhwa
ix. potato x. mild xi. Balochistan and Khyber Pukhtunkhwa
2. i. Punjab and Sindh ii. hot, wet iii. canal
iv. 2 v. chillies, onions
3. i. Wheat is grown all over Pakistan. The main wheat growing areas in Punjab extend from Sialkot in the north to Rahimyar Khan in the south, and from Okara in the east to Leiah in the west. In Sindh it covers the central Sindh region which includes Sanghar, Khairpur, and Naushero Feroze Districts. **Sugar cane:** the canal irrigated regions from Khyber Pukhtunkhwa to Sindh. There are three main growing regions in Pakistan. In Khyber Pukhtunkhwa Charsada, Mardan, Peshawar Districts; in Punjab Faisalabad, Kasur, Sargodha, Mandi Bahauddin Districts and in Sindh, Badin, Thatta, Nawabshah, Naushero Feroze Districts are main sugar cane growing areas. **Cotton:** the main cotton-growing regions are found in southern Punjab and central Sindh. Multan, Vihari, Bahawalpur, Bahawalnagar, Rahimyar Khan, Bhakkar, Dera Ghazi Khan in Punjab and Ghotki, Sukkur, Sanghsr, Khairpur, Hyderabad are cotton growing regions. **Rice:** the Northeastern Punjab comprising Sialkot, Gujranwala, Sheikhpura, Narowal, Hafizabad Districts. In Sindh Larkana, Shikarpur, Jacobabad, Badin, Thatta and in Balochistan, Nasirabad and Jaffarabad Districts are rice growing districts.
4. i. Agriculture is the backbone of Pakistan's economy. It is a major contributor of national income, accounting for 22.5 per cent in 2003–2004. Agriculture employs about 40 per cent of the total labour force.

- ii. Ploughing by wooden plough and harvesting by sickle is still common, but the use of tractors and combines is increasing day by day. Similarly the use of fertilizer and pesticides is also increasing which increases the yield production of crops. Poultry farming and dairy farming are still largely practised on subsistence farms. However, now large commercial dairy farms and poultry farms have emerged in large cities.
- iii. Irrigated and rain-fed
- iv. **Irrigated agriculture:** agriculture that depends on irrigation (man-made methods of supplying water) is called irrigated agriculture. Canals, tube wells, *karez* are the main sources of irrigation. Pakistan is the country where rainfall is low and highly variable. Therefore agriculture in Pakistan mainly depends on irrigation. The River Indus and its main tributaries, River Jhelum, River Chenab, River Ravi, River Sutlej, and River Kabul provide an excellent canal system. Canal irrigated agriculture is the most dominant form of cultivation in Pakistan. The advantage of irrigated farming is that due to sufficient water in all months, crops can be grown year round. The yield production is also high. Rice, sugar cane, cotton, and wheat are the main crops of canal-irrigated farming. **Rain-fed agriculture:** areas where due to unfavorable relief or lack of sufficient surface or subsurface sweet water agriculture depends on rainfall which is called rain-fed farming or locally called *barani* farming. Rain-fed farming depends upon the occurrence of rainfall which is seasonal, low, and variable. Therefore crops which need sufficient water like rice, sugar cane, etc. are generally not grown there. Similarly the yield of crop production is also low. Rain-fed farming is done in all provinces of Pakistan in deserts, on plateau surface, and mountainous areas. In Sindh, the Thar Desert is the region of *barani* cultivation. Crops are grown in such months and years when rainfall occurs. Due to scarcity of water, crops which need low amount of water like *jowar*, millet, and limited amount of wheat and vegetables are grown. In the Potwar Region, *barani* farming is dominantly practised. However, the amount of rainfall is relatively more than in the Thar region of Sindh. Therefore, wheat, maize, and mustard are grown there. *Barani* cultivation is also practised in several areas of Balochistan and hilly areas of Khyber Pukhtunkhwa where no other means of irrigation is available.
- v. **Mountain agriculture:** the north of Pakistan is dominated by mountains and hills. Agriculture is practised there on the slopes of mountains. Slopes of mountains and hills are cut in small flat patches, called terraces, and this type of farming is called terrace farming. Mountain agriculture in Pakistan is rain-fed and irrigated. In the mountainous region of Swat, Dir, and Chitral, a traditional irrigation system exists, called diversion canals or diversion channels. The water of streams is diverted and lifted through diversion channels which irrigate the cultivated lands of mountains. This irrigation system is based upon community participation and they have an old traditional water sharing system.
- vi. Winter season—*rabi*; summer season—*kharif*
- vii. Wheat, gram, *masoor*, rape-seed, mustard, and tobacco are important *rabi* crops. Cotton, rice, maize, *jowar*, and *bajra* are some of the important *kharif* crops.
- viii. Wheat is the staple food of the country and dominates all other crops in terms of cultivated area and production. Rice is an important cash crop. Sugar cane is Pakistan's most important cash crop after rice, and it is mainly used in the making of sugar and *gur*. Cotton is the main cash crop in Pakistan. Cotton is mainly consumed in making cotton yarn and cloth. Cotton and its products like yarn, cloth, garments have the leading share of the total export of Pakistan. **Other crops:** maize, millet, pulses, oil seeds, tobacco are other major crops which are grown in Pakistan. Maize is used mainly as fodder. Among the minor cereals, *bajra* (millet), *jowar* (sorghum), and barley are also grown in Pakistan. Pulses are an important part of our food. Gram, *moong*, *mash*, *masoor* are grown but a considerable amount is imported each year. Pulses can be grown in the *barani* areas. Oil

DISCOVERY 2

Teaching Guide

seeds are used in making vegetable ghee. The most important oil seeds are rape seeds, mustard, and sunflower. Tobacco is an important cash crop.

- ix. Animals supply meat, milk, and milk products like butter, ghee, leather, skin, wool, etc. Some of them are consumed locally and others are used in making export products. Therefore livestock can play an important role in the economy. In the rural areas of Pakistan, each house keeps some animals for their domestic and agricultural use. Cow dung is still used as fuel and fertilizer. Animals are still used in ploughing the fields. The chief farm animals in Pakistan are cattle, mainly buffaloes, cows, goats, and sheep. Punjab has the largest number of cattle among the provinces of Pakistan.

Worksheet 22

1. i. lift ii. low iii. scarcity iv. irrigation
v. tunnel vi. *qanat* vii. 78 viii. canals
ix. self-sufficient x. waterlogging
2. i. About 80 per cent of country has arid and semi-arid climate. More than 80 per cent of the total cropped area is under irrigation.
- ii. a) In lift irrigation, the water in river, lake, pond, or well is lifted by hands or by animals. There are several methods. One method is called *dhenkli* or *shaduf*. The *shaduf* consists of a bucket suspended by a rope from one end of a pole. Another method in which a rope and bucket move on a pulley is used for lifting water.
- b) In the desert areas of Pakistan like Thar desert, Cholistan or such areas where electricity is still not available, donkeys and camels are used for pulling water from wells. In the canal irrigated areas of Punjab and Sindh, where the water table is not lower than 5 m, a wheel driven by animals, called *charsa* or Persian wheel is used for lifting water from wells.
- c) Tube well is a method of irrigation in which water is pumped out through pipe. For this purpose a powerful pump and motor are used. Tube wells irrigate about 17 per cent of total irrigated area. Tube wells are utilized in such areas where sweet underground water is available. Excessive use of tube wells in such areas where sweet underground water is limited, creates a serious problem of depletion of subsurface sweet water.
- iii. Aridity, rugged topography, poor soil, plant diseases and pests, flood, water distribution and management problems; use of primitive tools and lack of mechanization, water logging and salinity, small landholdings, inadequate marketing facilities, inconsistent government agricultural policies.
3. i. False ii. True iii. False v. False
v. False vi. True vii. True

Worksheet 23

1. i. giving good value for the money spent
ii. the process by which minerals are extracted from the ground
iii. to obtain or remove with special force or pull
iv. rock or sand that covers a mineral deposit
v. mineral deposits in their rawest form found in rocks, etc.
2. i. In the earliest times the only minerals used by man were stones, such as flint, which was used in tool making.
- ii. Mining is an extractive industry. Mining has now become an important activity which provides employment and boosts the national economy. It adds to the wealth of a nation.

- iii. Minerals that are found on or near the surface can be extracted by digging. However, the extraction of those found several hundred metres below the surface, like natural gas, and petroleum, requires skilled labour and advanced machinery.
 - iv. Mining is an important activity which provides employment and boosts the national economy. Minerals provide raw materials for industries.
3. i. adit ii. panning iii. drilling iv. open pit
v. shaft

Worksheet 24

1.

Name of mineral	Category	Found/mined in	Uses
Salt	Non metallic	the Salt Range	Culinary use manufacture of soda ash and caustic soda which are the raw materials for detergents, and also used in tanning
Marble	Non metallic	Mullagori in Khyber Agency, Ghundai Tarko in Mardan, and Chagai in Balochistan	used for making marble tiles and decorative products
Coal		Punjab, in the Salt Range at Makarwal; in Balochistan, at Khost-Sharig-Harnai, Sor Range, and Mach; in Sindh, at Lakhra, and the Jhimpir-Meting area. Recently a huge coal deposit has been discovered in the Thar Desert of Sindh.	mainly used for burning in cement factories and brick kilns
Limestone	Non metallic	Potwar Plateau, Pezu in Dera Ismail Khan, Zindapir in Dera Ghazi Khan, Ganjo Takkar in Hyderabad, and Rohri Hill, Makli Hill, and Pir Mangho in Karachi	mainly used in cement manufacturing and making bleaching powder, glass, paint, etc.

DISCOVERY 2

Teaching Guide

Chromite	metallic	Muslim Bagh, Balochistan	used in steel manufacturing
China clay and soapstone	Non metallic	Shah Dari, Swat (China clay); Sherwan, Abbottabad (soapstone)	used in making ceramics
Barite	Non metallic	Khuzdar, and Kundi in Balochistan and some other locations	used in the oil industry, and in manufacturing paint, glass, and insecticides

2. i. True ii. True iii. False iv. False
 v. True vi. True vii. False

Worksheet 25

1.
 - i. Basic materials used to manufacture new products in factories are called raw materials. Sugar cane, raw cotton, iron and copper ores, marble, limestone, clay, etc. are examples of raw materials. Raw materials should be cheap, easily available, and easy to transport to factories. No manufacturing or processing can take place without raw materials.
 - ii. Industrial development is not possible without an adequate supply of electricity, which is required to run machinery. An industry will be set up in an area where there is uninterrupted supply of electricity to ensure a smooth flow of production.
 - iii. A market is a place where manufactured goods are sold. Large cities have large markets. Therefore large cities are considered appropriate places for establishing industries.
 - iv. Transport costs and the availability of transport have a bearing on industrial location. Raw materials are transported to factories and finished goods are delivered to the markets. For this purpose road transport, railways, and shipping are major means of transport. Pipelines are an important method of transporting crude oil from oil fields to refineries.
 - v. Human beings operate machines. Therefore, labour is an essential element of industrial activity. Cities are the places where educated, trained labourers are available. However, labour is also imported from other places within the country and from outside the country.
 - vi. Capital is a large amount of money that is required to establish an industry. Generally banks, either local or foreign, provide the capital. Stock exchanges and big investors also finance such huge ventures. Without capital, no industry especially large scale industries can operate.

- vii. The Government has an important role in the development of industries. Governments frame industrial policies and can offer incentives like relaxation in custom duties, low-priced electricity, tax exemptions, etc. Governments also establish industrial estates and special areas where infrastructure (roads, water, electricity, etc.) and facilities are available. The Government's policies and trade ties with other affect a country's exports and revenue.

Worksheet 26

1. i. True ii. False iii. False iv. True
v. True vi. False
2. i. Cottage industries are referred to as the informal sector of industry as they are generally not registered with the government or documented by the tax department.
ii. Steel industry, cement industry, sugar industry, fertilizer industry, automobile industry, electronic goods industry, textiles, and heavy engineering
iii. The textile industry includes cotton, woollen, art silk, and jute textile mills.
iv. Cement is an essential element used in construction. Limestone is the main raw material that goes into making cement, along with gypsum. These raw materials are heavy and difficult to transport.
v. Difficulty in storing sugarcane because it is bulky, rapid population growth, and the per capita consumption of sugar.

Worksheet 27

1. i. Countries make efforts to increase their export trade because it is the main source of foreign exchange which is essential for purchasing goods in the international market.
ii. The main purpose of these duties is to generate income for the government. However duties also play an important role in increasing or restricting trade. Paying duty increases the prices of commodities, which negatively affects trade. Sometimes a government imposes heavy duty on the import of a commodity to restrict its flow in the country and to protect local producers and the local market.
iii. The European Economic Community (EEC), the Latin American Free Trade Association (LAFTA), and the South Asian Free Trade Association (SAFTA). The World Trade Organization (WTO) is a trade organization that promotes a free market economy and relaxation of duties.
iv. Free trade means trade without any restrictions. Quotas are restrictions on the quantities imported. Free trade encourages international trade; quotas are a means of restricting trade.
2. i. True ii. True iii. False iv. True v. True

Worksheet 28

1. i. Pakistan is an agricultural country, but because of a huge population and low yield per hectare production, the country has to import wheat, sugar, and pulses in years when these goods are deficient.
ii. In 1947–48, 1950–51, and 1972–73
iii. In the absence of a balance of trade, the shortfall has to be met by foreign loans, aid, and remittances by Pakistanis working abroad. This is a grave situation for any economy.
iv. Western European countries, the Gulf countries, and the USA are the major trade partners of Pakistan. Western European countries account for 35.2 per cent, the Gulf countries (Saudi Arabia, Kuwait, the UAE, etc.) account for 22.6 per cent, and the USA and Canada have a 16.1 per cent share of the total trade of Pakistan.

DISCOVERY 2

Teaching Guide

- v. a) Rice, raw cotton, seafood, and fruit are major commodities that come under primary products. Primary products contribute about 10 per cent of the total exports.
 - b) Sports goods, leather goods, surgical goods, carpets, and engineering goods fall into the category of other manufactured goods which account for 20.3 per cent of the total exports.
2. i. 1971, as it used to come from East Pakistan
 - ii. total exports, accounting for 60 per cent of the total exports

Worksheet 29

1. i. producers, consumer ii. infrastructure iii. Romans
 - iv. mountain ranges v. inland vi. Europe vii. tramp steamer
2. i. Ocean liners run according to schedule over established routes. They are the fastest of ocean ships and are used to carry passengers and mail. Some of the most luxurious liners sail between Europe and North America. Cargo liners have all the qualities of ocean liners but are primarily used for transporting goods. Tramp steamers have no fixed routes and no fixed times. Their cost remains low and they are intended to carry cheap, bulky, non-perishable goods like grain, cotton, timber, coal, iron ore, etc. A tramp steamer is free to enter any port.
 - ii. The River Elbe, River Rhine, River Rhone, and River Danube are the main navigable rivers of Europe. In Russia, the River Volga is the most important navigable river.
 - iii. The construction and maintenance of railways requires huge amounts of capital.
3. i. mileages ii. 30 iii. Inland iv. roads

Worksheet 30

1. i. True ii. False iii. False iv. True
 - v. False vi. True vii. False
2. i. a. Overstaffing and mismanagement
 - b. The number of passengers has declined over the years due to increased fares and an unreliable, unpunctual service. The number of trains per day has decreased from 230 to just one train a day.
 - c. Karachi is the port city of Pakistan.
 - ii. Village roads serve to connect people from one village to other villages and provide links between farms and local markets. District roads provide services to carry goods and passengers from one district to another. They serve large collection and distribution centres, as well as larger railway stations. Motorways are designed to provide quick transport, avoiding the problem of traffic jams. Motorways do not pass through settlements, but link via overhead bridges and underpasses. The government has planned to construct a number of motorways. The Lahore-Islamabad motorway (M-2, 367 km) was the first motorway in Pakistan and was completed in 1997. The Islamabad-Peshawar (M-1, 154 km), and Pindi Bhattian-Faisalabad (M-3, 52 km) motorways have also been completed. Highways are the main link roads between the major cities of Pakistan, and therefore play a vital role in carrying passengers and goods. The oldest highway in Pakistan, which was built by Sher Shah Suri in the 16th century, is the Grand Trunk (G.T.) Road. It runs from Peshawar to Lahore. Most of the highways in Pakistan run parallel to railway routes on both sides of the River Indus. These roads connect the major cities of Pakistan with Karachi, its main sea port. Shakra-e-Karakoram, which starts at Hasan Abdal and ends at the Khunjerab Pass, not only provides a link between the Northern Areas (Gilgit, Hunza, Skardu, etc.) and the rest of the country, but also links

Pakistan with China. The Karachi-Quetta via Khuzdar is the main highway which transports goods to Qandhar, Afghanistan. The Makran Coastal Highway provides a link to the newly developed seaport of Gwadar. It has great strategic and economic importance.

- iii. Gwadar Port is located along the western side of the Balochistan coast. It was inaugurated in 2007, and started its operation in 2008. Because of its nearness to the Middle East it has economic and strategic importance. It is also expected to serve the landlocked Central Asian countries. Gwadar Port is connected to Karachi by the Makran Coastal Highway. The total cargo handled by the port in 2012-13 was 5.4 million tonnes.

