

Your Name \_\_\_\_\_

**Part One (60%) - Please carefully read each question and respond appropriately.**

1. Current estimates put the age of Earth at about \_\_\_\_\_ years. (circle one of the choices below)

15 thousand    5.5 million    66.5 million    4.5 billion    15 billion

2. The \_\_\_\_\_ Era (245 – 66.4 Ma), consisting of the Triassic, Jurassic and Cretaceous, is also known as “The Age of Dinosaurs.”

(check the word list)

3. Define the word geology, from its Greek roots: *geo*, and *logos* \_\_\_\_\_

4. Modern geology began in the late 1700’s when \_\_\_\_\_ published his *Theory of the Earth*, which stated that “the present is the key to the past.”

5. All science is based on the assumption that the natural world behaves in a consistent and predictable manner that is comprehensible through careful, systematic study.

True    False    (circle one)

6. When scientists try to explain what they have observed, they come up with a(n) \_\_\_\_\_, or model, an untested explanation of a natural phenomenon.

7. The \_\_\_\_\_ describes the loop that illustrates the processes by which one rock type is transformed to another.

8. The term \_\_\_\_\_ describes the process by which sediments turn into sedimentary rock.

9. \_\_\_\_\_ is molten material that forms in certain environments in Earth’s interior where temperatures and pressures are such that rock melts.

10. The \_\_\_\_\_ is one of the most prominent topographic features on earth, and it is contained within the ocean basins.

11. The stable interiors of the continents contain \_\_\_\_\_, extensive and relatively flat expanses of crystalline material.

12. The law of \_\_\_\_\_ can be summarized by “youngest on top, oldest on bottom,” as applied to sedimentary rocks or lava flows.

13. Earth’s outermost layer, based on physical properties, called the \_\_\_\_\_, consisting of the crust and uppermost mantle, is a relatively cool, rigid shell.

14. Over 82 percent of Earth's **volume** is contained in the crust.

True False (circle one)

15. The three rock types are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

16. Placing events in their proper sequence without knowing their numerical ages is called \_\_\_\_\_.

17. Plate boundary types are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

18. Which one of the following is not included in the definition of a mineral? \_\_\_\_\_

1. inorganic
2. a definite chemical composition that can vary within specified limits
3. a solid
4. contains silicon and oxygen
5. naturally occurring

19. Which type of bond occurs in a crystal of NaCl (salt or halite)? \_\_\_\_\_

20. \_\_\_\_\_ is the name we apply to minerals such as diamond and graphite that have the same chemical composition but different structures.

21. The total number of protons and neutrons in the nucleus of an atom is called the atom's \_\_\_\_\_.

22. Ions form when atoms gain or lose neutrons.

True False (circle one)

23. Some isotopes are unstable and disintegrate naturally through a process called \_\_\_\_\_.

24. Most \_\_\_\_\_ are aggregates composed of two or more minerals.

25. A \_\_\_\_\_ bond is produced when atoms share electrons.

26. \_\_\_\_\_ is the tendency of a mineral to break along preferred planes of weakness.

27. The \_\_\_\_\_ hardness scale consists of ten minerals arranged in order from 1 (softest) to 10 (hardest).

28. Name the minerals defining the following hardnesses: 1 - \_\_\_\_\_ 3 - \_\_\_\_\_ 7 - \_\_\_\_\_

29. Isotopes of the same element differ in the number of \_\_\_\_\_ in the nucleus.

30. Only eight elements compose the bulk of the rock-forming minerals.  
True False (circle one)
31. The most common mineral group is the oxide group.  
True False (circle one)
32. Two or more elements bonded together, is the definition of a \_\_\_\_\_.
33. The most abundant silicate mineral in the Earth's crust is \_\_\_\_\_.
34. The \_\_\_\_\_ proposes that the bodies of our solar system formed at essentially the same time from a rotating cloud of gases and dust.  
A. Big Band theory  
B. Plate Tectonics theory  
C. Nebular hypothesis  
D. Heliocentric theory
35. In the early part of the 20th century, \_\_\_\_\_ argued forcefully for continental drift.  
A. Karl Wagner  
B. Peter Rommel  
C. Alfred Wegener  
D. Bill Kohl
36. Back in Wegener's day, which of the following was NOT used to support his continental drift hypothesis?  
A. ancient climates  
B. paleomagnetism  
C. fit of South America and Africa  
D. fossil evidence
37. Which of the following is direct evidence for plate motion?  
A. magmatic island arcs  
B. mountain belts  
C. subduction zones  
D. hot spot island chains (like Hawaii)
38. Convergent plate tectonics includes which of the following?  
A. rifting and basaltic magmatism  
B. subduction, continental collision, and volcanic arc magmatism  
C. side-to-side sliding of plates, and no magmatism  
D. none of these
39. Hawaii is the oldest island of the Hawaiian Island chain.  
True False (circle one)

40. Earth's radius and surface area are slowly increasing to accommodate the new oceanic crust being formed at mid-oceanic ridges.  
True False (circle one)
41. The top of the asthenosphere is closest to Earth's surface
- A. along a mid-ocean ridge
  - B. above a deep mantle hot spot
  - C. along a transform fault
  - D. along a subduction zone
42. The atomic number and atomic weight of an atom are determined by which of the following, respectively?
- A. number of protons, number of protons plus electrons
  - B. number of protons, number of protons plus neutrons
  - C. number of protons plus neutrons, number of protons
  - D. number of neutrons, number of protons plus neutrons
43. Which of these is correct for isotopes of an element?
- A. different number of protons, same number of neutrons
  - B. different number of electrons, same number of neutrons
  - C. same number of electrons, different number of protons
  - D. different number of neutrons, same number of protons
44. Which of the following is not true about the two minerals graphite and diamond?
- A. both are composed of carbon atoms
  - B. same crystal structure but different chemistry
  - C. same chemistry but different crystal structures
  - D. diamond is "harder"
45. Atoms of the same element, zinc for example, have the same number of
- A. electrons in the nucleus
  - B. protons in the nucleus
  - C. neutrons in the outer nuclear shell
  - D. electrons in the valence bond level
46. Which carbonate mineral reacts readily with cool, dilute hydrochloric acid to produce visible bubbles of carbon dioxide gas?
- A. calcite
  - B. quartz
  - C. dolomite
  - D. plagioclase
47. Pegmatites are smaller volume, intrusive bodies with glassy textures.  
True False (circle one)

48. Olivine and quartz commonly crystallize together from mafic or basaltic magmas.

True False (circle one)

49. What is meant by "extrusive" and "intrusive"?

- A. Igneous rocks that cooled at the surface (volcanic) and interior to the surface (plutonic) of the Earth, respectively.
- B. Sedimentary rocks that cooled at the surface (volcanic) and interior to the surface (plutonic) of the Earth, respectively.
- C. Metamorphic rocks that cooled at the surface (volcanic) and interior to the surface (plutonic) of the Earth, respectively.
- D. All of these.

50. In an igneous rock with a phaneritic texture, the mineral grains are visible to the unaided eye.

True False (circle one)

51. A slowly cooled magma will most likely result in a rock with which one of the following textures?

- A. phaneritic
- B. pyroclastic
- C. glassy
- D. aphanitic

52. Bowen's reaction series predicts the sizes of the different mineral grains that grow from crystallizing magmas.

True False (circle one)

53. Which one of the following rock types has an aphanitic texture?

- A. granite
- B. basalt
- C. gabbro
- D. diorite

54. Most lava crystallizes to form igneous rocks with phaneritic textures.

True False (circle one)

55. A porphyritic texture includes two different sizes of mineral grains, the phenocrysts and the vesicles.

True False (circle one)

56. Which one of the following factors is most important in determining the texture of an igneous rock?

- A. the type of dissolved gases in the magma
- B. the rate at which the magma cools
- C. the composition of the magma
- D. the type of rock surrounding the magma

57. The process of magmatic differentiation can generate residual, more felsic magmas from mafic magmas such as basalt.

True False (circle one)

58. Minerals, such as plagioclase feldspar, on the continuous branch of Bowen's Reaction Series react with the magma to form lower temperature, more stable minerals such as hornblende or biotite.

True False (circle one)

59. Which rock and environment has the highest concentration of rare elements?
- A. pegmatite, crystallized from a water-rich, highly-differentiated, residual magma
  - B. basalt dike, crystallized and solidified in a vertical fracture at shallow depth
  - C. pumice, crystallized at depth in a mass of intrusive rock
  - D. peridotite, crystallized at depth in the upper mantle
60. The process of magmatic differentiation can generate residual, more felsic magmas from mafic magmas such as basalt.
- True False (circle one)

**Part Two (40%) - Please read each question and answer completely (complete thoughts and sentences). Use separate sheets of paper for your answers.**

61. The geologic time scale was established without the aid of radiometric dating. What principles were used to develop the time scale? Explain thoroughly.
62. Explain why the plate tectonics theory is such a good illustration of the scientific method. In other words, how did different disciplines contribute to the whole theory?
63. Considering the discussion of the Nebular hypothesis from Chapter 1 regarding the origin of our solar system, what is the likelihood that plate tectonics is a viable model for processes operating on other planets? Are certainly planets more likely than others to exhibit plate movements and why might plate tectonics not currently be active on those planets?
64. Explain the difference between the words *silicon* and *silicate*.
65. Based on the brief discussion of chemistry and chemical bonding in Chapter 3, why do minerals rarely exhibit pure chemical compositions (100% always the same chemical composition)?
66. What does a porphyritic texture indicate about an igneous rock?
67. The size of crystals in igneous rocks is generally a function of the rate of cooling. However, within the same rock crystal size does not necessarily reflect the order of crystallization for individual minerals. Without using Bowen's Reaction Series, how might you determine the order of crystallization of minerals in an individual rock sample? (Hint: Think about the texture)
68. Check out the web site [http://aese2006.geology-guy.com/sd\\_geology\\_marshall.htm](http://aese2006.geology-guy.com/sd_geology_marshall.htm) - summarize the nature of the San Diego plate boundary.