

Chapter 2 - Earth Concept Map (AICE)

AI-Generated Study Guide

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Concept Map

AICE Marine Science Study Guide: Earth Systems Concept Map

Chapter 2 - Earth's Dynamic Systems

Note: This study guide is designed for 11th-grade AICE Marine Science students and focuses on Earth systems with intermediate-level complexity.

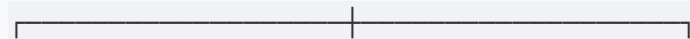
CONCEPT MAP STRUCTURE

CENTRAL CONCEPT: EARTH AS A DYNAMIC SYSTEM



EARTH'S DYNAMIC SYSTEMS

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GEOSPHERE HYDROSPHERE ATMOSPHERE

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BIOSPHERE



PRIMARY EARTH SYSTEMS

1. GEOSPHERE (Solid Earth)

Key Components:

- **Crust** → Oceanic & Continental plates
- **Mantle** → Convection currents drive plate tectonics
- **Core** → Inner (solid) & Outer (liquid) iron-nickel

Connections:

- → **Hydrosphere**: Seafloor spreading creates ocean basins
- → **Atmosphere**: Volcanic outgassing releases gases
- → **Biosphere**: Provides minerals and substrate for life

Marine Science Applications:

- Mid-ocean ridges and hydrothermal vents
- Continental shelf formation
- Tsunami generation from tectonic activity

2. HYDROSPHERE (Water Systems)

Key Components:

- **Oceans** (97% of Earth's water)
- **Ice caps & Glaciers**
- **Groundwater**
- **Surface water** (rivers, lakes)

Ocean Subdivisions:

- **Pacific Ocean** → Largest, Ring of Fire
- **Atlantic Ocean** → Mid-Atlantic Ridge
- **Indian Ocean** → Monsoon circulation
- **Arctic Ocean** → Sea ice dynamics
- **Southern Ocean** → Antarctic Circumpolar Current

Connections:

- → **Atmosphere**: Water cycle, weather patterns
- → **Geosphere**: Erosion, sediment transport
- → **Biosphere**: Habitat for marine organisms

3. ATMOSPHERE (Gas Layer)

Key Components:

- **Troposphere** → Weather, contains 80% of atmospheric mass
- **Stratosphere** → Ozone layer protection

- **Mesosphere** → Meteor burn-up zone
- **Thermosphere** → Aurora formation

Marine Interactions:

- Ocean-Atmosphere Exchange:

- Heat transfer
- Gas exchange (O₂, CO₂)
- Water vapor evaporation

Connections:

- → **Hydrosphere:** Drives ocean currents and tides
- → **Geosphere:** Weathering processes
- → **Biosphere:** Provides gases for respiration/photosynthesis

4. BIOSPHERE (Living Systems)

Key Components:

- Marine Ecosystems:

- Pelagic zone (open ocean)
- Benthic zone (ocean floor)
- Coastal ecosystems (coral reefs, estuaries)

Trophic Levels:

- **Primary Producers** → Phytoplankton, marine algae
- **Primary Consumers** → Zooplankton, small fish
- **Secondary Consumers** → Larger fish, marine mammals
- **Decomposers** → Bacteria, marine fungi

Connections:

- → **Hydrosphere:** Marine food webs
- → **Atmosphere:** Oxygen production, carbon cycling
- → **Geosphere:** Biogeochemical cycles

SYSTEM INTERACTIONS & PROCESSES

Ocean Currents (Hydrosphere ↔ Atmosphere)



Surface Currents ← Wind patterns (Atmosphere)

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Deep Water Currents ← Density differences (Temperature/Salinity)

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Global Circulation → Climate regulation

Carbon Cycle (All Systems)

Atmosphere (CO₂) ↔ Hydrosphere (Dissolved CO₂)

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Biosphere (Photosynthesis/Respiration)

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Geosphere (Fossil fuels, Limestone)

Rock Cycle (Geosphere ↔ Other Systems)

Igneous Rocks → Weathering (Atmosphere/Hydrosphere)

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Sedimentary Rocks → Heat/Pressure (Geosphere)

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Metamorphic Rocks → Melting → Magma

MARINE SCIENCE FOCUS AREAS

1. Ocean Zones & Characteristics

- **Photic Zone** (0-200m): Light penetration, photosynthesis
- **Aphotic Zone** (>200m): No light, chemosynthesis
- **Abyssal Zone** (>4000m): High pressure, low temperature

2. Marine Biogeochemical Cycles

- **Nitrogen Cycle**: Nitrogen fixation by marine bacteria
- **Phosphorus Cycle**: Upwelling brings nutrients to surface
- **Sulfur Cycle**: Hydrothermal vent ecosystems

3. Climate & Ocean Interactions

- **El Niño/La Niña**: Pacific Ocean temperature variations

- **Thermohaline Circulation:** Global conveyor belt
- **Ocean Acidification:** CO₂ absorption effects

STUDY CONNECTIONS & REVIEW

System Integration Questions:

1. How do plate tectonics affect ocean basin formation?
2. What role do oceans play in global climate regulation?
3. How do marine organisms influence atmospheric composition?

Key Processes to Master:

- **Convection** → Mantle circulation, atmospheric circulation
- **Density Stratification** → Ocean layers, atmospheric layers
- **Energy Transfer** → Solar radiation, heat distribution

Real-World Applications:

- Hurricane formation and ocean temperature
- Coral bleaching and climate change
- Deep-sea mining and ecosystem impacts

STUDY TIPS FOR SUCCESS

1. **Draw connections** between systems rather than studying them in isolation
2. **Use current events** to see Earth systems in action
3. **Practice with diagrams** showing system interactions
4. **Focus on energy and matter flow** between systems
5. **Connect local marine environments** to global processes

Remember: Earth's systems are interconnected - changes in one system affect all others!