

Chapter 1: Intro Stuff

- 1) The IPAT Equation
- 2) Exponential Growth of the Human Race

Chapter 2: Getting Around in Geology

- 1) Atoms, Elements, Ions, and Isotopes
- 2) What does it take to be a mineral?
- 3) Mineral Groups
- 4) The Three Types of Rocks
 - a. Igneous
 - b. Sedimentary
 - c. Metamorphic
- 5) Relative and Absolute Dating and Basic Techniques
- 6) Case Studies
 - a. Asbestos: Fact and Fiction
 - b. The Litter Belt

Chapter 3: Plate Tectonics

- 1) Wegener and Continental Drift
- 2) Arthur Holmes
- 3) Vine, Matthews and Morley and Paleomagnetism
- 4) Shadow Zones
 - a. Inge Lehmann: P Waves
 - b. Richard Oldham: S Waves
- 5) Wadati and Benioff
- 6) Plate Boundaries
 - a. Convergent
 - b. Divergent
 - c. Transform
- 7) Earth's Structure and the Compositional vs. Geophysical Views
- 8) Hot Spots
- 9) Case Studies
 - a. Exotic Terranes
 - b. Visions of how the Earth works

Chapter 4: Earthquakes

- 1) Types of Faults
 - a. Dip Slip Faults
 - i. Normal
 - ii. Reverse
 - b. Strike Slip
 - i. Right Lateral
 - ii. Left Lateral
- 2) Measuring Magnitude
 - a. Richter
 - b. Moment
- 3) Seismic Design Considerations
 - a. Ground Shaking
 - b. Landslides
 - c. Ground or Foundation Failure
 - d. Ground Rupture
 - e. Fires
 - f. Tsunami
- 4) Four Huge Earthquakes
 - a. Gujarat
 - b. Alaska, 2002
 - c. Colima, Mexico (2003)
 - d. Northridge, CA (1994)
- 5) Earthquake Danger Areas
- 6) Forecasting of Earthquakes
 - a. Statistical Analysis
 - b. Geological
 - c. Early Warning Systems
- 7) Case Studies
 - a. Earthquakes, Landslides and Disease
 - b. Predictable Future Shocks
 - c. Rx for Failed Freeways

Chapter 5: Volcanoes

- 1) Who Should Worry
- 2) The VEI
- 3) Types of Eruptions
 - a. Effusive
 - i. Shield Volcanoes
 - ii. Continental Flood Basalts
 - b. Explosive Eruptions
 - i. Stratovolcanoes or Composite Cones
 - ii. Lava Domes
 - iii. Cinder Cones
- 4) Benefits of Volcanic Action
- 5) Volcanic Hazards
 - a. Lava Flows
 - b. Ash Falls
 - c. Pyroclastic Flows
 - d. Lahars
 - e. Tsunami
 - f. Weather and Climate
 - g. Gases
- 6) Mitigation and Prediction
 - a. Diversion
 - b. Volcano Hazards and Risk
 - c. Eruption Forecasting
- 7) Case Studies
 - a. New Zealand
 - b. Mountserrat
 - c. CO₂, Earthquakes and Hot Water Supply

Chapter 6: Soils, Weathering and Erosion

- 1) Types of Mechanical Weathering
 - a. Ice Wedging
 - b. Sheeting
 - c. Disintegration
- 2) Types of Chemical Weathering
 - a. Hydrolysis
 - b. Dissolution
 - c. Oxidation
- 3) Weathering Characteristics of Common Rocks
 - a. Granite
 - b. Basalt
 - c. Sandstone
 - d. Limestone
 - e. Shale
- 4) Geologic Features of Weathering
 - a. Spheroidal Weathering
 - b. Cavernous Weathering
- 5) Soils
 - a. Typical Soil Profile including all horizon types
 - b. Residual, Transported, Volcanic and Loess Soils
- 6) Soil Classification based on climate type
 - a. Pedalfers
 - b. Laterites
 - c. Pedocals
 - d. Tundra Soils
- 7) Soil Erosion and Mitigation
- 8) Expansive Soils and Permafrost
- 9) Case Studies

Chapter 7: Mass Wasting and Subsidence

- 1) Types of Flows
 - a. Creep
 - b. Debris Flows
 - c. Debris Avalanche
- 2) Landslides that move as a Unit
 - a. Slumps
 - b. Block Glides, Block Slides or Translational Slides
 - c. Complex Landslides
- 3) Driving Forces and Resisting Forces of Slide Mechanics
- 4) Factors that lead to Landslides
- 5) Factors that reduce Slope Strength
- 6) Control and Stabilization of Slopes
- 7) Subsidence and Mitigation
- 8) Case Studies

Chapter 8: Freshwater Resources

- 1) Freshwater Use
 - a. Instream Use
 - b. Offstream Use
 - c. Consumptive Use
 - d. Nonconsumptive Use
- 2) Types of Lakes
 - a. Freshwater
 - b. Salt Lake
 - c. Playa
- 3) Nourishment Classification of Lakes
 - a. Oligotrophic
 - b. Eutrophic
 - c. Mesotrophic
- 4) Water Tables and Terminology
 - a. Aquifers
 - b. Aquiclude
 - c. Perched Water Table
 - d. Unconfined Water Table
 - e. Confined and Artesian Wells
- 5) Gaining vs. Losing Streams
- 6) Groundwater Mining
- 7) Karst Terranes
- 8) Ground Water Pollution
- 9) Case Studies

Chapter 9: Hydrologic Hazards of the Earth's Surface

- 1) Factors Important in a River System
 - a. Velocity
 - b. Discharge
 - c. Cross-sectional Area
- 2) Alluvial Fans and Deltas
- 3) Factors Determining Flooding
- 4) Flood Types and Measurement
- 5) Flood Frequency and Recurrence Interval
- 6) Mitigation Options
- 7) Flood Facts and Flood Planning
- 8) Case Studies

Chapter 10: Coastal Environments and Humans

- 1) Corals and Bleaching
- 2) Wind Waves and their Parts
- 3) Tsunamis
- 4) Types of Beaches
- 5) Mitigation of Beach Erosion
- 6) Estuaries
 - a. Coastal Plain
 - b. Fjords
 - c. Fault-Block
 - d. Bar-Formed
- 7) Hurricanes and Coastal Flooding
- 8) ENSO and the Coastal Zone
- 9) Case Studies

Chapter 11: Glaciation and Long Term Climate Change

- 1) Alpine vs. Continental Glaciers
 - a. Valley, Piedmont, and Cirque glaciers
 - b. Ice Sheets
 - c. Ice Caps
- 2) Glacial Budgets
- 3) Erosional Landscapes Associated With Alpine Glaciation
- 4) Depositional Features Associated with Glaciation
- 5) The Effects of Glaciation
 - a. Soils
 - b. Groundwater and Outwash
 - c. Sealevel Change
 - d. Isostasy
 - e. Human Transportation Routes
 - f. Pleistocene Lakes
 - i. Pluvial
 - ii. Proglacial
- 6) Causes of Climate Change
 - a. Variations in the Earth's Orbit: Milankovitch-Kroll Cycles
 - b. Atmospheric Gases, such as Carbon Dioxide
 - c. Variations in Solar Radiation
 - d. Plate Tectonic Influence
 - e. Dust and Aerosols
 - f. Changes in Ocean Currents
- 7) Evidence of Global Warming
 - a. Increasing Temperatures
 - b. Glacial Change
 - c. Thawing of subarctic regions
 - d. Rising Sea Level
 - e. Biological Responses
 - f. Thinning of Polar Ice Caps
- 8) Projections of the Scientific Community
 - a. Very Probable
 - b. Probable
 - c. Uncertain
- 9) Case Studies

Chapter 12: Arid Lands and Desertification

- 1) Kinds of Deserts
 - a. Polar
 - b. Subtropical
 - c. Mid-Latitude
 - d. Rainshadow
 - e. Coastal
- 2) Causes of Desertification
 - a. Overgrazing
 - b. Trampling by Livestock
 - c. Clearcutting of Land without Restoration
 - d. Surface Mining without Reclamation
 - e. Depletion of Groundwater
 - f. Replacement of Natural Vegetation with Cultivated Crops
 - g. Soil Salinization due to Evaporation of Irrigation Water
- 3) Arid Regions, Winds and Human Health
- 4) Case Studies

Chapter 13: Mineral Resources and Society

- 1) Mineral Reserves vs. Mineral Deposits
- 2) Origins of Mineral Deposits
 - a. Igneous Processes
 - b. Sedimentary Processes
 - c. Weathering Processes
 - d. Metamorphic Processes
- 3) Mineral Resources
 - a. Metallic Minerals
 - b. Nonmetallic Minerals
 - i. Industrial
 - ii. Agricultural
 - iii. Construction Materials
- 4) Mining and its Environmental Impacts
 - a. Impacts of Coal Mining
 - b. Impacts of Underground Mining
 - c. Impacts of Surface Mining
- 5) Impacts of Mineral Processing
 - a. Separation Methods
 - i. Flotation
 - ii. Gravity
 - iii. Chemical
 1. Leaching
 2. Cyanide
 - b. Smelting
- 6) Mine Land Reclamation
- 7) The Future of Mining
- 8) Case Studies

Chapter 14: Energy and the Environment

- 1) The Energy Equation
- 2) Petroleum
 - a. Origin and Accumulation of Hydrocarbon Deposits
 - i. Source Rock
 - ii. Reservoir Rocks
 - iii. Caprock
 - b. Geologic Traps
 - i. Structural Traps
 - ii. Stratigraphic Traps
 - c. Oil Production and Drilling
 - d. Quality, Price and the Future of Oil
- 3) Coal
 - a. Coalification and Rock
 - b. Reserves and Production
- 4) Non-Conventional Fossil Fuels
 - a. Tar Sands
 - b. Oil Shales
- 5) Problems of Fossil Fuel Combustion
 - a. Air Pollution
 - i. Sulfur Emissions and Acid Rain
 - ii. Nitrogen Oxides and Smog
 - iii. Domestic Coal Burning
 - b. Mine Collapses
- 6) Energy For the Future
 - a. Direct Solar Energy
 - b. Indirect Solar Energy
 - i. Wind
 - ii. Hydroelectric
 - c. Geothermal
 - d. Nuclear
 - e. Energy From the Sea
 - i. OTEC
 - ii. Wave
 - iii. Tidal Currents
- 7) Case Studies

Chapter 15: Waste Management and Geology

- 1) Municipal Waste Deposal Methods
 - a. Sanitary Landfills
 - b. Incineration
 - c. Ocean Dumping
- 2) Problems of Municipal Waste Isolation
 - a. Stabilization
 - b. Gas Generation
 - c. Leachate
- 3) Recycling
- 4) Composting
- 5) Hazardous Waste Disposal Methods
 - a. Secure Landfills
 - b. Deep-well Injection
- 6) Superfund
- 7) Nuclear Waste
 - a. High Level Wastes
 - b. Low-Level Wastes
 - c. Mill Tailings
- 8) Isolation of Nuclear Waste
 - a. Yucca Mountain
 - b. Health and Safety
- 9) Case Studies

I will ask you eight essay questions from this list of topics. You will be only required to answer five of those questions. There will also be a bonus question. The essay section of the test is worth 50 points. The multiple choice part of the exam is also worth 50 points.