ESS 106 – Living with Volcanoes
Autumn 2023
Exam # 1

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EXAM VERSION A

Fill in the circle for **Exam version A** on your scantron.

Each question has only one correct answer – mark the answer that is most accurate. Mark the answer to each question on your scantron sheet **and** circle your answer on this exam. In the event that there is trouble reading your scantron sheet, this will ensure that your exam is graded correctly.

Be sure to write your name and student ID on **both** the scantron sheet and this exam.

There are several versions of the exam, so mark the **exam version** on your scantron sheet.

After you have finished, hand in **both** this exam sheet and your scantron form.

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1. An example of a shield volcano is:
    a) Mt. St. Helens
    b) Mt. Shasta
    c) Mauna Loa
    d) none of the above

2. Flood basalts are commonly associated with:
    a) stratovolcanoes
    b) convergent margins
    c) large calderas, often 30 miles in diameter
    d) none of the above

3. Plinian eruptions are
    a) associated with mid-ocean ridges
    b) characterized by passive flow, and pillow lavas
    c) from systems that are fully degassed
    d) generally passively erupted from a single, central vent
    e) associated with eruption columns that send ash high into the atmosphere

4. The three types of plate boundaries are:
    a) divergent, convergent, circular
    b) convergent, transform, divergent
    c) convergent, divergent, hotspot
    d) none of the above
    e) hotspot, trivalent, convergent

5. Hawaiian type eruptions:
    a) generate large Plinian eruption columns
    b) often occur at subduction plate boundaries
    c) can have both central vents and fissure eruptions
    d) are a common hazard to aircraft
    e) generally produce only block and ash flows

6. Of the three types of plate boundaries, which is associated with Cascade (Washington) volcanism?
    a) circular
    b) transform
    c) divergent
    d) convergent

7. What volcanic characteristic is best described by the VEI index?
    a) the temperature of the magma
    b) the viscosity of the magma
    c) the tectonic setting of the eruption
    d) the earthquake energy associated with the eruption
    e) the amount of material erupted

8. The Earth's mantle is:
    a) about half melt, half solid and convecting in 1 layer
    b) made of rhyolite
    c) mostly melt and convecting
    d) mostly solid and convecting
    e) about half melt, half solid and convecting in 2 layers

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9. Why do oceanic intra-plate volcanoes tend to form a line?
    a) the hot spot is moving
    b) the oceanic plate is moving over a hot spot
    c) the volcanoes are erupting along a mid-ocean ridge
    d) both the hot spot and oceanic plates are stationary, but the magma is moving

10. Compared to a basalt, a *rhyolite* has more:
    a) silicon
    b) magnesium
    c) iron
    d) calcium
    e) kryptonite

11. Rift zones on intraplate oceanic volcanoes:
    a) are only present on the older volcanoes
    b) rarely erupt magma
    c) erupt rhyolite instead of basalt
    d) do not extend below sealevel
    e) may be connected to the summit magma chamber

12. An example of a divergent plate boundary is:
    a) the Mid-Atlantic Ridge
    b) the Aleutian trench
    c) the rift zone of Mauna Loa
    d) hot spots
    e) the San Andreas fault in California

13. Strombolian eruptions:
    a) start with massive Plinian columns, followed by block and ash flows
    b) build low-lying volcanoes that then fail by frequent landsliding
    c) are energetic eruptions, with large lava flows impacting 100 of square miles
    d) form steep-sided volcanoes of loose material
    e) have never been observed

14. Caldera forming eruptions
    a) leave large depressions caused by magma withdrawl
    b) are common in flood basalt provinces
    c) produce block and ash flows
    d) occur widely in Iceland
    e) produce columnar-jointed block and ash deposits

15. Pillow basalts form:
    a) in calderas
    b) under water
    c) along rift zones
    d) on Mount St. Helens
    e) in lava lakes

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16. The presence of water in magma
    a) increases the viscosity
    b) decreases the viscosity
    c) does not change the viscosity
    d) results in tetrahedral linkages
    e) causes polymerization

17. Vulcanian eruptions:
    a) have been responsible for changing the weather
    b) have eruption clouds that encircle the globe
    c) are associated with large basalt provinces
    d) have frequent blasts and dome collapse
    e) are most common on Hawaii

18. Which of the following is not characteristic of hot-spot, ocean island volcanism
    a) they have small explosive eruptions
    b) they are andesitic in composition
    c) they are basaltic in composition
    d) they form some of the largest volcanoes on Earth
    e) they erupt from both the summit and the rifts of the volcano

19. Mantle plumes are
    a) hot molten plumes of upwelling magma
    b) found only under oceanic crust
    c) are the primary cause of volcanism in the ring of fire
    d) narrow regions of mantle downwelling
    e) hot solid plumes of upwelling mantle

20. The hottest magmas are typically
    a) basalt
    b) rhyolite
    c) andesite
    d) found in stratovolcanoes
    e) a and d

21. Pahoehoe flows:
    a) can change into a'a' flows
    b) are only found on ocean islands
    c) were the first sign of imminent eruption at Mt. St. Helens
    d) are the most common type of post-fragmentation eruption activity
    e) are only found on the ocean floor

22. During the 2018 eruption of Kilauea:
    a) a plinian column rose well into the stratosphere and dumped ash on Kona
    b) lava flows were a minor and short lived occurrence
    c) over 237 people were killed from pyroclastic flows
    d) the summit caldera collapsed and the east rift zone was inflated
    e) was preceded by months of strong earthquakes, indicating magma movement

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23. A pyroclastic flow refers to:
    a) a lava flow that comes from the rift zone
    b) a downward-directed hot flow of broken rock fragments and hot gas
    c) the first stage of a pahoehoe flow
    d) a lava flow that comes from a fire fountain
    e) the products of a Strombolian eruption

24. Columnar jointing is commonly seen:
    a) in tephra fall deposits
    b) in mineral deposits
    c) in lava flows
    d) around strombolian eruption craters

25. The Columbia River Basalt flows:
    a) are found as far east as Texas
    b) were erupting while Lewis and Clark made their journey in 1806
    c) may have traveled in lava tubes and as inflated flows
    d) were triggered by a magnitude 8 earthquake
    e) are composed mostly of volcanic ash

26. The creation of magma at convergent margins is due to:
    a) the melting of the down-going plate
    b) depressurization of the mantle at constant temperature
    c) water from the down-going plate causing the mantle to melt
    d) the subducting plate heating-up the mantle and making it melt
    e) large earthquakes that heat the mantle

27. The two major controls on eruptive behavior are:
    a) gas content and viscosity of the magma
    b) height of volcano above sea level and amount of SiO_2
    c) SO_4 content and flank collapse
    d) size of precursor earthquakes and elapsed time since previous eruption
    e) fountain height and number of lava tubes

28. Vulcan is the Roman god of:
    a) spaghetti
    b) caves
    c) rain
    d) volcanoes and fire
    e) midterms

29. The island of Hawaii:
    a) was reduced in size by the destructive blasts in the 2018 eruption
    b) will someday in the distant future subduct under the Aleutian island chain
    c) has five active stratovolcanoes
    d) is the home of Vulcan
    e) has frequent eruptions of rhyolite

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30. A spatter rampart:
    a) forms during caldera collapse
    b) is a circular feature that forms the base of cinder cones
    c) is made of stacked a'a flows
    d) forms along the sides of linear fire curtains of magma
    e) is created by the interaction of hot water and magma

31. The creation of magma at hot spots is due to:
    a) the melting of the down-going plate
    b) depressurization of the mantle at nearly constant temperature
    c) water from the down-going plate causing the mantle to melt
    d) the subducting plate heating-up the mantle and making it melt
    e) large earthquakes that heat the mantle

32. The reason that SiO_2 (silica) influences eruptive behavior is:
    a) it can form microscopic chains by polymerization , increasing viscosity
    b) earthquakes cause the tetrahedra to separate into single molecules
    c) viscosity is reduced making the eruption produce lava flows
    d) because white kittens are actually meaner than black kittens
    e) steep, high volcanoes rise significant distance into the atmosphere

33. The largest volcano in the solar system:
    a) is on the Moon
    b) is on Mars
    c) is on Neptune
    d) is on Earth
    e) none of the above

34. When magma cools very slowly:
    a) it is most likely obsidian
    b) an eruption is imminent
    c) it produces lots of bubbles, a 'magma foam'
    d) crystals can grow large and form a granitic texture
    e) a and c only

35. Eruptive activity at Kiluea is:
    a) was first observed by Captain Cook
    b) restricted to the summit caldera
    c) strongly explosive, with frequent tephra fall that covers the Kona coastal area
    d) mostly in a lava flow or lava tube network
    e) entirely in the submarine environment as the plate moves over the hotspot

36. Magnetic stripping and polar reversals:
    a) provided evidence that the Columbia River flood basalts travelled mostly in a lava tube network
    b) were first observed by space shuttle astronauts documenting hot spot tracks
    c) are only observed at plate boundaries with large earthquakes
    d) are evidence for an early Earth atmosphere
    e) were evidence for sea floor spreading

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37. The Earth's interior is divided into a:
    a) inner core-outer core-mesosphere-crust
    b) cryosphere-(molten) inner core-outer core- mantle-crust
    c) inner core-outer core-mantle-crust
    d) mesosphere-cryosphere-outer core-mantle-crust
    e) terrasphere-cryosphere-mantle-crust

38. Plate motion is:
    a) westward in the northern hemisphere, with a rate of millimeters per year
    b) restricted to the extreme northern and southern latitudes with a rate of centimeters per year
    c) driven by hot spot plume activity that originates in the deep Earth
    d) speeding up, as more of the crust is subducted
    e) driven by mantle convection with a rate of centimeters per year

39. Volcanoes like Mt. St. Helens and Mt. Rainier:
    a) are long-lived, strong, permeant features of the landscape that resist erosion
    b) rapidly fall apart as they have little internal strength
    c) are hollow in the middle
    d) rarely erupt more than once in the same place
    e) are typical of Hawaiian type activity

40. Magma is:
    a) what you get if you blow-up sponge bob
    b) a mix of silicate liquid, crystals and maybe bubbles
    c) molten rock after it has completely cooled into granite
    d) wide-spread through-out the Earth's interior
    e) formed only one way

41. (8 points) Draw a cross section of a subduction zone showing the locations of the following features: 1) trench, 2) down going oceanic plate, 3) locations where earthquakes occur, 4) location of magma production

42) (12 points) Explain with a diagram the primary ways that the mantle melts to initially form magma. Explain how those particular styles of melting control both explosiveness and changes in magma composition.

(Spare page if needed)