CHAPTER 5 Volcanism

1. Magma is molten rock material below the Earth's surface, whereas lava is magma that reaches the surface. The silica content of magmas varies and serves to differentiate felsic, intermediate, and mafic magmas.

2. Why is silica the major component of magma?

3. A felsic magma:
   a. contains a high percentage of iron and magnesium; b. cools to form volcanic rocks such as basalt; c. contains more than 65% silica; d. is characterized as silica poor; e. contains mostly sodium and potassium.

4. How can a mafic magma be derived from ultramafic rock?

5. Volcanism is the process whereby magma and its associated gases erupt at the surface. Some magma erupts as lava flows, and some is ejected explosively as pyroclastic materials.

6. The most commonly emitted volcanic gas is:
   a. carbon dioxide, b. hydrogen sulfide; c. nitrogen; d. chlorine; e. water vapor.

7. Small, steep-sided cones that form on the surfaces of lava flows where gases escape are:
   a. lava tubes; b. spatter cones; c. columnar joints; d. pahoehoe; e. volcanic bombs.

8. Only a few percent by weight of a magma consists of gases, most of which is water vapor. Sulfur gases emitted during large eruptions can have far-reaching climatic effects.

9. Explain how pyroclastic materials and volcanic gases can affect climate.

10. The viscosity of lava flows depends mostly on their temperature and composition. Silica-rich (felsic) lava is more viscous than silica-poor (mafic) lava.

11. What controls the viscosity of a lava flow?

12. The viscosity of magma is primarily controlled by:
    a. temperature; b. silica content; c. pressure; d. texture; e. elevation.

13. Many lava flows are characterized by pressure ridges and spatter cones. Columnar joints form in some lava flows when they cool. Pillow lavas are erupted under water and consist of interconnected bulbous masses.

14. How do columnar joints form?

15. Volcanoes are conical mountains built up around a vent where lava flows or pyroclastic or both
materials are erupted.

16. Volcanic or extrusive igneous rocks form by the cooling and crystallization of lava flows and the:
   a. crystallization of magma beneath the surface; b. consolidation of pyroclastic materials; c. reaction of volcanic gases with the atmosphere; d. heating of sedimentary rocks beneath lava flows; e. all of these.

17. Shield volcanoes have low, rounded profiles and are composed mostly of mafic flows that have cooled and formed basalt. Cinder cones form where pyroclastic materials that resemble cinders are erupted and accumulate as small, steep-sided cones. Composite volcanoes are composed of lava flows of intermediate composition, layers of pyroclastic materials, and volcanic mudflows.

18. Why do shield volcanoes have such low slopes?

19. How do pahoehoe and aa lava flows differ?

20. A lava flow with a surface of jagged blocks is termed:
   a. lapilli, b. vesicular; c. aa; d. obsidian; e. pyroclastic sheet deposit.

21. Draw a cross section of a composite volcano. Indicate its constituent materials, and show how and where a flank eruption might occur.

22. Viscous masses of lava, generally of felsic composition, are forced up through the conduits of some volcanoes and form bulbous, steep-sided lava domes. Volcanoes with lava domes are dangerous because they erupt explosively and frequently eject a nuée ardente (incandescent cloud of gas, ash, and lava fragments).

23. What kinds of warning signs enable geologists to forecast eruptions?

24. Why are lava domes so dangerous?

25. Which of the following is most dangerous to humans?
   a. nuée ardente; b. lava flows; c. volcanic bombs; d. pahoehoe; e. pillow lava.

26. The volcanic conduit of a lava dome is most commonly plugged by:
   a. mafic magma; b. columnar joints; c. viscous, felsic magma; d. volcanic mudflows; e. spatter cones.

27. The summits of volcanoes are characterized by a circular or oval crater or a much larger caldera. Many calderas form by summit collapse when an underlying magma chamber is partly drained.

28. Explain how most calderas form.

29. Most calderas form by:
   a. summit collapse; b. explosions; c. fissure eruptions; d. forceful injection; e. erosion of lava domes.
30. *Crater Lake in Oregon is an excellent example of a:*  
a. caldera; b. cinder cone; c. shield volcano; d. basalt plateau; e. lava dome.

31. Fluid mafic lava erupted from long fissures (fissure eruptions) spreads over large areas to form basalt plateaus.

32. Pyroclastic flows erupted from fissures formed during the origin of calderas cover vast areas. Such eruptions of pyroclastic materials form sheetlike deposits.

33. **What accounts for the fact that volcanic ash can cover vast areas, whereas pyroclastic materials such as cinders are not very widely distributed?**

34. Basalt plateaus form as a result of: a. repeated eruptions of cinder cones; b. widespread ash falls; c. accumulation of thick layers of pyroclastic materials; d. the origin of lahars on composite volcanoes; e. eruptions of fluid lava from long fissures.

35. *The only area where fissure eruptions are currently occurring is:*  
a. the Red Sea; b. western South America; c. the Pacific Northwest; d. Iceland; e. Japan.

36. **Compare and contrast pyroclastic sheet deposits and basalt plateaus.**

37. Most active volcanoes are distributed in linear belts. The circum-Pacific belt and Mediterranean belt contain more than 80% of all active volcanoes.

38. *Most active volcanoes are in:*  
a. the Mediterranean belt; b. the Hawaiian Islands; c. Iceland; d. the circum-Pacific belt; e. the oceanic ridge belt.  

39. Volcanism in the circum-Pacific and Mediterranean belts is at convergent plate margins where subduction occurs. Partial melting of the subducted plate generates intermediate and felsic magmas.

40. **Why do composite volcanoes occur in belts near convergent plate margins? Are such volcanoes present at all convergent plate margins?**

41. *One other Cascade Range volcano besides Mount St. Helens has erupted during this century. It is:*  

42. Magma derived by partial melting of the upper mantle beneath spreading ridges accounts for the mafic lavas of ocean basins. Melting in these areas may be caused by reduction in pressure and/or hot mantle plumes.

43. *The magma generated beneath spreading ridges is mostly:*  
a. mafic; b. felsic; c. intermediate; d. all of these; e. answers (a) and (b) only.

44. *Much of the upper part of the oceanic crust is composed of interconnected bulbous masses of igneous rock called:*
45. The two active volcanoes on the island of Hawaii and one just to the south are thought to lie above a hot mantle plume. The Hawaiian Islands developed as a series of volcanoes that formed on the Pacific plate as it moved over the mantle plume may be caused by reduction in pressure and/or hot mantle plumes.

46. **Give a brief summary of the origin and development of the Hawaiian Islands.**

47. **Shield volcanoes have low slopes because they are composed of:**
   a. mostly pyroclastic layers; b. lahars and viscous lava flows; c. fluid mafic lava flows; d. felsic magma; e. pillow lavas.

48. The volcanoes of _____ are unrelated to either a divergent or a convergent plate margin.
   a. East Africa; b. the mid-oceanic ridges; c. the Cascade Range; d. the Hawaiian Islands; e. Iceland.

49. **The largest volcano in the world is:**