

APES Spring Semester Final Study Guide

For this final and the AP exam you should, at a minimum, know your vocabulary. Brush up on the terms we have studied this year because it will help you a lot as you read the questions and answer choices, and write on the essays. Look over past guiding questions, labs, and use the semester 1 study guide to help you recall and review content from the fall semester in addition to the more recent information from the second semester. The end of the year final is a mix of broad easier questions and more difficult specific application and problem solving questions, with an emphasis on application of the information through the interpretation of graphs and other visuals. Generally these more challenging questions come from topics that we spent more time on throughout the year. I have outlined some of the topics from the second semester that are definitely on the final; this is not a complete list. Fill in the outline as well as you can to help supplement your review of the second semester (chapters 11-12, 15 - 21). The more thoroughly you complete this, the better prepared you will be for the final.

Chapter 11: Biodiversity and Conservation Biology

1. Biodiversity
 - a. Species diversity

 - b. Genetic diversity

 - c. Ecosystem diversity

2. Global Patterns of Biodiversity
 - a. Dominant groups of species
 - b. Latitudinal gradients

 - c. Altitudinal gradients

3. Extinction and Biodiversity Loss

4. Natural Extinction
 - a. Background Extinction rate

 - b. Mass Extinction events

- iii. Seed Tree
- iv. Selection Systems
- v. Salvage logging

- g. Evolution of Forest management

- h. Fire and Pests
 - i. Effects of global warming

 - ii. Bark beetles

 - iii. Catastrophic wildfires v. prescribed/controlled burns

- i. Forest Certification

- 4. Parks and Protected Areas (intentions, restrictions, legislations for each)
 - a. National Parks

 - b. National Wildlife Refuges

 - c. Wilderness Areas

 - d. Opponents

 - e. Park design
 - i. Insights from island biogeography

 - ii. SLOSS Dilemma

 - iii. corridors

Chapter 15: Freshwater Systems and Resources

- I. Freshwater Systems
 - a. Surface Water
 - i. Watersheds

 - ii. Floodplain

iii. Surface Water Ecosystems

1. Littoral zone
2. Benthic zone
3. Limnetic zone
4. Profundal zone

b. Groundwater

i. Water table

ii. Aquifer

1. Confined
2. Unconfined

II. Human Activities Affect Waterways

a. Freshwater and human population distributions

b. Water use

i. Where does it go?

1. Consumptive uses
2. Non-consumptive Uses

c. Unsustainable Water use

i. Surface Waters

1. Aral sea Example
2. Colorado River Example
3. Water diversion Projects

ii. Groundwater

1. Falling Water tables
2. Saltwater intrusion
3. Sinkholes

4. Bottled Water

- d. Flood Control
- e. Dams
- f. Impact on Wetlands

III. Solutions to Freshwater Depletion

- a. Desalinization
- b. Reducing Agricultural Demand
- c. Lowering residential and Industrial Water use

IV. Freshwater Pollution

- a. Point v. Non-point Sources
- b. Toxic Chemicals
 - i. Types and Sources
 - ii. Solutions
- c. Pathogens and Waterborne Disease
 - i. Types / Examples
 - ii. Detection and solutions
- d. Nutrient Pollution
 - i. Source of Pollutants
 - ii. Eutrophication and Hypoxic Zones
 - iii. Measuring And Detecting (Dissolved Oxygen and BOD)
 - iv. Solutions

- e. Biodegradable Wastes
- f. Sediment
- g. Thermal Pollution
- h. Groundwater Pollution

V. Addressing Water Pollution

- a. Legislative and Regulatory Efforts

- b. Wastewater Treatment
 - i. Screens / Grit tank
 - ii. Primary Clarification
 - iii. Aeration
 - iv. Secondary Clarification
 - v. Filtering and Disinfection
 - vi. Waste Disposal
 - vii. Constructed Wetlands

Chapter 16: Marine and Coastal Systems and Resources

I. The Oceans

- a. Extent and Distribution
- b. Topography
- c. Chemical Make-up
- d. Effects of Solar Energy
- e. Currents
- f. Upwelling
- g. Effects on Climate
 - i. Thermohaline Circulation

- ii. El Nino – Southern Oscillation
 - 1. El Nino Conditions
 - a. Winds
 - b. Currents
 - c. Regional Climates
 - 2. La Nina
 - a. Winds
 - b. Currents
 - c. Regional Climates

II. Marine and Coastal Ecosystems

- a. Coastal Ecosystems
 - i. salt marshes
 - ii. mangrove forests
 - iii. estuaries
- b. Intertidal Zones
- c. Kelp Forests
- d. Coral Reefs
- e. Open Oceans

III. Marine Pollution and Threats

- a. Plastic Debris and “The Great Pacific Garbage Patch”
- b. Oil Pollution
- c. Toxic Pollutants and contaminated Seafood
- d. Excess Nutrients
 - i. Algal Blooms
 - ii. Red tides

- e. Climate Change (pH changes and Coral Bleaching)

IV. Emptying The Oceans

- a. Industrialization of Fishing
 - i. Longline Fishing
 - ii. Driftnetting
 - iii. Bottom Trawling
- b. By-catch
- c. Factors Masking Declines
- d. Marine biodiversity loss and the impact on ecosystem services

V. Marine Conservation

- a. Shortcomings of Maximum Sustained Yield Management Practices
- b. Protection Efforts

Chapter 19: Fossil Fuels, Their Impacts and Energy Conservation

1. Energy Basics

- a. 1st law of Thermodynamics
- b. 2nd Law of Thermodynamics
- c. Kinetic v. Potential Energy
- d. Heat
- e. Determining Energy efficiency
- f. Power / Energy Units, Conversions and Calculations

I. Sources of Energy

- a. Fossil Fuels

- b. Alternative Energy
- c. Renewable v. Nonrenewable Energy
- d. Global Patterns of Fossil Fuel Distribution and Consumption

II. Fossil Fuel Formation and Extraction

a. Coal

- i. Formation Process
- ii. Extraction Processes

b. Oil

- i. Formation Process
- ii. Extraction Processes
- iii. Refining

c. Natural Gas

- i. Formation Process
- ii. Extraction Process

d. Economic Factors governing how much will be extracted

- i. Proven Recoverable Reserves
- ii. Energy Return On Investment (EROI)
- iii. Reserve-to-Production Ratio (R/P Ratio)
- iv. Peak Oil and its Impacts

e. The Future Of Fossil Fuel Extraction (definitions, extraction methods, pros/cons)

- i. Secondary Extraction
 - ii. Hydraulic Fracturing

- iii. Deeper more remote off-shore Drilling

- iv. Unconventional Fossil Fuels
 - 1. Tar Sands

 - 2. Oil Shale (Sources/methods, Pros/cons)

 - 3. Methane Hydrate (Sources/methods, Pros/cons)

- f. Addressing the Impacts of Fossil Fuel Use
 - i. Clean Coal

 - ii. Carbon Capture and Carbon Sequestration / Carbon Storage

 - iii. Threats posed by Fossil Fuel Extraction
 - 1. Oil Spills

 - 2. Hydrofracking

 - 3. Acid Mine Drainage

- III. Energy Efficiency and Conservation
 - a. Industrial Cogeneration

 - b. Residential and Commercial Conservation

 - c. Transportation

Chapter 17: Atmospheric Science, Air Quality, and Pollution Control

- I. The Atmosphere
 - a. Gas Composition

 - b. Layers (temp trends, boundaries, ozone layer, weather, atmospheric pressure)

- c. Climate
 - i. Angle of Insolation and Seasons

 - ii. Convective Circulation
 - 1. Hadley cells, Feral Cells and Polar cells

 - 2. Coriolis Effect on air circulation

 - iii. Cold fronts, warm fronts, and inversion layers

II. Outdoor Air Quality

- a. Natural Sources of Pollution

- b. Ambient Air Pollution
 - i. Point Source v. Nonpoint Source

 - ii. Primary pollutants v. Secondary Pollutants

 - iii. Residence Time and its effect on the Scale of Impact

 - iv. Clean Air Act (1970, 1990)

 - v. Six Pollutants Monitored for Computing the Air Quality Index (AQI)
 - 1. Carbon Monoxide (CO)

 - 2. Sulfur Dioxide (SO₂)

 - 3. Nitrogen Oxides (NO_x)

 - 4. Volatile Organic Compounds (VOC's)

 - 5. Particulate Matter (PM₁₀ and PM_{2.5})

 - 6. Lead (Pb)

- V. Acid Deposition
 - a. Natural Rainfall
 - b. Primary Pollutants and their Sources
 - c. Secondary Pollutants and how they are formed
 - d. Effects of Acid Deposition
 - e. Regional Trends and Buffering Capacity of Soils
 - f. Addressing Acid Deposition

- VI. Indoor Air Quality
 - a. Fuelwood / dung burning
 - b. Cigarettes
 - c. Radon
 - d. Formaldehyde
 - e. Mold, Mildew, Bacteria
 - f. Sick building Syndrome

Chapter 18 Global Climate Change

- I. Climate Change a.k.a. Global Warming
 - a. Factors Naturally Influencing Climate
 - i. Sun and Milankovitch Cycles
 - ii. Atmosphere and the Natural Greenhouse effect
 - iii. Oceans

- b. "Enhanced" Greenhouse Effect
 - i. Earth's Energy Balance

 - ii. Greenhouse Gases (6) Sources and Global Warming Potential

- c. Radiative Forcing and Feedbacks
 - i. Greenhouse Gases

 - ii. Ozone

 - iii. Surface Albedo

 - iv. Atmospheric Albedo

 - v. Aerosols (black carbon v. Sulfurous)

II. Studying Climate Change

- a. Proxy indicators and what they can tell us about past climate

- b. Direct Measurements and what they tell us about current and recent climate

- c. Climate Modeling

III. Current and Future Climate Change

- a. Current levels of Climate Change

- b. Predicted Levels of Climate Change

IV. Impact of Climate Change

- a. Physical
 - i. Ocean Chemistry

- ii. Ocean Levels (explain the rise)
- iii. Ice Sheets, Glaciers, and Ice Caps (role of positive feedback)
- iv. Fires, Draughts and Extreme Weather

b. Biological

- i. Shifting Species Ranges, Biodiversity loss, and Extinction

- ii. Timing of Seasonal Phenomena

c. Social and Economic

- i. Altered growing seasons and crop tolerances

- ii. Conflicts over water

- iii. Population displacement

- iv. Spread of Disease

V. Responding To Climate Change

- a. Mitigation Strategies v. Adaptation Strategies

- b. Energy Efficiency

- c. Sources of Energy

- d. Transportation Choices and Technology

- e. Role of Government

- i. Cap and trade programs

- ii. Carbon Offsets

iii. Kyoto Protocol

iv. Paris Climate Accord

Chapter 20: Conventional Energy Alternatives

I. Nuclear

a. Energy from Nuclear

i. Radioactive Decay

ii. Half-Lives (calculation)

b. Fission v. Fusion

c. Uranium Enrichment

d. Nuclear Power Plant Design

i. Reactor Core

1. Control Rods

2. Fuel Rods

3. Moderator

ii. Reactor Vessel

iii. Containment Building

e. Benefits of Nuclear Power

f. Catastrophes (causes, effects, impact on nuclear future)

g. Storing Nuclear Waste

h. Thermal Pollution

II. Bioenergy

a. Biomass Combustion

i. Wastes

ii. Bioenergy Crops for combustion

- iii. Combustion Methods
 - iv. Developed v. Developing Countries
 - v. Benefits and Drawbacks
- b. Biofuels
- i. Ethanol
 - ii. Biodiesel
 - iii. Novel Biofuel Development
 - iv. Carbon Neutrality of Biofuels
- III. Hydroelectric Power
- a. Approaches
 - i. Storage
 - ii. Pump-storage
 - iii. Run of River
 - b. Benefits
 - c. Impacts
 - i. Habitat Destruction and Biodiversity
 - ii. Thermal Pollution / Thermal Shock

Chapter 21: New Renewable Energy Alternatives

- I. Growth of the “New” Renewables
 - a. Solar:
 - b. Geothermal:
 - c. Wind:
 - d. Role of _____ in the transition to “New” renewables
 - i. Policy

- ii. Technology

- II. Solar

- a. Passive

- b. Active

- i. Concentrated Solar Power

- 1. How does it produce energy

- 2. Pros/Cons

- ii. Photovoltaic

- 1. How does it produce electricity

- 2. Future Expansion

- a. Net metering

- b. Incentives and the effect of subsidies

- c. Efficiency improvements

- 3. Benefits

- 4. Potential Drawbacks

- a. Location

- b. Timing

- c. Mining and Manufacturing

- III. Wind

- a. What is it? How does it work?

- b. Locations for wind power and their suitability

- i. Open Plains

- ii. Mountain ridges and Passes

- iii. Offshore

- c. Benefits

- d. Drawbacks

- IV. Geothermal
 - a. What is it?
 - i. “Normal” or “Typical” Geothermal
 - ii. Enhanced Geothermal Systems
 - iii. Heat Pumps
 - b. Benefits
 - c. Limitations
- V. Ocean Energy Sources
 - a. Wave Energy
 - b. Tidal Energy
 - c. Ocean Thermal Conversion
- VI. Hydrogen
 - a. Uses
 - b. Producing Hydrogen for fuel cells
 - i. Electrolysis
 - ii. From methane
 - c. Hydrogen Fuels cells
 - i. What do they do?
 - ii. How do they work?
 - iii. What are their benefits?