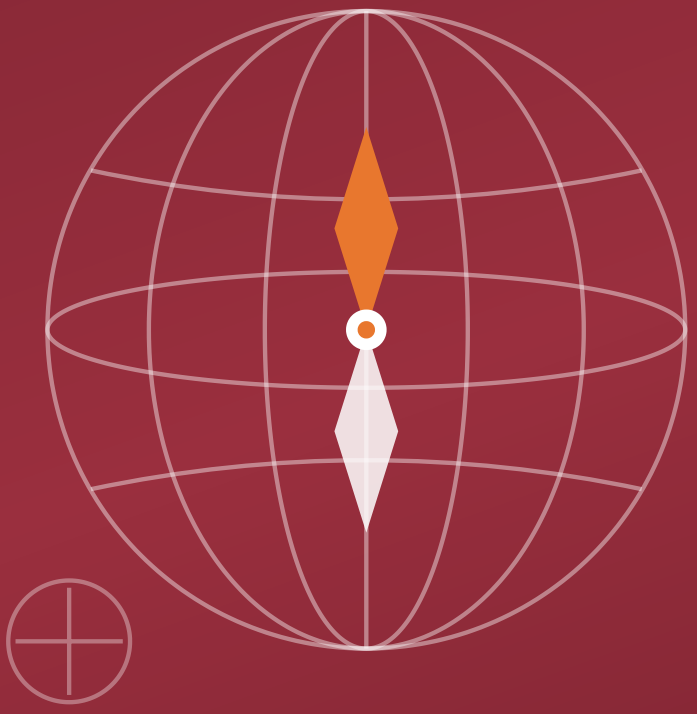
EXAM READY SOCIAL STUDIES

Exam Ready Social Studies

GRADE 8

Study Guide, Worked Examples and Practice Tests for the Grade 8 Examination



- ✓ **7 units** with clear key ideas, diagrams and “Watch out!” boxes
- ✓ **46 worked examples**, **22 diagrams** and **140+ practice questions**
- ✓ **140 unit-quiz questions** and **3 full mock exams** (60 MCQ each)
- ✓ Diagnostic test · Key Facts · Ethiopian history timeline · teacher notes

Follows the units and order of the Addis Ababa Grade 8 Social Studies textbook

ERMIAS WEDAJE TEGBARU

Exam Ready Social Studies

Grade 8

Study Guide, Worked Examples and Practice Tests

ERMIAS WEDAJE TEGBARU

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This is an independent study guide. It follows the Grade 8 Social Studies curriculum used in Addis Ababa, but it is not an official publication of the Addis Ababa City Administration Education Bureau or the Ministry of Education. All explanations, examples and questions are original.

Every answer key in this book was checked by computer, and the facts were checked against the textbook. If you find a mistake, please tell the author on Telegram (@Ermias_Wedaje) so it can be corrected in the next edition.

First edition, 2026.

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How to Use This Book

Each unit follows the same pattern, so you always know where to look. Each unit opens with a **How this unit is examined** box, and examples marked **Exam Booster** cover question types that appear often in recent model examinations.

Key ideas
The rules and facts of the section, short and clear.

Worked examples
Step-by-step solutions. Cover the solution and try first.

Watch out!
The mistakes students make most often, and the right way.

Practice
Level 1 Basic · Level 2 Standard · Level 3 Challenge.

Exam-style quiz
20 multiple-choice questions in the style of the Grade 8 examination.

For the Teacher
Timing, starters, misconceptions, activities and assessment.

For students

- Begin with the **Diagnostic Test** on page 1. It shows which units need the most work.
- Read the key ideas and the diagrams, then study each example with the solution covered.
- Do Level 1 and Level 2 practice for every section; try Level 3 when you are ready.
- Take the quiz in 30 minutes, mark it with the answers at the end of the unit, and redo every question you got wrong.
- In the final weeks, learn the Key Facts Sheet, the timeline and the Top 20 Mistakes page, and sit the three mock exams (60 questions, one hour) each. The mock answer keys show which unit each question comes from, so you know what to revise.

For teachers

- Each unit follows the textbook sections, so the book can be used alongside your lessons.
- The “For the Teacher” page gives a suggested number of periods, five-minute starters, common misconceptions with fixes, and ideas for activities and differentiation.
- The quizzes and mock exams can be used as class tests; the answer tables include a short reason for each answer.

For parents

- Ask your child to explain one worked example or one date on the timeline to you each day. Teaching is the best way to learn.
- Check the quiz score after each unit and celebrate progress, not only high marks.

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Diagnostic Test · Where Should I Start?

14 questions · 15 minutes. Take this test **before** you start the book. There are two questions on each unit. Your score only shows you where to spend your time.

1. Which pair of landforms is formed by faulting?
   A. an anticline and a syncline **B.** a sand dune and loess **C.** a rift valley and a block mountain **D.** a dyke and a sill

2. A town in Ethiopia at 1800 m belongs to which climatic zone?
   A. Dega **B.** Qolla **C.** Bereha **D.** Woina Dega

3. Which of these Ethiopian languages is Semitic?
   A. Gamo **B.** Tigrigna **C.** Berta **D.** Afar

4. If the price of teff rises sharply, buyers usually
   A. buy the same amount **B.** stop all trade **C.** buy more teff **D.** buy less teff

5. Water, soil and forests are renewable resources because they
   A. are found only in Ethiopia **B.** can be regenerated if used wisely **C.** cannot be used by people **D.** never run out whatever we do

6. Yejoka is the traditional conflict-resolution system of the
   A. Gurage **B.** Oromo **C.** Somali **D.** Afar

7. Which event happened FIRST?
   A. Columbus reached the Americas **B.** the Industrial Revolution began **C.** the First World War began **D.** the United Nations was founded

8. The Berlin Wall fell in
   A. 1961 **B.** 1989 **C.** 1991 **D.** 1945

9. In the triangular trade, ships returning to Europe from the Americas carried
   A. gold from Asia **B.** guns and cloth **C.** sugar, cotton and tobacco **D.** enslaved Africans

10. The African Union (AU) replaced the OAU in
    A. 1994 **B.** 1963 **C.** 1957 **D.** 2002

11. The Ethiopian army at Adwa was led by
    A. Tewodros II and Yohannes IV **B.** Menelik II and Empress Taytu **C.** Haile Selassie I and Ras Alula **D.** Zara Yaqob and Menelik II

12. Ethiopia was liberated from Italian occupation on
    A. 5 May 1941 **B.** 1 March 1896 **C.** 19 February 1937 **D.** 25 May 1963

13. The greenhouse effect is

A. the destruction of the ozone layer **B.** the growing of plants in glass houses only **C.** the trapping of the Sun's heat by gases in the atmosphere **D.** the cooling of the Earth by forests

14. The Kyoto Protocol on reducing greenhouse gases was adopted in

A. 1997 **B.** 2011 **C.** 1992 **D.** 2015

Answers and Study Plan

Q	Unit	Ans	Why
1	1	C	Faulting → rift valley, block mountain
2	1	D	1500–2300 m
3	2	B	Afar Cushitic, Gamo Omotic, Berta Nilo-Saharan
4	2	D	Law of demand
5	3	B	Used wisely, they renew
6	3	A	Sebat Bet Gurage
7	4	A	1492, about 1760, 1914, 1945
8	4	B	Built 1961, fell 1989
9	5	C	Plantation goods
10	5	D	Durban 2002
11	6	B	1 March 1896
12	6	A	Haile Selassie returned to Addis Ababa
13	7	C	CO_2, methane, water vapour
14	7	A	UNFCCC 1992, Kyoto 1997, Paris 2015

How to use your result

- **Both questions right in a unit:** read the Watch out! boxes, then go straight to the Level 2 and 3 practice and the quiz.
- **One right:** work through the unit normally, from the key ideas.
- **None right:** start with that unit, slowly, and try every worked example yourself before reading the solution.
- Take the test again when you finish the book and compare your scores.

Unit 1 · Physical Characteristics of the Earth

By the end of this unit you will be able to:

- tell internal (tectonic) forces from external (gradational) forces
- describe the landforms made by folding, faulting, volcanism and earthquakes, with Ethiopian examples
- explain weathering, erosion and deposition and the landforms they make
- describe the composition and the four layers of the atmosphere
- tell weather from climate, and name the elements of weather and the instruments that measure them
- explain the controls of weather and climate and the traditional climate zones of Ethiopia

Before you start — check yourself. (a) What is the outer layer of the Earth called? (b) Name a mountain in Ethiopia. (c) Which instrument measures temperature? (d) What is the difference between a lake and a river?
Answers: (a) the crust (b) for example Ras Dejen, Zuquala or Entoto (c) a thermometer (d) a lake is a body of still water in a hollow; a river is water flowing in a channel

Key words: internal force · external force · folding · anticline · syncline · fault · rift valley · block mountain · magma · lava · crater · caldera · batholith · dyke · sill · laccolith · focus · epicentre · Richter scale · weathering · erosion · deposition · denudation · atmosphere · troposphere · weather · climate · lapse rate · relief rain

How this unit is examined

Question types that appear again and again in Addis Ababa model examinations:

- Internal or external force? (earthquake, folding and faulting are internal; weathering and erosion are external)
- Fold mountains of the world (Atlas is the African one) · the East African Rift Valley · rift valleys and block mountains are made by **faulting**
- Active, dormant and extinct volcanoes — **Ethiopian examples** · advantages and disadvantages of volcanoes
- Focus and epicentre · Richter scale and seismometer
- Types of weathering · sheet, rill and gully erosion · wind is the main agent in deserts · sand dunes
- Order of the atmospheric layers · nitrogen is the most abundant gas · weather instruments · types of rain · temperature range

1.1 Forces Shaping the Earth's Surface

Background: the structure of the Earth

- The Earth has three main layers: the **crust** (the thin, solid outer layer we live on — 5 to 70 km thick), the **mantle** (hot, partly molten rock, about 2900 km thick) and the **core** (iron and nickel — a liquid **outer core** and a solid **inner core**, the hottest part).
- The distance from the surface to the centre is about **6371 km**.
- Heat and movement in the mantle push and pull the crust from below. This is the source of the **internal forces** in this unit.

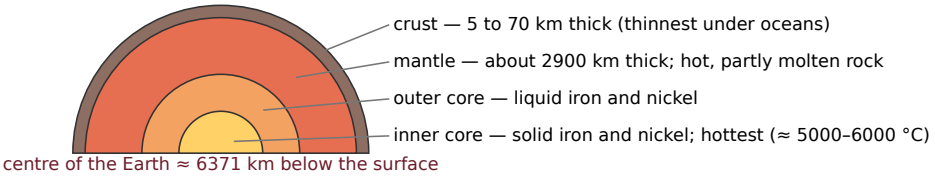


Figure 1.1 — the layers of the Earth

Key ideas

- The Earth's surface is shaped by two groups of forces:

	Internal (tectonic) forces	External (gradational) forces
Where they come from	**inside** the Earth	**on** the Earth's surface (sun, water, wind, ice, living things)
What they do	build **ups and downs** in the crust	**wear down** high land and **fill** low land (levelling)
Examples	**folding, faulting, volcanism, earthquakes**	**weathering, erosion, deposition**
Speed	mostly slow, but earthquakes and eruptions are sudden	slow and continuous

1.1.1 Internal Forces and Their Landforms

Folding

- **Folding** is the bending of rock layers when **compressional forces** push them from one or two sides. Folds are easiest to see in layered (**sedimentary**) rocks.
- An upward arch is an **anticline**; a downward trough is a **syncline**. In a **monocline** all layers bend in the **same** direction.

- **Fold mountains** form when thick sedimentary layers along the edges of continents are folded and uplifted. Major fold mountains of the world:

Fold mountain	Continent
Andes	South America
Rockies	North America
Alps	Europe
Himalayas	Asia (highest in the world)
Atlas	**North Africa**
Cape Ranges	South Africa
Australian Alps	Australia

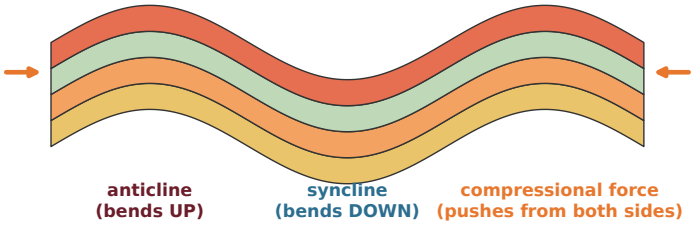


Figure 1.2 — anticline and syncline

Faulting

- A **fault** is a crack in the crust along which rocks have moved. Faults are caused by **tensional** forces (pulling apart) and **compressional** forces (pushing together).
- Tension makes a **normal fault**; compression makes a **reverse fault**.
- When land between two parallel faults **sinks**, a **rift valley** forms. When it is **pushed up**, a **block mountain (horst)** forms.
- The **East African Rift Valley** is the **largest rift valley in the world**. It runs about **7200 km** from Syria through the Red Sea to Mozambique, about **5600 km** of it in Africa. It passes through Eritrea, **Ethiopia**, Kenya, Tanzania, DR Congo, Rwanda and Burundi.
- The **Ethiopian Rift Valley** runs from north-east to south-west and contains active volcanoes, lakes (Ziway, Langano, Abijata, Shala, Hawassa, Abaya, Chamo), hot springs and fumaroles.

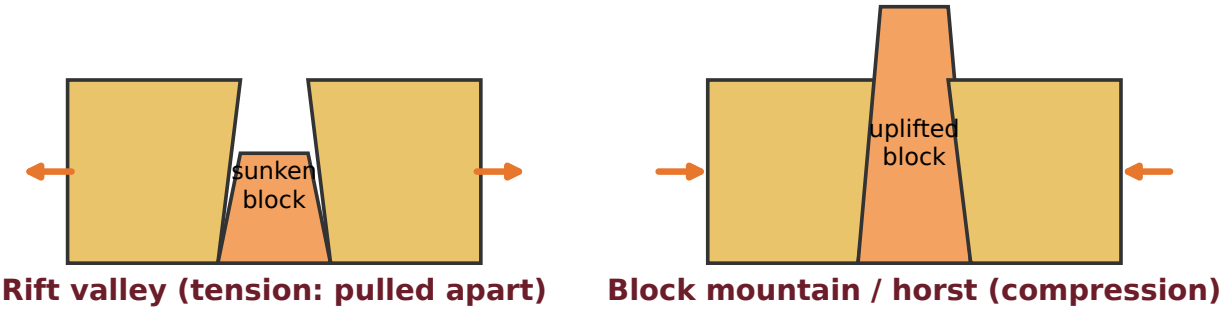


Figure 1.3 — a rift valley and a block mountain are both made by faulting

Volcanism

- **Volcanism** is the movement of molten rock (**magma**) from inside the Earth up to or towards the surface. Magma that reaches the surface is called **lava**.
- Lava comes out through a single hole (a **vent**) or through long cracks (**fissures**).
- A **crater** is the hole at the top of a volcano. A very wide crater is a **caldera**; a lake in it is a **crater lake** (for example Lake Zuquala and the Bishoftu crater lakes).
- **Extrusive landforms** form **on** the surface: volcanic cones, craters, calderas, lava plateaus.
- **Intrusive landforms** form when magma cools **inside** the crust:
- **batholith** — a very large mass of solidified magma deep in the crust
- **laccolith** — a mushroom-shaped body, smaller than a batholith
- **dyke** — magma that cooled in a **vertical** crack
- **sill** — magma that cooled in a **horizontal** layer between rock layers

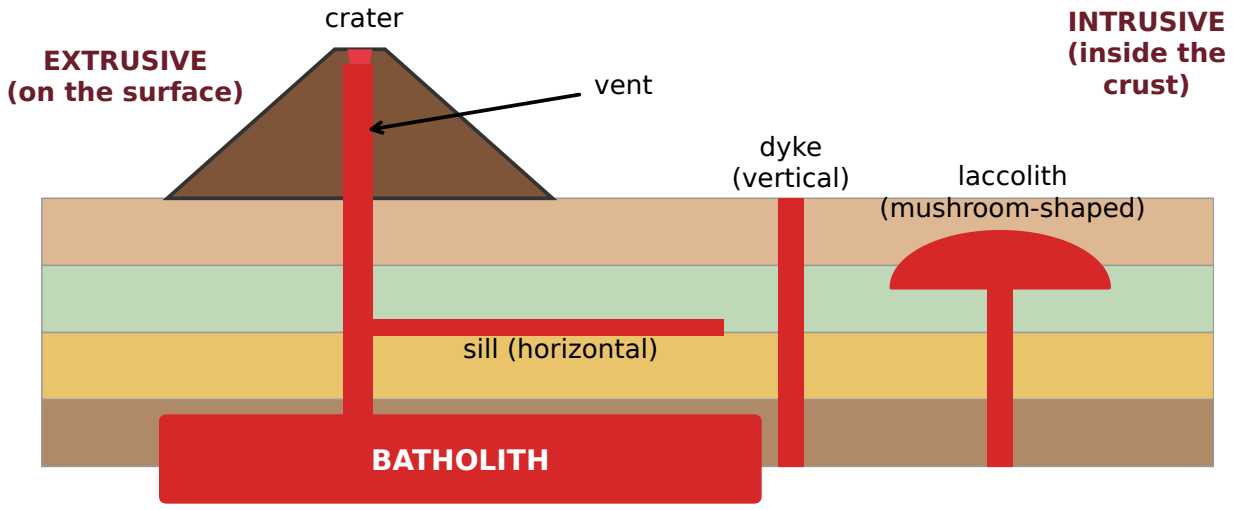


Figure 1.4 — extrusive and intrusive volcanic features

Types of volcanoes in Ethiopia

Type	Meaning	Ethiopian examples
Active	has erupted recently and is **likely** to erupt again	**Erta Ale**, Fentale, Dubbi, Dama Ali
Dormant ("sleeping")	has not erupted for a very long time but **may** erupt again	**Tatali**, **Dabbahu**
Extinct ("dead")	is **not expected** to erupt again	**Ras Dejen**, **Batu**, **Zuquala**

Advantages of volcanoes	Disadvantages of volcanoes
hot springs for bathing and health (Sodere, Wondo Genet)	loss of life and destruction of property
geothermal energy (Aluto–Langano power plant)	ash clouds, poisonous gases and breathing diseases
fertile soil for farming	fires, mudslides and floods
beautiful scenery for **tourism**	polluted water and damaged roads and power lines
minerals and hard rock for building	

Earthquakes

- An **earthquake** is a **sudden** shaking of the Earth's crust, usually along a fault.
- The **focus** is the point **inside** the Earth where the earthquake starts. The **epicentre** is the point on the **surface directly above** the focus, where shaking is strongest.
- A **seismometer** detects and measures earthquakes; the record it makes is a **seismograph**. Strength is given on the **Richter scale**: below 5 minor · 5–7 moderate to strong · 7–8 major · above 8 great.
- The **Pacific Ring of Fire** has about **75%** of the world's volcanoes and **90%** of its earthquakes.
- Effects: loss of life, collapsed buildings, landslides, deep cracks, fires, disease and changes to the sea floor (which can cause huge waves).

Example 1.1 — Internal or external?

Classify: weathering, folding, earthquake, wind erosion, volcanism, deposition by a river

Solution. Internal: **folding, earthquake, volcanism**. External: **weathering, wind erosion, deposition by a river**.

Example 1.2 — Which process made it?

Which process formed (a) the Atlas Mountains (b) the East African Rift Valley (c) Erta Ale (d) a horst?

Solution. (a) **folding** (b) **faulting** (tension) (c) **volcanism** (d) **faulting** — land pushed up between two faults

Exam Booster 1A — Active, dormant or extinct?

Which statement is correct? (a) "An extinct volcano may erupt in the future." (b) "Dabbahu is an example of an active volcano." (c) "A dormant volcano has not erupted for a long time but may erupt again."

Solution. (c) is correct. (a) is wrong — an extinct volcano is **not expected** to erupt. (b) is wrong — the textbook lists Dabbahu as **dormant**; Erta Ale is the best-known **active** volcano.
Tip: *active* = **likely** to erupt · *dormant* = **may** erupt · *extinct* = **not expected** to erupt.

Example 1.3 — The Ethiopian Rift Valley

Answer using the Ethiopian Rift Valley: (a) Which internal force made it? (b) In which direction does it run? (c) Name three of its lakes. (d) Give two ways it is useful to Ethiopia.

Solution.
(a) **Faulting** — tensional forces pulled the crust apart and the land between two faults sank.
(b) From **north-east to south-west**.
(c) For example **Ziway, Langano, Abijata, Shala, Hawassa, Abaya, Chamo**.
(d) Any two: fishing and irrigation from the lakes · **geothermal energy** (Aluto–Langano) · hot springs (Sodere) and **tourism** · fertile volcanic soils.

Example 1.4 — Volcanic landforms in Ethiopia

Match each feature with the correct term: (a) the lava lake at the top of Erta Ale (b) the wide crater holding the lake on Mount Zuquala (c) a vertical sheet of cooled magma exposed by erosion (d) a huge mass of cooled magma deep under the highlands

Solution. (a) **crater** (b) **caldera** — a crater lake (c) **dyke** (d) **batholith**

Example 1.5 — Focus and epicentre

An earthquake starts 15 km below a town. Which point is the focus and which is the epicentre? Where is the damage greatest?

Solution. The starting point 15 km underground is the **focus**. The point on the surface right above it, in the town, is the **epicentre**. Damage is usually greatest **at and near the epicentre**.

1.1.2 External Forces and Their Landforms

Weathering

- **Weathering** is the breaking down of rocks **in place** (without moving them).
- **Physical (mechanical) weathering** breaks rock into smaller pieces without changing its minerals:
- **temperature change** — hot days and cold nights make rock expand and contract until outer layers peel off (**exfoliation**, "onion-skin" weathering)
- **frost action** — water freezes in cracks, expands and splits the rock; broken pieces collect at the foot of a slope as **scree**

- **plants and animals** — roots widen cracks; burrowing animals break up rock
- **Chemical weathering** changes the minerals of the rock:
- **rain action** — rain with carbon dioxide forms a weak **carbonic acid** that dissolves **limestone**, making caves. Inside caves, **stalactites** hang from the roof, **stalagmites** grow up from the floor, and when they meet they form a **pillar** (for example Sof Omar Cave).
- **plants and animals** — acids from decaying plants and bacteria break down minerals.

Erosion and deposition

- **Erosion** is the **removal** of weathered material by moving agents: **running water, wind, moving ice and sea waves**. **Deposition** is the laying down of this material in a new place.
- **Denudation** is the general **lowering** of the land by weathering **and** erosion together.
- **Running water** is the most important agent of erosion:
- **sheet erosion** — a thin layer of soil is washed away by water flowing in a **wide sheet**
- **rill erosion** — water cuts **small channels**
- **gully erosion** — floods cut **deep, wide** channels (gullies)
- **Wind** is the strongest agent of erosion in **deserts**. Wind deposits make **sand dunes**, crescent-shaped **barchans**, and fertile **loess** soils.

Example 1.6 — Type of weathering or erosion

Name the process: (a) a rock in the Afar desert peels like an onion (b) water freezes in cracks on Ras Dejen (c) limestone dissolves to make a cave (d) a flood cuts a deep channel in a farm

Solution. (a) **exfoliation** (physical, temperature change) (b) **frost action** (physical) (c) **chemical weathering** by rain (carbonic acid) (d) **gully erosion**

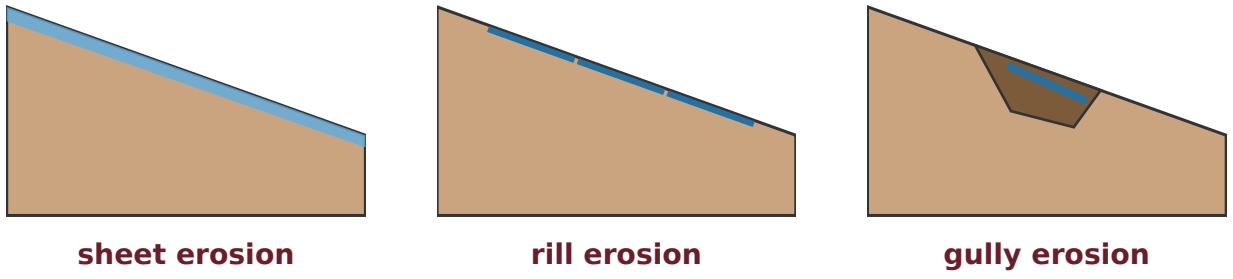


Figure 1.5 — sheet, rill and gully erosion (from mild to severe)

Exam Booster 1B — Weathering and erosion in Ethiopia

Name the process or landform: (a) rocks in the hot Danakil lowland crack and peel because the days are very hot and the nights cool (b) rainwater dissolves limestone and makes the Sof Omar caves in Bale (c) after many years of ploughing up and down a slope in the highlands, deep ditches cut across farms (d) wind piles sand into crescent-shaped hills in the Afar desert

Solution. (a) **exfoliation** — physical weathering by temperature change (b) **chemical weathering** (carbonic acid) (c) **gully erosion** (d) **barchans** (sand dunes) — wind deposition

Watch out!

✗ Wrong	✓ Right
Erosion is an internal force	Weathering, erosion and deposition are **external** forces
Rift valleys are made by folding	Rift valleys and block mountains are made by **faulting**
The epicentre is deep underground	That is the **focus**; the epicentre is **on the surface** above it
An extinct volcano may erupt again	That describes a **dormant** volcano
The Andes are in Africa	The **Atlas** are Africa's fold mountains; the Andes are in South America
Weathering moves rock away	Weathering breaks rock **in place**; **erosion** carries it away

Practice 1.1

Level 1 — Basic

1. Give two internal and two external forces.
2. What is (a) an anticline (b) a syncline?
3. Name one active, one dormant and one extinct volcano in Ethiopia.
4. Which agent of erosion is strongest in deserts?

Level 2 — Standard

5. Explain how a rift valley forms. Name the world's largest rift valley and four countries it passes through.
6. Give three advantages and three disadvantages of volcanoes to people.
7. What is the difference between a dyke and a sill?
8. Explain the difference between sheet, rill and gully erosion.

Level 3 — Challenge

9. Why are stalactites and stalagmites found in limestone areas but not in granite areas?
10. A farmer on a steep slope in the highlands sees small channels forming after rain, which later become deep ditches. Name the two stages and suggest two ways to stop them.
11. Explain why most fold mountains are found along the edges of continents.

Exam-style practice (model-exam wording)

12. Which of the following is **NOT** an internal force? A. folding B. faulting C. erosion D. volcanism
13. A very large mass of magma which accumulates in the crust is known as A. dyke B. batholith C. sill D. lava
14. Which of the following is **NOT** a cause of physical weathering? A. temperature change B. frost action C. plant roots D. a dormant volcano
15. The intensity of an earthquake is measured by an instrument called A. seismometer B. barometer C. anemometer D. rain gauge

1.2 Composition and Structure of the Earth's Atmosphere

Key ideas

- The **atmosphere** is the layer of gases around the Earth, held by gravity. It also contains dust and water droplets (together called **aerosols**).
- **Composition: nitrogen** about **78%** (the most abundant gas) · **oxygen** about **21%** (made mainly by plants) · **argon** about 0.9% · **carbon dioxide** about 0.04% · tiny amounts of other (trace) gases.
- The atmosphere has **four layers**, based on how temperature changes with height (from the ground upwards):

Layer	Height	Key facts
Troposphere	0 to 8–16 km	**lowest** layer · about ¾ of the air's mass · **all weather** happens here · temperature **falls** with height · its top is the **tropopause**
Stratosphere	to about 50 km	contains the **ozone layer**, which absorbs harmful ultraviolet (UV) rays · temperature **rises** with height
Mesosphere	to about 80–85 km	**coldest** layer (about −100 °C at the top) · most **meteors burn up** here
Thermosphere	above 85 km	very thin air · temperature rises very high · includes the **ionosphere**, which reflects radio waves, and the **exosphere**

- **Memory aid (bottom to top):** "**T**all **S**tudents **M**ake **T**owers" — Troposphere, Stratosphere, Mesosphere, Thermosphere.

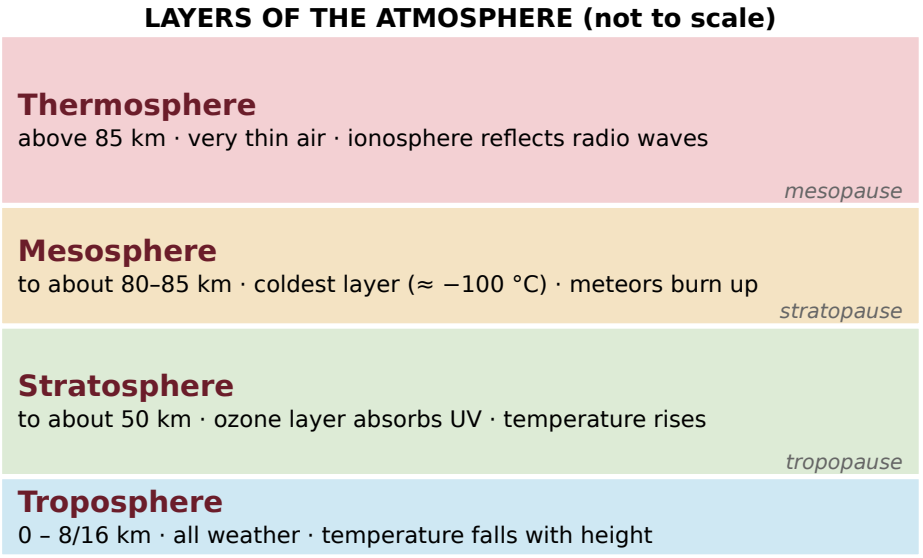


Figure 1.6 — the four layers of the atmosphere

Exam Booster 1C — Ordering the layers

A student draws the layers from the **upper** layer to the **lower** layer. Which order is correct? (a) troposphere, stratosphere, mesosphere, thermosphere (b) thermosphere, mesosphere, stratosphere, troposphere

Solution. (b). Order (a) is from the **ground upwards**. Always check whether the question says "upper to lower" or "lower to upper".

Practice 1.2

1. Which gas is (a) the most abundant (b) the second most abundant in the atmosphere?
2. In which layer (a) does all weather happen (b) is the ozone layer (c) do meteors burn up?
3. Write the layers from the top down.
4. Why is the ozone layer important to life on Earth?

1.3 Elements and Controls of Weather and Climate

Weather and climate

- **Weather** is the condition of the atmosphere at a place over a **short** time (hours or days): "It is cloudy and rainy in Addis Ababa today."
- **Climate** is the **average** weather of a place over a **long** time (about **30 years** or more): "Addis Ababa has mild temperatures and heavy summer rain."
- **Elements of weather and climate** and the instruments used to measure them:

Element	Instrument	Unit
Temperature	**thermometer**	°C
Rainfall	**rain gauge**	mm
Air pressure	**barometer**	millibars (mb)
Wind speed	**anemometer**	km/h
Wind direction	**wind vane**	compass direction
Humidity	hygrometer	%
Sunshine	sunshine recorder	hours

- (An earthquake is measured by a **seismometer** — it is not a weather instrument.)

Temperature calculations

- **Daily (diurnal) range** = maximum temperature − minimum temperature of a day.
- **Daily mean** $= \dfrac{\text{maximum} + \text{minimum}}{2}$
- **Monthly mean** = the average of the daily means of the month.
- **Annual mean** $= \dfrac{\text{sum of the 12 monthly means}}{12}$

- **Annual range** = mean of the **hottest** month − mean of the **coldest** month.

Example 1.7 — Daily range and mean

In Addis Ababa one day, the maximum temperature was 24 °C and the minimum was 10 °C. Find the daily range and the daily mean.

Solution. Range $= 24 - 10 = 14$ °C. Mean $= \dfrac{24 + 10}{2} = 17$ °C.

Example 1.8 — Annual mean and range

The monthly mean temperatures (°C) of a town are: 18, 19, 21, 22, 22, 20, 17, 17, 18, 19, 18, 17. Find the annual mean and the annual range.

Solution. Sum $= 228$, so the annual mean $= \dfrac{228}{12} = 19$ °C. Annual range $= 22 - 17 = 5$ °C.

Heat, pressure, wind and water

- The Sun's energy reaches the Earth by **radiation** (electromagnetic waves). Heat moves through solids by **conduction** and through air and water by **convection**.
- **Air pressure** at sea level is about **1013 mb**. It **falls** as altitude **rises** and as air is heated. **Wind** blows from **high** pressure to **low** pressure, and is named after the direction it comes **from** (a north wind blows from the north).
- **Water cycle words:** evaporation (water → vapour) · transpiration (water lost from leaves) · **evapotranspiration** (both together) · condensation (vapour → water droplets) · sublimation (ice → vapour) · deposition (vapour → ice).

Types of rainfall

Type	How it forms	Where it is common
Relief (orographic)	moist wind is forced **up a mountain**, cools and condenses	windward sides of highlands — much of the Ethiopian highlands
Convectional	the ground is heated strongly, warm moist air **rises**, cools and gives heavy afternoon rain	hot, humid equatorial areas
Frontal (cyclonic)	a **warm** and a **cold air mass meet**; the warm air rises over the cold air	middle and high latitudes

Controls of weather and climate

Control	Effect
Latitude (the most important)	places near the **equator** get strong, direct sunlight and are hot; places near the **poles** are cold
Altitude	temperature **falls** about **6.4 °C for every 1000 m** of height (normal lapse rate)
Distance from the sea	coasts are milder and wetter; inland places have bigger temperature ranges
Ocean currents	warm currents bring warmth and rain; cold currents bring cool, dry conditions
Winds, air pressure, cloud cover	bring rain or dry air; clouds reduce heating by day and cooling by night

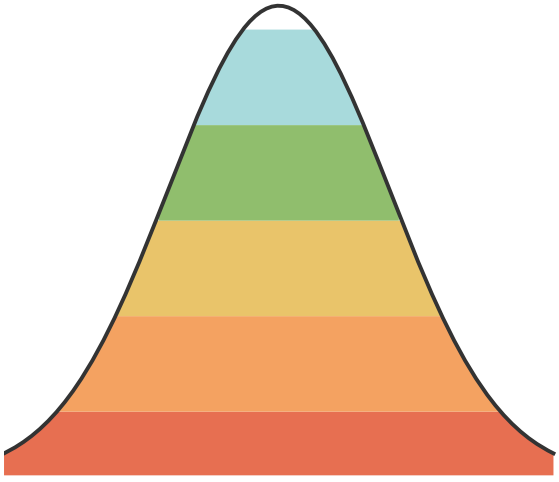
(**Folding** is a landform process, **not** a control of climate.)

Climate of Ethiopia

- Ethiopia is in the **tropics**, but **altitude** gives it many climates. The traditional **agro-climatic zones** are:

Zone	Altitude	Mean annual temperature
Wurch (Kur)	above 3300 m	below 10 °C
Dega	2300–3300 m	10–15 °C
Woina Dega	1500–2300 m	15–20 °C
Qolla	500–1500 m	20–30 °C
Bereha	below 500 m	above 30 °C

- **Seasons: Kiremt** (June–September, the main rainy season) · **Bega** (October–January, dry) · **Belg** (February–May, the "small rains" in many areas).



	altitude	mean temp.
Wurch (Kur)	above 3300 m	below 10 °C
Dega	2300 – 3300 m	10 – 15 °C
Woina Dega	1500 – 2300 m	15 – 20 °C
Qolla	500 – 1500 m	20 – 30 °C
Bereha	below 500 m	above 30 °C

Figure 1.7 — traditional climate zones of Ethiopia

Exam Booster 1D — Matching Ethiopian places with climate zones

Match each place with its traditional zone, using its approximate altitude: (a) the summit of Ras Dejen, 4550 m (b) Debre Berhan, about 2800 m (c) Addis Ababa, about 2350 m (d) Bahir Dar, about 1800 m (e) Gambella, about 500 m (f) the Danakil depression, below sea level

Solution. (a) **Wurch** (above 3300 m) (b) **Dega** (c) **Dega** (just above 2300 m) (d) **Woina Dega** (e) **Qolla** (on the 500 m border with Bereha) (f) **Bereha**
Tip: use the altitude first, then check with the temperature. Each zone is about 1000 m tall, so it is about 6 °C cooler than the zone below.

Example 1.9 — Using the lapse rate

Bahir Dar is at about 1800 m and has a mean temperature of 20 °C. Estimate the temperature at the top of a mountain 2800 m higher in the same region, at 4600 m.

Solution. The rise is 2800 m $=$ 2.8 thousand metres. Temperature falls by $2.8 \times 6.4 = 17.92 \approx 18$ °C. So the mountain top is about $20 - 18 = 2$ °C — in the **Wurch** zone.

Example 1.10 — Which zone?

A town is at 2000 m with a mean temperature of 18 °C. Which traditional zone is it in? Give one example of such a town.

Solution. Woina Dega (1500–2300 m, 15–20 °C) — for example Bishoftu (about 1900 m).

Watch out!

✗ Wrong	✓ Right
Weather is the average over many years	That is **climate**; weather is short-term
A rain gauge measures wind	Rain gauge → rainfall · anemometer → wind speed · barometer → pressure
Daily range = (max + min) ÷2	That is the daily **mean**; range = max − min
Oxygen is the most abundant gas	**Nitrogen** (about 78%)
Relief rain is caused by two air masses meeting	That is **frontal** rain; relief rain forms on **mountains**
Higher places are warmer	Temperature **falls** about 6.4 °C per 1000 m

Practice 1.3

Level 1 — Basic

1. Give two differences between weather and climate.
2. Name the instrument for (a) air pressure (b) wind speed (c) rainfall.
3. Name the five traditional climate zones of Ethiopia from the highest to the lowest.

Level 2 — Standard

4. The maximum temperature of a day is 28 °C and the minimum is 12 °C. Find the daily range and the daily mean.
5. Describe how relief rain forms.
6. Explain why Addis Ababa (about 2350 m) is cooler than Gambella (about 500 m) even though both are in the tropics.

Level 3 — Challenge

7. A place at sea level has a temperature of 30 °C. Estimate the temperature at 2500 m above it.
8. The hottest month of a town has a mean of 26 °C and the annual range is 9 °C. Find the mean of the coldest month.
9. Which control of climate would you use to explain why the Afar lowlands are among the hottest places on Earth?

Exam-style practice (model-exam wording)

10. The average of all weather conditions over a long period of time is A. weather B. climate C. temperature D. wind
11. A type of rain formed when two air masses meet is A. relief rain B. convectional rain C. frontal rain D. acid rain
12. Which one is **NOT** a control of weather and climate? A. latitude B. altitude C. folding D. distance from the sea
13. The combined loss of water through evaporation and transpiration is A. condensation B. sublimation C. evapotranspiration D. deposition

Unit 1 Summary

Topic	Remember
Forces	internal: folding, faulting, volcanism, earthquakes · external: weathering, erosion, deposition
Folding	anticline up · syncline down · fold mountains: Andes, Rockies, Alps, Himalayas, **Atlas**, Cape Ranges
Faulting	tension → normal fault, rift valley · compression → reverse fault, block mountain · East African Rift: largest, about 7200 km
Volcanoes	active: Erta Ale, Fentale · dormant: Tatali, Dabbahu · extinct: Ras Dejen, Batu, Zuquala
Intrusive	batholith (huge) · laccolith (mushroom) · dyke (vertical) · sill (horizontal)
Earthquakes	focus underground · epicentre above it · seismometer · Richter scale
Weathering	physical: exfoliation, frost, roots · chemical: carbonic acid → caves, stalactites, stalagmites
Erosion	sheet → rill → gully · wind strongest in deserts → sand dunes, barchans, loess
Atmosphere	N_2 78%, O_2 21% · troposphere (weather) → stratosphere (ozone) → mesosphere (coldest) → thermosphere
Weather / climate	short time / average of 30 years · thermometer, rain gauge, barometer, anemometer, wind vane
Temperature	range $=$ max $-$ min · mean $=\frac{\text{max}+\text{min}}{2}$ · annual mean $=\frac{\text{sum}}{12}$
Rain	relief (mountains) · convectional (heating) · frontal (air masses meet)
Controls	latitude (most important), altitude (6.4 °C per 1000 m), distance from sea, currents, winds
Ethiopia	Wurch > 3300 m · Dega · Woina Dega · Qolla · Bereha < 500 m · Kiremt, Bega, Belg

Unit 1 Exam-Style Quiz

Choose the correct answer. Suggested time: 30 minutes.

1. Which of the following is an **internal** force?
   A. weathering **B.** deposition **C.** wind erosion **D.** faulting

2. An upward fold of rock layers is called
   A. a rift valley **B.** an anticline **C.** a syncline **D.** a fault

3. Which fold mountain is found in Africa?
   A. Atlas **B.** Andes **C.** Alps **D.** Rockies

4. Rift valleys and block mountains are formed by
   A. weathering **B.** deposition **C.** faulting **D.** folding

5. The largest rift valley in the world is the
   A. Nile Valley **B.** Rhine Valley **C.** Jordan Valley **D.** East African Rift Valley

6. Which Ethiopian volcano is **active**?
   A. Zuquala **B.** Ras Dejen **C.** Batu **D.** Erta Ale

7. A volcano that has not erupted for a very long time but may erupt in the future is
   A. a caldera **B.** dormant **C.** active **D.** extinct

8. Magma that cools in a vertical crack in the crust forms a
   A. batholith **B.** sill **C.** dyke **D.** laccolith

9. Which of the following is a **disadvantage** of volcanic eruptions?
   A. threats to health from ash and gases **B.** fertile soil **C.** geothermal energy **D.** hot springs

10. The point on the Earth's surface directly above the origin of an earthquake is the
    A. fault **B.** epicentre **C.** crater **D.** focus

11. Which pair is correctly matched?
    A. wind speed — anemometer **B.** air pressure — thermometer **C.** rainfall — seismometer **D.** temperature — rain gauge

12. Rocks peeling off in layers because of daily heating and cooling is called
    A. exfoliation **B.** deposition **C.** frost action **D.** carbonation

13. Erosion by water that flows over the land in a wide, thin layer is
    A. sheet erosion **B.** wind erosion **C.** rill erosion **D.** gully erosion

14. Which is the strongest agent of erosion in deserts?
    A. running water **B.** wind **C.** ice **D.** sea waves

15. The most abundant gas in the Earth's atmosphere is
    A. argon **B.** oxygen **C.** nitrogen **D.** carbon dioxide

16. Which order of the atmospheric layers is from the **top down**?
    A. mesosphere, troposphere, stratosphere, thermosphere **B.** thermosphere, mesosphere, stratosphere, troposphere **C.** troposphere, stratosphere, mesosphere, thermosphere **D.** stratosphere, mesosphere, troposphere, thermosphere

17. All weather takes place in the
    A. mesosphere **B.** stratosphere **C.** troposphere **D.** thermosphere

18. The difference between the maximum and minimum temperature of a day is the
    A. daily mean **B.** annual mean **C.** annual range **D.** daily range

19. Rain formed when moist air is forced to rise over a mountain is
    A. acid rain **B.** frontal rain **C.** convectional rain **D.** relief rain

20. A place 3500 m above sea level with a mean temperature of 8 °C belongs to which traditional zone?
    A. Woina Dega **B.** Dega **C.** Wurch **D.** Qolla

For the Teacher — Unit 1

Suggested timing (about 14 periods). 1.1: 7 periods · 1.2: 2 periods · 1.3: 4 periods · Quiz and review: 1 period.

5-minute starters.
- *Towel folding:* push a flat towel from both ends — students see anticlines and synclines form, and name the force (compression).
- *Weather report:* one student gives today's weather each morning; at the end of the month the class works out the "climate" of the month.

Common misconceptions and how to fix them.
- **Weathering and erosion are the same.** Weathering breaks rock *in place*; erosion *moves* it. Crush chalk (weathering), then blow the dust away (erosion).
- **Focus and epicentre.** Draw a vertical line from the focus up to the surface: the epicentre is always on that line, at the top.
- **Dormant and extinct.** "Dormant = sleeping (it may wake up); extinct = dead."

Activity ideas.
- *Ethiopian map work:* on an outline map of Ethiopia, students mark the Rift Valley, its lakes, Erta Ale, Ras Dejen, Zuquala and Sof Omar Cave.
- *Class weather station:* a thermometer and a home-made rain gauge (a straight-sided bottle and a ruler). Record maximum and minimum temperature for a week and calculate the daily range and mean.
- *Altitude and zones:* students find the altitude of their home town and decide its traditional zone.

Differentiation. Supported learners: the summary table, Examples 1.1, 1.2, 1.3, 1.7 and Level 1 questions. Extension: Examples 1.8 and 1.9, Exam Boosters 1A–1D and Practice 1.1 Q9–11, 1.3 Q7–9.

Assessment. Quiz questions 1–10 check internal forces; 12–14 external forces; 15–17 the atmosphere; 11 and 18–20 weather and climate.

Answers and Worked Solutions — Unit 1

Practice 1.1

1. Internal: for example folding, faulting, volcanism, earthquakes. External: weathering, erosion, deposition.
2. (a) an upward arch of rock layers (b) a downward trough of rock layers
3. Active: Erta Ale (or Fentale, Dubbi, Dama Ali). Dormant: Tatali or Dabbahu. Extinct: Ras Dejen, Batu or Zuquala.
4. Wind
5. Tensional forces make two parallel faults, and the land between them sinks. The East African Rift Valley; for example Ethiopia, Kenya, Tanzania and Eritrea (also DR Congo, Rwanda, Burundi).
6. Advantages (any three): fertile soil, geothermal energy, hot springs, tourism, minerals and building stone. Disadvantages (any three): loss of life and property, ash and poisonous gases, breathing diseases, fires, mudslides, polluted water.
7. A dyke is magma that cooled in a **vertical** crack; a sill cooled in a **horizontal** layer between rock layers.
8. Sheet: a thin layer removed by water flowing as a wide sheet. Rill: small channels cut by water. Gully: deep, wide channels cut by floods.
9. Carbonic acid in rainwater dissolves **limestone**, so caves and dripstone form there. Granite does not dissolve in this weak acid.
10. **Rill** erosion followed by **gully** erosion. Prevention (any two): terracing, contour ploughing, planting trees and grass, check dams, avoiding overgrazing.
11. The thickest layers of sedimentary rock collect along the edges of continents, and that is where compressional forces fold them upward.
12. C — erosion is external

13. B — batholith
14. D — a volcano is an internal force, not a cause of weathering
15. A — seismometer (Richter scale)

Practice 1.2

1. (a) nitrogen (b) oxygen
2. (a) troposphere (b) stratosphere (c) mesosphere
3. thermosphere, mesosphere, stratosphere, troposphere
4. It absorbs harmful ultraviolet rays from the Sun, which can cause skin cancer and damage living things.

Practice 1.3

1. Weather is short-term (hours or days); climate is the average over a long time (about 30 years). Weather changes quickly; climate changes slowly.
2. (a) barometer (b) anemometer (c) rain gauge
3. Wurch (Kur), Dega, Woina Dega, Qolla, Bereha
4. Range $= 28 - 12 = 16$ °C; mean $= \frac{28+12}{2} = 20$ °C
5. Moist wind meets a mountain and is forced to rise. As it rises it cools, the water vapour condenses into clouds, and rain falls on the windward side.
6. **Altitude**: Addis Ababa is about 1850 m higher, and temperature falls about 6.4 °C per 1000 m, so it is about $1.85 \times 6.4 \approx 12$ °C cooler.
7. $2.5 \times 6.4 = 16$ °C cooler: about $30 - 16 = 14$ °C
8. $26 - 9 = 17$ °C
9. **Altitude**: much of the Afar lowland (Danakil) is near or below sea level — in the Bereha zone — together with its low latitude.
10. B — climate
11. C — frontal rain
12. C — folding is a landform process
13. C — evapotranspiration

Unit 1 Quiz

Q	Ans	Why
1	D	Faulting comes from inside the Earth
2	B	Anticline = arch
3	A	Atlas, North Africa
4	C	Faulting
5	D	About 7200 km long
6	D	Erta Ale
7	B	Dormant
8	C	Vertical = dyke
9	A	A danger to people
10	B	Epicentre
11	A	Anemometer
12	A	Onion-skin weathering
13	A	Sheet erosion
14	B	Wind
15	C	About 78%
16	B	Top down
17	C	Troposphere
18	D	Max – min
19	D	Relief (orographic) rain
20	C	Above 3300 m, below 10 °C

END OF FREE SAMPLE

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