

Earth Systems and Resources

AP Environmental Science ■ Unit 4

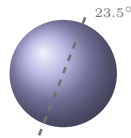
AP Environmental Science



Earth Systems and Resources

What we will cover

- 1 Plate tectonics
- 2 Soil
- 3 The atmosphere
- 4 Global wind patterns
- 5 Seasons and radiation
- 6 Climate and El Niño



1

Plate tectonics

Plate tectonics

Plates 板块 drift on the mantle:
divergent, convergent, transform.

Boundaries build earthquakes, volcanoes, mountains; hot spots make island chains.



Volcanoes mark plate boundaries and hot spots

2 Soil

Soil

Soil forms slowly from weathering + decomposition, in horizons (O, A, B, C).

Erosion strips topsoil first; vegetation roots hold it in place.



*Soil horizons:
litter to parent rock*

3 Atmosphere

The atmosphere

The **atmosphere** 大气层 is ~78% N₂, 21% O₂.

- **troposphere** 对流层: weather; cools with height
- **stratosphere** 平流层: holds the **ozone layer** 臭氧层

Ozone absorbs UV, so temperature **rises** again in the stratosphere – the shield for land life.



Climate desert

4 Winds

Global wind patterns

Uneven heating 不均匀加热 drives air in giant **convection cells** 对流环流 (3 per hemisphere).

- rise & rain at the **equator** 赤道
- sink & dry at 30° (deserts)

The **Coriolis effect** 科里奥利效应 bends winds sideways into the **prevailing winds** 盛行风.



Soil
formation

5 Watersheds

Watersheds and seasons

A **watershed** 流域 is all the land draining to one river. Slope & vegetation set water quality; upstream land use becomes a downstream problem.

Axis tilt makes seasons; ray angle sets climate bands.



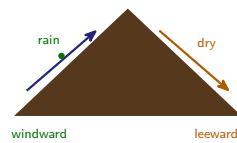
Watershed: all land draining to one river

6 Climate

Climate and El Niño

Climate is set by latitude, elevation, and nearness to water.

- a mountain **rain shadow** 雨影: wet windward, dry **leeward** 背风
- **ocean currents** 洋流 move heat poleward



In **El Niño** 厄尔尼诺, weak **trade winds** 信风 stop **upwelling** 上升流 – fisheries collapse.

7 Recap

Worked example – a water budget

A region gets 80 cm of rain a year; 50 cm evaporates and 10 cm runs off. How much recharges the groundwater?

- Water in = water out + storage:
precipitation =
evaporation + runoff + infiltration.
- $80 = 50 + 10 + \text{infiltration}$
- Infiltration = $80 - 60 = 20 \text{ cm yr}^{-1}$
- Paving the region **raises runoff** and **cuts recharge** $\Rightarrow$ wells drop and floods worsen.

Every APES budget question is **in = out + change in storage**. Name where the water goes; impervious surfaces shift it from **infiltration to runoff**.

Unit 4 – key takeaways

1 Tectonics

divergent, convergent, transform;
hot spots

2 Soil & air

O/A/B/C horizons; troposphere
then ozone stratosphere

3 Winds

3 convection cells; equator rain,
30° desert; Coriolis

4 Climate

tilt makes seasons; rain shadow;
El Niño stops upwelling

Check yourself

- 1 Which boundary type pulls plates apart?
- 2 Which soil horizon is the rich, dark topsoil?
- 3 Why does air sinking at 30° make deserts?
- 4 What causes Earth's seasons?



Answers 1. divergent 2. A horizon 3. sinking air is dry 4. the 23.5° axial tilt