

GRADE 11 STUDY GUIDE | 2024

Atmosphere and Climate

Geography

1. Composition and Structure of the Atmosphere

- Troposphere (0-12 km): weather occurs here; temperature decreases with altitude; contains most of water vapour
- Stratosphere (12-50 km): ozone layer; temperature increases with altitude (ozone absorbs UV)
- Mesosphere (50-85 km): temperature decreases with altitude; meteors burn up here
- Thermosphere (85-600 km): temperature increases rapidly; auroras; space begins at ~100 km (Karman line)

2. Factors Affecting Temperature

- Latitude: lower latitudes receive more direct sunlight => higher temperatures
- Altitude: temperature decreases with altitude (~6 deg C per 1000 m -- lapse rate)
- Distance from sea (continentality): oceans moderate temperature; interior = greater range
- Ocean currents: warm currents increase temperature; cold currents decrease temperature (Benguela Current = cold along SA west coast)
- Cloud cover: clouds reduce temperature by day (reflect insolation); increase at night (trap radiation)
- Aspect: north-facing slopes (Southern Hemisphere) receive less sun; south-facing slopes warmer

3. Pressure Belts and Wind Systems

- Equatorial Low (ITCZ): intense heating => rising air => low pressure => rainfall (tropical rainforests)
- Subtropical High (30 deg N/S): descending air => high pressure => dry conditions (deserts)
- Sub-polar Low (60 deg N/S): frontal activity; stormy weather
- Polar High (90 deg N/S): extreme cold; dry; descending air
- Trade winds: blow from subtropical high to equatorial low (NE in N hemisphere; SE in S hemisphere)
- Westerlies: blow from subtropical high toward sub-polar low

4. Weather Systems Affecting South Africa

Cold Fronts (Western Cape winter rainfall)

- Cold polar air advances under warmer air
- Cold front: sudden drop in temperature, wind shift, heavy rain then clearing
- Western Cape: rain in winter when westerlies shift northward bringing cold fronts

Convictional Rainfall (Eastern regions, summer)

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Strong daytime heating => air rises => condensation => cumulonimbus clouds => thunderstorms

- Typical pattern: hot, humid morning => build-up of clouds => afternoon thunderstorm

Berg Winds

- Dry, hot winds blowing from interior toward coast (especially Western and Eastern Cape)
- Air descends from highveld plateau, compresses and heats
- Associated with high-pressure cells over interior

5. Climatic Zones of South Africa

- Summer rainfall (Highveld, KZN, Limpopo): rain Oct-Mar; dry winters
- Winter rainfall (SW Cape): Mediterranean climate; rain May-Aug from cold fronts
- Year-round rainfall (Garden Route): SE coast receives rain from easterly winds; no dry season
- Arid/semi-arid (Karoo, Northern Cape): very low rainfall; extreme temperatures