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WORLD WATCH **SECOND EDITION**
GEOGRAPHY

A Geography Course for Grade 6

TEACHING GUIDE

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Introduction

An outline of the course

World Watch Geography is a geography course for the 21st century. It is designed for secondary grades that want to stimulate curiosity, thinking skills, and a love of learning. The course comprises four components: Student's Textbooks, Skills Books, My E-Mate companion website, and Teaching Guides.

Core features

- It draws its content and skills from the National Curriculum for Pakistan (2022) and international secondary school syllabuses while focusing on Pakistan for examples.
- At all levels, learning is built on students' knowledge; the teacher eliciting what they already know and building on this, not simply loading them with facts.
- The language, content, and tasks are progressively graded according to class levels.
- Each level is split into separate units, each focusing on a different topic.
- High priority is given to independent and critical thinking skills and building geospatial skills.
- Ideas for discussion are provided to help students to express their own ideas in open-ended tasks.
- Mapping skills are taught in a progressive way that builds on the students' previous learning.
- Diagrams and charts/tables are used to vary the presentation of content.
- Students are encouraged to make connections between the geographical environment and the way people live.

Student's Books

- The Student's Books form the core of the course. The illustrations, photographs, and maps bring alive the familiar environment and distant places, and both natural and man-made geographical features.
- The 'Contents' page details the learning outcomes for each unit.
- Each unit of the Student's Book consists mainly of reading texts and making observations, followed by assessment questions.
- The 'Overview' at the end of each unit virtually represents the various topics in the unit and how they are interlinked to each other.
- Fact boxes contain interesting information about the relevant topics and key fact boxes at the end of each unit summarize the unit.

- The 'Building Skill' feature box serves as a valuable tool for students to develop geospatial skills and actively engage with the subject matter. These suggested activities provide practical exercises, real-world scenarios, and opportunities for critical thinking, allowing the students to apply their learning in a meaningful and relevant way.

Skills Books

- At each level, there is an accompanying Skills Book.
- The tasks are varied and enjoyable, and include maps, diagrams, charts or tables, crosswords, fill-in-the-blanks, and situational questions.
- Skills Book pages should be introduced in class and can be completed either in class or for homework.
- Students are usually expected to write in the Skills Book.
- There is a brief learning outcome at the top of every page.

Teaching Guides

Teaching Guides are an invaluable resource for the teacher. It provides a framework for formative assessment of students during each lesson. It has the following features:

- background knowledge
- student learning outcomes
- step-by-step lesson plans
- ideas for further activities and student research
- answer keys for Assessments and Skills Book activities
- scheme of work
- geography skills checklist

Content

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1 Structure of the Earth and Types of Rocks

Background knowledge for the unit

Geography studies the Earth's physical features, climate, population, and how humans interact with the environment. It helps us understand the world, including the landscapes, cultures, and ecosystems that make each place unique. In today's modern world, geography is aided by advanced tools and technologies that enhance our understanding and analysis of the Earth's features. You will briefly explore some of these modern tools and their significance in geography.

Modern tools and technologies have revolutionised the field of geography, enabling us to explore, understand, and analyse the Earth's features in ways previously unimaginable. From GIS and remote sensing to GPS and digital mapping, these tools enhance our ability to study landscapes, monitor environmental changes, and make informed policy decisions. Embracing these modern tools is crucial for students and professionals alike, as they open exciting possibilities for exploration and research in the dynamic field of geography.

Moving further, students will also study about the internal structure of the Earth and different types of rocks. Rock is a natural material made up of solid crystals of different minerals that have fused together. Rocks can be grouped into three basic types: igneous, sedimentary, and metamorphic. Igneous rocks are volcanic formed from molten material. Extrusive rocks (e.g., pumice, basalt, obsidian, tephrite, etc.) are formed from lava that has solidified on the surface of the Earth. Intrusive rocks (e.g., granite, gabbro, quartz) are formed by magma that has solidified underground. When igneous rocks cool quickly, they have small crystals; when they cool slowly, they have large crystals. The most common igneous rock is granite, which makes up large parts of every continent.

Under the sea, the main rock is basalt, the most common volcanic rock. Basalt can sometimes be intrusive (formed underground). The oldest rocks on Earth are types of granite: geologists think that some granite in Australia is more than four billion years old. Sedimentary rocks are formed when other rocks are eroded. They are made up of fragments of other rocks, and many (mainly limestone) contain the remains of plants or animals, and fossils. Other sedimentary rocks include chalk, flint, sandstone, mudstone, shale, dolomite, and tufa.

A fossil is the preserved remains of a plant or animal that lived at least 10,000 years ago, or it is the trace of these remains. Some of the oldest fossils are the remains of algae that lived in oceans more than 3 billion years ago. Preserved remains include bones, shells, and teeth. Trace fossils are not fossilized remains, but the fossilized traces of organisms, such as the imprint of a leaf, skeleton, or footprint. When animal or plant material is fossilized,

it has been covered with sediment (such as sand), or lava, soon after it died, so that it did not decompose. Minerals from the sediment seep into the plant or animal remains. Amber is a type of fossil formed from the sticky resin of trees.

Metamorphic rocks are formed when sedimentary or igneous rocks are changed by pressure, heat, or both. Examples are quartzite (made from sandstone), marble (from limestone), gneiss (from granite), and slate (from shale). Soil is formed from eroded material, but there are several factors that affect soil:

- **Composition:** Rock is made of different minerals.
- **Time:** 1 cm depth of soil takes about 1000 years to form.
- **The shape of the land:** The soil that forms is affected by the slope of the land and its aspect (whether it faces north, south, east, or west) because different aspects have different temperatures, wind, and rainfall.
- **Drainage:** Soil is changed by how well water carrying dissolved materials passes through it.
- **Climate:** Rainfall and temperature affect the plants and other living things in the soil, and how well water evaporates depends on the surface of the soil.
- **Vegetation** affects the amount of humus (organic material) in the soil.
- **Human activity**, such as construction, can change the angle of a slope or the vegetation on the ground. It can alter drainage patterns.

Before we proceed

For this unit it will be useful to have some knowledge about geography and what maps are, how did they look initially with plenty of examples of different types of maps, so that the students can use them to learn how to use them, to identify the purposes of different kinds of maps, and to look for (and use) the key elements: title, north sign, symbols and key, scale, and grid lines. The collection of maps should include a globe, physical and political maps of the world and of Pakistan, maps of some students' hometowns, tourist maps, street maps, and plans of places such as shopping malls, tourist centres such as wildlife parks, housing schemes, etc.

To prepare for this unit, study GIS, GPS, and remote sensing with a simplified approach that introduces the basic concepts and practical applications of these technologies. Start by familiarising yourself with basic geographical concepts such as maps, coordinates, and the Earth's features. Learn about latitude and longitude, continents, countries, and major landmarks. Use these to explain how we know about the internal structure of the Earth.

Also, collect as many samples of identified rocks as possible, also samples of soil of different types: clay, silt, sand, chalk, loam, and peat. This is easier if you, or anyone you know, are visiting different places. If you do not know what the samples are, you and the students can use information from this unit to try to identify them. If possible, also have some identified, labelled, samples, which can be bought from school suppliers. Failing this, close-up photos can be used, but the real thing is much better.

If it is not possible to take the students to look at rock in their surroundings, ask them to notice anything in or around their homes that is made from rock; let them look around the school for examples of uses of different types of rock, and have plenty of photos of different rock used in buildings, pavements, ornamental features such as statues, floors, kitchen worktops, and so on; also those in everyday use (the abrasive material used in 'glasspaper' or 'sandpaper' is made from sand; other useful abrasives are corundum, flint, and pumice). This will help them determine the economic uses of rocks and identify how many different types of rock are in everyday use.

Expected learning outcomes of the Unit

Students should be able to:

- define Geography and describe its importance from the uses of its modern tools
- describe the internal structure of the Earth
- differentiate between three layers of the Earth
- explore the theory of tectonic plates
- describe the characteristics of different types of rock (igneous, sedimentary, and metamorphic)
- explain how rocks and soil are formed
- identify different types of rock and soil from samples and pictures
- ask questions and draw conclusions about their observations of the types of rock and soil they see around them
- explain how different soils vary in colour, permeability, and nutrient content'
- identify the most found rocks in Pakistan
- describe the importance of rocks in the economy of the region.
- recognise the modern techniques in geography (GIS, GPS, google maps, Google Earth, etc.)
- use maps, google maps, GIS, etc. to understand the structure of the earth and rock formation.
- analyse the importance and uses of rocks.
- gather, organise, and interpret data to conclude the types of rocks found in Pakistan.

Lesson Plan # 1	
Reference pages 1-3	
<p>Topics</p> <ul style="list-style-type: none"> • Geography • Tools of Geography • How are maps read • More tools of geography 	<p>Resources</p> <ul style="list-style-type: none"> • globe • map of your city • atlas • paper or printouts of a basic map of the school grounds • colored pencils or markers • rulers or measuring tapes • computers/mobile devices/ GPS units (optional) • Skills Book activity 'What is Earth made up of'
<p>Prior knowledge / Introduction</p> <ul style="list-style-type: none"> • Remote sensing involves collecting data about the Earth's surface from a distance, typically using satellites or aerial platforms. It provides valuable information about land use, vegetation patterns, weather patterns, and changes over time. Remote sensing data helps map, monitor environmental changes, and study natural disasters like hurricanes or forest fires. • The Global Positioning System, or GPS, on the other hand is a satellite-based navigation system that allows precise location determination on the Earth's surface. GPS devices and applications are widely used in geography for mapping, navigation, and tracking purposes. They help us determine coordinates, plan routes, and collect field data with high accuracy. • With the advent of the internet, online mapping and visualization tools have become increasingly popular. Platforms like Google Maps and interactive web-based applications provide access to maps, satellite imagery, street views, and 3D models. These tools allow users to explore locations, plan routes, and visualize geographical information from anywhere in the world. 	<p>Teacher's Notes</p>

Steps using the Student's Book	Teacher's Notes
<ol style="list-style-type: none"> 1. Mind map with students what do they think of geography as a study. (It is a fascinating subject that can help us to understand the world around us. It can help us to learn about different cultures, climates, and ecosystems. It can also help us to understand the impact of human activities on the environment.) 2. Introduce geographic tools by showing Google maps and urban settlement or road plans to discuss its importance and the role of modern technology in making it. 3. Introduce and discuss how Geographic Information Systems, or GIS, are powerful tools used in geography to capture, store, analyse, and present spatial data. (GIS enables us to visualise and interpret information about landforms, vegetation, population distribution, and other geographical phenomena. It helps us make informed urban planning, environmental management, and disaster response decisions.) 4. After introducing and discussing basic concepts of GIS, GPS, and remote sensing, show examples of maps and satellite images to give students a visual understanding of the information that can be collected and analysed. 5. Distribute the maps of the school grounds to each student or group. 6. Instruct the students to explore the school environment, both indoors and outdoors, and identify various features such as classrooms, playgrounds, entrances, trees, or other landmarks under supervision of adults. 7. Using coloured pencils or markers, ask students to annotate the map by adding symbols or labels to represent the identified features. 8. Encourage students to measure distances between different points on the map using rulers or measuring tapes. For more advanced students, if available, have them use GPS units or mobile devices with GPS capabilities to mark specific locations on the map 9. Discuss their findings when back in the classroom. Ask questions such as: <ul style="list-style-type: none"> • What did you observe during the mapping activity? 	

<ul style="list-style-type: none"> • How did you mark the different features on the map? • Did you encounter any challenges while measuring distances or using GPS? <p>7. Introduce the concept of remote sensing and explain how satellite images can provide additional information about the school environment that may not be visible during the mapping activity.</p> <p>8. Show satellite or aerial photographs of the school grounds, comparing them to the students' annotated maps. Discuss the differences and similarities between the two representations.</p> <p>9. Recap the key concepts learned during the activity, including GIS, GPS, and remote sensing. Discuss potential GIS, GPS, and remote sensing applications in real-world scenarios, such as urban planning, disaster response, or environmental monitoring.</p>	
<p>Homework</p> <p>Encourage students to explore further and think about how these technologies can be used to solve problems or enhance their understanding of the world around them.</p> <ul style="list-style-type: none"> • For an extended project, students can collaborate to create a more detailed and comprehensive map of the school grounds using digital mapping software or online tools. This can involve incorporating additional layers of information, such as land use, vegetation, or accessibility features. • Ensure students have permission and supervision to explore the school environment and use any electronic devices required for the activity. 	
<p>Discussion and Review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> • I learned that geography is • I learned that people began to draw maps in ancient times. • I learned that there are different types of maps for different purposes. • I learned that the first maps were drawn by navigators and explorers, and by scholars who learned from them. • I learned that digital mapping involves creating, manipulating, and displaying maps using computer-based tools. • I have learned the difference between GIS, GPS, and remote sensing. 	

Lesson #2	
Reference pages 3-6	
<p>Topics</p> <ul style="list-style-type: none"> • Internal Structure of the Earth • Tectonic Plates • What is rock? • What are rocks made of? 	<p>Resources</p> <ul style="list-style-type: none"> • Multimedia or a poster for the internal structure of the Earth • Image of a seismograph • samples (or photos) of different types of rock • magnifying glass • Skills Book activity 'Tectonic plate boundaries'
<p>Introduction</p> <p>Ask the students what they know about the materials the Earth is made of and what we would find if we could dig or excavate down to the centre of the Earth.</p> <p>Ask the students about any types of rock they have noticed in use in and around their homes and school. Ask what the rocks are used for and whether they know what type of rock is used for each purpose: for example, hard rock is good for floors, outdoor paving, and kitchen worktops; softer rocks are easier to carve for ornamental purposes; if chalk is used at school, ask what makes it good to use for writing. (It is soft and wears away easily.)</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Internal structure of the Earth:</p> <ol style="list-style-type: none"> 1. Ask the students to read page 3-5 of the Student's Book and help them to read the labels on the diagram of the Earth's internal structure. They should compare this with their own diagrams so that they can see what they have learnt. They should then read the table on page 4 that describes the materials that make up each layer of the Earth. <p>Explain that the depths for each layer given in the table are the greatest depths of each layer, from the surface – not the thickness of each layer. (Apart from the crust whose thickness is the same as its depth from the surface, as it is the top layer.)</p> <ol style="list-style-type: none"> 2. Explain that the parts of the Earth's crust that are under the oceans are called the oceanic crust and those where there is land are the continental crust. Explain that the oceanic crust is between 5–10 km thick, whereas the continental crust is about 25–35 km thick. They could work out the thickness of each layer of the Earth using the information in the table. This could be 	<p>Teacher's Notes</p>

recorded in their notebooks on a copy of the table, with an extra column added, headed 'Thickness'. Ask them to list the layers of the Earth in order from thinnest to thickest. Remind the students to read 'It's a fact'.

Tectonic plates:

1. Explain that the continents are part of large masses of rock that move around on top of the softer material of the upper part of the Earth's mantle, and that when they pull apart, push against one another, or grind past one another, they change the shape of the land. Look at the map on page 5 (find one to show enlarged on multimedia If possible) with them and point out the places where the tectonic plates meet (boundaries) and ask the students to look at the arrows to find out in which direction each plate is moving.
2. Explain that the directions of the movements where the tectonic plates meet give rise to different types of boundaries between the plates:
 - Where the plates slide past one another, the boundary is called a conservative boundary.
 - Where they are pulling apart, it is a divergent boundary.
 - Where they are pushing against one another, it is a convergent boundary.
3. Ask if they remember what they learned about the formation of mountains, valleys, plateaus, and plains and how the movement of tectonic plates created these. The students can now read more about the tectonic plates on pages 5-6, including the information on the photos, maps, and diagrams. Invite them to tell the story of the Indian subcontinent.

Suggested Activity

Ask the students to draw diagrams to show what we might find if we could bore a hole down to the centre of the Earth.

They should keep their diagrams, so that they can compare them with what geologists have discovered using scientific equipment.

What are rocks:

The Earth's interior is constantly moving and changing. The mantle is convecting, which means that hot material rises and cold material sinks. This convection is what drives the Earth's plate tectonics,

which is the movement of the Earth's tectonic plates. The Earth's core is also generating the Earth's magnetic field.

The Earth's internal structure is a complex and fascinating topic. Geologists are constantly learning more about the Earth's interior and how it works. This knowledge helps us to understand the Earth's natural hazards, such as earthquakes and volcanic eruptions. It also helps us to understand the Earth's resources, such as oil and gas.

Ask the students to read pages 6 of the Student's Book 'What is rock?' and 'What are rocks made of?', to learn about the definition of rock, its structure, and how it is formed. They will also find out about the properties of some rocks that make them useful for certain purposes. Ask them to compare the magnified photos of porous and non-porous rock to explain what these terms mean and introduce other words that are also used for this property of rocks (permeable and impermeable) and to say how their structures differ.

Homework

Students can do question B and C. They can also attempt Skill Book activity 'Tectonic Plate boundaries' independently.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned that the Earth is made up of layers of different types of material.
- ✓ I learned that the continents are part of the Earth's crust and that this is the thin outer layer of the Earth.
- ✓ I learned that the Earth's crust and the top part of the mantle is split into huge plates of rocky material called tectonic plates.
- ✓ I learned that the Indian subcontinent was part of a supercontinent called Gondwana.
- ✓ I learned that tectonic plates have moved around and are still moving.
- ✓ I learned that the forces of the moving tectonic plates create landforms such as mountains, valleys, plateaus, and plains.
- ✓ I learned that rocks are made up of organic and inorganic material.
- ✓ I learned that rocks can be permeable and impermeable.

Lesson #3	
Reference Pages 7-10	
<p>Topics</p> <ul style="list-style-type: none"> • Different types of rocks • Igneous • Sedimentary • metamorphic 	<p>Resources</p> <ul style="list-style-type: none"> • samples (or photos) of different types of rock • magnifying glass • 4 Skills book topics (Rock Types, stalagmite and stalactites, Rock quiz, Guess what rock it is) • Skills book activity 'Rock Types' • Skills Book activity 'Stalagmite and stalactites' • Skills Book activity 'Rock quiz' • Skills Book activity 'Guess what rock it is'
<p>Using the Student's book</p> <p>The students can then read page 3 'Different types of rock' and 'Igneous rocks', and 'It's a fact' and look at the photos and read the captions. They should then be able to name some examples of igneous rocks. Ask what makes granite good for kitchen worktops. (It is hard, has attractive patterns and can be polished.) Also ask them to look at the photograph of Zuma Rock, Nigeria. It is an example of a natural feature made of gabbro. Ask them to look at the photograph of the world's tallest cliffs, which are formed from granite (the Trango Towers in the Karakoram Mountains).</p> <p>They could compare the photos of the Trango Towers and the cliffs at Beachy Head, England, and comment on why the Beachy Head cliffs have worn away and collapsed, whereas the Trango Towers have stayed tall. (Beachy Head cliffs have the force of the sea, carrying sediment and pebbles, eroding them and they are made of chalk – a soft rock; Trango Towers are not attacked by the sea and are made of granite, a hard rock that is not easily weathered or eroded.) Ask what they can tell from the photo and caption about what was happening on the coast of Antrim in Northern Ireland when the rocks there were formed. The students could write these questions and their answers in their notebooks.</p>	<p>Teacher's Notes</p>

<p>Ask the students to name some sedimentary rocks they have read about (sandstone, limestone, and chalk). They can then read page 8 'Sedimentary rocks' and study the diagram showing how these rocks are formed. Ask about the differences between sedimentary and igneous rocks. They should be able to use the terms permeable/non-permeable, and soluble/insoluble correctly.</p> <p>They can then read about an example of a sedimentary rock (limestone), and some of its features. Ask what makes caverns so common in limestone areas, and how stalactites and stalagmites are formed. Ask the students to read page 10 'Metamorphic rocks', and to look at the photo and read the caption. They can then answer Questions D and E.</p>	
<p>Homework</p> <p>They can then answer Questions D and E. They can also answer Skills Books activities 'Rock types, Stalagmite and stalactite, Rock quiz, Guess which rock it is' independently or as a group activity.</p>	
<p>Discussion and review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned that there are three main types of rock: igneous, sedimentary, and metamorphic. ✓ I learned about the characteristics of igneous rocks and how they are formed. ✓ I learned what makes rocks suitable for different purposes. ✓ I learned how sedimentary rocks are formed. ✓ I learned about some examples of sedimentary rocks. ✓ I learned about some of the features of limestone. ✓ I learned that metamorphic rocks are formed when other rocks are changed by heat and ✓ pressure. ✓ I learned that although coal and diamonds are made from carbon from organic remains, they are formed by pressure, in a similar way to metamorphic rocks. 	

Lesson #4	
Reference Pages 10-13	
<p>Topics</p> <ul style="list-style-type: none"> • Rock cycle • Economic benefits of rocks • What is soil? • Types of soil 	<p>Resources</p> <ul style="list-style-type: none"> • a box of classroom chalk • the same quantity of soil • a grater, such as a nutmeg or cheese grater or something to crush the chalk with a jar of water • a small, shallow tray, about 15–20 cm long and 10–15 cm wide • Skills Book activity ‘Decoding the rock cycle’ • Skills Book activity ‘Uses of rocks’ • Skills Book activity ‘A soil profile’ • Skills Book activity ‘Clay, sand, silt, or loam’
<p>Introduction</p> <p>Explain that, just as the Earth’s tectonic plates continue to move, and to change the landscape, the formation of rocks is a continuous process, with rock being formed, weathered, eroded, and transformed into soil and new rocks. So, just as we have the water cycle, in which water is changed from one form to another and moves from place to place, this process is called the ‘rock cycle’.</p> <p>Suggested activity</p> <p>Demonstrate how the rock cycle works by grating or crushing at least ten sticks of chalk and collecting the powdered chalk in the small tray. Mix it with water in a jar to make a thin, runny paste. Mix this with about the same amount of soil, then spread it in the tray and leave it in a sunny place to dry. Show the students how to record this as a cycle:</p> <p>Rock (chalk) was worn away (weathered). → This was washed away in water as sediment. → It flowed to another place. → The water evaporated. → A new form of rock was deposited.</p>	<p>Teacher’s Notes</p>

<p>Using the Student's book</p> <p>Ask the students to read page 10 of the Student's Book 'The rock cycle' and explain that there are many different processes that change rock and form new rocks. Some of these are like the demonstration; others use heat and pressure. Ask what else is formed when rocks are weathered (soil). Read the importance of rocks. Introduce the idea of economy and how our daily life revolves around economic decisions.</p> <p>Ask students to read pages 12-13 'What is soil?' and its types. Check that students study the diagram that shows how soil profiles can be seen where deep holes are dug in the ground, for example, for road works or construction. They can also be seen where riverbanks have been eroded by floods. Ask them to look at the soil profile diagram and explain that a soil profile shows the different layers of soil that have formed over many thousands of years. Read out the letter that labels each layer and ask the students what that layer consists of. They should also read 'It's a fact'. Now students can then complete Question F and G.</p>	
<p>Homework</p> <p>Students can answer question F. The Skills Book activities 'Decoding the rock cycle', 'Uses of rocks', 'A soil profile', 'Clay, sand, silt, or loam' could be completed for homework, with the student's using information from their practical activities using rocks, and on information from this unit.</p>	
<p>Discussion and review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned that rocks change their form over millions of years under various weather conditions like rain, wind, ice, temperature, and pressure. This process is called the rock cycle. ✓ I learned rocks have significant economic importance as they serve as primary sources of valuable minerals used in various industries, such as construction, manufacturing, and energy production. ✓ I learned that soil begins as particles of weathered and eroded rock. ✓ I learned about the factors that affect soil formation. ✓ I learned how a soil profile shows the layers of soil that have formed over the years. 	

Lesson #5	
Reference Page 14	
Topics <ul style="list-style-type: none"> • What is a mineral? 	Resources <ul style="list-style-type: none"> • Samples of different minerals • Skills Book activity Impact of mining
Introduction <p>Minerals are the building blocks of our planet. They are naturally occurring substances that form the Earth's crust and have distinct chemical compositions and crystal structures. Minerals come in a dazzling array of colors, shapes, and sizes, and they contribute to the stunning variety of rocks and landscapes we see around us. Minerals are more than just geological curiosities – they are integral to our lives in countless ways. From the sparkle in gemstones to the strength in construction materials, minerals are essential components of everything from technology to art. Whether you're admiring the glint of a diamond or holding a smartphone in your hand, you're interacting with the incredible world of minerals.</p>	Teacher's Notes
Using the Student's book <p>Ask students to read page 14. Explain that soil contains minerals from the rock it was formed from, as well as others that have been deposited in sediment. The students can then read about minerals on pages 14–15 and notice the different shapes of the crystals that make up minerals, and the different arrangements of crystals: shapes that interlock in blocks or sheets. Tell them that there is a scale for measuring the hardness of minerals, which they can read about in 'It's a fact' on page 11. Students can now do Question A.</p>	Teacher's Notes
Homework <p>Students can now do Question A and G. The Skills Book activity 'Impact of mining' could be completed for homework, with the student's using information from their practical activities using rocks, and on information from this unit.</p>	
Discussion and review <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned that minerals are made of inorganic materials. ✓ I learned that minerals contain crystals which can be of different shapes ✓ I learned that each mineral has a chemical formula. 	

Answers to assessments

A) Choose the correct answer:

- i. 1%
- ii. divergent
- iii. northwards
- iv. sedimentary
- v. igneous
- vi. metamorphic
- vii. diamond
- viii. porous

B 1 a) Continental drift theory: Alfred Wegener, a geophysicist and meteorologist, proposed the Continental Drift Theory in 1912. According to this theory, the Earth was once a single super continent, called Pangea, before breaking up into several smaller continents.

Theory of Plate Tectonics: The lithosphere is separated into plates that move over the asthenosphere. The tectonic plates are not still; they move slowly across the planet. This movement is called continental drift. They can move because the lithosphere sits on top of a layer of less rigid material the asthenosphere. Tectonic plates move between 0–100 mm across the Earth each year.

- b) crust, lithosphere, asthenosphere, lower mantle, outer core, inner core
- c) the crust
- d) The thinnest parts are under the oceans.

C 1. A divergent boundary is one between tectonic plates where they are pulling apart. As the tectonic plates pull apart, magma flows into the gap and forms a ridge.

2 a) up to 10 centimetres, but usually just 1 or 2 cm

b) It turned around.

c) The Indian Plate and the Eurasian Plate are pushing against one another and pushing up the land where they meet. The Himalayas are on this land. As the two plates continue to push against one another, the mountains continue to rise slowly.

D 1. The rock cycle is a continuous process in which rocks undergo transformation over time. It involves the creation, erosion, transportation, deposition, and reformation of rocks. Igneous rocks can be weathered and eroded, eventually forming sedimentary rocks. Sedimentary rocks can be buried, compacted, and lithified, resulting in the formation of sedimentary rocks. Both igneous and sedimentary rocks can be exposed to high heat and pressure, leading to the formation of metamorphic rocks. Metamorphic rocks can then undergo melting and remelting, giving rise to magma and restarting the cycle. The rock cycle is influenced by various geological processes, such as tectonic activity, weathering, and erosion.

2. They are formed when rainwater or ground water seeps through the soil and reaches the rocks below. It runs into small spaces in the limestone and erodes holes and cracks, called swallow holes or sinkholes. Some of these holes grow large enough to become caverns.
3. Water drains through the ground into sinkholes.
4. Limestone has versatile applications across various industrial sectors. It is extensively used as a building material in infrastructure projects, including buildings, bridges, and roads. Pakistan's cement industry heavily relies on limestone as a primary raw material. It also generates foreign revenue through exports. It plays a vital role in producing iron and steel and is also utilised in agriculture to make fertilisers. Limestone provides essential nutrients like calcium and magnesium to the soil, promoting healthy plant growth. It is used in producing various chemicals, such as calcium chloride, calcium carbonate, and calcium hydroxide, with applications in pharmaceuticals, food processing, paper manufacturing, and water treatment.

E 1 a) and b) Answer can vary.

c) Marble can have a wide range of colours, but three common colours of marble are white, grey, beige, black, green, multicoloured.

d) Allow the use of the Internet or other sources. Most common place for marble quarrying in Pakistan are

F 1 a-b) the students' own responses. Examples are given here:

Rock	Something made from it	Why the rock is good for this use
Limestone	cement	It is easily crushed.
Sandstone	building	It is quite soft and easy to cut into blocks for building.
Chalk	sticks used for writing	It wears away easily and leaves marks on a dark, matt surface.
Granite	kitchen worktops	It is hard and can be polished.
Obsidian	sharp knives	It is very hard and, when cut and shaped, it has smooth surfaces.
Pumice	as an abrasive for removing hard skin	It is abrasive and quite rough, but light and soft – easy to cut and shape.
Marble	for building	It has very attractive patterns and its light colour (often white) gleams in the sunshine.
Slate	roof tiles	It is impermeable and easy to cut into thin sheets.

2 a) igneous rock

- b) quartz, feldspar, and mica.
 - c) It can be found in many parts of Pakistan, for example: in the Karakoram and Himalaya mountains in the north; the Chaghai Hills in Balochistan; and the Karoonjhar Mountains of Sindh. There are more than 3,000 shades of granite. Gilgit-Baltistan has white granite. The minerals give granite its colour: for example, the Karoonjhar Mountains in Sindh have mainly pink granite, but there is blue granite in some parts of the Himalayas and black granite in Khyber Pakhtunkhwa.
 - d) Rocks hold significant economic importance, particularly due to their mineral composition. Various minerals found in rocks have valuable applications. For instance, magnetite plays a crucial role in the production of steel, which is used extensively in the manufacturing of items like nails, kitchen appliances, furniture, tools, bridges, buildings, automobiles, construction equipment, machinery, highways, ships, trains, and railroads. Minerals like iron oxides, talc, zinc oxide, and titanium dioxide are finely ground and processed to create cosmetic products. Additionally, phosphate rock, another mineral derived from rocks, is utilised in the production of fertilizers, contributing to agricultural practices.
- G 1**
- a) A soil horizon is the different layers of soil that have formed over thousands or millions of years.
 - b)
 - O organic material (material from plants and animals)
 - A minerals that dissolve in water that seeps through the soil
 - B deposited minerals
 - C weathered rock
 - R solid rock that has not been weathered

Answers for Skills Book activities

Skills Book activity 'What is the Earth made of?'

A-C. The diagram should be labelled to match the one on page 3 of the Student's Book and the labelling boxes should include as much of the following information as possible.

Skills Book activity 'Tectonic plate boundaries'

A 1-2. Ask them to look at each diagram and compare it with the diagrams on page 4 and 5 of the Student's Book to find out what kind of boundary it is and how it can change the shape of the land. They can then write a heading for each diagram and an explanation of what is happening.

Skills Book activity 'Rock types'

A. (top-left caption) Rocks formed when magma moves up to the surface of the Earth and cools just below it (top-right caption) Rocks formed deep inside the

Earth under immense pressure and heat (bottom caption) Rocks formed when layers of eroded sediment are pressed under lakes, seas, rivers, and oceans

- B. (top-right heading) igneous rocks
 (top-left heading) metamorphic rocks
 (bottom heading) sedimentary rocks

Skills Book activity 'Stalagmite and stalactites'

Refer to diagram in Students Textbook page 9.

Skills Book activity 'Rock Quiz'

- | | | |
|------------------|--------------|---------------|
| A 1. sedimentary | 6. calcite | 11. pumice |
| 2. porous | 7. igneous | 12. extrusive |
| 3. impermeable | 8. granite | 13. slate |
| 4. stalactite | 9. gabbro | 14. marble |
| 5. stalagmite | 10. obsidian | |

Skills Book activity 'Guess which rock it is'

- A 1-2. Rocks formed deep inside the Earth under immense pressure and heat. The students should play the game as instructed, using the information about rocks in this unit to answer their partner's questions with correct answers (yes or no), until their partner has deduced which rock was chosen.

Skills Book activity 'Decoding the rock cycle'

- A. top to bottom: melting; weathering, erosion, and deposition; compaction and cementation.
 Corner: melting
- B. Drawings may vary.

Skills Book activity 'Uses of rocks'

- A. 1. Granite 2. Limestone 3. Sandstone
- B. Some answers may vary for the sample the student uses:

Chalk:

- Colour: White or pale gray, because of calcium carbonate content.
- Size: Answers may vary.
- Arrangement and Shape of Crystals or Grains: Chalk is composed of microscopically small and irregularly shaped calcium carbonate particles, rather than distinct crystals.

- **Cracks or Breaks in the Rock:** Chalk can be relatively soft and prone to fracturing, leading to the development of cracks and breaks.
- **Layering:** Chalk can exhibit layers or bedding, often indicating the accumulation of sediment over time.
- **Relative Hardness:** Chalk is relatively soft and has a low hardness compared to many other rocks. It can be easily scratched with a fingernail.
- **Chemical Reactivity:** Chalk reacts with certain chemicals, especially acids, due to its calcium carbonate composition. It effervesces when in contact with acids like hydrochloric acid.
- **Presence of Fossils:** Chalk is known for containing abundant microscopic fossils of coccolithophores, which are ancient marine plankton. These fossils are crucial indicators of the rock's origin and the ancient environment in which it formed.

Pumice:

- **Colour:** Pumice can vary in color from white to gray, depending on mineral content and impurities.
- **Size:** Answers may vary.
- **Arrangement and Shape of Crystals or Grains:** Pumice typically has a frothy appearance due to the presence of gas bubbles during its formation. Its crystals and grains are often irregularly shaped.
- **Cracks or Breaks in the Rock:** Pumice is fragile and can easily break into irregular pieces. It often has a porous texture with interconnected voids.
- **Layering:** Pumice may not exhibit distinct layering, as it is primarily formed through volcanic eruptions and subsequent cooling.
- **Relative Hardness:** Pumice is relatively soft and has a low density due to its high porosity, making it feel lightweight.
- **Chemical Reactivity:** Pumice can react with certain chemicals, especially acids, due to its mineral composition. It can effervesce when exposed to acids.
- **Presence of Fossils:** Pumice does not typically contain fossils, as it forms from volcanic processes that do not involve the accumulation of organic material.

Marble:

- **Colour:** Marble comes in a wide range of colors, including white, gray, pink, green, and various shades in between. The coloration depends on the mineral impurities present.
- **Size:** Answers may vary.
- **Arrangement and Shape of Crystals or Grains:** Marble's crystals are usually interlocking and can vary in shape. The texture can be granular or foliated (with visible layers of mineral grains).
- **Cracks or Breaks in the Rock:** Marble is relatively hard and durable, but it can still break along lines of weakness due to tectonic forces or pressure.

UNIT 2 Mountains, Plateaus, and Valleys

Background knowledge for the unit

Mountains

There is no exact definition of a mountain, nor any precise distinction between a hill and a mountain, although mountains usually have steeper sides than hills and are usually higher than 300 metres. There are three main types of mountains: volcanic, fold, and fault block, all formed by plate tectonics: when parts of the Earth's lithosphere (the crust and upper part of the mantle) move upwards, downwards, or sideways on top of the asthenosphere (the part of the mantle that is immediately below the lithosphere which has a viscous consistency). The main mountain ranges are found along tectonic plate boundaries.

The movement of magma (molten rock) can form volcanic mountains. Magma collects in magma chambers (pools beneath the surface of the Earth), where it stays until it either cools to form igneous rock, moves into another magma chamber, or erupts as a volcano. Magma rises through cracks in the crust because it is less dense than the surrounding rock. It can form a dome mountain where it pushes a large area of rock upwards.

Plateaus

A plateau is an area of high ground (a high plain), with a flat surface and usually with one or more steeply sloping sides, or even cliffs. Plateaus can be formed in different ways. Magma rises from the mantle, pushing large, flat areas of rock upwards, in a similar way to dome mountains, but wider and flatter. Where lava spreads outwards from cracks and weak areas in the crust, this can form a plateau. Plateaus can be formed where glaciers erode mountain ranges, leaving high areas between the main mountain ranges. A plateau can also be formed where water erodes the softer rock of mountains or other landforms, leaving a high, flat area of harder rock.

Valleys

A valley is an area of lowland between mountains. It is usually longer than it is wide. Most valleys are V-shaped or U-shaped, depending on how they were formed. V-shaped valleys are usually formed by fast-flowing water in streams or rivers. U-shaped valleys are usually formed by glaciers. Rift valleys are formed by the movement of tectonic plates.

Before we proceed

A useful way to introduce the topic of mountains and of helping the students to notice the significant similarities and differences between mountains is to provide as many photos of different mountains as possible and ask the students to work in groups to sort

them into sets, according to similarities they notice. They can then give each set a name or description that distinguishes it from the other sets before learning how each type is formed into its distinctive shape.

While focusing on the varied landscapes of Pakistan, this unit also provides an opportunity to consolidate the students' learning about the natural physical features themselves (mountains, plateaus, and valleys). There are also opportunities to develop students' understanding of how the landscapes affect the lives of people who inhabit them and how these physical features have influenced the development of settlements.

In a similar way, a selection of photos of plateaus can be used to help the students to come up with a definition of a plateau. Photos of different types of valleys can be sorted in a similar way to the photos of mountains, to encourage the students to notice their distinctive features before learning how each type is formed.

Expected learning outcomes

Students should be able to:

- explain that tectonic plates are parts of the Earth's crust and the top layer of the mantle that have been split up into massive pieces.
- explain how the movement of tectonic plates has formed the landscape.
- identify different types of mountains.
- explain the formation of different types of mountains.
- discover the major types of mountains in Pakistan.
- describe the importance of the Himalayas, Karakorum, and Hindu Kush mountains.
- explain the reasons for frequent earthquakes in Pakistan.
- differentiate between a plateau and a mountain.
- differentiate between V-shaped valleys and U-shaped valleys and their formation.
- describe rift valley and explore where it is located.
- identify some major valleys in Pakistan.
- compare the lifestyles of people living in mountains, plateaus, and valleys.
- describe the importance of the Himalayas in the geography of Pakistan.
- use contours to find out about the elevation and shape of a landscape.

Lesson Plan 1	
Reference Page 17-19	
<p>Topics</p> <ul style="list-style-type: none"> • How are mountains different from other landscapes? • Types of mountains (fold and fault block mountains) 	<p>Resources</p> <ul style="list-style-type: none"> • globe • Oxford School Atlas for Pakistan • 5 towels (about the same size) in different colours • 2 boxes of books, or other heavy items • Skills Book activity 'Tectonic plate and mountains'
<p>Introduction</p> <p>Do the suggested activity mentioned in Background Knowledge above first and then help students link the descriptions they gave to each set, according to the appearance of the mountains. Explain that the shape of mountains depends on how they were formed, and that they are going to learn about the main ways in which mountains are formed.</p> <p>Ask them to look at a physical map of the world to find and name the main mountain ranges on each continent. Tell the students that they are now going to find out about two other ways in which mountains are formed. Explain that tectonic plates can pull apart with immense force that sometimes makes them break along weak points or cracks.</p>	<p>Teacher's Notes</p>
<p>Using the Student's Book</p> <p>Ask the students to read the sections on page 17. Tell them that they are going to carry out an investigation to show how the force of tectonic plates pushing against one another forms mountains.</p> <p>Ask the students to read 'Fault block mountains' to find out what happens. Ask them to compare the photos of the fault block mountains with the photos of fold mountains on page 17-18 and to describe the differences they can see. If they find this difficult, draw their attention to the folded ripples shown in the layers of rock in fold mountains and the straighter layers with sharp breaks in fault block mountains. They should also use Oxford School Atlas for Pakistan to find the locations of the mountains in the photos</p> <p>Activity</p> <p>Set up the investigation to find out how fold mountains were formed (page 18). The students should follow the instructions on</p>	<p>Teacher's Notes</p>

page 18 and then complete the exercise. Tell them that the boxes of books or other heavy items represent tectonic plates moving towards one another and pushing against one another. The towels represent the edges of the tectonic plates. Ask the students to use what they observe to help them to explain how tectonic plates form mountains when they push against one another. (The forces push the edges of the tectonic plates upwards so that layers of rock fold into ripples.)

Homework

Ask the students to answer question B and do Skills Book activity 'Tectonic plates and mountains' using a physical map of the world to help them to locate and name the mountain ranges listed. They should mark the volcanoes as accurately as they can, but the map might help them only to place these in the correct countries. Ask what they notice about the locations of the main mountain ranges of the world and many of the volcanoes. (They are all close to the boundaries of tectonic plates.)

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned the locations of the world's main mountain ranges.
- ✓ I learned that mountains are formed by forces caused by movements within the Earth.
- ✓ I learned that fold mountains are formed where two tectonic plates push against one another.
- ✓ I learned how fault block mountains are formed.

Lesson Plan 2	
Reference Page 19-22	
	<p>Resources</p> <ul style="list-style-type: none"> • <i>Oxford School Atlas for Pakistan</i> • a beaker • enough clay to make two layers of clay that will just fit into the beaker, as shown in the diagram below (image on WWG TG 1 page 49 old SB) • water mixed with flour to thicken it (the paste should be a thick liquid) • Skills Book (Formation of mountains and Grid references)
<p>Introduction 5-10 minutes</p> <p>Tell the students that they are going to find out how some volcanic mountains form. Explain that volcanoes can be:</p> <ul style="list-style-type: none"> • Active (erupting or likely to erupt): Most scientists consider a volcano as active, if it has erupted in the last 10,000 years; has exhibited unusual seismic activity; or produced significant new gas emissions. • Extinct (no written records of its activity): It is unlikely to erupt again because there is no longer a supply of magma. • Dormant (not known to be active): It has shown no sign of volcanic activity but there is still a supply of magma. 	<p>Teacher's Notes</p>
<p>Using the Student's Book</p> <p>Volcanic, dome, and residual mountains</p> <p>Tell the students that they are going to find out how some volcanic mountains form. Explain that volcanoes can be:</p> <ul style="list-style-type: none"> • Active (erupting or likely to erupt): Most scientists consider a volcano as active, if it has erupted in the last 10,000 years; has exhibited unusual seismic activity; or produced significant new gas emissions. • Extinct (no written records of its activity): It is unlikely to erupt again because there is no longer a supply of magma. 	<p>Teacher's Notes</p>

- Dormant (not known to be active): It has shown no sign of volcanic activity but there is still a supply of magma.

Ask the students to look at the photo of Castle Dome Peak in Arizona and to describe its appearance. Ask what is unusual about it. They should notice the flat-topped mass of rock. Ask how it could have formed. Explain that these mountains were formed by volcanic activity that was different from the formation of a cone volcano. They might be able to locate these volcanoes on maps and note their position in relation to tectonic plate boundaries.

Ask the students to read 'Volcanic mountains' on page 19, including 'It's a fact.' Ask the students to read the information about dome mountains and study the diagram on page 20. Ask them to explain how a dome mountain is formed (if possible, without looking at the Student's Book). Ask them to point out the similarities and differences between the two types of mountains.

Discuss with students the text for residual mountains on page 20 which are the remains of previously existing mountains that have been subjected to weathering and erosion for a long period. The erosion process is not even since a softer rock erodes faster than the harder rock. This leaves the harder rocks behind, forming residual mountains. Residual mountains typically exist as standalone peaks, with a lower elevation compared to more recently formed mountain ranges. The most famous ones are the Shivalik Hills of India and the Sierra Nevada of Spain.

Grid references:

Remind the students of what they learned previously about grid lines, where they used the numbers that run from west to east (left to right) along the bottom of the map and up the side of the map (from south to north) to identify a square on the map. To help them to remember that we give the number along the bottom of the map first, point out the mnemonic 'First go along the corridor, then go up the stairs.' Introduce the geographical terms for these numbers: 'eastings' because the numbers along to bottom are numbered towards the east, and 'northings' because the numbers up the side are numbered towards the north. Ask the students to read the information about grid lines and to give the easting for the orange square (76), then the northing for the orange square (25), and finally, the complete grid reference for the orange square (7625).

Answers for the grid reference activity:

- | | | |
|-----|----------|-----------|
| A 1 | a) 7433 | b) 7027 |
| | c) 7033 | d) 7633 |
| 2 | a) green | b) orange |
| | c) blue | d) purple |

Suggested activity for volcanic mountains

Put a layer of clay in the base of the beaker. Explain that this represents rock below the Earth's crust. Pour some thickened water onto the clay (about 1–2 cm deep). Explain that this represents a magma chamber (a pool of magma that has collected under the Earth's crust). Make a hole about 5 mm diameter in the other layer of clay and push this onto the water, explaining that this represents rock in the Earth's crust. The water should come upwards through the hole (a little might escape at the sides of the layer of clay.) Explain that this is what happens because of the downward pressure of the rock: magma escapes upwards with great force through cracks and holes in the rock.

Homework

Ask the students to re-read the pages of this unit and then to complete Skills Book activity 'Formation of mountains' and to write the correct headings for and label the diagrams. Different students could also use the diagrams to explain to the rest of the class how each type of mountains is formed. They can also answer question C and Skills Book activity 'Grid references'

Discussion and review (reflection)

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned how cone volcanic mountains are formed when magma under the Earth's crust is forced upwards and escapes onto the Earth's surface.
- ✓ I learned that the numbers across the bottom of the map are called eastings because they are numbered towards the east.
- ✓ I learned about the differences between cone and dome mountains.
- ✓ I learned how dome mountains are formed when magma pushes a block of rock upwards.
- ✓ I learned that the numbers up the side of the map are called northings because they are numbered towards the north.
- ✓ I learned that a grid reference gives the easting first and then the northing.

Lesson #3	
Reference Page 22-25	
<p>Topics</p> <ul style="list-style-type: none"> • Effects of highland topography on human activities 	<p>Resources</p> <ul style="list-style-type: none"> • <i>Oxford School Atlas for Pakistan</i>
<p>Introduction</p> <p>Pakistan has many different types of landscapes: coast, plateau, plain, hill, mountain, river, valley, desert, and forest. The northern, north-eastern, and western parts are mountainous, with the Indus Plain to the east and south-east, and the coastal plain to the south. Some of the world's highest mountains are in northern Pakistan, including Nanga Parbat, Gasherbrum I, Broad Peak, and Gasherbrum II, all of which are more than 8000 metres high.</p> <p>Mountain passes</p> <p>A mountain pass is a gap of lower land through a mountain range or over a ridge. This gap is often the low point in a ridge. A common site for a mountain pass is just above the source of a river; so, the pass is close to a watershed (highland that separates water flowing in different directions downhill). Some passes are very short, with steep slopes to the top of the pass; others are valleys, several kilometres long. The tops of many passes are the only flat land in an area.</p> <p>In the mountainous areas of Khyber Pakhtunkhwa and Gilgit-Baltistan in the north, and FATA and Balochistan in the west and south-west, mountain passes provide very important gaps in the highland for roads. These roads have developed from ancient trade routes: for example, the Karakoram Highway, on the ancient Silk Route. The Karakoram Highway is known as the Asian Highway or, in China, as the Friendship Highway; it was built through cooperation between the governments of Pakistan and China. Construction of the 1300 kilometres-long road began in 1959 and it was opened in 1979. It runs from Kashgar, in the Xinjiang region of China, to Abbottabad, in Pakistan.</p> <p>The N-35 highway extends the Karakoram Highway south-west from Abbottabad to join the Grand Trunk Road (N-5) at Hasan Abdal. This links Islamabad and Rawalpindi to the end of the Karakoram Highway.</p> <p>Many roads also follow valleys, for example, Peshawar, Bannu, and Kohat valleys in Khyber Pakhtunkhwa; Neelum, Hunza, Swat, Naran, and Chitral valleys in the north, and Quetta and Ziarat valleys in Balochistan. The largest plateaus are the Balochistan Plateau and the Potohar</p>	<p>Teacher's Notes</p>

<p>Plateau (mainly in Punjab); the largest plain is the Indus Plain in the east and south-east; the main river system is the Indus and its tributaries.</p>	
<p>Using the Student's book</p> <p>Ask the students to read pages 22-25 and name as many physical geographic features as they can. List these on the board. They should include mountain, coast, valley, plateau, plain, desert, river, and forest. If they do not mention mountain passes, ask what they know about these. They will probably have heard of the Khyber Pass and Khunjerab Pass, and possibly others in Pakistan. Ask them to discuss mountain passes in small groups for a few minutes and to come up with a definition of a mountain pass. Invite each group to give their definition, which should indicate that a mountain pass is a gap of lower land through a mountain range or over a ridge.</p> <p>Ask students to identify the locations of the most mountainous parts of Pakistan. They can check their answers by looking at a physical map of Pakistan. Encourage them to describe the locations of the mountains by referring to the provinces where they are located and using compass directions. This is an opportunity to do some revision of compass points and on using the key to a physical map, where different shades of colour are used to show land elevation. Remind them of the meaning of elevation (height above or below sea level).</p> <p>Ask the students to read the sections of page 78 'What is the land like in Pakistan?' and 'Mountain landscapes' and to look at the map and photos and read the captions. They should also read the two 'It's a fact' panels on pages 79-80. Ask what they notice about the elevation of mountain passes. Ask how mountain passes have influenced transport routes. Also discuss how the landscapes of mountains, valleys, rivers, and passes have influenced trade routes and the development of settlements. By referring to physical and political maps of Pakistan, they should observe that the routes of roads and railways are planned around valleys and mountain passes. Also elicit that most settlements have developed along valleys and passes, especially where two valleys meet, or a pass meets a valley.</p> <p>Tell the students that they are going to find out about a town situated in a mountainous region of Pakistan: Skardu, the capital of Gilgit-Baltistan. Ask them to find Skardu on the map on page 78. This is an opportunity to focus on the effect of landforms on the development of settlements. Ask the students to discuss, in groups, why Skardu developed in this location. Invite feedback.</p>	<p>Teacher's Notes</p>

<p>Tell them that Skardu is in a valley and discuss what makes a valley a suitable place for a settlement. They should also notice the location of Skardu in relation to communication links: mountain passes and valleys, where roads can be built. Ask the students to read about Skardu and to consider what it might be like to live there.</p>	
<p>Homeework Students can answer question D.</p>	
<p>Discussion and review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned the names and locations of the main mountain ranges of Pakistan. ✓ I learned the names and locations of the main mountain passes that link parts of Pakistan and link Pakistan with neighbouring countries. ✓ I learned how landforms have influenced the development of roads, railways, and settlements in mountainous areas of Pakistan. ✓ I learned how the city of Skardu developed in the Karakoram Mountains. ✓ I learned about life in Skardu. ✓ I learned about the physical features of the two largest plateaus in Pakistan. ✓ I learned how river basins are formed by rainwater running down mountains. ✓ I learned about the main rivers and valleys of Pakistan. 	

Lesson #4	
Reference Page 25-29	
<p>Topics</p> <ul style="list-style-type: none"> • Plateaus • Valleys 	<p>Resources</p> <ul style="list-style-type: none"> • Multimedia or images • Oxford School Atlas for Pakistan
<p>Introduction</p> <p>Explain that this section begins with plateaus. Some students might know what a plateau is (a large area of flat or gently sloping land at a high elevation; a high plain). Ask them what they know about the location of the two plateaus of Pakistan (the Potwar Plateau and the Balochistan Plateau) and ask what they know about these plateaus (province, main towns or cities, and other features such as rivers, canals, roads, and railways).</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Ask the students to read page 25-26 about the Potwar Plateau and the Balochistan Plateau, and then ask them to identify the similarities and differences between the two plateaus: elevation, what the land is like, cities or towns, and any other features they notice. They should look at the photos of plateaus on these pages and notice how these are different from plains on lowland. Then they should use Oxford School Atlas for Pakistan to find the location of each of the plateaus mentioned. Invite the students to explain the different ways in which plateaus can be formed.</p> <p>Ask the students to define a valley (an area of lowland between mountains). A valley is usually longer than it is wide. Ask if they can give examples of any valleys they know. Tell the students that valleys are formed in different ways and ask them if they have any idea about how a valley is formed. They could make a note of their ideas before reading pages 26-28 including 'Rift valleys' and looking at the photos of the different types of valleys.</p> <p>Ask them to look at maps in Oxford School Atlas for Pakistan to find the locations of these valleys. Ask the students to name the three main types of valleys they have read about. Write the names of these valleys on the board: V-shaped, U-shaped, and rift valleys. Then invite volunteers to describe how each type of valley is formed. They could write notes about each type of valley and then, in their notebooks, write explanations of how they formed, using diagrams to help.</p>	<p>Teacher's Notes</p>

Homework

Students can answer questions E, F, and G. They can also answer Skill Book activity 'Mapping landscapes of Pakistan.'

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned the meaning of plateau and how a plateau is different from a plain or a mountain.
- ✓ I learned to recognize the main types of valleys.
- ✓ I learned how these different valleys are formed.

Lesson #5	
Reference Page 30	
<p>Topics</p> <ul style="list-style-type: none"> • Landforms on maps 	<p>Resources</p> <ul style="list-style-type: none"> • modelling clay, a very large stone, or small piece of rock (about the size of a closed fist) • an indelible felt-tipped marker pen (fine) in a dark colour (black is best) • a ruler • a map that has contour lines • Skills Book activity 'A contour model'
<p>Introduction</p> <p>Ask the students if they have seen contour lines on a map and, if so, whether they know what they are for. Tell them that they are going to learn how to interpret contour lines, which show not only the elevation of the land, but also its shape.</p>	<p>Teacher's Notes</p>
<p>Activity</p> <p>If you have enough clay or stones and indelible marker pens the students could carry this out in groups; if not, it could be presented as a demonstration. Make a hill-like shape from the clay (or use a large stone); it should have a gentle slope and a steep slope.</p> <p>At several point around the base of this hill, measure points that are 1 cm above the base of the hill. Measure vertically, not along the side of the hill. The base represents sea level. Mark each point with the marker pen, then join up all the dots, keeping the line 1 cm higher than the base, as shown in the diagram.</p> <p>Repeat this for a line that is 2 cm higher than the base; then a line 3 cm higher than the base, and so on, until you reach the highest point that you can mark. Point out that each line joins places of the same height above the base and ask the students to look at the hill from each side and then from above.</p> <p>Ask what they notice about the lines on the steep side of the hill. (They are close together when viewed from above.) Ask what they notice about the lines on a gently sloping side. (They are much farther apart.) The students should then draw pictures of the 'hill' viewed from different sides, marking the contour lines. They should</p>	<p>Teacher's Notes</p>

<p>then draw a view from above, with the height marked on each contour.</p> <p>Show the students a map that has contour lines and point out different sections of the map (using grid references if these are included on the map). Ask them to describe the land in each section you choose. These should include a gentle slope, a steep slope, and a cliff, as well as places where there are hills of different heights side by side, or mountains with more than one peak.</p>	
<p>Using the Student's book</p> <p>Ask the students to read page 30 Landforms on maps. In their notebooks, they can also draw some hills viewed from above, with contour lines, for a partner to draw these hills as they would be seen from the side.</p> <p>Suggested activitys</p> <p>To make a contour map of your city describing different levels of height, you can follow these brief instructions:</p> <ul style="list-style-type: none"> • Collect elevation data for different locations in your city. You can use topographic maps, satellite imagery, or digital elevation models (DEMs) to obtain elevation values. • Determine the appropriate scale for your contour map. Decide how much elevation difference each contour line will represent. For example, you may choose intervals of 10 meters or 50 feet between contour lines. • Decide on the contour line intervals based on the scale you have chosen. Determine the range of elevations in your city and set intervals accordingly. For example, if the lowest elevation in your city is 50 meters and the highest is 250 meters, you may choose to have contour lines every 20 meters. • On a blank sheet of paper or using a digital mapping software, start drawing the contour lines. Begin with the lowest contour line, representing the lowest elevation in your city. Use the chosen contour line interval to draw subsequent contour lines, marking the points of equal elevation. • Label each contour line with the corresponding elevation. You can use numbers or colors to indicate the height represented by each line. • Include key features in your map, such as rivers, lakes, roads, and landmarks. This will provide additional context and reference points for the contour lines. • Create a legend that explains the meaning of the contour lines and symbols used in your map. Also, give your map a title that describes its purpose or the specific area it represents. 	

- | | |
|---|--|
| <ul style="list-style-type: none">• Review your contour map for accuracy and clarity. Make any necessary adjustments or refinements to ensure it accurately represents the different levels of height in your city. | |
|---|--|

Homework

Students can answer question A, H, and I. They can also attempt Skills Book activity 'A contour model' for homework.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned what contour lines look like on a map.
- ✓ I learned how to use contour lines to find out the elevation and shape of the land on a map.

Answers to assessments

A. Choose the correct answer:

- i. Fault
- ii. 300
- iii. Tectonic plates
- iv. U-shaped
- v. V-shaped
- vi. Rift valley
- vii. Plateaus
- viii. Fault-block

- B 1.** a) Mountains are a barrier to travel, as roads and railways have to find a way either around them or through a tunnel.
- b) The mountains form a barrier between Pakistan and China and between Pakistan and Afghanistan, so that there are few roads between the countries; these roads follow mountain passes. The high mountains cause difficulties for building railways.
- c) The students' own responses should focus on the opening up of routes between the two countries, and cooperation between Pakistan and China on road links for trade as far south as Gwadar in Balochistan (China-Pakistan Economic Corridor). They should also refer to the 'adventure tourism' industry, which at present attracts mainly Pakistanis and overseas citizens of Pakistan, and mountaineers and cyclists who visit the area.

2. Khyber Pass

C 1 and 2) Fault block mountains have straight, steep sides and cliffs through faulting driven by tectonic forces. One block is uplifted when the Earth's crust fractures along fault lines while the other subsides. The uplifted block rises vertically, creating steep sides called fault scarps. These fault scarps often form cliffs due to the significant displacement during faulting. Over time, erosion further shapes these mountains, but their initial steepness and straightness are primarily a result of the faulting process.

- D 1.** a) normal
- b) an active cone volcano
- c) Both are formed by magma pushing up from under the Earth's crust.
- d) A volcano erupts but a dome mountain does not: instead, the magma forces a huge section of rock upwards.

- E 1. a)** The source of the Indus River is in Tibet, and it flows in a winding path towards the south, traversing through the Himalaya Mountains. A large amount of the Indus's water is provided by melting snows and glaciers of the Karakoram,

Hindu Kush, and Himalayan ranges.

- b) Jhelum, Chenab, Ravi, Sutlej, and Beas join the River Indus in Panjnad (Punjab).
- c) The answers will vary.
- d) a plain on high ground.
- e) lava flows (e.g. the Columbia Plateau) and the movement of tectonic plates (e.g. the Tibetan Plateau)

F 1. A valley is an area of lowland between mountains. It is usually longer than it is wide.

- 2. a) Tectonic plates pull apart so that a huge block of bedrock drops to a lower level between the two plates, or tectonic plates grind past one another.
- b) List some ways in which valleys in Pakistan are important for agriculture. Water is abundant in rivers, streams, or groundwater in valleys, used for irrigation. It has fertile soil composed of alluvial sediments rich in nutrients. It can protect from elements like wind, rain, and snow that helps reduce crop damage and improve crop yields. Valleys can store water during periods of high rainfall, which can help reduce flooding and droughts. It controls erosion by slowing down the flow of water and sediment and providing habitat for various wildlife, including fish, birds, and mammals.

G 1. a) According to some sources, Balochistan plateau is higher than Potwar plateau. However, the highest elevation of Potwar, Murree Hills, which has an elevation of 3,429 meters (11,278 feet) whereas the highest point on the Balochistan plateau is the Makran Coastal Range, which has an elevation of 2,842 meters (9,329 feet). The sources will vary.

- b) The Balochistan plateau has basins, which are low areas that collect water when it rains. The water cannot flow out of the basins because they are lower than the land around them. After the rain stops, the lakes dry up and leave behind salty minerals that were in the water, called the salt lakes.

H 1. True or False

- a) False. The highest land in Pakistan is located in the north, specifically in the Karakoram Range of the Himalayas.
 - b) True
 - c) True
 - d) False. It links Jalalabad in Afghanistan and Peshawar in Pakistan.
2. Answers will vary.

I 1 and 2) Answers will vary.

Answers for Skills Book Activities

Skills Book activity 'Tectonic plates and mountains'

A 1-2. Check that the students mark in the correct places.

3. students' own observations

Skills Book activity 'Formation of mountains'

A 1-2. Check that students have written the correct headings and labels.

Skills Book activity 'A contour model'

A 1. Students should look at the picture and draw the contour lines of the island.

2. Students should draw a contour map of the land.

B 1. Students should draw a contour map of the land.

Skills Book activity 'Grid references'

A 1 a) i) 2461

ii) 2360

iii) 2559

b) i) railway station ii) library iii) shopping mall iv) bank v) park vi) swimming pool

Skills Book activity 'Mapping landscapes of Pakistan'

A and B. Use the Oxford School Atlas for Pakistan

C. Answers will vary as per research and discussion. Landscape features such as coastlines, rivers, mountains, and arable land have influenced settlement patterns, economic activities, and population density. The availability of resources, trade opportunities, and geographical characteristics have all played a role in shaping the demographic distribution of these cities.

Karachi	Hyderabad	Peshawar	Tando Allahyar	Lahore
The availability of a natural harbour has historically made it a hub for trade and commerce. The presence of the sea, coupled with urban infrastructure and economic opportunities, has attracted	Hyderabad is situated on the bank of the Indus River and has fertile land suitable for agriculture. The availability of water resources from the river has supported agricultural activities,	Peshawar is in the northwestern part of Pakistan, surrounded by mountains and hills. The city's proximity to the Khyber Pass, a historically significant trade route,	Tando Allahyar is situated in the Sindh province and is known for its predominantly flat and fertile landscape. The city benefits from its proximity to the Indus River and the availability	Lahore is in the northern part of Pakistan and is situated on relatively flat terrain along the Ravi River. The presence of a river and fertile land has historically supported agriculture and settlement.

<p>a dense population to the city. The coastal location has facilitated maritime trade, making Karachi the most populous city in Pakistan.</p>	<p>which in turn have influenced settlement patterns. The combination of water availability and arable land has led to a moderate population density in Hyderabad.</p>	<p>has contributed to its importance as a regional trade center. The mountainous terrain, however, limits the available flat land for settlement and agriculture. As a result, the population density of Peshawar is influenced by the challenges posed by the rugged landscape.</p>	<p>of irrigation water, making it suitable for agriculture. The presence of fertile land has attracted a population engaged in farming activities, resulting in a moderate population density.</p>	<p>Lahore's significance as a cultural, educational, and economic center has attracted people from various regions, contributing to a higher population density.</p>
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UNIT 3 Climatic Regions of the World

Background knowledge for the unit

Climate is determined from average weather conditions over a long period – usually 30 years. From recorded weather statistics, meteorologists can determine the patterns of weather conditions such as temperature, humidity, atmospheric pressure, wind, and precipitation, as well as average conditions. Climate includes the amounts by which weather conditions vary, for example: differences in temperature, rainfall, wind speed, direction, and so on.

Weather describes the short-term conditions in a place. There are different systems for describing climate. Most climatologists use the Köppen classification system, which uses letters to define the characteristics of a climate. This is rather complicated, but the descriptions used in this unit are based on it and described by name for simplicity.

Climate affects a region's agriculture, buildings, infrastructure, clothing, and many aspects of everyday life. These differences are more noticeable when extreme climates are compared for example, in extremely cold regions, such as parts of Russia, the permafrost makes the digging of foundations for buildings very difficult. As a result, most buildings are placed on pillars, which requires a smaller volume of land to be dug out, and pipelines for sewage and water, and cables for electricity and communication are kept above the ground, rather than laid underground.

Although the world can be split into climatic zones by latitude, with the colder places nearer the Poles and the hotter places nearer the Equator, there are factors other than proximity to the Poles or to the Equator that influence climate. Within these zones, places at the same latitude can have very different climates, depending on land elevation (height above or below sea level); position in relation to plains or mountains; the size of the land mass; distance from the sea, and wind patterns.

Although Pakistan is within the Earth's temperate climate zone, its climate is mainly continental, as it is situated on a large land mass between latitudes 24° and 37°N, and much of it is semi-arid. The south is nearer the Equator than the north and is therefore warmer. Altitude plays a part, too, with the mountainous areas of FATA, Khyber Pakhtunkhwa, and western Balochistan having colder climates. Distance from the sea, wind patterns, and ocean currents also affect the climate, creating warm humid summers and the mild, dry winters near the coast of Sindh and Balochistan.

Before we proceed

It is useful to begin with the students' own experiences of different climates. They could be asked to prepare a presentation on a place that has a different climate from that of their hometown, focusing on a description of the climate and anything they noticed about how it affects everyday life, buildings, cities, agriculture, etc.

Questions such as 'How are the homes different from ours?' and 'Why do you think the homes were built like that?' are useful for focusing on the effects of climate. If possible, the students could also exchange information with their friends or family who live in a different climatic zone. This unit provides information, illustrations, photographs, and diagrams that help students to understand the influences on climate, and why places at the same latitudes can have very different climates. They can compare photographs and climate statistics of different places.

Expected learning outcomes

Students should be able to:

- Distinguish between weather and climate.
- Identify the factors that affect the climate of a place: latitude, elevation, landforms, land mass size, distance from the sea, and ocean currents.
- Identify the main climatic zones of the world.
- Describe how people adapt their lives and buildings to suit the climate.
- Identify and describe the main climatic regions of the Earth.
- Identify the different climatic regions of Pakistan, and some of the causes of the differences.

Lesson #1								
Reference Page 33-35								
<p>Topics</p> <ul style="list-style-type: none"> • Weather and climate • Factors affecting climate • The air around us 	<p>Resources</p> <ul style="list-style-type: none"> • a globe • Oxford School Atlas for Pakistan • Skills Book (Weather or climate; Factors affecting climate; Living in places with very cold and very hot climates) 							
<p>Introduction</p> <p>Ask what climate means. Ask ‘Is climate the same as weather?’ They could record what they know about climate in a chart. Here is an example:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 25%; padding: 5px;">What I know about climate</th> <th style="width: 25%; padding: 5px;">Questions</th> <th style="width: 50%; padding: 5px;">Answers</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px; vertical-align: top;"> 1. Places near the Equator are hotter than places near the Poles. 2. Mountainous places have cooler climates than places on lowland. 3. Some places have rainy seasons or monsoons. </td> <td style="padding: 5px; vertical-align: top;"> 1. Why can deserts, with hot climates, have very cold temperatures at night? 2. Why do some places have wetter climates than others? 3. What causes monsoon climates? </td> <td style="padding: 5px; vertical-align: top;"> * They should write the answers after completing the unit. This helps them to assess what they have learnt. </td> </tr> </tbody> </table>		What I know about climate	Questions	Answers	1. Places near the Equator are hotter than places near the Poles. 2. Mountainous places have cooler climates than places on lowland. 3. Some places have rainy seasons or monsoons.	1. Why can deserts, with hot climates, have very cold temperatures at night? 2. Why do some places have wetter climates than others? 3. What causes monsoon climates?	* They should write the answers after completing the unit. This helps them to assess what they have learnt.	<p>Teacher’s Notes</p>
What I know about climate	Questions	Answers						
1. Places near the Equator are hotter than places near the Poles. 2. Mountainous places have cooler climates than places on lowland. 3. Some places have rainy seasons or monsoons.	1. Why can deserts, with hot climates, have very cold temperatures at night? 2. Why do some places have wetter climates than others? 3. What causes monsoon climates?	* They should write the answers after completing the unit. This helps them to assess what they have learnt.						
<p>Explain the main factors that affect climate.</p> <p>1. Latitude / distance from the Equator</p> <p>The Earth’s curvature means that the farther an area is from the Equator, the lower the air temperature. Near the Poles, sunlight must pass through a larger area of atmosphere and the Sun is at a lower angle in the sky. Also, white, and lighter colours reflect more light than darker colours, so the ice and snow near the Poles reflect more sunlight than most land surfaces.</p>								

<p>2. Land elevation/ altitude</p> <p>Locations at a higher altitude have colder temperatures. Temperature usually decreases by 1°C for every 100 metres in altitude because air pressure is lower at higher altitudes. As air rises, air pressure decreases. You can demonstrate this using a bicycle pump. As you depress the pump this puts pressure on the air that is to be forced into the tyre. This increase in temperature is enough to be felt (safely) by hand. If you release air from a tyre, the air is under less pressure as it escapes, so the air expands and cools; so, air escaping from a tyre feels cool.</p> <p>3. Size of the land mass/ distance from the sea</p> <p>Water heats up and cools down much more slowly than land. So, places near the sea are usually cooler in the summer and warmer in the winter than inland places at the same latitude and elevation.</p> <p>4. Warm or cold sea currents</p> <p>Many places near the sea have a maritime climate. As well as the difference made by being near the sea, warm ocean currents also give them a warmer and wetter climate than places at the same latitude and elevation that are not affected by ocean currents. Cold ocean currents have the opposite effect.</p> <p>5. Wind</p> <p>The prevailing wind is the main wind direction in a place. If the prevailing wind crosses an ocean or sea, it can increase the rainfall. When prevailing winds blow over land areas, they can help to create a desert climate. An example of this is Kuwait.</p>	
<p>Using the Student's book</p> <p>Ask the students to read page 33, and the conversation box to discuss what factors, other than latitude, affect climate. These are:</p> <ul style="list-style-type: none"> • land elevation – the height of the land • the size of the land mass – larger land masses tend to have greater differences between summer and winter than smaller ones • distance from the sea – because the sea warms up and cools down more slowly than land does, places near the sea tend to have milder climates than inland places • warm or cold sea currents – the seas flow in directions influenced by the Earth's rotation and other factors. <p>Ask students to read page 35 and discuss how the air quality affect weather and climate of an area. Greenhouse gases, such as carbon dioxide and methane, trap heat in the atmosphere, leading to higher</p>	<p>Teacher's Notes</p>

temperatures. It can also increase the amount of greenhouse gases in the atmosphere, contributing to and accelerating climate change.

Air pollution can increase the number of aerosols in the atmosphere, affecting the Earth's climate. While some aerosols, such as sulfates, reflect sunlight into space, which can help to cool the environment, other aerosols, such as black carbon, can absorb sunlight and heat the atmosphere, contributing to warming. Clouds are made up of water droplets and ice crystals. Air pollution can affect clouds' formation and properties, affecting rainfall patterns. For example, air pollution can make clouds more reflective, leading to less rainfall. Discuss what can be done to improve air quality and mitigate the effects of climate change:

- Greenhouse gases are the primary driver of climate change, so reducing emissions is essential to mitigating its effects. This can be done by switching to renewable energy sources, improving energy efficiency, and reducing deforestation.
- Other pollutants, such as particulate matter and ozone, can also harm human health and the environment. These pollutants can be reduced by reducing emissions from cars, trucks, factories, and power plants.
- Trees help to clean the air by absorbing carbon dioxide and other pollutants. They also help to cool the air and provide shade, which can help to reduce the effects of heat waves.
- Several policies can be used to promote clean air, such as emissions standards, fuel economy standards, and renewable energy incentives. By supporting these policies, we can help to improve air quality and mitigate the effects of climate change.

Homework

Students can do questions B, C, and F. The students can also answer Skills Book activity 'Weather and climate.'

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned the difference between weather and climate.
- ✓ I learned about the factors that affect the climate of a place.
- ✓ I have learned about the impact of air pollution on weather and climate
- ✓ I have learned what measures can be taken to improve the AQI around me.

Lesson #2	
Reference Page 35-39	
<p>Topics</p> <ul style="list-style-type: none"> • Climatic zones of the world • Tropical climate • Continental climate • Temperate climate 	<p>Resources</p> <ul style="list-style-type: none"> • a globe • <i>Oxford School Atlas for Pakistan</i> • Skills Book (Locating places in different climatic zones; Comparison of different climatic regions of the world)
<p>Introduction</p> <p>Explain that this type of climate is generally found in parts of the world just outside the Tropics and on large land masses. Explain that this type of climate is more common in the northern hemisphere than in the southern hemisphere, because large land masses are found in the northern hemisphere.</p> <p>Explain that this lesson will focus on temperate climates, which are usually found in regions between the Tropics and the Antarctic or the Arctic Circle and are neither very hot nor very cold. Ask them to look at a map of the world and try to identify places that might have a temperate climate. Remind them that places on large land masses (particularly near east coasts), especially in the northern hemisphere, are more likely to have a continental than a temperate climate, even though they are around the same latitudes. The students should make a note of their ideas about places with temperate climates.</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Ask the students to look at the map of the world's climatic zones and to name places that have:</p> <ul style="list-style-type: none"> • a polar climate • a temperate climate • an arid climate • a tropical climate • a Mediterranean climate (note that this type of climate is not restricted to areas around the Mediterranean Sea – other places can have a similar climate) • a mountain climate 	<p>Teacher's Notes</p>

<p>Ask the students to name the main climatic regions of the Earth. They should make a note of their answers. Ask why some places have warmer climates than others. (Places near the Equator like Kuwait generally have warmer climates than those nearer to the Poles like Greenland.) Explain that the Earth's main climatic zones are marked by latitude and ask what else that might affect the climate of a place.</p>	
<p>Tropical climate</p> <p>The students should be able to locate the Tropics on a map of the world. Ask them to name some countries in these regions. They can then read pages 36-37 and look at the map on page 35 to find out about the climatic regions of the world. Ask if they need to change their answers about the names of the Earth's main climatic regions. Then ask them between which latitudes tropical climates are found. (Between the Tropics of Cancer and Capricorn, i.e., between latitudes 23.5°N and 23.5°S)</p> <p>Explain that there are different types of tropical climate, which they are going to read about. They should read the sections headed 'Tropical climate', 'Tropical rainforest climate', and 'Tropical monsoon climate' on pages 36-37. Ask why the monsoon climate regions of Pakistan are not tropical monsoon climates. (Tropical climates are hotter, having mean temperatures of at least 18°C.) Ask them to describe what they see in the photo of a tropical rainforest climate in Sumatra. They should also locate Sumatra in Indonesia, and Chittagong in Bangladesh on a world map on page 35. They could then write notes about the different tropical climates in their notebooks. For homework, they could find out more and add this information to their notes.</p> <p>Ask students what savannah means. (Grassland plains – mainly found in Africa, Asia, and northern parts of South America) They should locate Nigeria on a map of the world in their Oxford School Atlas for Pakistan. Ask them to describe its location. They should notice its latitude within the Tropics, the size of the land mass it is on, distance from the sea, the land elevations of different parts of the country, and the wind patterns. (See the map on page 42.)</p> <p>Ask about the factors that might affect Nigeria's climatic zones. They should notice that the south has a coast on the South Atlantic Ocean, where the climate is tropical monsoon, influenced by monsoon winds that affect West African regions between latitudes 9° and 20°N, blowing south-westerly during warmer months and north-easterly during the cooler months. Central Nigeria and most of Western Nigeria have a tropical savannah climate, with a rainy season and a dry season. As in other tropical countries, altitude affects some parts within the main climate areas of Nigeria, with high mountains having an alpine climate. Ask which other</p>	

continents have regions with savannah climates. They could locate these on maps of the world and on more detailed maps of the continents.

Continental climate

Ask the students to read page 37-38 'Continental climate', 'Hot summer continental climate', and 'Warm summer continental climate'. Ask them to look at a map of the world and to use the descriptions of the locations of regions with continental climates on this page to help them to find places that could have a continental climate. (These are likely to be in the northern hemisphere, on the east coasts, and in the interiors of large land masses, around latitude 40°N, or farther north.) They should be able to give an example (South Korea), based on what they have read.

Ask what kind of weather makes a continental climate different from a tropical climate. (Mean monthly temperatures are lower than 18°C and sometimes it snows in winter) The students should be able to describe the main characteristics of each type of continental climate and say what causes these differences. Ask them to discuss with a partner, and compare the climates of Warsaw, Poland, and Seoul, South Korea, and to explain the differences to one another.

Temperate climate

Ask the students to read page 38-39 'Temperate climate', 'Warm temperate climates', and 'Maritime temperate climates', and consider this information when checking their answers from the Introduction. Explain that 'maritime' means near the sea. Ask them to distinguish between the two types of temperate climate (warm and maritime). Ask why regions between latitudes 26° and 45° tend to have warm temperate climates, and what gives maritime temperate climates warmer winters and cooler summers than many other places at the same latitudes. (Ocean currents because the sea/ocean takes much longer to warm up or cool down than does the land.)

Using the Skills Book

The students should continue the exercise of the Skills Book, 'Comparison of different climatic regions of the world' but should complete only the section on the climate they have learnt about during this lesson. The others should be completed after the appropriate lessons. Ask them to read the descriptions of climates and to find the one that describes the tropical, continental, and temperate climate, and to complete it with examples.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned about the main climatic regions of the world.
- ✓ I learned about the different factors that affect climate.
- ✓ I learned about the differences between tropical monsoon and tropical rainforest climates.
- ✓ I learned about the conditions of tropical savannah climates.
- ✓ I learned why Nigeria has different climatic zones.
- ✓ I learned how winds affect the climates of different parts of Nigeria.
- ✓ I learned about the conditions of continental climates with warm or hot summers.
- ✓ I learned why continental climates have different rainfall patterns and different summer temperatures.
- ✓ I learned how the size of the land mass and the distance from the sea affect the climate of a region.
- ✓ I learned about the different types of temperate climate.
- ✓ I learned how ocean currents and winds affect climates.

Lesson #3	
Reference pages 39-44	
<p>Topics</p> <ul style="list-style-type: none"> • Arid climate • Polar climate • Rainfall in Pakistan 	<p>Resources</p> <ul style="list-style-type: none"> • a globe • Oxford School Atlas for Pakistan • Skills Book (Comparison of different climatic regions of the world)
<p>Introduction</p> <p>Explain that in this lesson they are going to learn about arid and cold climates. Ask/ elicit what arid means (dry) and invite them to name some regions with arid climates, and to locate them on a map of the world. They should be able to locate deserts in Pakistan and other countries, such as Egypt and Kuwait, which they learned about in Grade 6. Ask about the latitudes of the world’s deserts (around 30° North or South). Ask what they know about the temperatures of these regions, and what makes them so hot. (They are near the Equator, so are always closer to the Sun than other regions of the Earth.)</p> <p>Explain that in this lesson they are going to learn about regions that have different types of polar (cold) climate. Ask if they know the meanings of the following words: tundra (regions that have low and slow-growing vegetation, mainly small shrubs, sedges and grasses, mosses, and lichens, with perhaps a few scattered trees), ice cap (places that are permanently covered with ice), and alpine (mountain).</p>	<p>Teacher’s Notes</p>
<p>Using the Student’s book</p> <p>Ask the students to read pages 39-40. Explain that there can be hot and cold arid regions. Ask what they have learnt about temperature changes in arid regions. (There are large differences between day and night temperatures.) Also ask how Makkah, which is in a region with an arid climate, can have flash floods. Although Makkah has a very low rainfall, most of this fall at around the same time. Makkah is at a low elevation, and rain that falls on the nearby mountains rushes downhill on to the lowland.)</p> <p>Next, ask how cold arid these places, which are in temperate climatic zones of the Earth, can have this type of climate. (They tend to be at high elevations or next to high mountains.) Invite the students to explain the factors that can cause this type of climate at high elevations close to high mountains, and to give examples.</p>	<p>Teacher’s Notes</p>

Explain that polar climates are the coldest of all, but that there are different types of polar climate, which they will find out more about in this unit. Ask them about the very cold places of Alaska, USA, and Yakutsk, Russia. What kind of weather do these places have? (Cold, icy, sometimes foggy but with hardly any precipitation – even snow)

They can then read about ‘Tundra climate’ and ‘Ice cap climate’ on page 41. Ask them what they have learnt about temperatures in these regions. (In tundra regions, average winter temperatures are around -28°C – with temperatures sometimes as low as -50°C , and the warmest summer months can have average temperatures as low as 10°C , sometimes dropping to below zero at night, and hardly ever above 12°C during the day. In ice cap regions, the temperature hardly ever rises above 0°C . Also ask how these climates affect the vegetation of these regions. (It grows slowly; there are very few trees; bushes are small; the main vegetation is algae, mosses, and lichens, with some grasses.)

Ask what they have learnt about climate and altitude. (The higher a region, the lower its average temperatures, with air temperatures falling by about 6.4°C for every thousand metres of altitude.) They should next read about ‘Alpine climate’ on page 42. Ask what types of places can have alpine climate. (This climate occurs on mountains, above the treeline – the height at which trees will grow.) Ask about the altitude of the treeline. (It varies, according to latitude: near the Tropics the treeline is higher than in places farther from the Equator.)

Invite volunteers to explain why the air temperature is lower on high than low ground. There are several reasons: (i) The Earth’s surface stays warm for a longer time than the air; the Earth’s surface warms the air, so air that is farther away (higher up) is warmed less, especially if it is dry. (ii) At higher elevations the air is less dense; this means that the particles of gases in the air are spread out, so there is less air to hold the warmth. (iii) At higher elevations there is less air pressing down, the lower the air pressure, the lower the air temperature. The students can now complete Question G.

Rainfall in Pakistan

Despite receiving 5 types of rainfall, Pakistan gets varied and unreliable rainfall. Most of precipitation comes during the summer monsoon rainfall in Sindh and Punjab, while the western

and northern parts are inundated during the winters as well. Use the Oxford School Atlas and the given diagrams to help students understand the directions of winds, convectional, and relief rainfall. The students could copy the rain shadow explanation and diagram and use this to help them to write an explanation of how the rain shadow affects climate.

Using the Skills Book

The students should complete topic Skills Book ‘Comparison of different climatic regions of the world’ but should complete only the section on the climates they have learnt about during this lesson. This will complete the page. Ask them to read the descriptions of climates and to find those that describe the polar climates (tundra, alpine, and ice cap), and to complete them with examples. These should be the only remaining climates in the chart to be completed.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned about the conditions of hot and cold arid climates.
- ✓ I learned how the rain shadow affects climate.
- ✓ I learned about the conditions of the different polar climates.
- ✓ I learned how latitude, altitude, wind patterns, distance from the sea, the size of the land mass, and ocean currents affect climate.

Lesson #4	
Reference page 44-48	
Topics <ul style="list-style-type: none"> Climatic zones of Pakistan 	Resources <ul style="list-style-type: none"> Oxford School Atlas for Pakistan Images/multimedia for different climatic zones in Pakistan Skills Book (
Using the Student's book Ask students to read the pages 44-48 and work in groups to make a report on the average temperatures, rainfall, type of crops, and the lifestyle of people from different climatic zones in Pakistan (suggested on page page 47)	Teacher's Notes

Climatic zones	Average temperature	Rainfall	Types of crops	Lifestyle of people
Northern Mountainous Zone	The Northern Mountainous Zone exhibits a wide temperature range, with cooler temperatures prevailing in higher altitudes. Average temperatures range from 0°C to -15°C (32°F to 5°F).	This zone receives moderate rainfall, ranging from 400 to 800 millimeters (16 to 32 inches) annually.	wheat, barley, maize, apples, apricots, and cherries	People in this zone have a close association with mountains and are often engaged in agriculture, horticulture, and animal husbandry. They have a distinct cultural heritage and practice traditional mountain lifestyles.
Western Mountainous Zone	The Western Mountainous Zone experiences extreme temperatures, ranging from very hot summers to extremely cold winters. Average	The region receives limited rainfall, generally less than 300 millimeters (12 inches) annually.	wheat, maize, barley, and fruits like apples, grapes, and pears	People in the Western Mountainous Zone have a rural lifestyle, mainly relying on agriculture and animal husbandry for their livelihood. The region is also known for its unique

	temperatures range from 20°C to -10°C (68°F to 14°F).			cultural heritage and traditional practices.
Lowland zone	The lowland climatic zone experiences high temperatures throughout the year, with average temperatures ranging from 25°C to 45°C (77°F to 113°F) during summer. Winters are relatively mild, with average temperatures ranging from 10°C to 20°C (50°F to 68°F).	The lowland climatic zone generally receives low to moderate rainfall, ranging from 100 to 400 millimeters (4 to 16 inches) annually during July-Sept.	Major crops grown in this region include rice, cotton, sugarcane, maize, wheat, vegetables, and fruits such as citrus, mangoes, and bananas. Rice cultivation is particularly significant, as the region's fertile alluvial plains and favorable climate provide optimal conditions for its growth.	People mostly engage in crop and livestock farming, industrial work, handicrafts, including textile weaving and pottery.
Arid Zone	The Arid Zone experiences extremely hot temperatures in summers and relatively mild winters. Average temperatures range from 30°C to 5°C (86°F to 41°F).	This zone receives very limited rainfall, typically less than 200 millimeters (8 inches) annually.	wheat, barley, millet, dates, and various fruits adapted to arid conditions, such as citrus and pomegranate	People in the Arid Zone have a semi-nomadic lifestyle, practicing subsistence agriculture, livestock rearing, and engaging in trade. Water conservation and efficient irrigation techniques are crucial for agriculture in this region.

Coastal Zone	The Coastal Zone experiences a warm to hot climate throughout the year, with average temperatures ranging from 25°C to 35°C (77°F to 95°F).	This zone receives moderate to heavy rainfall, ranging from 200 to 800 millimeters (8 to 32 inches) annually.	rice, sugarcane, cotton, vegetables, and fruits like mangoes	Fishing is a primary livelihood for many communities residing along the coast. This zone also plays a significant role as a center for maritime trade and transport. Ports and harbors, such as Karachi Port and Port Qasim, act as important facilitators of international trade, contributing to the region's economic growth.
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Discuss with students that Pakistan is a diverse country, characterised by a wide range of climatic zones that significantly influence the lifestyles, agriculture, and overall socio-economic aspects of its regions. After discussion, encourage students to use the Internet, Atlases, and books from the school library. Students can do questions D and F.

Answers to assessments

A. Choose the correct answer

- i. Weather
- ii. Climate
- iii. Tropical
- iv. Ice cap
- v. Continental
- vi. Arid
- vii. Desert
- viii. tropical

- B. 1. a)** weather describes the current atmospheric conditions in the short term, while climate refers to the long-term average of these conditions over an extended period in a particular region.
- b)** latitude, altitude, wind patterns, distance from the sea, the size of the land mass, ocean currents
- c)** any two from: being at a higher altitude, affected by cold winds, being on a large land mass or far from the sea, or affected by cold ocean currents

C 1 a) 23.5°N and 23.5°S

b) It has a mean monthly temperature of at least 18°C.

- 2 a)** tropical monsoon
- b)** tropical rainforest

c) tropical savannah

D 1 a) Skardu, Gilgit, Hunza, Chitral, Murree

b) Answers will vary but should be based on information in this unit.

E 1 a) mangroves, salt marshes, cliffs, beaches, mud volcanoes, bays, and mudflats.

b) Answers will vary but should be based on information in this unit.

c) Answers will vary but should be based on information in this unit. You can discuss that Gwadar Port is strategically vital for China, offering access to the Arabian Sea, enhancing trade routes, and boosting energy security. For Pakistan, it presents opportunities for economic growth, regional connectivity, and diversification of energy and trade, leading to job creation and socioeconomic development.

d) Answers will vary but should be based on information in this unit. You can discuss that it provides importance transportation link for CPEC and Makran Coastal Highway and that it plays a vital role in promoting connectivity, trade, tourism, security, and socioeconomic development in Balochistan. It facilitates the movement of people and goods, supports the development of Gwadar Port, and enhances the overall economic growth of the region.

e) Mangroves, delta, etc. Answers will vary but should be based on information in this unit

F 1 and 2. Answers will vary but should be based on information in this unit.

3 a) Discussion and research: Air quality affects people in a number of ways, both short-term and long-term. Air pollution can irritate the lungs and make it difficult to breathe. This can lead to coughing, wheezing, and shortness of breath. It can increase the risk of heart attacks and strokes, can irritate the eyes and cause conjunctivitis (pink eye), and pollution can reduce visibility, making it difficult to see. This can be a problem for drivers, pilots, and others who need to see clearly.

b) make informed decisions about whether to stay indoors, exercise outdoors, or take other steps to reduce their exposure to air pollution

4. a) India, China, Bangladesh, Pakistan, etc.

b) Answers will vary but should be based on information in this unit. (Iceland, Finland, Norway, Switzerland, Sweden, Canada, etc.)

G 1. a) Sialkot is in north-east Punjab

b) Answers will vary but should be based on information in this unit.

2. impact of flood and low rainfall on farming, fishing, livestock, daily wage labourers, etc.

3. Answers will vary but should be based on information in this unit.

This climate is neither very hot nor very cold; it occurs mainly between latitudes 26° and 45°N or S; the ocean currents keep its climate warmer than other climates at the same latitudes.	Maritime temperate	London, UK
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The students should have completed only the sections of the chart that describe the hot and cold arid climates.

Description	Climate type	Example
This climate occurs mainly around latitudes 30°N or S; it is the hottest, sunniest, and driest climate of all; less than 250 mm of rain per year; nights can be cold but hardly ever below 0°C.	Hot arid	Saudi Arabia, Kuwait
This climate occurs in the rain shadow of mountains; it is very dry and there is never more than 250 mm of rain per year; summers are hot and dry but winters can be very cold – as low as -40°C; it sometimes snows in winter.	Cold arid	Gobi Desert, China and Mongolia

The students should now have completed the chart by identifying the three main Polar climates and completing the examples.

Description	Climate type	Example
The average monthly temperature is lower than 10°C and average annual temperature is between 0 and 10°C; there is permafrost; the temperature in winter can drop as low as -50°C; there is very little precipitation.	tundra	Yakutsk, Russia and Alaska, USA
Regions above the treeline have this kind of climate; the average monthly temperatures are no higher than 10°C; there is very little precipitation (around 230–300 mm per year).	alpine	Ben Lawers, Scotland, UK, and Mount Yushan, Taiwan
It is the coldest of all climatic regions of the world; it is hardly ever warmer than 0°C; there is permanent ice.	ice cap	Parts of Greenland, Antarctica

Skills Book activity 'Factors affecting climate'

- A 1 a–c) The globe should be shaded and labelled to match the key and should show the three main climate zones: tropical, between the Tropics of Cancer and

Capricorn, temperate (between the Tropics and each Pole), and polar within the Arctic and the Antarctic circles.

- B 1 a) polar (more accurately maritime polar)
 b) polar tundra
 c) Ocean currents bring rain to Reykjavik, but stop the winters being as cold as those of Fairbanks, which has a polar tundra climate. Fairbanks is on a larger land mass, so it has colder winters and warmer summers than Reykjavik. Fairbanks has a slightly higher elevation, which keeps it slightly colder at night in the summer, but with slightly higher daytime temperatures.
 d) tropical savannah
 e) hot summer continental
 f) It is at a high altitude.
 g) warm summer continental
 h) It is on a smaller land mass and near the sea, where ocean currents bring rain but keep it warmer than places far from the sea.

Skills Book activity 'Locating places in different climatic zones'

A 1-2. Check that the students mark the map in the correct places.

Skills Book activity 'Living in places with very cold and very hot climates'

A 1. Check that the students write the relevant statements in the correct parts of the Venn diagram.

Skills Book activity 'Comparing seasonal temperature and rainfall'

A Conversion of data from Fahrenheit to Celsius:

High	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Isl	16.6	18.8	23.8	29.4	35	37.2	35	33.3	32.7	29.4	23.8	18.8
Khi	25.5	27.7	31.1	33.8	34.4	34.4	32.2	31.1	32.2	33.8	31.1	27.2
Quetta	10.5	12.7	18.3	25	30.5	33.8	34.4	33.8	30	24.4	18.3	12.7
Lahore	18.8	21.6	27.2	33.8	38.3	38.8	35.5	34.4	33.8	31.1	26.1	20.5
Low	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Isl	3.8	6.6	11.1	16.1	21.1	23.8	25	23.8	21.1	15	8.8	4.4
Khi	13.3	15.5	20	24.4	27.2	28.8	28.3	27.2	26.1	23.3	18.3	13.8
Quetta	-1.6	0.5	5	10	15	18.8	21.6	19.4	13.8	7.2	2.2	-1.1
Lahore	8.3	11.1	16.1	21.6	26.1	28.3	27.7	27.2	25.5	20	13.8	9.4

- B-D will be plotted on the graph as per data. Ask students to just plot one city's high and low temperatures on the graph and use colours for high (red) and low (blue) variation.
- E. **Islamabad:** Hottest Month: June; Coldest Month: January
Karachi: Hottest Month: June; Coldest Month: January
Quetta: Hottest Month: June; Coldest Month: January
Lahore: Hottest Month: June; Coldest Month: January
- F. Islamabad's proximity to mountains, its altitude, and its exposure to moist monsoonal winds create favorable conditions for higher rainfall compared to Karachi and Quetta, which are influenced by geographical features that result in drier atmospheric conditions.

Skills Book activity 'Distribution of rainfall in Pakistan'

- A. Temperature and rainfall
- B. Monsoons are seasonal; Winter winds are called north-east monsoon; Monsoon winds are seasonally reversed and driven by temperature differences between land and sea
- C. Answers may vary. Positive: replenishes rivers, streams, and reservoirs; supports and boosts agricultural and industrial activities in a country.
Negative: floods, rapid surface runoff, landslides; damage to crops, property; government support needed for rehabilitation of land; debt
- D. Answers may vary. Damage to buildings, roads, bridges, and other infrastructure, leading to substantial repair and reconstruction costs; disrupts trade activities; loss of income for daily wagers; affects agricultural production and livelihoods, etc.
- E. Answers may vary. Positive: Late rainfall can extend the growing season, allowing for additional cultivation or a second planting of certain crops.
Negative: waterlogging and salinity; can promote the growth of weeds, droughts, etc.

UNIT 4 Forests of the World

Background knowledge for the unit

There are many definitions of forest. 'Forest' usually means a collection of trees, but there is no agreed minimum size or precise distinction between a forest and a wood, although woods are generally agreed to be smaller than forests. A forest is not just a group of trees, but includes the soil that supports the trees, and the water and air around them. This makes up a complex ecosystem that supports many living things, including shrubs, vines, grasses, and other herbaceous (non-woody) plants, mosses, algae, fungi, insects, mammals, birds, reptiles, amphibians, and microorganisms.

Forest habitat

A forest is usually a habitat for numerous animal species, depending on its location and climate, for example:

Asia

- Eastern Himalayas: Asian elephant, snow leopard, panda, tiger, one-horned rhino
Mekong River Forest: tiger, rhino
- Borneo and Sumatra: orangutan, rhino, pygmy elephant, tiger, elephant
- Yangtze River Forest: giant panda, snow leopard Amur-Heilong Forest (north-eastern China and eastern Russia): tiger, leopard

Africa

- Namibia: elephant, black rhino, white rhino
- Madagascar: lemur, tortoise, gecko, chameleon
- Congo Basin: mountain gorilla, chimpanzee, elephant

South America

Amazon Forest: jaguar, macaw, black spider monkey, poison dart frog

Temperate deciduous forests

(Eastern USA and Canada, most of the Europe, and parts of China and Japan) An enormous variety of animal life, such as insects, spiders, slugs, frogs, turtles, and salamander; various birds, e.g. hawks, cardinals, snowy owls, and woodpeckers; and mammals, including deer, raccoon, opossums, porcupines, and foxes. Animals of the temperate deciduous forest have to adapt to the changing seasons, migrate, or hibernate in the winter.

Types of forests

Latitudes between 10°N and 10°S of the Equator are mainly covered with tropical rainforests. Tropical rainforests receive rainfall in all months of the year and have a hot, humid climate, with average monthly temperatures between 18°C and 35°C. There are also tropical dry forests in some regions whose climates are warm all year. They do not necessarily have a low annual rainfall; in fact, many tropical dry forests have several hundred centimetres of rain per year, but they have long dry seasons lasting several months. These droughts affect all the living things in the forests. Examples of tropical dry forests are Doi Inthanon National Park, in the north of Thailand, and Chacachare, in the Republic of Trinidad and Tobago. Other examples are in Sri Lanka and Guatemala.

Deciduous forests lie between 45°N and 45°S in the temperate climatic zone. Coniferous forests are found at very high altitudes with very cold climates, mainly in the northern hemisphere.

Most forests that are made up mainly of broad leaf trees have many more species of living things than those made up mainly of conifers. Some forests, such as tropical rainforests and temperate deciduous forests, have numerous tree species in a small area; coniferous forests have a few species over a large area.

Around 66% of the world's forests are in just ten countries. About 80% of the Earth's plant biomass is contained in forests, mainly under the ground in roots and in rotting plant material. Primary forests are natural forests, although most have had new trees planted. Planted forests are planted for a purpose. Most forests are a mixture of primary and planted.

The benefits of forests

A report by the FAO (Food and Agriculture Organization of the United Nations) in 2016 concluded that, although agriculture is the main cause of deforestation, forests and trees support sustainable agriculture. They do this by stabilizing the climate and soil. They also provide protection from water erosion and flooding and provide shade from sunlight, and shelter from wind and storms. In addition, they provide a habitat for insects and other species that pollinate plants, as well as animals that feed on insects and other species that destroy crops.

The FAO report describes projects in Costa Rica, Chile, the Gambia, Georgia, Ghana, Tunisia, and Vietnam that have shown that agricultural productivity can be increased without deforestation, and even while reversing deforestation. Forests provide food, energy, and income for hundreds of millions of people around the world.

Non-food products include timber, paper, charcoal, and other wood products, both for construction and energy; cork, tar, turpentine (used for thinning paints and furniture polish) rubber, and creosote (used for protecting timber and in the chemical industry). Numerous chemical products are by-products of wood.

Food products from forests include those from trees growing naturally, such as Brazil

nuts, other nuts, fruits, berries, and seeds; also, edible fungi grow among the trees. Food also comes from the animals of the forest habitat, such as fish, shrimps, oysters, crabs, and cockles from mangrove estuaries, and honey from bees in numerous forests.

Rubber-tapping

A rubber tree takes about six years to grow enough for its sap (latex) to be harvested. The tapper makes a thin, diagonal cut to remove a thin slice of bark and fixes a small bucket below this to collect the latex. Latex runs out for about six hours and then stops. Usually about 2.5 litres of latex can be collected each day from a single tree. The next day the tree can be tapped again, but most rubber tappers tap different trees the next day. A dilute acid is added to the latex, which is left to thicken in shallow metal pans. This forms a soft block of thickened latex.

The block of thickened latex is then passed through rollers to squeeze out the water. Then it is washed to remove the acid, and rolled again, to squeeze out the water. After rolling, the sheet of raw rubber is hung to dry on a rack over a wood fire. The smoke from the fire stabilizes the rubber. This rubber is then sold to manufacturers.

Before we proceed

It is useful to show students the maps of world ecosystems from Oxford School Atlas for Pakistan, to help them identify the countries where different types of forests are located. Also help them identify the climatic zones of the countries where these forests are found.

Reference books about forests and trees will be useful in finding examples of coniferous and deciduous trees. The students could also find information on websites such as www.pakistangeographic.com/forests.html and Forest, Wildlife, and Fisheries Department of Pakistan <http://fwf.punjab.gov.pk> and the Food and Agriculture Organization FAO www.fao.org

Expected learning outcomes

Students should be able to:

- differentiate between natural vegetation and agriculture
- describe the climates of different types of forests
- compare primary and planted forests
- explain how forests and woodland improve the environment
- identify the characteristics of the main layers of a tropical rainforest
- explain some of the ways in which people make a living in forests
- describe the importance of the Amazon rainforest.
- evaluate the economic role played by forests in the region.
- identify the four major types of forests in Pakistan.
- discuss the extent to which planted forests are sustainable in the long run

Lesson #1	
Reference pages 51-53	
<p>Topics</p> <ul style="list-style-type: none"> • What is a forest? • Difference between natural and planted forests • Types of forests: coniferous and deciduous forests 	<p>Resources</p> <ul style="list-style-type: none"> • Oxford School Atlas for Pakistan • Skills Book activity 'Planted forests' • access to the Internet, if possible
<p>Introduction</p> <p>Ask what is meant by a forest. Point out that there is no real distinction between a wood and a forest, although most people agree that a forest is bigger than some wood. If they have visited a forest, students could describe how a forest is different from other landscapes; the difference made by the trees to the weather, local climate, other plants, and wildlife.</p> <p>Show them the map of the world's main forests and explain the difference between primary forest and planted or semi-planted forest.</p> <p>Suggested Activity</p> <p>Ask the students to use the Internet or reference books to find out about the different types of forests found in different climatic zones. They could mark a world map to show the locations of the world's coniferous and deciduous forests.</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Ask the students to read the following sections of pages 51-53. Then ask them to describe coniferous and deciduous forests, giving examples of some of the trees and to say what kind of climate is suitable for each type of forest and why. Ask why some parts of Pakistan are suitable for coniferous trees, although Pakistan is not in a cold climatic zone. (Because the coniferous forests grow at high altitudes, where temperatures are much colder than in the lowlands, e.g. Juniper forest in Ziarat, Murree, and northern areas of Pakistan.) Using tools such as sample leaves and images for reference, explain:</p> <ul style="list-style-type: none"> • Coniferous forests are characterized by trees that have needle-like leaves. These leaves are typically green all year round, although they may turn a different colour in the fall. Coniferous trees also produce cones, which contain the seeds of the tree. Coniferous forests are found in a variety of climates, but they are most common in cold, northern regions. 	<p>Teacher's Notes</p>

- Deciduous forests are characterized by trees that have broad, flat leaves. These leaves change colour in the fall and fall off the tree in the winter. Deciduous trees produce flowers, which are pollinated by insects or wind. Deciduous forests are found in a variety of climates, but they are most common in temperate regions.

Building Skills

Students can collect data on the different types of trees in the forest they visit. They can record the height, diameter, and species of each tree. They can also collect data on the condition of the trees, such as whether they are healthy or diseased. They can also collect data on the soil composition in a forest. They can record the soil type, pH level, and moisture content. They can also collect data on any pollutants in the soil. Students can create a map of the vegetation in a forest. They can record the type of vegetation, the foliage’s height, and the vegetation’s density.

Homework

Ask the students to do ‘Planted forests’ from Skills Book and ask what a planted forest is and how it differs from a primary forest. Using Oxford School Atlas for Pakistan, help them locate the countries listed on the page and mark them on the blank political map of the world.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- I learned about the factors that affect the type of forest that grows in a place.
- I learned about the difference between deciduous and coniferous forests.

Lesson #2	
Reference pages 53-55	
<p>Topics</p> <ul style="list-style-type: none"> • Types of forests: tropical rainforest • Layers of tropical rainforest 	<p>Resources</p> <ul style="list-style-type: none"> • Oxford School Atlas for Pakistan • Skills Book activity 'Layers of a tropical rainforest' • Skills Book activity 'The climate of a tropical rainforest'
<p>Introduction</p> <p>Tell the students that they are now going to find out more about tropical rainforests and ask them to look at the map on page 50 that shows the tropical rainforests of the world. Ask them which latitudes most tropical rainforests lie between. Also ask them to name any countries at the same latitudes as these forests that do not have tropical rainforests. Ask them to explain why some tropical regions have rainforests while others do not. Point out that some tropical regions have arid climates – deserts, which do not support trees; others have tropical dry forests (see Before we proceed).</p> <p>Explain that forests, particularly rainforests, can be split into horizontal layers. Each layer has a different collection of plants and animals depending upon the amount of sunlight, water, and food available. From the ground upwards, these layers are:</p> <ul style="list-style-type: none"> • forest floor – rotting leaves, animal dropping, and dead trees, which form new soil and provide nutrients for the plants, living plants, including ferns, grasses, fungi, and tree seedlings • under canopy – bushes, shrubs, and young trees that can survive in the shade under the canopy • canopy – branches, twigs, and leaves of mature trees, where the tops of the tallest trees get most of the sunlight • emergent layer – in tropical rainforests, where a few scattered trees rise above the canopy 	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>If possible, show the students an example near the school of any area of vegetation and ask what they notice about the heights of the plants. (They are usually different heights, with some needing more sunlight than others which survive in the shade.) Explain that forests are like this: some trees grow taller than others and there are many plants that grow well in shady places, while some reach the sunlight by climbing up others.</p>	<p>Teacher's Notes</p>

Ask the students to read 'Layers of the rainforest' and to look at the diagram of a rainforest. Ask them to describe the layers of a rainforest without referring to the Student's Book. Then ask them to give an example of a tropical rainforest tree, saying which layer of the rainforest it belongs to, and why this layer suits it. They should be able to name the kapok tree and to say why it is suited to the emergent layer.

Homework

After reading this section, the students should complete Questions A1-2. Ask the students to do the Skills Book 'Layers of a tropical rainforest'. They should try to complete this without referring to the Student's Book. They can proceed also do 'The climate of a tropical rainforest' or complete this for homework.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- I learned about the climate of a tropical Rainforest.
- I learned how different trees and other plants survive together in a tropical rainforest.
- I learned that a tropical rainforest can be split into layers, with the tallest trees growing to the top layer – the emergent layer.

Lesson #3	
Reference (pages 55-56)	
<p>Topics</p> <ul style="list-style-type: none"> • Make a living in the rainforest of Brazil • Forests of Pakistan 	<p>Resources</p> <ul style="list-style-type: none"> • Oxford School Atlas for Pakistan • pictures of products of the Amazon rainforest
<p>Introduction</p> <p>Ask the students to locate Brazil on a map of the world. Ask them to describe its location (continent, neighbouring countries, seas/oceans, and latitude). Ask them to find the main river in Brazil, and to name it. They should be able to describe the climatic zone of the area around this river (the Amazon). Using a physical map of Brazil/South America, they should be able to describe the land there (whether it is mountainous, a valley, a plain, or a plateau).</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Show the students some pictures of the products of the Amazon rainforest: rubber and Brazil nuts (if possible, show the nuts in their shells – perhaps use nutcrackers to open them for the students to eat.) Explain that the nuts grow in pods – around 10–21 nuts in each pod.</p> <p>If you are unable to find Brazil nuts, show them pictures of Brazil nuts and tell them that a pod is approximately the size of a baseball. Its outer shell is very hard. It falls from the trees when it ripens. Ask the students to read the sections about rubber-tapping and Brazil nut harvesting. After they have read these, ask if they think the workers face any dangers. (Many workers are injured, or even killed by Brazil nut pods falling from trees as these are hard and quite heavy. They also face possible danger from some of the animals of the rainforest.)</p> <p>Ask if rubber-tapping and Brazil nut harvesting harm the rainforest, and why not. Inform them that rubber trees have a wax-like liquid called latex in their bark which is tapped by rubber-tappers. Ask them to name some of the products made from rubber. Give them examples like rubber shoe soles, balloons, tires, pencil erasers, etc.</p> <p>Ask students to refer to the Oxford School Atlas and read page 56. Ask them similarities and differences between different forests in Pakistan and identify the locations for each on the map in the Skills Book.</p>	<p>Teacher's Notes</p>
<p>Homework</p> <p>Ask them to complete Questions B1–3 and Skills Book activity 'Mapping forests of Pakistan' if not done in class.</p>	

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- I learned that the rainforests contain trees that are very useful to people: for example, the rubber tree and the Brazil nut tree.
- I learned how Brazil nuts are harvested and sold without harming the trees and rubber-tappers collect latex without harming the trees and sell it to rubber manufacturers.

Lesson #4	
Reference pages 57-58	
<p>Topics</p> <ul style="list-style-type: none"> • Uses of forests • Role of forests in the global economy • Urban planted forests 	<p>Resources</p> <ul style="list-style-type: none"> • Skills Book activity 'Advantages of planted forests'
<p>Introduction</p> <p>Ask students to read pages 56-58. Discuss that forests are essential for life on Earth. They provide oxygen, water, habitat for plants and animals, prevent soil erosion, and have economic benefits. They also help mitigate climate change by absorbing carbon dioxide. Forests provide wood for furniture, paper, and fuel. They also have fruits, nuts, and medicinal plants that people can use for food and medicine.</p> <p>Forests are popular for ecotourism, which creates jobs and income for local communities. They help regulate water and absorb carbon dioxide from the air, which helps with climate change. Forests also filter air and water, making them cleaner. They provide homes for plants and animals and have cultural and spiritual value for many people.</p> <p>Remind the students about the term 'primary forest' and ask them to explain it. Point out that there are very few forests that have grown completely naturally, but most forests began as primary forests, and new trees have been planted in and around them. Ask if they have visited, or heard of a forest that was planted specially, and if they know what the trees were planted for. Tell them that they are going to learn some of the reasons why people plant forests and about some examples.</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Ask the students to read the sections of pages 58-59. Discuss the uses of forests and refer to the local data showing impact of forest products on the economy. Discuss how forests make significant contributions to the global economy in various ways. They are a vital source of timber and wood products, supplying materials for construction, furniture, paper, and other industries. It generates substantial revenue and employment opportunities, particularly in regions with extensive forest resources. Additionally, forests support the livelihoods of millions worldwide, particularly those in rural and indigenous communities who depend on forest resources for sustenance and income generation. Furthermore, forests contribute to tourism, attracting visitors with their natural beauty and recreational opportunities.</p>	<p>Teacher's Notes</p>

Forest-based ecotourism activities such as hiking, wildlife observation, and nature-based experiences generate revenue and employment in many countries.

Discuss the idea of sponge cities and the role of urban forests. Explain that for centuries, dust storms from the Gobi Desert have affected the major cities of China like Beijing and are a major cause of desertification. Since 1978, the Chinese government has started planting forests to address this issue and it has been quite successful in this regard. The vegetation has increased, and the intensity of the dust storms has decreased.

Explain that, as well as protecting the land from dust storms, a planted forest could be useful in another important way and ask what this might be. (A forest can protect the land from wind that could cause soil erosion, where soil is blown away by the wind, leaving the land much poorer for farming. It could also help to prevent soil being washed away, as the tree roots hold the soil.)

Ask the students not to refer to the Student's Book, and invite volunteers to say what they have learnt, and to give examples of primary and planted forests. Also ask why people plant forests, apart from making the environment look pleasant. If they do not mention it, remind them of the information in 'It's a fact.' and ask how forests can help to protect the environment. Explain that carbon dioxide is a gas that is released into the air when animals (including humans) breathe, and that many human activities, such as industry and transport, release carbon dioxide into the air. Point out that carbon dioxide replaces other useful gases in the air, such as oxygen, which we and other animals need to stay alive.

Carbon dioxide is one of the gases that help to keep the Earth warm, but too much carbon dioxide leads to global warming. Trees and other plants take in carbon dioxide during the day, when they use energy from sunlight to produce glucose from carbon dioxide and water. They build new material from glucose. So large forests are important for reducing the amount of carbon dioxide in the air. The tropical rainforest of Brazil makes a huge difference to the entire world therefore many countries are helping Brazil to protect its forest.

Homework

Ask the students to complete Questions C1–3. You can also ask students to refer to Skills Book activity and read the series of quotations from different people about a new forest that is being planned for land in a rural area that is being used for farming.

They could read the quotations in groups and discuss the effects of the planned forest and then write what they think each group of people would want the planners to do. Visit each group and ask them to explain their answers. Each group could also plan a presentation for the rest of the class, or they could arrange a mock 'consultation meeting' with different students taking the roles of the people described on the pages. Encourage them to represent their characters' views in a persuasive but polite way.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned about the differences between primary and planted forests and can describe some examples of each type of forests.
- ✓ I learned some of the purposes for which forests are planted, including to help reduce climate change.

Lesson #5	
Reference pages 58-60	
<p>Topics</p> <ul style="list-style-type: none"> • How do forests help a city • Deforestation • Sustainable forestry 	<p>Resources</p> <ul style="list-style-type: none"> • <i>Oxford School Atlas for Pakistan</i> • Skills Book activity 'How forests cool a city'
<p>Introduction</p> <p>Tell the students that forests are an important part of our environment. They affect the atmosphere of the neighbouring towns and cities. Ask if any of them have visited Changa Manga Forest near Lahore, in Punjab. They could tell the others about their visit. If not, tell them that Changa Manga is one of the oldest planted forests in the world and was once the largest, but it is now much smaller than it used to be, because of clearing forests.</p> <p>Changa Manga is on a plain in a region with a hot, dry climate, and before the forest was planted, scrubland was cleared of bushes and irrigation canals were dug. The first trees to be planted were chosen because they could adapt to this type of climate: sheesham and kikar (coniferous trees, whose wood is useful for many purposes, and parts of the trees have medicinal uses); also, white mulberry (a broad-leafed tree that has many medicinal uses as well as being a grown for feeding silkworms). Eucalyptus trees were planted later.</p> <p>Ask if any student knows the purpose of Changa Manga forest, where planting began in 1866. They might remember from their history lessons that this was during the time of British rule, and that the British were keen to build railways for transporting military personnel and goods as well as crops such as tea. The forest provided wood for railway construction and for fuel for steam trains. Tell the students that they are going to find out about the new purposes for Changa Manga and another forest in England that was planted with different coniferous trees for a different purpose, but now has a very similar purpose to Changa Manga.</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Ask students to read pages 58-60. Invite the students to explain what makes the air in cities warmer than the air in the surrounding countryside, and how a forest can help to cool the air in a city. Ask the students to read the sections of pages 54-55 'A planted forest in Pakistan: Changa Manga' and 'A planted forest in the UK: Kielder Forest' and to look at the photos of the forests.</p> <p>Then they should use Oxford School Atlas for Pakistan to find the locations of the Kielder and Changa Manga forests.</p>	<p>Teacher's Notes</p>

Ask the students what Kielder forest was planted for (timber). It is still one of the UK's main sources of timber for various industries. Ask them to compare these two planted forests. They should comment on the types of trees, the wildlife, and the new purpose for each forest. Ask them if using wood as a material or fuel is harmful to the environment or whether it could be helpful. Explain to them that a forest where new trees are planted to replace the ones that have been cut down can be in better condition than a forest left to nature. It can also provide a sanctuary for wildlife. The students could find out more from <http://fwf.punjab.gov.pk>.

Ask students to define deforestation. Explain that deforestation means the removal of trees. This is sometimes done to clear land for farming, roads, or settlements. It is a big problem globally. Give examples of global problems from deforestation, such as in the Amazon Rainforest in South America around 13,235 km² of trees were cut down in 2021. Trees are removed to make space for things like farmland to raise cattle for the meat industry. That's the same as around 2 million football pitches worth of trees being cut down in a year. It is not sustainable.

In Scotland lots of our forests are now more sustainable. That means that when we cut down trees, we plant new ones to replace them, so our forests stay alive, and we protect our wildlife and environment. This is especially true of hardwood trees (like oak and ash) which can take up to hundreds of years to grow back. By comparison, softwood trees (like pine) grow back quite quickly so are a more sustainable option. As wood is a natural material, it can sustain other types of life when it biodegrades naturally. This means it breaks down as part of nature and becomes part of the nutrient cycle by supporting wildlife and other living things.

We should leave most trees in the ground. This will help:

- protect us from climate change
- keep our air quality good
- provide a habitat for other plants and animals
- soak up water from the soil which helps prevent flooding
- give us beautiful landscapes to look at and enjoy

Ask students to explore possible pros and cons of forests and wood (or other products) if they were managing a piece of land. Here is a sample of advantages and disadvantages of wood:

Advantages

- It is a strong and flexible material to use in building.
- It has thousands of different uses and is often used in building, to make furniture, toys and types of tools.

- It is naturally replenishing and renewable as it grows naturally in the ground. This means using it damages the environment less than non-renewable energy sources and materials which don't grow back.
- It biodegrades and breaks down naturally so contributes to the nutrient cycle to support other living things.

Disadvantages

- There are many disadvantages to using wood as a material because when alive as trees, wood is very useful to us!
- Deforestation negatively affects natural ecosystems, biodiversity, and the climate.
- By absorbing carbon dioxide, trees help to slow down climate change. They also release oxygen and so are a natural part of the ecosystem. Cutting trees down to use as material means we don't get this fantastic benefit.
- They are a beautiful part of nature when alive – it's a real shame to cut them down and lose stunning views, good air quality and the support of other life such as insects, animals, and birds.

Ask students to discuss what new did they learn about sustainable forestry. For example, discuss Corporate Social Responsibility and to what extent can it be successfully adopted in developing countries like Pakistan.

Suggested activity

Introduce the concept of 'sponge cities' which are urban areas with abundant natural areas such as trees, lakes and parks, or other good designs intended to absorb rain and prevent flooding. This nature-based solution uses the landscape to retain water at its source, slow down water flow and clean it throughout the process. The focus is to retain rainwater in urban areas by waterproofing the paved floor so that part of it evaporates and the rest is drained gradually. Ask students to find out:

- Name the best sponge city in the world. (Auckland: it boasts a high percentage of green and blue space, with roughly half of its land covered by these elements, making it one of the best "sponge cities" in the world of the eight profiled, with a sponginess score of 35%.)

<ul style="list-style-type: none"> • What material is used in sponge cities? (Sponge city uses permeable asphalt concrete, permeable cement concrete, permeable brick, and novel permeable materials. Pore characteristics have a significant impact on mechanical and hydrological properties of permeable pavements.) • What are the techniques of sponge city? (Associated techniques for sponge cities include permeable roads, rooftop gardens, rainwater harvesting, rain gardens, green space and blue space such as ponds and lakes. The idea of a sponge city is to make cities more permeable so as to hold and use the water which falls upon it.) • What are the disadvantages of sponge city? (The more impermeable the city is, the more water will be mixed with wastewater and will not be able to be treated but discharged directly into rivers. This increases the level of pollution of local water bodies. Degradation of urban ecosystems and green areas due to sprawling.) 	
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Homework

Ask them to complete Question C2 a–e and C4. Show the students the diagram on page 59 and ask them to discuss how a forest could help to improve the atmosphere and keep the air in a neighbouring town/city cool, and where it could be planted. The students could also discuss whether everyone in the city or town would be in favour of planting new forest and give reasons to support their answers. This is an opportunity for a class debate, also using what has been learned in previous lessons. The students could complete this exercise for homework.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- I learned how a forest can help to cool hot air in a city.
- I learned how trees can help to prevent air pollution in a city.
- I learned that forests that are planted for timber can become pleasant places for recreation and for protecting wildlife.
- I learned about the similarities and differences between a planted forest in Pakistan and another in the UK.

Answers to Assessments

A Choose the correct answer:

- i. Nine
- ii. Deciduous
- iii. Mangrove
- iv. Coniferous
- v. 4.8%
- vi. 11
- vii. Desertification
- viii. Carbon

B. 1 a) Tropical rainforests are found between the Tropics of Cancer and Capricorn. Their climate is hot and humid. They receive rain throughout the year and the average temperatures each month are between 18°C and 35°C. The world's largest tropical rainforest is in Brazil.

b) a hot climate with no dry season, and rain during every month of the year

2 a) Emergent layer: the topmost layer, which receives the most sunlight. Leaves are big and leathery or hairy, with a pointed shape that lets water run off easily.

Canopy: the second layer, which has shorter trees that do not need much sunlight. The leaves are so dense that they form a canopy and block out sunlight to the lower layers. Most of the animal and plant life of the forest is found here.

Under canopy: the third layer, which has shorter trees than the canopy and need even less sunlight, but need shelter from heavy rain. They get water that drips off the leaves of the canopy trees.

Forest floor: the bottom layer, which is very cool and shaded, so very few plants grow there, apart from those that do not need much sunlight, such as shrubs, mosses, ferns, and bushes. Some small trees can grow up to 3.5 metres, while other forest floor plants grow up till the trees to reach sunlight.

b) It is an emergent tree that grows very quickly to the top of the canopy, where plenty of sunlight reaches it. It has a thick trunk and many roots that spread out to support the tree in shallow soil. These large roots help the tree to take up water. Its leaves turn to face the Sun and their fan shape helps the rain to run off them.

c) Some plants do not need much sunlight; others can climb up the taller plants to reach the sunlight.

C. 1 a) They make a small cut in the bark of the tree and fix a cup to collect the latex that runs out. Later in the day, they go back to collect the cups of latex. The next day, they tap different trees.

b) The rubber-tappers and Brazil nut harvesters look after the forest by making sure

they do not damage the trees. They know they need the forest so that they can make a living out of it. The rubber tappers tap different trees each day and hence do not damage them. The Brazil nut harvesters collect Brazil nut pods that have fallen and cut down other nuts carefully.

c) Bolivia, Brazil, and Peru

2. a) The government pays them to help them make a living from the trees in the wild. Only wild trees are tapped, so no forest is cut down to plant rubber trees. They tap different trees each day.
- b) Each morning they go along forest trails to gather the pods of nuts that fall from the trees. They open the pods using a machete and then take out the nuts. They put the nuts in large bags and carry them to a nearby house or settlement near a road or river. Then they hand over the nuts to the people who transport them by road or river to processing plants in towns.

D 1. The students' own responses should include the effects on farmers (who might lose some of their farmland); people in nearby villages, towns, or cities (who could benefit from the reduction in pollution and flooding and fresher, cooler air, and enjoy visiting a forest for recreation); local businesses (whose trade could benefit from visitors).

- 2 a) gyps vulture, blue bull, urial, spotted deer, peacock, partridge, various species of monkey
- b) They can go to the zoo, walk in the forest, ride on the train, visit the pagoda, water turbine, or waterfall. They can also go to the children's play area, on the boating lake, and have a picnic.
- c) students' own responses
- d) The forest could help to prevent flooding, because trees take up a lot of water from the soil. It could provide shelter from wind and hot sunshine. It provides a pleasant place for a day out. It brings tourists to the area; this could provide income for local businesses. It could also make local roads and railways busier. This might lead to improved roads for the area which could be useful for local people and businesses.
- e) the students' own responses, using information from this unit and from leaflets from Changa Manga, and the Internet.

E 1. The correct answer is 'b'

F 1. Answers will vary.

2. Answers will vary. The argument should highlight the complex and different perspectives surrounding the issue of cutting down trees in the rainforest. One should emphasize the importance of preserving the rainforest for biodiversity and climate regulation, while the other should acknowledge the economic benefits and argues for responsible logging practices. Encourage students to end on a positive note by helping person A and B find a common ground that

prioritizes sustainability, conservation, and the well-being of both ecosystems and communities is crucial to addressing the challenges faced in the rainforest.

- G a)** Encourage students to refer to authentic sources such as the following:
- <https://data.worldbank.org/indicator/AG.LND.FRST.ZS>
 - <https://www.fao.org/state-of-forests/2020/en/>
 - <https://ourworldindata.org/>
- b)** Answers will vary due to their individual research. Recommend referring to reliable sources such as the Food and Agriculture Organization of the United Nations (FAO), which regularly publishes comprehensive reports on global forest resources and deforestation rates.
- c)** Answers will vary.
- H 1 a)** Refer to the Oxford School Atlas for Pakistan.
- b)** Northern areas in GB and KPK.
- 2 a)** Deciduous - foothills of the Himalayas and the Karakoram Mountain ranges
Coniferous - Swat, Shangla (KPK), Murree, Rawalpindi (Punjab), Quetta and Qalat (Balochistan)

Tropical - none found in this region

Mangrove - Indus delta and Hub delta

b and c) Answers will vary.

Coniferous: Cold climates since it can withstand snow because of their strong, supple, downward-sloping branches and their conical-shape which allows the snow to slide off.

Deciduous: These forests are found in areas that receive plenty of rainfall all year round. These are found along the Equator belt between the tropic of Cancer and tropic of Capricorn. The tropical deciduous forests are majorly found in Coastal regions

Tropical: These are found in the regions surrounding Tropics of Cancer and Capricorn. The climate of a tropical rainforest is hot and humid, as it receives rain throughout the year

Mangrove: Typically found in tropical and subtropical regions where temperatures are warm year-round. They are uniquely adapted to live in brackish water, where freshwater and saltwater mix. These often grow in sheltered areas such as estuaries, deltas, and protected bays.

3. Planted forests can contribute to resource management and environmental conservation, their long-term sustainability depends on appropriate management practices, biodiversity considerations, soil and water conservation efforts, climate change mitigation strategies, and addressing social and economic aspects.

Answers to Skills Book

Skills Book activity 'Layers of a tropical rainforest'

- A 1. emergent, canopy, under canopy, forest floor
 2. Answers will vary. Plants might include: banana, coffee, Brazil nut, rubber, tea, kapok.

Skills Book activity 'The climate of a tropical rainforest'

- A. hot; Tropics of Cancer; Capricorn; humid; rises; clouds; cool; condenses; rain; tree canopy; under canopy; nutrients; dead plants and animals decompose quickly; shallow; nutrients; water.

Skills Book activity 'Planted forests'

- A 1. Check that the students mark and label the planted forests in the correct places.
 B. 1-2) students' own responses

Skills Book activity 'How forests cool a city'

- A 'Students'' own answers

Skills Book activity 'Advantages of planted forest'

- A 1. Students should read the information.
 2 and 3. 'Students' own responses

Skills Book activity 'Mapping forests in Pakistan'

Refer to the information on page 56 to colour the map.

Skills Book activity 'Impact of deforestation'

- A. Brainstorm and then elaborate on the possible steps and the limitation in implementing identified steps. Sample:

Possibilities	Limitations
Promoting sustainable forest management to meet the needs of people and the environment. This includes replanting trees after they are harvested and reducing the fire risk.	Local communities often resist efforts to protect forests because they rely on forests for their livelihoods.
Pakistan's laws prohibit deforestation, but these laws often need to be executed. It is important to implement these laws to prevent deforestation.	The government of Pakistan needs more resources to enforce the laws against deforestation effectively or to promote sustainable forest management.
Raising awareness of the importance of forests and the threats they face can encourage people to take action to protect them.	There needs to be more political will to address the problem of deforestation in Pakistan.

UNIT 5 **Natural Disasters**

Background knowledge for the unit

This unit focuses on natural disasters: how they occur, how human activity increases their frequency and ferocity, and their impact on humans and the landscape. Special consideration is given to an exploration of why developing nations suffer more from natural disasters than developed nations, and how people can prepare for natural disasters.

While natural disasters can occur anywhere, the Asia–Pacific region experiences among the most frequent and most disastrous natural disasters. These include earthquakes, volcanic eruptions, cyclones, monsoons, floods, and fires. This region is also home to many developing countries, which exasperates the problem because evidence shows that most people killed or otherwise severely affected by natural disasters come from developing countries.

The impact of natural disasters is not necessarily associated with the force and scale of the event, but the vulnerabilities within the area it hits. For example, an earthquake that hits a city in a developed nation that has strong, enforced building codes, will prove far less of a disaster than an earthquake of the same magnitude hitting a city in a developing nation where there are usually no strictly enforced regulations for buildings and infrastructure.

The capability of governments and emergency services to respond to disasters is also a factor in the final assessment of the scale of a disaster. Governments and aid organizations conduct risk assessments and make plans to deal with natural disasters. However, allocating resources is not as simple as it seems. Governments and organisations have limited resources.

It has been established that human-induced activity is changing the Earth's climate. As a result, evidence suggests that natural disasters have become more frequent and extreme and will continue to do so. The ramifications are enormous. Increased temperatures and heatwaves will lead to drought conditions in some parts of the world, while other areas will suffer from more potent floods due to increased rainfall. Cyclones/hurricanes have increased in intensity, and they also cause flooding.

Before we proceed

Before beginning this unit, you should acquaint students with some of the types of natural disasters such as volcanoes, cyclones, earthquakes, forest fires, landslides, desertification, and floods. Also reacquaint them with the notion of climate change, particularly the

production of greenhouse gases from the burning of fossil fuels. The difference between renewable and non-renewable resources could be one focus of this discussion.

It would also help if students were aware of the differences between developed and developing countries. Perhaps start the study of this unit by asking students if they are aware of any natural disaster that has occurred recently. They might have learnt about it from the news (TV, newspaper, Internet, etc.) This leads nicely into the area of the unit dealing with natural disasters.

Expected learning outcomes

Students should be able to:

- explain the links between natural disasters, sustainable development, and climate change
- identify ways in which natural disasters have impacted on human activity
- discuss why developing nations suffer more from natural disasters than developed nations
- describe several ways in which humans contribute to natural disasters
- explain what actions can be taken to reduce the risk and impact of natural disasters

Lesson #1	
Reference pages 63-65	
<p>Topics</p> <ul style="list-style-type: none"> • What is a natural disaster? • Types of natural disaster • Climate change and natural disaster 	<p>Resources</p> <ul style="list-style-type: none"> • Oxford School Atlas for Pakistan • Skills Book activity 'Comparing magnitudes of earthquakes'
<p>Introduction</p> <p>One of the most well-known natural disasters in ancient times was the eruption of Mount Vesuvius in 79 AD. This catastrophic event caused the destruction of the Roman cities of Pompeii and Herculaneum. Explain that on August 24, 79 AD, Mount Vesuvius, a volcano near these cities, erupted with catastrophic consequences. Explain the events leading up to the eruption of Mount Vesuvius, including any precursors or warning signs. Show artistic impressions of the event, if possible, on multimedia. Please explain how the cities were buried under layers of ash and pumice, preserving them for centuries and were rediscovered when the cities were excavated in the 18th century. Describe the tragic human toll of the eruption, including the loss of thousands of lives and discuss the impact on neighbouring communities and the wider region.</p> <p>Suggested Activity</p> <p>Assign students to research and present on other famous natural disasters in ancient history, such as the Minoan eruption on the island of Thera (Santorini) or the flood of the Yellow River in China.</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Students should read pages 63-65. This section starts with an explanation of natural disaster and climate change and the relationship between the two. In discussing greenhouse gases, it is worth pointing out that the greenhouse effect can be both natural and human induced. The following image helps to show this.</p> <p>Students may be wondering what the connection is between climate change/greenhouse gases and natural disasters. Read this with the students. Now ask them to research and write a paragraph on floods in Vietnam and/or tsunamis in Japan, focussing on how they affect life, property, and the economy. This image from https://www3.epa.gov/climatechange/kids/impacts/signs/oceans.html shows how the oceans have warmed over the past 125 years. Showing this to your students will help to illustrate how oceans</p>	<p>Teacher's Notes</p>

have warmed. It is worth pointing out that the wide-scale emission of human produced greenhouse gases started during the Industrial Revolution, near where this graph starts.

It took about 30 years for the greenhouse effect to increase the temperature of the oceans, but since then the trend has been a steady rise. You can talk about Tuvalu, which is an island in the Pacific Ocean. Rising water levels have made this island very vulnerable.

1. Ask your students to find Tuvalu on a map.
2. Ask them to research climate change in Tuvalu and find out how much the sea levels are rising around the island. (Answer: about 5mm per year)
3. Ask the students to write down some of the ways the rising sea levels are already harming Tuvalu. (Answer: contaminating fresh ground water and therefore putting at risk the supply of clean drinking water; destruction of important crops; changes to ecosystem of the sea life around the island, threatening the fishing industry)

Homework

Students should complete the Skills Book activity ‘Comparing magnitude of earthquakes’ for homework.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned how natural disasters are caused and how the damage they cause.
- ✓ I learned that there is a direct relationship between climate change and the occurrence of natural disasters.

Lesson #2	
Reference pages 65-67	
<p>Topics</p> <ul style="list-style-type: none"> The impact of natural disasters 	<p>Resources</p> <ul style="list-style-type: none"> <i>Oxford School Atlas for Pakistan</i> Skills Book activity 'Impact of natural disasters'
<p>Introduction</p> <p>On 26 December 2004, an earthquake in the Indian Ocean, near Indonesia, caused a tsunami that killed more than 200,000 people throughout Asia and as far away as the coast of Africa. (Note for teachers: This can be a whole class activity using one large map or individual activity where each student is given his/her own copy of a map.)</p> <ol style="list-style-type: none"> Use a map of the world, or one that at least covers Asia and the East coast of Africa. Start by asking the students to conduct research and find and mark the epicenter of the Earthquake. Ask the students to highlight the countries where casualties occurred because of the tsunami. Their map should show the following countries: <ul style="list-style-type: none"> • Indonesia • India • Somalia • Sri Lanka • Thailand • Myanmar • Maldives • Malaysia • Tanzania • Seychelles • Bangladesh • South Africa • Yemen • Madagascar 	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Natural disasters can leave individuals, families, and communities devastated in many ways. Start by explaining that the effects of a natural disaster can be divided into two categories: primary effects and secondary effects.</p> <p>Ask your students for examples of each and do Skills Book activity 'Impact of natural disasters.' Their responses should include primary: human casualties, destroyed buildings, and collapsed infrastructure; secondary: psychological damage, spread of disease, and permanent loss of communities. Give the example of the floods in Bangladesh in 2016 during the monsoon season. The water level rose dangerously, affecting the lives of more than 3.7 million people in one way or another. Ask what the primary and secondary effects of these floods might have been on the affected people.</p>	<p>Teacher's Notes</p>

<p>Suggested Activity</p> <p>Case study of a disaster This activity is a research project into the effects of a natural disaster. Ask each student to do some research into a particular natural disaster. They can all pick different ones or the whole class can choose the same one. Ask them to respond to the following questions, either on paper or in discussion:</p> <ul style="list-style-type: none"> • What sort of disaster was it? • What happened during the disaster? (How did people respond?) • How many people were affected? • How was property affected? • How was the environment affected? • What was the government response? • How did aid agencies respond? 	
<p>Homework</p> <p>The students should complete Questions/activities B from the Student’s Book as homework.</p>	
<p>Discussion and review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned about the impact of natural disasters on the life and property of individuals. ✓ I learned about the economic and psychological impacts of natural disasters. 	

Lesson #3 Reference pages 67-68	
Topics <ul style="list-style-type: none"> • Climate change and sustainable development • Natural disasters and the developing nations 	Resources <ul style="list-style-type: none"> • Access to the Internet or library
Introduction <p>Engage students in a discussion by asking them to identify any SDGs they are familiar with and explain what they understand about them. Facilitate a class discussion to highlight the interconnectedness of the SDGs and their role in addressing global challenges, including natural disasters. Discuss the relevance of specific SDGs, such as Goal 11 (Sustainable Cities and Communities), Goal 13 (Climate Action), and Goal 15 (Life on Land), to natural disaster management.</p> <p>Divide students into small groups and assign each group a specific SDG related to disaster risk reduction (e.g., SDG 1: No Poverty, SDG 2: Zero Hunger, SDG 3: Good Health and Well-being). Instruct each group to research and identify the connections between their assigned SDG and disaster risk reduction. Have each group present their findings, highlighting the ways in which achieving their assigned SDG can contribute to building resilience and reducing vulnerability to natural disasters.</p>	Teacher's Notes
Using the Student's book <p>All nations, but particularly developing nations, face a dilemma in pursuing development in a way that does not harm their economies. However, pursuing development in the cheapest way possible has ramifications for the environment, climate change, and natural disasters. Give examples of burning coal to generate electricity. Germany and other European countries have closed their coal mines because of environmental hazards, while Pakistan and other developing countries are still relying on coal to produce energy.</p> <p>Talk about alternative energy/renewable energy options, like solar, tidal, and wind, being used in the world. Lead a discussion about the pros and cons of pursuing development using cheap non-renewable energy sources instead of renewable sources that may be more expensive. Examples:</p> <ul style="list-style-type: none"> • non-renewable pros: cheap; infrastructure already exists; easily transportable • non-renewable cons: harm the environment; will leave future generations without an energy source • renewable pros: clean, so good for the environment; will never run out; easily available (once infrastructure exists) 	Teacher's Notes

<ul style="list-style-type: none"> renewable cons: not reliable 24 hours a day; difficult or impossible to transport <p>Engage the class in a group discussion about the challenges faced by less economically developed countries (LEDC) in coping with natural disasters and the potential responses. Prompt students to consider questions like: What are the immediate and long-term challenges faced by LEDCs after a natural disaster? What measures can be taken to enhance their disaster preparedness and response capabilities? Encourage critical thinking and the exploration of various perspectives, including the role of international aid, community resilience, and sustainable development approaches.</p>	
<p>Homework Students should complete Questions C.</p>	
<p>Discussion and review Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned that climate change is triggered by social and economic developmental activities. 	

Lesson #4	
Reference pages 68-69	
<p>Topics</p> <ul style="list-style-type: none"> • Impact of human activities on natural disasters 	<p>Resources</p> <ul style="list-style-type: none"> • Skills Book 'Natural disasters in Pakistan'
<p>Introduction</p> <p>Explain the concept of human activities and their potential influence on natural disasters. The Amazon rainforest, often referred to as the “lungs of the Earth,” is a vital ecosystem that plays a significant role in regulating global climate patterns and supporting biodiversity. However, human activities, particularly deforestation, have had a profound impact on this valuable natural resource and have contributed to an increased risk of natural disasters, such as landslides.</p> <p>The Amazon rainforest covers approximately 5.5 million square kilometers across several South American countries, including Brazil, Peru, and Colombia. It is home to a rich variety of plant and animal species, as well as indigenous communities. However, human activities, primarily driven by agricultural expansion, logging, and infrastructure development, have resulted in widespread deforestation. Explain how deforestation occurs in the Amazon rainforest due to logging, clearing land for agriculture (primarily cattle ranching and crop cultivation), and infrastructure development.</p> <ul style="list-style-type: none"> • Highlight the scale of deforestation, emphasizing the significant loss of forest cover over the years. • Discuss the relationship between deforestation and landslides, focusing on the ecological consequences. • Explain that deforestation disrupts the natural equilibrium of the rainforest by removing the protective canopy and weakening the soil structure. • Clarify that the removal of trees reduces the ability of the soil to absorb and retain water, leading to increased surface runoff during heavy rainfall. • Highlight how this runoff can trigger landslides, as the loose soil becomes unstable and prone to erosion. • Highlight the potential consequences of landslides, including loss of lives, displacement of communities, and destruction of infrastructure. Discuss the impact on local ecosystems and biodiversity, as landslides can lead to the destruction of habitats and the loss of species. • Discuss strategies for mitigating the impact of deforestation and reducing the risk of landslides. 	<p>Teacher's Notes</p>

<ul style="list-style-type: none"> • Explore sustainable practices such as reforestation and afforestation efforts to restore forest cover and strengthen soil stability. • Highlight the importance of land-use planning and regulations to control deforestation and promote sustainable agricultural practices. • Discuss the role of international cooperation and awareness in addressing deforestation and its impact on natural disasters. <p>Conclusion:</p> <p>The case study of deforestation and landslides in the Amazon rainforest illustrates the influence of human activities on natural disasters. It demonstrates how deforestation disrupts the ecosystem, leading to increased vulnerability to landslides. It emphasizes the need for sustainable practices and responsible land management to mitigate the risks associated with deforestation. By understanding these interconnections, we can take proactive measures to protect our environment and minimize the impact of human activities on natural disasters.</p>	
<p>Using the Student's book</p> <p>Explain that developing nations suffer more from natural disasters because they do not have adequate resources to cope with them. Read page 68-69 and explain that the governments of developed countries have enough resources to evacuate and resettle the people of disaster- stricken areas to safer places.</p> <p>Explain that the term 'natural disaster' is not really an accurate description. Human activity can contribute to natural disasters too. Discuss the issue of deforestation in Pakistan. (Punjab is the region with the worst deforestation, followed by Sindh, then Balochistan, and Khyber Pakhtunkhwa.)</p> <p>Also discuss overgrazing, particularly in northern Pakistan. Ask students to research where Pakistan's ten largest dams are. (They are Mangla Dam, Tarbela Dam, Hub Dam, Mirani Dam, Sabakzai Dam, Gomal Zam Dam, Allai Khwar Dam, and Duber Khwar Dam.) Explain that while dams are important to produce hydroelectricity, they may threaten the surrounding areas with a natural disaster like an earthquake. Ask students to research Pakistan's mining activity and discuss how it may induce a natural disaster.</p>	<p>Teacher's Notes</p>
<p>Homework</p> <p>Students should complete Questions D and E. Students should complete the activity 'Natural disasters in Pakistan' for homework.</p>	
<p>Discussion and review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned that developing nations suffer the most from natural disasters because they do not have adequate resources to cope with their aftermath. ✓ I learned that activities like deforestation, overgrazing, building dams, mining and drilling 	

Lesson #5	
Reference pages 70-72	
<p>Topics</p> <ul style="list-style-type: none"> • Dealing with natural disasters 	<p>Resources</p> <ul style="list-style-type: none"> • Skills Book activity 'Preparing for a natural disaster' • Skills Book activity 'Evacuation plan' =
<p>Introduction</p> <p>Using multimedia tools, discuss successful and failed responses to natural disasters. This can be local and international. Here is a sample:</p> <p>Successful Response: Cyclone Phailin in India (2013)</p> <p>In October 2013, Cyclone Phailin struck the eastern coast of India, affecting several states, including Odisha and Andhra Pradesh.</p> <p>Response: The Indian government, in collaboration with local authorities, implemented one of the largest evacuation efforts in the country's history, successfully evacuating around one million people from vulnerable coastal areas. Prioritized emergency response plans were executed, including pre-positioning relief supplies, setting up temporary shelters, and deploying rescue and relief teams. Timely warnings, public awareness campaigns, and coordination among various government agencies played a significant role in the successful management of the disaster.</p> <p>Outcome: Despite the cyclone's intensity, the well-coordinated response resulted in a low death toll compared to previous cyclones in the region. The evacuation efforts and effective disaster management measures were widely recognized as successful in saving lives and minimizing the impact of the disaster.</p> <p>Failed Response: Hurricane Katrina in the United States (2005)</p> <p>Hurricane Katrina landed in August 2005, causing significant devastation along the Gulf Coast of the United States, particularly in New Orleans.</p> <p>Response: The response to Hurricane Katrina faced numerous challenges and shortcomings. Delays in evacuation efforts, inadequate emergency planning and coordination, overwhelmed emergency response systems, and communication failures could have helped the response. There needed to be more in providing essential services, such as rescue operations, medical assistance, and emergency supplies. The failure to adequately respond and deliver timely assistance resulted in a significant loss of lives and prolonged suffering for affected communities.</p>	<p>Teacher's Notes</p>

<p>Outcome: The inadequate response to Hurricane Katrina exposed significant gaps in local, state, and federal disaster preparedness and response. It led to widespread criticism of the government’s handling of the disaster and sparked significant reforms and policy changes in disaster management in the United States.</p> <p>Case studies should highlight the importance of effective disaster management, including timely warnings, proactive evacuation plans, coordination among various stakeholders, and well-resourced response systems. Successful responses are characterized by proactive measures, efficient coordination, community engagement, and effective communication. In contrast, failed responses often stem from inadequate planning, insufficient resources, coordination failures, and delayed or ineffective actions.</p>	
<p>Using the Student’s book</p> <p>Read page 70-72 and explain that being prepared for a natural disaster is the best way to minimize casualties and damage. Engage your students in a discussion on how communities can prepare for natural disasters. Topic points should include:</p> <ul style="list-style-type: none"> • being aware of escape routes • having survival kits packed and easily accessible (They should contain food, water, and first aid materials.) • having sandbags nearby (in case of floods) • conducting controlled burnings (in places where forest fires occur) • ensuring communication channels are known and working (to alert all members of the community) • recognizing warning signs <p>Elicit responses about the importance of school evacuation/fire drill. The objective is to train people how to take safety precautions in case of fire, earthquake, etc. Give example of Japan, where regular earthquake drills take place. Also mention that earthquake-proof buildings are constructed in Japan, as the region is prone to earthquakes.</p> <p>Ask your students to do some research into natural disasters in their local area so they can determine which natural disaster is most likely to occur close to their homes. For example, if they live near the coast, they should be aware of the possibility of storms, cyclones, typhoons, tsunamis, etc. They should look at local newspapers from the past, and other local historical records, as well as ask older members of the community.</p> <p>2. Ask them to make a list of things they can do to prepare for such a disaster. (The responses will differ depending on the type of disaster they have identified.)</p>	<p>Teacher’s Notes</p>

Encourage students to find out how Australians monitor and respond to tsunami warnings. (http://www.bom.gov.au/tsunami/about/tsunami_warnings.shtml)	
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Homework

The students should complete Questions A, F, and G. Students should also complete the activity 'Preparing for a natural disaster' and 'Evacuation plan' for homework if not done in the class.

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned that risk management and mitigation are the effective ways to deal with natural disasters.
- ✓ I learned that preparing for a possible natural disaster makes it lot easier to cope with a natural disaster.
- ✓ I learned about few a successful and failed response to natural disasters.

Answer from Assessments

A. Choose the correct answer:

- i. Greenhouse
- ii. Oceans
- iii. Clean drinking water
- iv. Australia
- v. Droughts
- vi. 36.4%
- vii. drilling
- viii. dam

B. 1. 1. Students' answers should include the following: loss of jobs and income; destruction of infrastructure that needs rebuilding; disruption to trade and commerce.

2. Their answers should include the following:

- Buildings are not strong enough to withstand natural disasters.
- Cities are overcrowded.
- Health services are not adequate to cope.
- The supply of water, electricity, food, and medicines is unreliable.
- Governments do not have adequate funds for rebuilding or providing financial support to those affected.

3. It increases the amount of water vapour in the atmosphere. As water vapour condenses and forms clouds, it releases an enormous amount of latent heat. This warms the surrounding air, which also begins to rise and thus creates instability in the atmosphere. As the surrounding warm air rises and its water vapour condenses, the cloud continues to grow, and eventually produces a storm. When a higher amount of latent energy is released from the condensation of water vapour, the intensity of the storm increases.

C. 1. 1. Deforestation can lead to droughts through the removal of moisture from the forest. Forests naturally store moisture that evaporates and forms clouds. These clouds then provide rainfall. Without the trees there is no moisture. The trees also provide shade, which allows moisture to remain longer in the atmosphere, so by removing trees, moisture is also removed from the atmosphere, which leads to drier weather conditions. As a result, droughts occur and it is harder to grow crops.

2. Fracking is a form of mining that is linked to earthquake activity. Fracking involves drilling into the earth and directing a high-pressure water mixture against the rocks to release the gas inside. Drilling into the earth can make already unstable underground rock structures even more unstable. The injecting of wastewater into underground wells, which often occurs in mining operations, has the same effect as water leaking from dams.

3. Controlled burning involves setting fire to grass and other dry materials, under strict supervision, in the weeks and months ahead of the fire season. This land is then no longer a threat during the fire season.
 4. Answers will vary. Promote sustainable land management practices such as conservation agriculture, agroforestry, terracing, and contour farming. Protect and restore ecosystems, including forests, wetlands, and grasslands. Transition to renewable energy and encourage the use of energy-efficient technologies. Implement water conservation measures to reduce water consumption and optimize water use efficiency. Encourage the use of public transportation, carpooling, cycling, and walking as alternatives to private vehicles. Raise awareness and educate the public about the importance of environmental conservation, pollution prevention, and sustainable land use practices. Enforce stricter environmental regulations and policies to address pollution and unsustainable land use practices.
- D. 1**
- a) natural disaster: a devastating event caused by a natural phenomenon; it results in extensive damage to property, and many deaths and serious injuries.
 - b) sustainable development: developing a country in a way that preserves the resources of the Earth for future generations
 - c) deforestation: the destruction of forests through the cutting down of trees to make the land available for other uses, such as agriculture or human habitation
 - d) overgrazing: when animals eat all the grass and other pasture plants over a long period of time
2. Earthquakes and floods; earthquakes occur because the boundary between the Eurasian and Indian Plates runs along the region where Pakistan is located; floods occur because of the monsoon rains that are a feature of the region.
 3. Advantages are that water can be stored for use when rainfall is low; and water can be released according to when it is required by farmers and communities. Disadvantages are that rivers are not able to cope with larger than-normal flows of water; and water that leaks from dams can damage the earth beneath the surface and cause earthquakes.
 - 4 a) Primary effects are those that are noticeable immediately, such as human casualties, destroyed buildings, and collapsed infrastructure. Secondary effects are those that become apparent later, such as psychological damage, the spread of disease, and permanent loss of communities.
 - b) (i) **health** Responses should include extreme high and low temperatures can result in deaths of vulnerable members of a community, e.g., the elderly; excessive rainfall and unnatural average temperatures can increase the spread of diseases such as malaria.
 - (ii) **food security** Responses should include extreme temperatures can result in crop and livestock loss; rising food prices means poorer communities lose access to affordable nutritious food.

(iii) energy security Responses should include the closure of non-renewable energy facilities (e.g., coal mines) decreases options for cheap energy sources which particularly affects developing nations; developing nations have less capacity to invest in infrastructure for renewable energy sources and are therefore, at the mercy of other countries for their energy.

- E 1.** Responses will differ depending on the location of the student and the types of human activity taking place.
2. Responses will differ depending on the research undertaken.
 3. Responses will differ depending on the research undertaken.
 4. Responses should include the following:
 - first part of report focusing on cause, which was earthquake off the coast of Indonesia, near Aceh
 - second part of report focusing on spread of the tsunami throughout Asian coastal areas as far as the east coast of Africa, with overall casualties of more than 200,000
 - third part of report focusing on precautions such as the establishment of tsunami early warning systems to alert people across Asia/Pacific
- E 1.** Responses should include:
- knowing where escape routes are, and practicing the routes
 - knowing where the nearest medical assistance and facilities are
 - having links with other governments and international agencies that can provide urgent assistance
 - evacuating people as soon as a natural disaster is known about
 - having warning systems such as those for tsunamis
 - taking precautionary measures such as controlled burning in areas prone to forest fires.
2. Responses will differ depending on the research undertaken.
 3. Responses should include tips such as: know escape routes; have survival packs ready; know communication channels; know where medical assistance is.
- G 1.** Answers will vary. The SDGs aim to eradicate poverty, promote inclusive and sustainable economic growth, protect the planet, and ensure peace and prosperity for all. These goals encompass many interconnected issues, including poverty alleviation, education, gender equality, clean energy, sustainable cities, responsible consumption and production, climate action, biodiversity conservation, and more. The SDGs provide a roadmap for countries, organisations, and individuals to work together and take collective action towards building a more sustainable, equitable, and resilient world by 2030.
2. Answers will vary. Developing countries like Pakistan face difficulties in providing sustainable development to their citizens due to poverty, lack of resources, political instability, and lack of awareness.

3. Answers will vary for students will reinforce their knowledge from other chapters as well. By cutting down on our resource consumption, we can decrease the amount of waste produced, which can help prevent pollution and environmental damage. Additionally, reusing and recycling materials can further reduce the amount of waste produced while also conserving resources. Technology can help develop early warning systems and improve collaboration for disaster preparedness and response.

Answers to the Skills Book

Skills Book activity 'Comparing magnitudes of earthquakes'

A 1. The students' graphs should look like this:

a)

- Island of Honshu: 7.9
- Nanshan City, China: 7.6
- Turkmenistan: 7.6
- Assam, Tibet: 8.6
- Tangshan, China: 8.2
- Indonesia: 9.1
- Muzaffarabad, Pakistan: 7.6
- Sumatra, Indonesia: 8.6
- Sendai, Japan: 9

b) The 2004 earthquake in Indonesia has the greatest magnitude (9.1). It triggered the Indian Ocean tsunami and killed and displaced thousands of people. The earthquakes of Nanshan in China, Turkmenistan, and Pakistan have the lowest magnitudes (7.6).

c) graph on page 67 TG 3

Skills Book activity 'Shaking Earth'

A. The students should look carefully at the locations of the earthquakes from 1990 to 2005 (Map 1), and then mark them on the tectonic plates (Map 2). They should find that the earthquake zones are along the boundaries of tectonic plates.

- B 1. They are at the boundaries of tectonic plates.
2. They are far from the boundaries of tectonic plates.

Skills Book activity 'Preparing for a natural disaster'

A 1 Responses should be similar to:

- (i) An earthquake: They are hiding under a table to protect themselves from falling rubble and other materials.

- (ii) A forest fire: They are taking precautions to minimize damage to their property from a fire.
- (iii) A volcano: They are staying inside so they are not impacted by lava and other dangerous elements from a volcanic eruption.
- (iv) A flood: They are sandbagging houses to stop floodwater entering.

Skills Book activity 'Natural disasters in Pakistan'

A 1. Students' answers will vary.

Skills Book activity 'Evacuation plan'

A 1 a) The students' responses will depend on the layout of their homes.

Skills Book activity 'Impact of natural disasters'

A. Earthquake:

Primary Impacts: collapse of buildings and infrastructure from shaking of the ground; damage to roads, bridges; loss of lives and injuries; ground rupture and landslides.

Secondary Impacts: Aftershocks causing further damage to weakened structures; disruption of services such as electricity, water supply, and communication; displacement of populations and loss of homes; psychological and emotional trauma; possible debt and strain on economy to recover from damage to infrastructure and loss of productivity.

Floods:

Primary Impacts: Inundation of areas by excessive rainfall or overflowing rivers; damage to buildings and infrastructure; destruction of crops and farmland; loss of lives and injuries due to drowning.

Secondary Impacts: Spread of waterborne diseases; displacement of population; contamination of water sources; disruption of transportation and communication networks; loss of livelihoods and damage to businesses.

Volcano:

Primary Impacts:

Eruption of lava, ash, and gases; destruction of surrounding landscape and vegetation; pyroclastic flows, lava flows, and volcanic bombs; release of toxic gases and volcanic ash into the atmosphere.

Secondary Impacts: Lahars (mudflows) and debris flows; ashfall affecting air quality and visibility; disruption of air travel due to ash clouds; volcanic tsunamis in coastal areas; long-term impacts on agriculture and ecosystems.

Tsunami:

Primary Impacts: Large ocean waves triggered by undersea earthquakes, volcanic eruptions, or landslides; inundation of coastal areas; destruction of buildings, infrastructure, and coastal ecosystems; loss of lives and injuries due to drowning and impact forces.

Secondary Impacts:

Contamination of freshwater sources with saltwater; coastal erosion and changes in shoreline configuration; damage to marine habitats and ecosystems; displacement of populations and loss of homes; economic impacts, particularly on coastal communities reliant on tourism and fishing.

Avalanche/Landslide:

Primary Impacts: Rapid movement of snow, ice, rock, or debris down a slope; burial of structures, roads, and infrastructure; destruction of vegetation and alteration of landscape.

Secondary Impacts: Damming of rivers and formation of landslide lakes; flooding due to dam bursts or blockages; displacement of populations and loss of homes; disruption of transportation and communication networks; impacts on ecosystems, including habitat destruction.

Bushfire/Forest Fire:

Primary Impacts: Uncontrolled fire spreading through forests and vegetation; destruction of plant and animal life; damage to buildings, infrastructure, and utilities; loss of lives and injuries.

Secondary Impacts: Air pollution due to smoke and ash; soil erosion and degradation; loss of biodiversity and habitat destruction; displacement of populations; economic impacts on local communities and industries reliant on forests or tourism.

B. Answers may vary.

UNIT 6 **Changing Earth and Human activities**

Background knowledge for the unit

Weathering and erosion are closely linked natural phenomena but are not exactly the same. Weathering refers only to the effect on the natural feature, material, or structure that is worn away: for example, rock can be broken by water that seeps into cracks and then freezes. Erosion is when rocks and sediment are picked up and moved to another place by the movement of ice, water, wind, or the force of gravity.

There are three types of weathering: physical (or mechanical), chemical, and biological (or organic). Physical or mechanical weathering is very common where there is little soil and few plants, for example, in hot deserts and in mountain ranges. Expansion and contraction of the surface layer of rocks breaks them up. This is the result of the repeated melting and freezing of water in climates where there are wide variations in temperature. It can happen in colder climates such as tundra, alpine, or in hot desert climates.

Flowing water can also cause mechanical weathering, especially when the water carries particles of grit and sediment. A common type of mechanical weathering is 'freeze-thaw' weathering, which takes place where water runs into cracks, freezes, and expands. This expansion is powerful enough to break the rock into pieces.

Exfoliation is a more complex type of mechanical weathering. It takes place mainly on high land where certain types of igneous rock are exposed and there is pressure from other layers of rock. The pressure cracks the rock, and the cracks follow the land surface. Where the land is flat, the cracks are wide and flat, rather than deep into the ground. On mountain sides or hillsides, the cracks are quite steep. Water runs into the cracks and dissolves some of the minerals in the rock, forming new minerals (chemical weathering). The cracks enlarge, and large flat slabs of rock break off.

Chemical weathering happens mainly when materials react with minerals in the rock to form new materials. Biological weathering: occurs when living things, including animals, plants, or even microscopic organisms, break down rock. Tree roots grow through cracks in the rock as they try to reach water. As they grow, they push the rock apart. Animals scrape away rock to create a cavity for shelter, or the organic acid produced by plant roots or microorganisms dissolves the rock.

Erosion often begins with weathering, during which flowing water or wind removes soil, rock, or dissolved material from one place and transports it to another place. The force of the water takes material from the riverbanks or riverbed and transports it downstream, and then deposits it on other parts of the riverbanks or riverbed.

Animations of these processes can also be seen on My E-Mate companion website. Coastal erosion happens where wave action, tidal currents, wave currents, drainage, or strong winds remove material from coastal land and transport it out to sea or to other parts of the coast. The processes are the same as for rivers. As for coastal erosion, the actions of water and wind erode and shape high and lowland. Fastmoving water or air erodes the rock and transports particles (even quite large ones).

The Grand Canyon in Arizona, USA, was cut through the mountains by erosion. Uluru, in Central Australia, was created by erosion, where the softer rocks of the surrounding high land were eroded, leaving the mountain that came to be known as Ayers Rock. When the water or wind slows down or stops, it deposits material in a different place. This can create fertile land (as in floodplains, such as those of the Indus and Nile).

Ice is important in land erosion: glaciers are constantly moving downhill, wearing away the rock beneath them and depositing it in mounds, called terminal moraines, where they stop. Glaciers formed the fjords of Norway and Iceland. Bare soil is eroded more easily than land covered by vegetation, often leading to landslides.

Erosion by wind and water can be minimized by constructing physical structures such as gabions, riprap, and windbreaks. Plants can help to minimize erosion: for example, grass and other vegetation on sand dunes, or woodland, and even forests can be planted as windbreaks.

Wetland coastal areas can be protected by creating living shorelines, with native plants on a base protected by stone and sand. Animals such as oysters can also help to anchor the soil. Once the land is secure, living shorelines become a natural habitat, protecting the coast from erosion and storms.

People can help to minimize land and river erosion by ensuring that land is not left bare, avoiding deforestation, and, where possible, leaving natural floodplains to flood – and avoiding building on them.

Before we proceed

This unit explains different types of weathering and erosion and their effects, including coastal erosion and landforms; and there are explanations of how the effects of erosion can be minimized or avoided. Examples from around the world are included to illustrate how deserts form and expand, and the role of humans in causing erosion and desertification. The importance of vegetation, especially trees, in combatting erosion, is highlighted, with examples of successful uses of vegetation.

Expected learning outcomes

Students should be able to:

- Explain the terms 'weathering' and 'erosion'

UNIT 6 CHANGING EARTH AND HUMAN ACTIVITIES

- Explain how weathering and erosion can affect the physical and human features of places
- Describe some causes and effects of desertification, and give examples from Pakistan and the rest of the world
- Identify some of the projects that are taking place in Pakistan to prevent the erosion of farmland and habitats, and to prevent desertification
- Explain how human actions can cause or worsen erosion
- Identify the 'push and pull' factors of migration
- Discuss the causes, advantages, and disadvantages of migration

Lesson #1	
Reference pages 75-77	
<p>Topics</p> <ul style="list-style-type: none"> • Denudation • Weathering and erosion • How does weathering occur? 	<p>Resources</p> <ul style="list-style-type: none"> • Skills Book activity 'The effects of weathering'
<p>Introduction</p> <p>Elicit what the students know about weathering and erosion and explain that denudation is a term that refers to the overall process of weathering and erosion. It is the process by which the Earth's surface is worn away over time. Denudation is caused by a variety of factors, including climate, tectonics, and human activity.</p> <p>Different students could contribute to the explanation. Point out that these processes are linked, but not the same, and that they are going to find out more about them.</p>	<p>Teacher's Notes</p>
<p>Using the Student's Book</p> <p>Ask the students to read page 75-77 to find out how weathering and erosion are different, then invite them to explain this without looking at the Student's Book. Ask them to close their Student's Books, then ask them to name the different types of weathering. Invite volunteers to explain each of these and give examples. Ask how rainwater can change the appearance of a building. Make sure they understand the main features of each type of weathering. Also ask what stalactites and stalagmites are; they will have learnt about these in the first chapter.</p>	<p>Teacher's Notes</p>
<p>Homework</p> <p>The students can then complete Questions A and B. Ask the students to look at the Venn diagram in Skills Book and explain how to use it. Venn diagrams are used to present information visually. The overlapping sections are for weathering that involves more than one type of process, for example mechanical and organic, which are the processes involved where people wear away a stone step (the action involves living things and mechanical abrasion).</p>	
<p>Discussion and review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> ✓ I learned that weathering and erosion are involved in wearing away and breaking up rock. ✓ I learned that erosion also moves material that has been worn away and deposits it somewhere ✓ else. ✓ I learned about the different types of weathering: mechanical, chemical, and organic. 	

Lesson #2	
Reference pages 77-80	
<p>Topics</p> <ul style="list-style-type: none"> • Water erosion 	<p>Resources</p> <ul style="list-style-type: none"> • Skills Book page 34 'Preventing water erosion'
<p>Introduction</p> <p>Ask the students what they have learnt about weathering. They should know the main types of weathering and the difference between weathering and erosion. Ask them to consider what they know about the causes of erosion, and to list these in their notebooks. After completing this topic, they should write a new list and compare it with this one, to highlight what they have learnt.</p>	<p>Teacher's Notes</p>
<p>Using the Student's book</p> <p>Ask how rivers, streams, and rain cause erosion, and what happens to the soil and rock they erode. They should then read pages 77-80 about the different types of water erosion. The students should be able to complete Skills Book 'Preventing water erosion' for homework. Ask them to look at each picture and make a note of how water is causing erosion of the land, thinking about the direction from which it is coming, the direction of its flow, and what it is doing to the land. They should then consider how to prevent this erosion: whether the water-flow could be diverted, or its force reduced, or whether vulnerable parts of the land could be strengthened and protected.</p> <p>They can then consider the methods of erosion prevention they have read about in the Student's Book, choose the best solution, and explain how it will help.</p>	<p>Teacher's Notes</p>
<p>Homework</p> <p>They can then complete Question C and Skills Book activity 'Preventing water erosion.'</p>	
<p>Discussion and review</p> <p>Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:</p> <ul style="list-style-type: none"> • I learned how streams and rivers erode land. • I learned how run-off from rainfall can erode land. • I learned how erosion by streams, rivers, and run-off can be prevented. 	

Lesson #3	
Reference pages 80-82	
<p>Topics</p> <ul style="list-style-type: none"> • Wind erosion • Erosion caused by humans 	<p>Resources</p> <ul style="list-style-type: none"> • a tray of dry, dusty soil • a tray of wet soil • a tray of soil with grass or other plants growing in it; this could be dry • a hairdryer
<p>Introduction</p> <p>Use the hairdryer on cold setting to show the students how wind erosion affects soil. Ask them to watch what happens.</p> <ol style="list-style-type: none"> 1. Begin with the tray of dry soil and the hairdryer set on low speed (cool setting, if possible, but warm will be fine). The hairdryer should be directed so that it does not blow soil onto anyone. Switch on the hairdryer and hold it slightly above the soil and almost parallel with it, so that the air from the hairdryer blows on the soil. Increase the speed of the hairdryer if possible. 2. Repeat the above procedure on the tray of wet soil. 3. Repeat the above procedure on the tray of soil with plants growing in it. <p>Ask the students to use what they have seen to explain what happens when wind blows across dry, dusty land, wet land, and land with vegetation growing on it.</p>	<p>Teacher's Notes</p>
<p>Using the Student's Book</p> <p>Ask the students to read pages 80-82 'Wind erosion' and 'Effects of wind erosion'. Then ask them to explain how wind can change the shape of a solid rock. Also ask what happens to the materials eroded by wind. Ask how this material can affect farmland, crops, buildings, people, animals, machinery, and traffic. Also ask how this material can change the landscapes of other places; they should be able to give an example in Pakistan. Ask them to explain how dust from the Sahara Desert gets to places as far away as the north of England.</p> <p>Ask them to think about the trays of soil they looked at earlier in the lesson and to suggest how wind erosion could be prevented or minimized. (Keep the land moist and plant trees or other vegetation that will help to hold the soil in place and keep it moist.) They should then read about prevention of wind erosion.</p>	<p>Teacher's Notes</p>

Homework

The students can then complete Question D. abrasion).

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- I learned how wind erodes land.
- I learned how wind erosion can cut away solid rock.
- I learned how wind erosion can be prevented.

Lesson #4	
Reference pages 83-86	
<p>Topics</p> <ul style="list-style-type: none"> • Desertification • Desertification around the world • Preventing desertification 	<p>Resources</p> <ul style="list-style-type: none"> • Skills Book activity 'Damage from overuse of land' • Oxford School Atlas for Pakistan
<p>Introduction</p> <p>Ask what desertification means. They should be able to figure out that it refers to land that changes into desert. Ask them how this happens. Their previous learning about climate change and erosion should help. Tell them that they are going to find out about some ways in which farmers and landowners in Pakistan are helping to protect their land from desertification, with help from the Pakistan Agricultural Research Council.</p>	<p>Teacher's Notes</p>
<p>Using the Student's Book</p> <p>Ask the students to read the sections of pages 83-84 headed 'Desertification' and 'Desertification around the world' and ask which parts of the world they think are likely to suffer from desertification (places with arid and semi-arid climates).</p> <p>They should now look at the world map that shows desertification vulnerability. If necessary, explain how to interpret the map using the key. They should use a political map of the world in the Oxford School Atlas for Pakistan in conjunction with this map to help them to find out which countries are vulnerable to desertification. Ask them to read on to find out why much of the Africa is particularly vulnerable to desertification.</p> <p>Ask if Africa's desertification problem could have been avoided, and how (through better land management, including the avoidance of overgrazing and deforestation). It is useful to discuss why people do things that damage the land they need for agriculture. Point out that people living in poverty or struggling to survive do not usually have a choice about what fuels to use; they need to graze their livestock to produce food, they cut down trees to make charcoal because they need it for fuel, and they might overgraze their land because they have no other way of feeding their livestock. Ask the students to explain why land continues to deteriorate once desertification has begun.</p> <ul style="list-style-type: none"> • Which tree that is native to countries in the Mediterranean region of Europe is being planted in Punjab to help to prevent desertification? (olive) 	<p>Teacher's Notes</p>

<ul style="list-style-type: none"> • In what type of soil and climate do olives grow? (An arid climate and poor soil.) • How will olive trees help to prevent desertification? (They will prevent wind and water erosion and help to stop the Thar Desert expanding.) • What useful products come from these trees? (Olives and olive oil). • Which tree is being planted in Khushab to protect land from erosion and to stabilize the sand dunes? (Eucalyptus). • What product will come from this tree? (wood) • Which tree is being planted by farmers in Tharparkar, Sindh, to help stop the expansion <p>he Thar Desert? (lemon). How will these trees be useful? (For their fruit and to provide shade to reduce evaporation from the land)</p> <p>They can then write a short report about the ways in which farmers are helping to prevent desertification, including finding out more from the Internet or other sources about a specific project in Pakistan.</p>	
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Homework
They can then complete Question F.

Discussion and review
Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- I learned how human actions lead to desertification.
- I learned why some parts of the world are especially vulnerable to desertification.
- I learned about the actions we can take to prevent desertification.
- I learned how trees can help to prevent desertification.
- I learned about three projects that are helping to prevent desertification in Pakistan.

Lesson #5	
Reference pages 87-88	
<p>Topics</p> <ul style="list-style-type: none"> • Effect of erosion on water supply • Migration • Impact of migration 	<p>Resources</p> <ul style="list-style-type: none"> • Skills Book activity ‘Net migration’ • Skills Book activity ‘Where are the world’s refugees?’ • Skills Book activity ‘Internally displaced persons.’
<p>Introduction</p> <p>Ask the students to define the word migration. Explain that it means moving from one place to live in another. Ask them to suggest causes or reasons why people migrate. List their answers and explain that they are going to learn more about what makes people migrate and what it is about some places that makes people want to migrate to them. Introduce and, if necessary, explain the terms ‘emigration’ and ‘immigration’.</p> <p>Before the first lesson, it is useful for the students to watch, listen, or read the news and take note of any migration that is taking place, and how the migrants’ needs are being met.</p> <p>To begin the lesson, ask the students about any migration issues that have been in the news. Ask what migrants need when they arrive in a new country and how these needs are being met. Also ask them about the advantages and disadvantages of migration:</p> <ul style="list-style-type: none"> • for migrants (considering the reasons why they migrated) • for their new country • for the country they have left 	<p>Teacher’s Notes</p>
<p>Using the Student’s book</p> <p>Ask the students to read ‘What does migration mean?’ and ‘Why do people migrate?’ on page 87 of the Student’s Book, including the information in the illustration about ‘push and pull’ factors. Ask if their list from the introductory discussion includes all the reasons for migration given in the Student’s Book. Invite students who wish to speak about any experiences of migration in their own families. They might be able to identify some of the ‘push’ factors that made them want to move away from the place where they lived, and the ‘pull’ factors that drew them towards the place where they live now.</p> <p>Ask the students to read impact of migration and discuss more about why people migrate and the problems they face. They might have their own experiences to contribute, such as family members who have emigrated, or who migrated across the Pakistan–India border after Partition. They could discuss these topics in groups and come up with questions; for example: What happened to the migrants after they left their homes? Did they get any help? Who helped them? They could make a note of anything they would like</p>	

to find out. Ask what they learned about people who migrate as a way of life – why they do this and how it might affect aspects of their lives such as the types of homes they live in and their children’s education.

Ask the students to read ‘Advantages and disadvantages of migration’ on page 88 of the Student’s Book. The students should be able to complete Questions.

Suggested activity

After the students have read the given pages, ask them to consider all they have learnt about migration, and, in groups of about 6–8, to plan a short role-play about migrants arriving in a new country. They should consider what feelings the migrants might experience when they set off from home, during their journey, when they first arrive in their new country, and after they have been there for a while. Some of them could enact the parts of people who deal with migrants, the people the migrants meet on their journey, and those they meet in their new country.

Once they have planned their role-play, they could each work on their roles for homework. The roleplay of each group can then be presented during another lesson, with the rest of the class watching and noting anything they think might be incorrect for discussion afterwards.

Homework

Ask students to complete Questions A, H3, and I. Ask the students to complete Skills Book activities ‘Net migration’, ‘Where are the world’s refugees?’, and ‘Internally displaced persons.’

Ask the students to name the countries they know that have taken in refugees and then ask them to read the table of countries with refugees of the Skills Book. Explain that it shows the total number of refugees living in the countries, not the numbers the countries accepted each year – the numbers have been changing over the years as more arrive in, or leave, the countries. Ask them to consider the numbers of refugees compared with the countries’ total populations.

They can then calculate the percentage of each country’s population that is made up of refugees:
 $\text{Number of refugees} \div \text{total population} \times 100$

Discussion and review

Ask the students what they have learnt in this lesson. They could make a note of this, summarizing the lesson, for example:

- ✓ I learned about the ‘push’ factors that make people want to emigrate.
- ✓ I learned about the ‘pull’ factors that draw immigrants to a place.
- ✓ I learned about some of the ways in which immigration and emigration affect the places people emigrate from and the places that receive immigrants.
- ✓ I learned how people have migrated throughout history to escape from danger.
- ✓ I learned about the lifestyles of people who migrate regularly as a way of life.
- ✓ I learned the meaning of net migration.

- ✓ I learned about the effects of illegal immigration.
- ✓ I learned about the effects of migration on migrants, and on their host countries.

Answers to Assessments

A. Choose the correct answer:

- I. Soil
 - II. Mechanical
 - III. Chemical
 - IV. Biological
 - V. Abrasion
 - VI. Attrition
 - VII. Urbanisation
 - VIII. Overgrazing
- B. 1 a) Weathering is when rock is broken into smaller pieces by conditions such as rain or wind. Erosion is when sediment and fragments of rock are moved from one place to another by wind, water, or gravity.
- b) mechanical, chemical, and organic.
- 2 a) Chemical weathering occurs when rock dissolves in water or weak acids and forms new materials. Mechanical weathering happens when rock is broken into smaller pieces, for example, when water gets into holes in the rock and freezes. Then it expands, cracking the rock.
- b) Organic weathering is caused by living things, for example, when plants break up rocks when their roots push through the small holes in the rock and enlarge them, or when animals scratch rocks.
- c) It breaks up the rock and soil.
3. Answers will vary. Erosion and weathering are natural processes that shape the Earth's surface. They have both constructive and destructive aspects. Constructively, they create sediment and fertile soil, leading to the formation of new landforms and supporting ecosystems. They also carve out spectacular landscapes and features. However, destructively, excessive erosion can lead to habitat loss, property damage, and geological hazards. Balancing these forces is essential for maintaining a sustainable and resilient environment.
- C a) erosion of the bed of a river or stream: scour
- b) piles of rocks or concrete rubble arranged on a riverbank to prevent bank erosion: riprap
- c) metal cages filled with rocks or concrete and fixed to a riverbank to prevent erosion: gabions

- d) cutting down forests: deforestation
 - e) when a large area of rock and soil moves down a hillside: landslide
 - f) rainwater running down the surface of land: run-off
- C 1 a) Streams and rivers carry sediment that wears away the rock that the water flows across. Flowing water wears away the banks and bed of the stream or river.
- D. 1 a) Streams and rivers carry sediment that wears away the rock that the water flows across. Flowing water wears away the banks and bed of the stream or river.
 b. Students' own suggestions should include either run-off barriers or terraces.
- E 1 a) The soil is dry, and lighter than wet soil, so the wind can blow it away more easily.
 b) There are no natural barriers to slow the wind, so the winds there are stronger and can pick up more material than can gentle winds.
 c) Leave stubble from harvested crops to hold the soil in place. Plant trees or other vegetation, whose roots can hold the soil in place. Spread mulch to keep the soil moist.
- F 1 a) Answers may vary. Farmers and developers engage in practices that lead to erosion due to lack of awareness, economic pressures, and limited access to alternative methods. Intensive farming or development without soil conservation can degrade the soil. Clearing forests for agricultural or development purposes can remove natural vegetation. Excessive grazing by livestock can remove vegetation cover, leaving the soil vulnerable to erosion. Inadequate construction practices, such as improper grading or lack of erosion control measures, can also lead to erosion on construction sites.
 b) Answers may vary. Terracing on the hillside can slow down water flow, reducing erosion. Planting crops along the contours of the land helps reduce water runoff and encourages water to infiltrate the soil, minimizing erosion.
 c) Answers may vary. Measures such as planting cover crops during fallow periods can cover the soil and protect it from raindrop impact, reducing erosion. Adopting minimum or no-till farming practices helps keep the soil undisturbed, improving its structure and reducing erosion caused by tillage operations. Planting strips of vegetation, like grass or shrubs, along waterways or field edges can trap sediments and filter runoff, reducing water erosion.
 d) Answers may vary. Employing efficient irrigation methods, such as sprinkler systems, ensures water is targeted directly to plants, minimizing evaporation losses. Planting rows of trees or shrubs around fields can reduce wind speed, which lowers evaporation rates from the soil.
- G 1 a-b) deforestation, overgrazing of livestock, poor methods of growing crops, and urbanization
 Deforestation
 Trees help to prevent water and wind erosion by acting as windbreaks, and by

holding the soil together with their roots. Leaves that fall from the trees form a layer of leaf litter. This, along with other plant and animal material, decays, and forms humus. As more leaves fall, they cover the humus. Leaf litter and humus are porous, so rainwater can percolate through them into the soil below, rather than flowing over the surface as run-off. Another useful function of trees is that their canopies shelter the forest floor from erosion by heavy rainfall.

Overgrazing

Where too many animals graze on the land for too long, they trample the ground, squeezing out the air, so that it becomes compacted and absorbs less water. If the land is overgrazed, the vegetation is reduced, making the land vulnerable to wind and water erosion.

Poor methods of growing crops

Modern farm machinery ploughs the fields more deeply, breaking the soil into small particles that can easily be blown or washed away. Modern pesticides and chemical fertilizers kill the organisms that help to bind the soil together.

Urbanization

Urbanization (the building of cities, towns, and roads) speeds up erosion.

Heavy machinery used in construction work compacts the soil. Buildings and roads cover land that used to be covered with vegetation. The ground in towns has mainly asphalt or concrete surfaces, which are impermeable. This changes the drainage patterns and creates run-off in places where water cannot percolate through the soil. Towns also alter wind patterns – usually increasing low-level wind speeds. This adds to wind erosion.

Run-off from urban areas carries sediment that is contaminated with oil and other chemicals. So, not only is there increased run-off to erode nearby land and flood the waterways, but polluted sediment is also deposited by this run-off.

2. The students' own reports about a wasteland area that they know, should explain what has happened to it and how they would try to put it right if they were a local governor. This should focus on how the land became degraded or eroded and the methods that could be used to improve it and prevent further damage. They should use what they have learnt from this unit.
- H. 1 Development can lead to deforestation, soil erosion, and loss of nutrients. Agriculture can overuse land and require chemical fertilizers. Increased demand for natural resources can harm ecosystems and water levels.
- 2 a) Urbanisation and agriculture can harm animal habitats and soil quality. Water scarcity can lead to conflicts, and pollution from buildings and factories can harm the environment and public health.
 - b) People migrate for better job opportunities, education, family reunification, or due to war, political instability, violence, and environmental issues.
 - c) Answers may vary.

- 3 a) Most of Pakistan's immigrants come from Afghanistan, Iran, and Bangladesh.
- b) The reasons for most of these immigrants coming to Pakistan include seeking economic opportunities and jobs, fleeing conflicts and political instability in their home countries, and accessing better living conditions and educational opportunities.

Answers to the Skills Book

Skills Book activity 'Sorting weathering and erosion'

1. Refer to page 76 of the Students Book
2. Refer to page 77 of the Students Book
3. Refer to page 78 of the Students Book
4. Refer to page 80 of the Students Book

Skills Book activity 'Experimenting with rocks'

A. Observations will vary. A sample is shared here:

- The rocks will start to rub against each other and against the sides of the jar. This will cause them to wear away, and small pieces of rock will break off.
- The water will also help to erode the rocks. The waves will cause the water to move back and forth, and this will wear away at the rocks.
- The chalk will help to show the erosion of the rocks. As the rocks wear away, the chalk will rub off, and the rocks will become more visible.
- After 50 shakes, the rocks will be noticeably smaller than they were before. They will also be more angular, as the sharp edges will have been worn away.

Conclusion:

When waves crash into rocks, they cause the rocks to erode. The waves cause the rocks to rub against each other and against the seabed, and the water also helps to erode the rocks. This erosion can be seen by the fact that the rocks become smaller and more angular over time.

B. Observations will vary. A sample is shared here:

- Chalk in water: The chalk in the jar of water will not change significantly after three hours. The chalk may become slightly softer, but it will still be recognizable as chalk.
- Chalk in vinegar: The chalk in the jar of vinegar will dissolve completely after three hours. This is because vinegar is an acid, and acids can dissolve chalk.

Conclusion:

The chalk in the jar of water will not change significantly in size or shape. However, the chalk may become slightly softer. On the other hand, the chalk in the jar of vinegar will dissolve completely because vinegar is an acid, and acids can dissolve chalk.

Skills Book activity 'The effects of weathering'

- A 1. Chemical weathering: a Mechanical weathering: b and d Organic weathering: e
Organic and mechanical weathering: c

Skills Book activity 'Preventing water erosion'

- A 1. The students' own ideas should include the fact that run-off water flows down the gentle slope, taking soil with it, eroding the land. The water flow could be slowed down by using run-off barriers (such as large bales of straw wedged into trenches, or thick tubes of netting filled with straw, staked to the ground to hold them in place) that stop the water flowing straight down the slope. Good drainage would also help so that water could soak into the ground.
- B 2 a) The riverbank could be strengthened and protected by riprap or gabions (which should be drawn and described as in the Student's Book).
b) The hillside could be terraced for agriculture or held in place by planting trees. It would be too steep for run-off barriers.
c) The barren hillside should have run-off barriers to slow down the flow of water.

Skills Book activity 'Overuse of land'

- A 1. Positive: economic growth and job opportunities, improved infrastructure, wider access to services and amenities, social and cultural diversity in cities
Negative: loss of agricultural land, land fragmentation, rural-urban migration, deforestation and environmental degradation, uneven distribution of resources, social unrest, food insecurity.
- B 1. Impact on the Natural Habitat of Animals:
Urbanization negatively affects wildlife habitats by reducing natural spaces. This leads to loss of biodiversity and displacement of species. Animals may struggle to find food and shelter, causing conflicts with humans.
- Impact on Human Health:
Urbanization has both positive and negative effects on human health. It can provide better access to healthcare, education, and job opportunities. However, it can also lead to air and water pollution, traffic congestion, and high population density which can negatively impact public health. Pollution from vehicles and industries can cause respiratory problems and overcrowded living conditions may spread infectious diseases.
- Impact on Availability of Food and Resources:
Urbanization can reduce available land for food production, leading to a greater dependence on imported food and affecting food security. It also increases demand for resources, putting a strain on local ecosystems and natural resources. Sustainable practices must be promoted to support urban populations.

- C. Answers may vary. Urban migration can lead to challenges like pressure on infrastructure, crime, poverty, environmental degradation, and loss of cultural identity. Overcrowding strains systems, causes congestion and pollution, and increases competition for resources and opportunities, leading to crime and poverty. More people require more resources, resulting in deforestation and pollution. Exposure to new cultures can be positive but may also lead to a sense of alienation and loss.

Skills Book activity 'Net Migration'

- A 1. emigrants
2. It grew.
- B 1 a) Australia, Canada, Saudi Arabia, the United States, the United Kingdom
b) Afghanistan, China, Democratic Republic of Congo, Pakistan, Saudi Arabia,
c) Canada encouraged immigrants because of its low population density which developed the need for workers in the country.
d) conflict, civil unrest, poverty, and natural disasters such as volcano eruptions, etc.
- 2 a) Australia
b) It attracted many immigrants because it offered job opportunities and high quality of living.
- 3 a) Afghanistan
b) The students' own responses from research. Talk about Afghan refugees. Since 1979, about 4 million refugees have migrated to Pakistan to escape from the Soviet-Afghan war in their country and they continue to migrate to Pakistan for refuge whenever there is unrest in their country. About 2 million refugees have also returned to Afghanistan.

Skills Book activity 'Where are the world's refugees?'

- A 1-2 Chad: 3.24%
Ethiopia: 0.68%
Germany: 1.51%
Iran: 0.91%
Jordan: 27.34%
Kenya: 0.91%
Lebanon: 23.77%
Pakistan: 0.64%
Turkiye: 4.43%
Uganda: 3.34%

Skills Book activity 'Internally displaced persons'.

- A 1 a) internally displaced person(s)
b) They have not crossed an international border.
- 2 a) Dadu is in a region that is more susceptible to the impact of floods due to its proximity to rivers and low-lying areas. Karachi, on the other hand, is situated along the coastline and may not experience as severe flooding events.
b) IDP camps in Pakistan for 2022 flood relief are in Dadu, Shikarpur, Matiari, Mirpur Khas, Jacobabad, Jamshoro, Tando Allahyar, Thatta, Khairpur, and Karachi
- B a-b) Students' responses will depend on their research. Refer to URL Answer's may vary from year to year. Sindh may face the biggest challenge in providing food, shelter, healthcare, and education for its IDPs due to the large-scale displacement, limited resources, infrastructure damage from natural disasters and frequent extreme weather conditions, disrupted services, health risks, educational disruption, social and cultural factors, coordination and response issues, and the need for long-term support.

Lesson Plan no	Subtopics	Reference pages	Learning Outcomes	Suggested Activities
1.1	<ul style="list-style-type: none"> • Geography • Tools of Geography • How are maps read? • More tools of geography 	1-3	<ul style="list-style-type: none"> • Define geography. • Recognise the modern techniques in Geography (GIS, GPS, Google Maps, Google Earth, etc.). 	<ul style="list-style-type: none"> • Have students work in pairs, with one student acting as a geographical tool and the other as a user. The “tool” explains its purpose and how it’s used, while the “user” demonstrates how to use it in different scenarios. • Develop a game where students answer questions related to map reading and use their map-reading skills to move through different locations.
1.2	<ul style="list-style-type: none"> • Internal Structure of the Earth • Tectonic Plates • What is rock? • What are rocks made of? 	3-6	<ul style="list-style-type: none"> • Describe the internal structure of the Earth. • Differentiate between three layers of the Earth. • Explore the theory of tectonic plates. 	<ul style="list-style-type: none"> • Divide students into groups and assign each group a specific layer of the Earth. Have them create a short presentation or skit imagining a journey through Earth’s layers, explaining the features they would encounter. • Have students create a diorama depicting different types of plate boundaries (divergent, convergent, transform) using craft materials. Label and explain the processes occurring at each boundary. • Provide students with various rock samples. They can observe the color, texture, and other characteristics, and then create a chart to classify the rocks based on their properties.
1.3	<ul style="list-style-type: none"> • Different types of rocks • Igneous • Sedimentary • metamorphic 	7-10	<ul style="list-style-type: none"> • Identify different types of rocks. 	<ul style="list-style-type: none"> • Have students work in groups to create a “rock museum” where each group focuses on one type of rock. They can display rock samples, posters, and information about how each rock type forms. • Have students create a comic strip that follows a rock’s journey through the rock cycle, showcasing its transformation from one type of rock to another.
1.4	<ul style="list-style-type: none"> • Rock cycle • Economic benefits of rocks • What is soil? • Types of soil 	10-13	<ul style="list-style-type: none"> • Explore the process of the rock cycle in the formation of rocks. • Discover the uses of rocks. • Describe the importance of rocks 	<ul style="list-style-type: none"> • Assign students to different roles (igneous rock, sediment, metamorphic rock) and have them write short narratives describing their experiences during the rock cycle. • Provide different soil samples and have students conduct simple experiments to test properties like water retention, permeability, and particle size.

1.5	<ul style="list-style-type: none"> • What is a mineral? 	14	<p>in the economy of the region.</p> <ul style="list-style-type: none"> • Identify the most commonly found rocks in Pakistan. 	
			<ul style="list-style-type: none"> • Define and explain what a mineral is, identify common characteristics of minerals, and differentiate between minerals and non-mineral materials. 	<ul style="list-style-type: none"> • Provide students with magnifying glasses, mineral samples, and rock samples. They can observe and compare the minerals' physical properties and identify differences between rocks and minerals.

Lesson Plan no	Subtopics	Reference pages	Learning Outcomes	Suggested Activities
2.1	<ul style="list-style-type: none"> How are mountains different from other landscapes? Types of mountains (fold and fault block mountains) 	17-19	<ul style="list-style-type: none"> Identify different types of mountains. Explain the formation of different types of mountains. Discover the major types of mountains in Pakistan. 	<ul style="list-style-type: none"> Create a Venn diagram on the board with circles representing different landscape types. Have students list characteristics unique to mountains and characteristics common to all landscapes in the appropriate sections.
2.2	<ul style="list-style-type: none"> Volcanic mountains Dome mountains Residual mountains How are grid references used? Six grid references 	19-22	<ul style="list-style-type: none"> Describe the importance of the Himalayas in the geography of Pakistan. Describe the importance of the Himalayas, Karakoram, and Hindu Kush mountains. 	<ul style="list-style-type: none"> Assign different groups of students to research and create models of different types of mountains using craft materials. They can present their models to the class, explaining the processes that formed each type.
2.3	<ul style="list-style-type: none"> Effects of highland topography on human activities 	22-25	<ul style="list-style-type: none"> Compare the lifestyles of people living in mountains, plateaus, and valleys. Explain the reasons for frequent earthquakes in Pakistan. 	<ul style="list-style-type: none"> Assign students to design a settlement plan for a town located on a plateau and another town in a valley. They must consider how topography affects factors like transportation, agriculture, and infrastructure.
2.4	<ul style="list-style-type: none"> Plateaus Valleys 	25-29	<ul style="list-style-type: none"> Differentiate between a plateau and a mountain. Differentiate between V-shaped valleys and U-shaped Valleys and their formation. 	<ul style="list-style-type: none"> Have students create a 3D diorama depicting a plateau landscape. They can use craft materials to construct the plateau's flat-topped surface, and add details like vegetation, rivers, and any distinguishing features. Provide students with a template of a valley's cross-section profile. Have them color and label the different

2.5	<ul style="list-style-type: none"> Landforms on maps 	30	<ul style="list-style-type: none"> Describe rift valley and explore where it is located. Identify some major valleys in Pakistan. Draw and interpret contour lines to identify and describe various landforms on topographic maps, and use contour lines to create their own topographic map of a specific area. 	<p>parts of the valley, such as the valley floor, sides (slopes), and watershed boundaries.</p> <ul style="list-style-type: none"> Give students a blank map with a legend that includes landform symbols. Students search for real-world examples of each landform and mark them on the map using the appropriate symbols.
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Lesson Plan no	Subtopics	Reference pages	Learning Outcomes	Suggested Activities
3.1	<ul style="list-style-type: none"> Weather and climate Factors affecting climate The air around us 	33-35	<ul style="list-style-type: none"> Identify the difference between weather and climate. Identify factors that affect the climate of a region. 	<ul style="list-style-type: none"> Create a Venn diagram on the board with circles representing weather and climate. Have students list characteristics unique to each and characteristics common to both. Divide students into groups and assign each group a specific factor affecting climate. Have them create dioramas illustrating how their assigned factor influences the climate in different regions.
3.2	<ul style="list-style-type: none"> Climatic zones of the world Tropical climate Continental climate Temperate climate 	35-39	<ul style="list-style-type: none"> Name and describe the climatic zones of the world. 	<ul style="list-style-type: none"> Have students create collages representing different climatic zones using images from magazines or printed from the internet. Each collage should highlight the characteristic features of the zone.
3.3	<ul style="list-style-type: none"> Arid climate Polar climate Rainfall in Pakistan 	39-44	<ul style="list-style-type: none"> Identify plants that grow in different climatic regions. 	<ul style="list-style-type: none"> Provide students with climate data (temperature, precipitation, etc.) for different climatic zones. They can create comparison charts that highlight the differences and similarities among the zones.
3.4	<ul style="list-style-type: none"> Climatic zones of Pakistan 	44-48	<ul style="list-style-type: none"> Describe the climatic zones of Pakistan. 	<ul style="list-style-type: none"> Provide students with rainfall data from different cities in Pakistan. They can analyse the data to identify patterns and trends in rainfall distribution across the country. Assign each student or group a specific climatic zone found in Pakistan (e.g., arid, coastal, mountainous). They can research and present the characteristics, vegetation, and human activities associated with that zone.

Lesson Plan no	Subtopics	Reference pages	Learning Outcomes	Suggested Activities
4.1	<ul style="list-style-type: none"> • What is a forest? • Difference between natural and planted forests • Types of forests: coniferous and deciduous forests 	51-53	<ul style="list-style-type: none"> • Uses of forests • Role of forests in the global economy • Urban planted forests 	<ul style="list-style-type: none"> • Have students research and create a chart comparing the features of coniferous and deciduous trees, including their adaptations, growth patterns, and uses.
4.2	<ul style="list-style-type: none"> • Types of forests: tropical rainforest • Layers of tropical rainforest 	53-55	<ul style="list-style-type: none"> • Compare and contrast rainforests with other types of forests. 	<ul style="list-style-type: none"> • Assign each student a rainforest layer (emergent, canopy, understory, forest floor). They can create a 3D diorama depicting the vegetation, animals, and characteristics of their assigned layer.
4.3	<ul style="list-style-type: none"> • Make a living in the rainforest of Brazil • Forests of Pakistan 	55-56	<ul style="list-style-type: none"> • Explore different shapes and functions of the three layers of the rainforests. • Describe the importance of the Amazon rainforest. • Identify the four major types of forests in Pakistan. • Discover different types of trees in the particular regions of Pakistan. • Explore why the forests of the various regions across Pakistan differ. 	<ul style="list-style-type: none"> • Assign each student a forest product (wood, paper, medicinal plants) and have them create displays showcasing the product's uses, benefits, and potential environmental impact. • Divide students into groups representing different countries. Each group must trade forest-related products (timber, fruits, etc.) to understand the role of forests in the global economy. • Have students design a plan for a small, planted forest in an urban area. They can consider factors like species selection, benefits to the city, and community involvement.

4.4	<ul style="list-style-type: none"> • Uses of forests • Role of forests in the global economy • Urban planted forests 	57-58	<ul style="list-style-type: none"> • Evaluate how forests play an important role in the economy of the region. 	<ul style="list-style-type: none"> • Provide students with a model “forest” made of blocks or other materials. They can simulate logging, point out problems from it, and also discuss strategies for sustainable forestry.
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Lesson Plan no	Subtopics	Reference pages	Learning Outcomes	Suggested Activities
5.1	<ul style="list-style-type: none"> • What is a natural disaster? • Types of natural disaster • Climate change and natural disaster 	63-65	<ul style="list-style-type: none"> • Describe the impact of natural disasters on human beings. • Identify the primary and secondary impacts of natural disasters. 	<ul style="list-style-type: none"> • Have students work in pairs to create news reports about how climate change can influence the occurrence and severity of natural disasters. They can present their reports to the class.
5.2	<ul style="list-style-type: none"> • The impact of natural disasters 	65-67	<ul style="list-style-type: none"> • Analyse and describe the various ways in which natural disasters can affect communities, environments, and economies. 	<ul style="list-style-type: none"> • Provide students with images depicting the aftermath of different natural disasters. They can create collages showing the immediate and long-term impacts on communities, infrastructure, and the environment.
5.3	<ul style="list-style-type: none"> • Climate change and sustainable development • Natural disasters and the developing nations 	67-68	<ul style="list-style-type: none"> • Explore how global warming (the rising surface temperature of the Earth) can change the frequency and intensity of natural disasters. • Identify the most common natural disaster in Pakistan. 	<ul style="list-style-type: none"> • Have students design a model of a sustainable city that takes climate change and the risk of natural disasters into consideration. They should incorporate green infrastructure and disaster-resilient features. • Assign each student or group a developing nation. They research and present case studies on how natural disasters impact these nations' development and strategies they can adopt for resilience.
5.4	<ul style="list-style-type: none"> • Impact of human activities on natural disasters 	68-69	<ul style="list-style-type: none"> • Explore how global warming (the rising surface temperature of the Earth) can change the frequency and intensity of natural disasters. • Identify the most common natural disaster in Pakistan. 	<ul style="list-style-type: none"> • Divide students into groups, with each group representing a different human activity (deforestation, urbanisation, pollution). Have them discuss and present how these activities can exacerbate natural disasters.

5.5	<ul style="list-style-type: none"> Dealing with natural disasters 	70-72	<ul style="list-style-type: none"> Suggest ways that can help to deal with natural disasters. Sort out multiple ways to preserve natural resources for future generations, including the three Rs (Reduce, recycle, reuse). 	<ul style="list-style-type: none"> Organise a simulation activity where students role-play as disaster relief workers. They can work in teams to provide aid, resources, and support to communities affected by simulated natural disasters.
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Lesson Plan no	Subtopics	Reference pages	Learning Outcomes	Suggested Activities
6.1	<ul style="list-style-type: none"> • Denudation • Weathering and erosion • How does weathering occur? 	75-77	<ul style="list-style-type: none"> • Describe the processes of weathering and erosion. 	<ul style="list-style-type: none"> • Create a Venn diagram on the board with circles representing weathering and erosion. Have students list characteristics unique to each and characteristics common to both. • Provide students with different rock types (e.g., limestone, granite) and various weathering agents (water, temperature changes). They can observe and record how different rocks weather over time.
6.2	<ul style="list-style-type: none"> • Water erosion 	77-80	<ul style="list-style-type: none"> • Identify the types of erosion (water). • Explain the four processes of coastal erosion. • Explain the effect of the processes of coastal erosion on landforms 	<ul style="list-style-type: none"> • Create a mini landscape using sand and water. Students can simulate rainfall and observe how water erosion changes the landscape over multiple trials.
6.3	<ul style="list-style-type: none"> • Wind erosion • Erosion caused by humans 	80-82	<ul style="list-style-type: none"> • Identify the types of erosion (wind) 	<ul style="list-style-type: none"> • Provide students with a tray of sand and a fan. They can experiment with how wind affects the sand's surface and forms features like sand dunes.
6.4	<ul style="list-style-type: none"> • Provide students with a tray of sand and a fan. They can experiment with how wind affects the sand's surface and forms features like sand dunes. 	83-86	<ul style="list-style-type: none"> • Explain erosion caused by human activity on the Earth. 	<ul style="list-style-type: none"> • Divide students into groups and assign each group a strategy for preventing desertification (afforestation, sustainable farming). They create presentations or posters outlining their strategies.

6.5	<ul style="list-style-type: none"> • Effect of erosion on water supply • Migration • Impact of migration 	87-88	<ul style="list-style-type: none"> • Explain the causes of migration. • Identify both the negative and positive effects of excessive urbanisation on land use. 	<ul style="list-style-type: none"> • Lead a class discussion about how erosion can affect water supply through sedimentation in rivers and reservoirs. Discuss the importance of soil conservation to protect water resources. • Have students write short stories from the perspective of migrants, describing their reasons for migrating and their experiences in a new place. This can help foster empathy and understanding.
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Geography Skills Checklist						
Skills overview	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Use, interpret information, and complete missing details on physical maps						
Use and interpret Atlas maps						
Use and interpret climate maps						
Use and interpret ground, satellite, aerial, topographic photos						
Label and annotate maps						
Make and complete a bar chart						
Male and complete a line graph						
Make and complete a pie chart						
Use, interpret, and draw climate graphs						
Understand and use numerical data						
Use appropriate statistical measures (range, mean, etc.) in explanations and analysis						
Collect and interpret fieldwork data						
Use written and digital sources						
Write descriptively						
Make analysis (finding limitations and possibilities in policies, measures, and suggestions; supporting views with reasoning and evidence to explain choices, etc.)						
Draw conclusions						
Analyse sustainability or feasibility of options						
Spatial awareness and understanding						
Problem solving						
Interdisciplinary links						
Habitat mapping to identify ecological links						
Global perspective						
Environmental ethics, advocacy, and engagement						