

**Geology 103**  
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**Exam I–Study Guide**

- I. Geologic Time
  - A. Relative Dating
    - 1. Can you describe the following tenets of relative dating?
      - a. Law of Superposition
      - b. Principle of Original Horizontality
      - c. Principle of Cross-cutting Relationships
      - d. Principle of Inclusions
      - e. Principle of Unconformities
        - (1) Can you discern between an angular unconformity, a disconformity, and a nonconformity?
    - 2. How are rock layers correlated over widely-space geographic areas?
    - 3. What are index fossils, and how are they used to help date and correlate rock units?
    - 4. Can you order a sequence of geologic events by observing a cross-section of rocks?
  - B. Radiometric (Absolute) Dating
    - 1. Basic atomic structure
      - a. How are isotopes of the same atomic element different?
      - b. How do unstable isotopes achieve stability?
    - 2. What is a *half-life*?
    - 3. Can you calculate the absolute age of a specimen if you know the percentages of parent:daughter products, given the half-life of the isotope measured?
  - C. Geologic Time Scale
    - 1. How old is the Earth?
    - 2. What are the general subdivisions (eras) of geologic time?
      - a. On what are the start-stop times of the eras based?
      - b. Can you name the periods of the Paleozoic Era in chronological order?
      - c. Can you name the periods of the Mesozoic Era in chronological order?
      - d. Can you name the periods of the Cenozoic Era in chronological order?
- II. Earth Materials
  - A. Minerals
    - 1. What is a mineral? How is a mineral different from a rock?
    - 2. What are some physical characteristics of minerals, useful in identification?
    - 3. How are graphite and diamond similar? How are they different?
    - 4. What are the most common mineral types found on Earth?
  - B. Rocks and the Rock Cycle
    - 1. Igneous Rocks

- a. What are igneous rocks?
  - b. How and where do they form?
  - c. How are magma and lava different? How are they similar?
  - d. Extrusive Igneous (Volcanic) Rocks
    - (1) What are some common physical characteristics of volcanic rocks?
    - (2) Can you name at least one extrusive igneous rock?
  - e. Intrusive Igneous (Plutonic) Rocks
    - (1) What are some common physical characteristics of plutonic rocks?
    - (2) Can you name at least one intrusive igneous rock?
    - (3) Can you name a mountain range composed of plutonic rocks?
2. Sedimentary Rocks
- a. What are sedimentary rocks?
  - b. How and where do they form?
  - c. Detrital (Clastic) Sedimentary Rocks
    - (1) How do they form?
    - (2) Can you name different rock “clasts,” in order of increasing size?
    - (3) How are sedimentary rocks classified?
    - (4) Can you name at least one detrital sedimentary rock?
  - d. Chemical Sedimentary Rocks
    - (1) How do they form?
    - (2) Can you name at least one chemical sedimentary rock?
    - (3) What are biochemical, or “organic” sedimentary rocks?
      - (a) Can you name at least one sedimentary rock of biological origin?
  - e. Characteristics of Sedimentary rocks
    - (1) What are “strata?” How do they form?
    - (2) What are fossils? Why are they found only in sedimentary rocks?
3. Metamorphic Rocks
- a. What are metamorphic rocks?
  - b. How and where do they form?
  - c. How are metamorphic rocks different from igneous rocks? How are they similar?
  - d. What are the three agents of metamorphism?
  - e. How is the texture of metamorphic rocks different from that of their “parent” rocks?
    - (1) What is meant by *foliated* texture?
      - (a) Can you name at least one metamorphic rock that

exhibits foliated texture?

- (2) Can you name at least one metamorphic rock that exhibits non-foliated texture?
4. Can you tell the difference between a sedimentary, a metamorphic, and an igneous rock?
5. What does the “rock cycle” refer to?
  - a. How can an igneous rock one day “change into” a metamorphic rock?
  - b. How can an igneous rock one day “change into” a sedimentary rock?
  - c. How can a metamorphic rock one day “change into” an igneous rock?
  - d. Etc!

### III. Earthquakes, Volcanoes, and Plate Tectonics

#### A. Earthquakes

1. What happens when strains building up in the crust exceed the rocks’ strengths?
2. What is an earthquake focus?
3. What is an earthquake epicenter?
4. What is a fault scarp, and how does one form?
5. Can you identify and describe three types of faults?
  - a. What type of fault is the San Andreas?
6. Earthquake Waves
  - a. How are earthquake waves recorded?
  - b. Body waves
    - (1) What are P waves? How do they travel through Earth? What types of materials do they travel through? How does their speed compare to that of S waves?
    - (2) What are S waves? How do they travel through Earth? What types of materials do they travel through? How does their speed compare to that of P waves?
    - (3) Which waves are the first to be detected by a seismograph?
  - c. Surface waves
    - (1) How are surface waves different from body waves?
  - d. How do earthquake waves give us evidence to the structure and composition of Earth’s interior?
  - e. If you are shown two seismograms, recorded at different locations, of the same earthquake event, can you determine which seismograph was *closer* to the epicenter?
  - f. Why are three seismograms required to locate the epicenter of an earthquake?
7. Earthquake Intensity and Magnitude
  - a. How is magnitude different from intensity?
  - b. What scale measures intensity? What are some difficulties in using this

- scale?
- c. What scales measure magnitude? What do successive numbers on the Richter scale tell us about the total energy released by an earthquake?
8. Can you name and describe at least three hazards associated with earthquakes? Which of these may affect us here in the Bay Area?
- B. Igneous Activity
1. Constructive (Extrusive) Igneous Processes
    - a. How do magma composition and temperature affect the resultant type of volcanic activity?
    - b. What type of volcano would result from a low-temperature, gaseous, high-silica-content magma?
    - c. What type of volcano would result from a high-temperature, low-gas content, low-silica-content magma?
    - d. Can you identify these different types of volcanoes (b and c, above) in cross section?
    - e. Which type of volcano would you rather live near, and why?
    - f. What types of volcanoes do we have here in California? In Hawaii?
    - g. What is the difference between pahoehoe and a'a?
    - h. What are cinder cones? What are *pyroclastics*?
    - i. What are fissure eruptions, and what causes them?
    - j. What are volcanic craters? What are calderas, and how do they form?
  2. Destructive (Intrusive) Igneous Processes
    - a. Discordant Plutons
      - (1) What are dikes? Volcanic necks? Stocks? Batholiths?
      - (2) Could you identify them, given a cross-sectional diagram?
    - b. Concordant Plutons
      - (1) What are laccoliths? Sills?
      - (2) Could you identify them, given a cross-sectional diagram?
    - c. Why are intrusive igneous landforms considered *destructive* features?
- C. Plate Tectonics
1. Can you describe at least three lines of evidence to support the concept that Earth's crust is broken into plates?
  2. What is the lithosphere? What is the asthenosphere?
  3. Can you describe at least one hypothesis that explains why lithospheric plates move?
  4. What are "hot spots?" What type of volcanic activity is associated with them?
  5. Plate boundaries
    - a. What are the three main categories of plate boundaries?
    - b. What type of faults would you expect to be associated with strike-slip boundaries?
    - c. What type of volcanic activity would you expect to be associated with

subduction zones?

#### IV. Weathering, Soil, and Mass Wasting

##### A. External vs. Internal Processes

###### 1. Internal processes

- a. Can you name some examples of internal Earth processes that cause the disintegration of rock material?
- b. What is/are the source(s) of energy for these processes?

###### 2. External processes

- a. How is weathering different from erosion? What is mass wasting?
- b. What is/are the source(s) of energy for these processes?
- c. Weathering

###### (1) What is mechanical weathering?

- (a) Can you describe how the following processes disintegrate rocks?

- i) frost wedging
- ii) unloading (exfoliation/sheeting)
- iii) biological activity

###### (2) What is chemical weathering?

- (a) Can you describe how the minerals in the igneous rock granite weathers chemically?
- (b) What is meant by hydrolysis? Oxidation? Dissolution?

- (c) What type of chemical weathering are carbonate rocks most susceptible to?

- (d) What factors control the rate at which chemical weathering takes place?

###### (3) How does mechanical weathering facilitate physical weathering?

###### (4) What types of climates favor mechanical weathering? What types of climates favor chemical weathering?

###### (5) What is *differential weathering*, and how can you recognize where this has taken place?

##### B. Soils

###### 1. What is soil?

- a. What is it composed of?
- b. What processes form soil?

###### 2. How are soil textures described?

- a. What soil texture is best for plants?

###### 3. Controls of soil formation

- a. What is the *CLORPT* Equation?

###### 4. Soil Profiles

- a. What do the following letters refer to, in terms of soil horizons?
    - (1) O
    - (2) A
    - (3) B
    - (4) C
  - b. What lies beneath the C horizon?
5. Soil types
- a. Can you describe general characteristics and generation processes of the following soils?
    - (1) pedalfer
    - (2) pedocal
    - (3) laterite