

Geology 103
Exam 2: Hydrosphere and Atmosphere
Study Guide

I. Running Water

- A. Water Resources and the Hydrologic Cycle
 - 1. How do the relative amounts of salt water/fresh water resources on Earth compare?
 - 2. In what form is most of Earth's fresh water found?
 - 3. What processes move water through the hydrologic cycle?
- B. River Systems
 - 1. Where does a river's water supply come from?
 - 2. What is meant by a "graded" stream? What are the characteristics of a graded stream?
 - 3. What is meant by *base level*? How is a river affected when base level is *lowered*?
 - 4. How does a stream's slope affect its velocity and its erosion potential?
 - 5. When a river empties into a body of water, in what order are sediments deposited?
 - 6. Can you describe three ways that young river systems are different from old river systems?
 - 7. Can you identify the extent of a drainage basin? Can you identify a drainage divide?
 - 8. Can you identify at least three different types of drainage systems? On what type of landscape would each of them form?

II. Oceanography

- A. What is the composition of sea water?
- B. How do temperature and salinity vary with increasing depth?
- C. How is a passive margin different from an active margin?
- D. What drives ocean currents?
 - 1. Why is water off the coast of California so cold?
 - 2. Why is water off the east coast of the United States so much warmer?
 - 3. Can you describe the Coriolis Effect?
- E. Tides
 - 1. What causes tides?
 - 2. What is meant by a *spring tide*?
 - 3. What is meant by a *neap tide*?
- F. How does the ocean affect coastlines?
 - 1. How do waves respond to shallowing water?
 - 2. What causes wave refraction, and what are the effects of it?

3. What are the characteristics of an emergent coastline? What are the characteristics of a submergent coastline? Which type of coastline does California have?

III. Earth's Atmosphere

- A. What gases compose Earth's atmosphere?
 1. What are the four layers of the atmosphere, and what defines their heights?
 - a. In which of the layers does weather originate?
 - b. In which layer is most of Earth's ozone found?
- B. What is meant by *air pressure*?
 - a. How does air pressure vary with increasing altitude through Earth's atmosphere?

IV. Earth's Astronomical Motions

- A. What is meant by Earth's *revolution*? How long does it take for Earth to make one complete orbit around the Sun?
- B. What is meant by Earth's *rotation*? How long does it take for Earth to spin once on its axis?
- C. How do the following affect seasons on Earth?
 1. Earth's tilted axis
 2. Earth's revolution around the Sun
 3. Directness of Sun's rays at a location
 4. Length of daylight/nighttime period at a location
- D. When do solstices occur? When do equinoxes occur? What do they signal?

V. Heat and the Atmosphere

- A. Can you define heat? Can you define temperature? How are they different? In what units are they measured?
- B. What are three ways that heat may get from one location to another?
 1. Which methods of heat transfer require a medium (in other words, which methods take place only through matter)?
 2. How is energy transferred from the Sun to the Earth through the vacuum of space?
- C. What are electromagnetic waves?
 1. What type of electromagnetic energy is visible to humans?
 2. What type of electromagnetic energy is felt as heat?
- D. In what five ways can electromagnetic energy interact with matter?
 1. Why do we wear white clothes in the summer?
 2. Why do we wear dark clothes in the winter?
 3. If a material absorbs heat well, how well will it be able to radiate heat?
 4. What happens to insolation that reaches Earth from the Sun?

- a. How much insolation is absorbed at Earth's surface?
 - b. How do clouds affect the amount of energy received at Earth's surface during the day?
 - c. How do clouds affect the amount of energy re-radiated by Earth back into space at night?
- E. Earth's Energy Balances
- 1. If Earth absorbs as much energy as it re-radiates to space, how will that affect global temperatures?
 - 2. If Earth absorbs less energy than it re-radiates to space, how will that affect global temperatures?
 - 3. If Earth absorbs more energy than it re-radiates to space, how will that affect global temperatures?
 - 4. How is Earth's atmosphere like a greenhouse?
 - a. What wavelengths of electromagnetic energy are easily transmitted by the atmosphere?
 - b. What wavelengths of electromagnetic energy are generally trapped by the atmosphere?
 - c. What gases contribute to the greenhouse effect?

VI. Weather Basics

- A. Moisture, Clouds, and Precipitation
- 1. What does the *specific heat* of a substance refer to? How does water's high specific heat affect its ability to increase (or decrease) in temperature?
 - 2. Given the number of grams of water, the number of degrees of temperature change, and the specific heat of water, can you calculate the number of calories needed to increase the temperature of liquid water?
 - 3. What does the *latent heat* of a substance refer to?
 - a. What is meant by the *heat of fusion* of water?
 - b. What is meant by the *heat of vaporization* of water?
 - c. To change 1 gram of water from its _____ phase to its _____ phase, you would need to add 80 calories of heat.
 - d. To change 1 gram of water from its _____ phase to its _____ phase, you would need to add 600 calories of heat.
 - e. To change 1 gram of water from its _____ phase to its _____ phase, you would need to take away 80 calories of heat.
 - f. To change 1 gram of water from its _____ phase to its _____ phase, you would need to take away 600 calories of heat.
 - 4. What is specific humidity? What is relative humidity?
 - a. Given the amount of water vapor in the air and the amount of water vapor the air could hold, can you calculate relative humidity?
 - b. Name two ways that air's relative humidity can increase.

5. What is meant by *dewpoint*?
 - a. If air's temperature and dewpoint are the same, what can you infer about the air's relative humidity?
6. Adiabatic Temperature Changes
 - a. What happens to air pressure as you travel up through Earth's troposphere?
 - b. What happens to the volume (the amount of space it takes up) of air as you travel up through Earth's troposphere?
 - c. What happens to the spacing of air molecules as you travel up through Earth's troposphere?
 - d. What happens to the number of collisions between air molecules as you travel up through Earth's troposphere?
 - e. What happens to air's temperature as it travels upwards through the troposphere?
 - f. What happens if air's temperature decreases to its dewpoint?
 - g. Can you determine the level of a cloud base given the temperature and dewpoint of air at Earth's surface?

Note: You do not need to memorize the adiabatic lapse rates for dry and moist air; these will be provided to you on the exam.

- h. What is meant by *orographic uplift*? Where does it occur?
7. Precipitation
 - a. How do clouds form? What are they composed of?
 - b. Why do some clouds produce rain, while others produce snow?
 - c. How is hail formed? Is hail cool, or *what*?
8. Wind
 - a. What causes air to move horizontally?
 - b. Air Pressure drives wind; air pressure is dependent on:
 - (1) humidity (as humidity increases, air pressure decreases)
 - (2) temperature (as temperature increases, air pressure decreases)
 - (3) altitude (as altitude increases, air pressure decreases)
 - c. Given a map showing air pressure readings in millibars, can you show where High and Low pressure systems are?
 - (1) What type of weather is associated with High Pressure Systems (anti-cyclones)?
 - (2) What type of weather is associated with Low Pressure Systems (cyclones)?
 - (3) How does air circulate in a High Pressure System (anti-cyclone) in the Northern Hemisphere?
 - (4) How does air circulate in a Low Pressure System (cyclone) in the Northern Hemisphere?
 - d. Given a map showing isobars, can you tell the direction and relative

speed of the wind in various locations?

VII. Weather Patterns

- A. Planetary Wind Belts
 - 1. Where on Earth is air rising? Where on Earth is air sinking?
 - 2. Where on Earth are air masses converging? Where on Earth are air masses diverging?
 - 3. What type of weather would you expect in areas where air is sinking, and air masses diverge?
 - 4. What type of weather would you expect in areas where air is rising, and air masses converge?
 - 5. Where on Earth would you find the following planetary wind belts:
 - a. Trade winds
 - b. Prevailing westerlies
 - c. Polar easterlies
- B. Air Masses and Fronts
 - 1. What are the four types of air masses, over what types of places would they form, and what are their symbols?
 - 2. What conditions favor the formation of a cold front? What type of clouds/precipitation result from a cold front? Can you identify a cold front symbol on a weather map?
 - 3. What conditions favor the formation of a warm front? What type of clouds/precipitation result from a warm front? Can you identify a warm front symbol on a weather map?
 - 4. What conditions favor the formation of an occluded front? What type of clouds/precipitation result from an occluded front? Can you identify an occluded front symbol on a weather map?
 - 5. What is a stationary front? Can you identify its symbol on a weather map?

VIII. Climate

- A. How do the following interact to affect climate?:
 - 1. Atmosphere
 - 2. Lithosphere
 - 3. Hydrosphere
 - 4. Biosphere
 - 5. Cryosphere
- B. How is climate affected by the following?:
 - 1. Increased latitude
 - 2. Increased altitude
 - 3. Planetary winds, and zones of diverging/converging air
 - 4. Proximity to an ocean

5. Proximity to locally rising or sinking air
- C. How does the rain shadow effect contribute to California's inland climates?
 1. Given temperature and dewpoint readings on the windward side of a mountain range, can you predict what the temperature and dewpoint readings will be on the mountain's leeward side?
- D. Can you determine the approximate climates of locations on an imaginary continent?