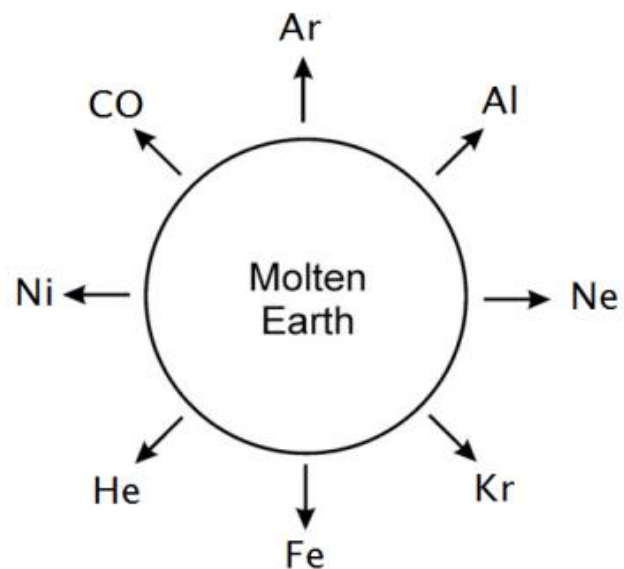


1. The following statements all relate to the origin of our solar system. Which is **FALSE**?

- a) About 13.7 billion years ago, the solar system was created by a big bang that can be partially described by the Doppler Effect
- b) The first elements formed after the big bang included H and He
- c) Nuclear fission reactions can take place on Earth
- d) Heavy elements were formed in stars, they could not be produced on a planet like Earth

2. The diagram is representative of Earth 4.5 billion years ago. Which of the labeled elements sank toward the centre of the Earth to form the core?

- a) Al
- b) Ni
- c) Fe
- d) Ar
- e) Both (b) and (c)
- f) All of the above

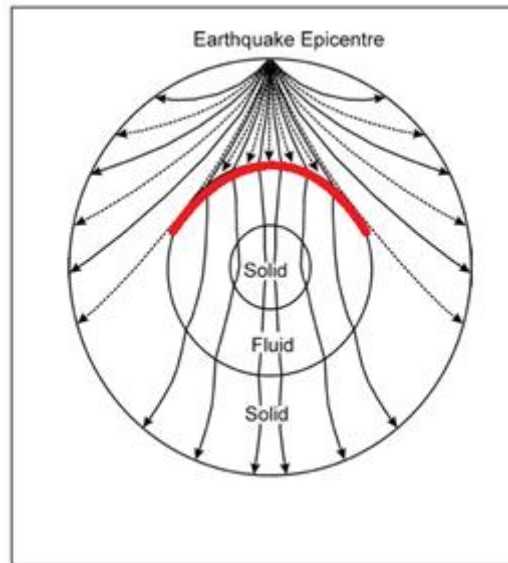


3. There was a time in Earth's history when the planet was an uninhabitable molten ball. From this point, approximately how long is it estimated that it took for oceans to form? Nobody knows the exact time so pick the age that is closest.

- a) 100 million years
- b) 1 billion years
- c) 3 billion years
- d) 4 billion years

4. If a parent/daughter ratio of 1:1 indicates that one half-life has passed, then a parent/daughter ratio of 1:7 indicates that:
- a) 2 half-lives have passed
  - b) 3 half-lives have passed
  - c) 3.5 half-lives have passed
  - d) 7 half-lives have passed
5. How much of the parent material is still present after 3 half-lives have passed?
- a) 25%
  - b) 12.5%
  - c) 30%
  - d) one third
6. Energy can be created by splitting an atomic nucleus into two or more lighter ones. What is this process called?
- a) Atomic mitosis
  - b) Supernova
  - c) Fission
  - d) Fusion
7. The evolution of life followed a specific path. Which of the following is in the correct order from oldest to youngest?
- a) Fish, amphibian, reptile
  - b) Algae, mammal, amphibian
  - c) Fish, reptile amphibian
  - d) Mammal, reptile amphibian
8. What is the best evidence that material deeper than 2900 km below the Earth's crust is fluid?
- a) Information found by drilling
  - b) P-waves speed up beyond that depth
  - c) Studying the composition of iron-rich meteorites.
  - d) S-waves are not transmitted beyond that depth

9. In the image, what happens when S-waves and P-waves hit the red barrier?



- a) S-waves slow down and P-waves speed up
- b) S-waves are lost and P-waves slow down
- c) S-waves slow down and P-waves are lost
- d) S-waves are lost and P-waves speed up

10. I am a physical layer of the Earth approximately 2900 km below the crust. I am made of a fluid substance that plays a large part in generating the Earth's magnetic field. Which layer am I?

- a) Lithosphere
- b) Mantle
- c) Inner core
- d) Outer Core

11. Which of the following is **FALSE** regarding the internal structure of the Earth?

- a) Basalt is a major component of the oceanic crust
- b) Oceanic crust is older than continental crust
- c) Oxygen is the most common element in the Earth's crust
- d) The crust is the thinnest solid layer of the Earth
- e) Both (b) and (d) are false

12. Figure 1 is a typical seismograph. Figure 2 is the relative travel-time graph for P and S-waves. Using both figures and your knowledge of seismology (and a ruler), determine the distance to the epicentre of the earthquake.

Figure 1.

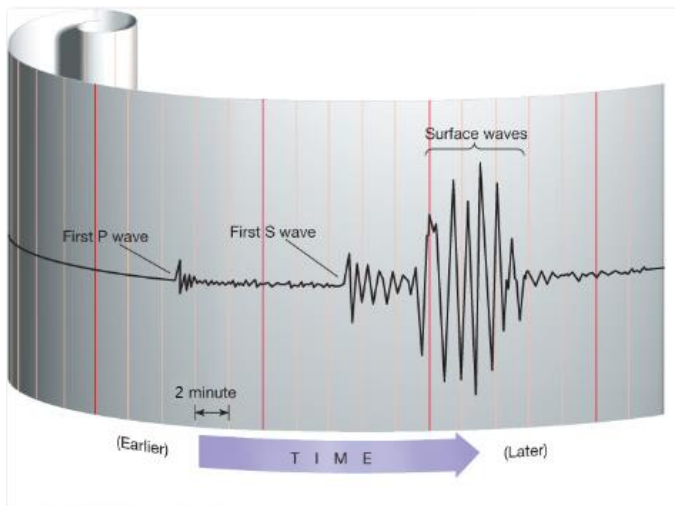
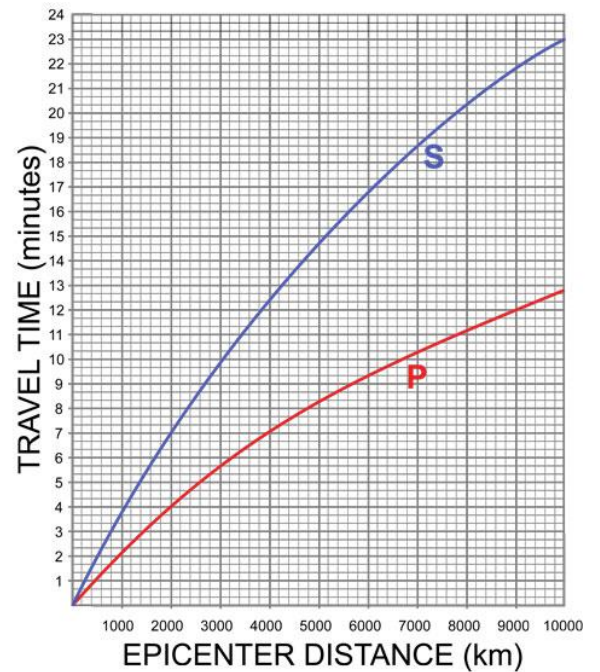


Figure 2.



- a) 500 km
- b) 2000 km
- c) 4000 km
- d) 8000 km

13. Seismic techniques have found that there is a major discontinuity called the MOHO at which major boundary?

- a) The upper mantle and the lower mantle
- b) The lower mantle and the outer core
- c) The crust and the mantle
- d) The outer core and the inner core

14. Humans probe the Earth's surface for several reasons including exploratory research and extraction of valuable resources. Approximately how deep have we been able to drill and collect samples.

- a) Deep into the crust
- b) Into the upper mantle
- c) Into the outer core
- d) Approximately 100km

15. Among the following locations, where on Earth would you expect to find the lowest geothermal gradient?

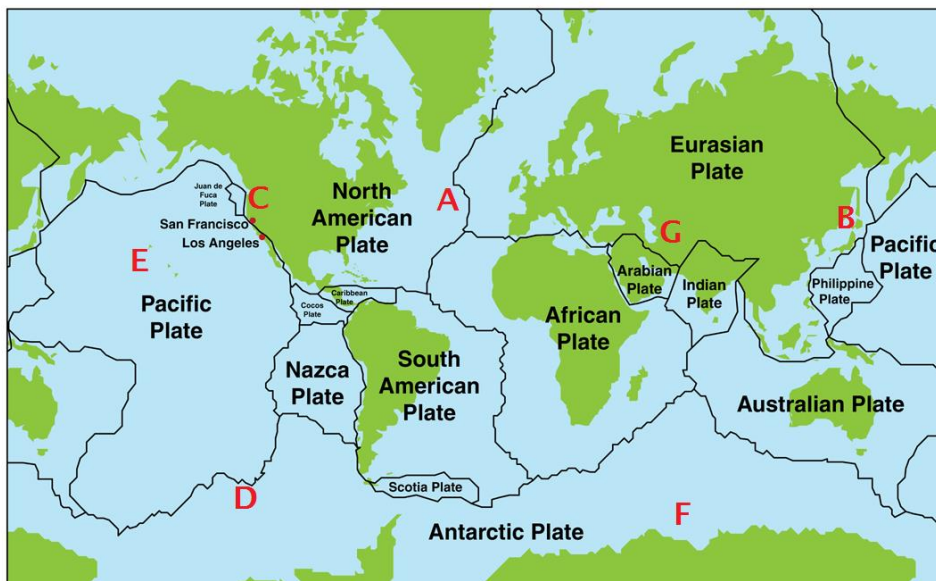
- a) Oceanic spreading centers
- b) Southeast Iceland
- c) Central Russia
- d) The Aleutian Island chain

16. Continental drift was an early idea to explain how the Earth rearranged its continents from one large supercontinent, called Pangaea, to what we know today. What/which piece(s) of evidence eventually helped prove this theory in the 1960s?

- a) The study of paleomagnetism
- b) Tracking of continental motion using GPS satellites
- c) Similar fossils records across vast ocean bodies
- d) All the above
- e) (a) and (c) only

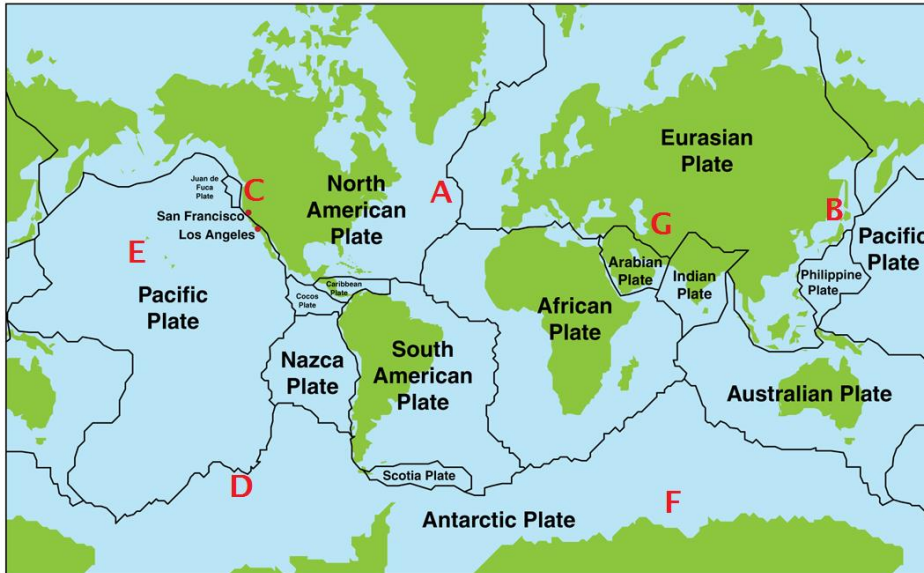
17. Look at the map of the Earth, including the major plate boundaries. Divergent boundarie(s) can be found at which location(s)?

- a) A
- b) D
- c) G
- d) E
- e) At locations A and D



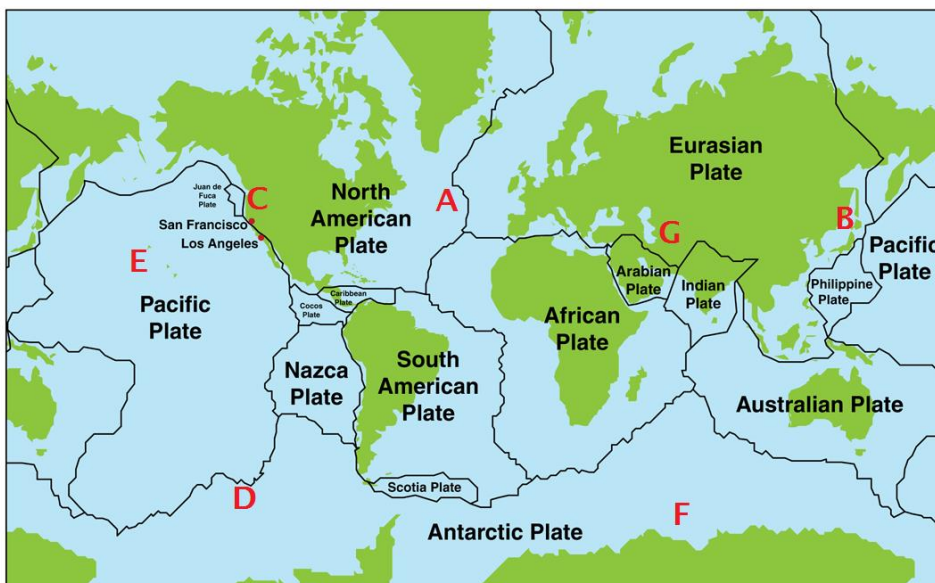
18. Look at the map of the Earth, including the major plate boundaries. Where would you most likely find active volcanoes that **do not** lie on a plate boundary?

- a) E
- b) F
- c) Both E and F
- d) There are no active volcanoes except on plate boundaries



19. Look at the map of the Earth, including the major plate boundaries. Which location is closest to a large subduction zone?

- a) A
- b) G
- c) C
- d) D
- e) F



20. Rocks are continuously recycled, just like many other natural resources, through several different processes. Which of the following sequences **does not** represent a direct pathway for rock material to take within the rock cycling processes?

- a) Sedimentary Rock > Metamorphic Rock > Magma
- b) Sedimentary Rock > Low grade Metamorphic Rock > high grade metamorphic rock
- c) Igneous Rock > Sediment > Metamorphic Rock
- d) Metamorphic rock > Magma > Plutonic rock

21. The image shows an example of what kind of rock?

- a) Extrusive Igneous Rock
- b) Sedimentary Rock
- c) Metamorphic Rock
- d) Intrusive Igneous Rock



22. Which of the following pairings has an example of both an active and passive continental margin?

- a) Nova Scotia, Canada and New Jersey, USA
- b) Kenya, Africa and California, USA
- c) France and Uruguay
- d) The Andes Mountains and the Cascade Mountains

23. Which of the following statements is **FALSE** regarding sea-floor spreading?

- a) Sea-floor spreading can give rise to oceanic features including hydrothermal vents
- b) Sea-floor spreading is a result of convection pushing two diverging plates apart
- c) The Mid-Atlantic Ridge is an example of sea-floor spreading
- d) During sea-floor spreading, new Silica-rich rock is added to the lithosphere

24. The Hawaii Islands have formed as a result of type of convection occurring under the Earth's crust. What is this movement called and what is another place this is occurring?

- a) Mantle Plume (or hot-spot), Yellowstone National Park
- b) Sea-floor Spreading, Yellowstone National Park
- c) Mantle Plume (or hot-spot), Andes Mountains
- d) Subduction, Japan

25. At what type of plate boundary would you expect strong earthquakes but little or no volcanism?

- a) Ocean spreading boundaries
- b) Subduction zones
- c) Continent-Continent collisions
- d) Andean-type Mountains
- e) Passive continental margins

26. An island arc, such as the Kuril Islands, is formed when:

- a) Oceanic crust moves over a stationary hot spot
- b) Two plates converge to cause subduction zone volcanism
- c) Coral islands form in warm tropical seas
- d) Tsunami wash up sediment from the deep ocean floor

27. Using your knowledge of plate tectonics, which of the following oceans is youngest?

- a) Indian Ocean
- b) Pacific Ocean
- c) Atlantic Ocean
- d) Arctic Ocean

28. Which of the following is TRUE regarding bonding?

- a) The order of bond strength from strongest to weakest is: covalent-Van der Waals-ionic
- b) The mineral halite has it's atoms linked together by ionic bonds
- c) Native metals form weak metallic bonds that allow them to be good electrical insulators
- d) All of the above

29. Calcite is an example of a mineral that has \_\_\_ cleavage directions, \_\_\_\_\_ 90 degrees.

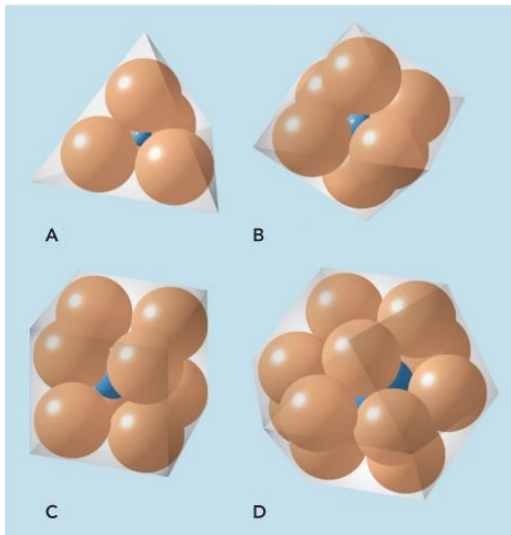
- a) 2, at
- b) 2, not at
- c) 3, at
- d) 3, not at
- e) 4, not at

30. Make sure you look up the definition of a mineral from your course notes. Which of the following is considered a mineral?

- a) Sugar
- b) Ice
- c) Granite
- d) Coal

31. Which of the figures in the image shows the main building block of quartz?

- a) A
- b) B
- c) C
- d) D
- e) None of the above



32. Which of the following silicate minerals has one perfect cleavage plane and is structurally arranged in a sheet structure?

- a) Quartz
- b) Biotite
- c) Muscovite
- d) Augite
- e) Both (b) and (c)

33. Polymorphs are minerals that share the same chemical composition, but appear different due to their conditions of formation. \_\_\_\_\_ and \_\_\_\_\_ are an example of polymorphs.

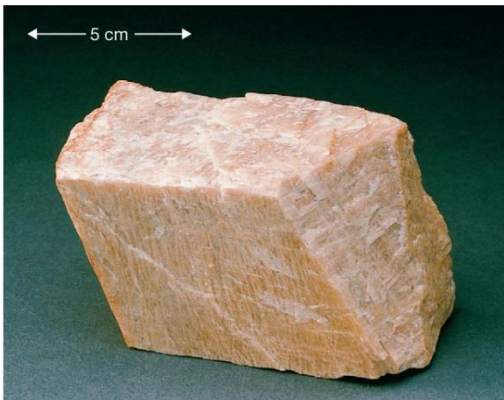
- a) Diamonds and Graphite
- b) Diamonds and Quartz
- c) Quartz and Olivine
- d) Graphite and Biotite

34. The coordination number of a structure is the number of anions surrounding a cation. What is the coordination number of a substance that is ideally packed as a cubic structure?

- a) 4
- b) 6
- c) 8
- d) 10

35. Shown is an image of a common mineral, widely distributed in the Earth's lithosphere. What kind of internal structure does this mineral have?

- a) Independent tetrahedral linked via ionic bonds
- b) A double chain silicate
- c) A sheet silicate
- d) A 3D framework silicate



36. How many electrons does the inert gas Argon have in its outer orbital?

- a) 4
- b) 6
- c) 8
- d) They don't have outer orbitals

37. Which of the following statements is **FALSE** regarding Bowen's reaction series?

- a) It is a system that can be used to rank silicate minerals and their structures based on approximate formation temperatures
- b) Minerals that form at higher temperatures have more strong covalent bonds than those formed at cooler temperatures
- c) The statement "Only pretzels and beer keep me quiet" can be used to remember the order of minerals in Bowen's reaction series
- d) Bowen's reaction series can be used to make connections between minerals and types of volcanism

38. Which of the following is TRUE regarding magma?

- a) It is formed through partial melting
- b) It rises due to buoyancy because it is less dense than the surrounding rocks
- c) Plate tectonics and the geothermal gradient play a large role in its formation
- d) It consists of 3 parts: a gaseous component, a liquid component and a solid component
- e) All of the above are true

39. Magma that is formed from melting of peridotite would be:

- a) Felsic
- b) Metamorphic
- c) Relatively low in silica
- d) Mafic
- e) (c) and (d) are both correct

40. Which of the following pairs do not belong with each other?

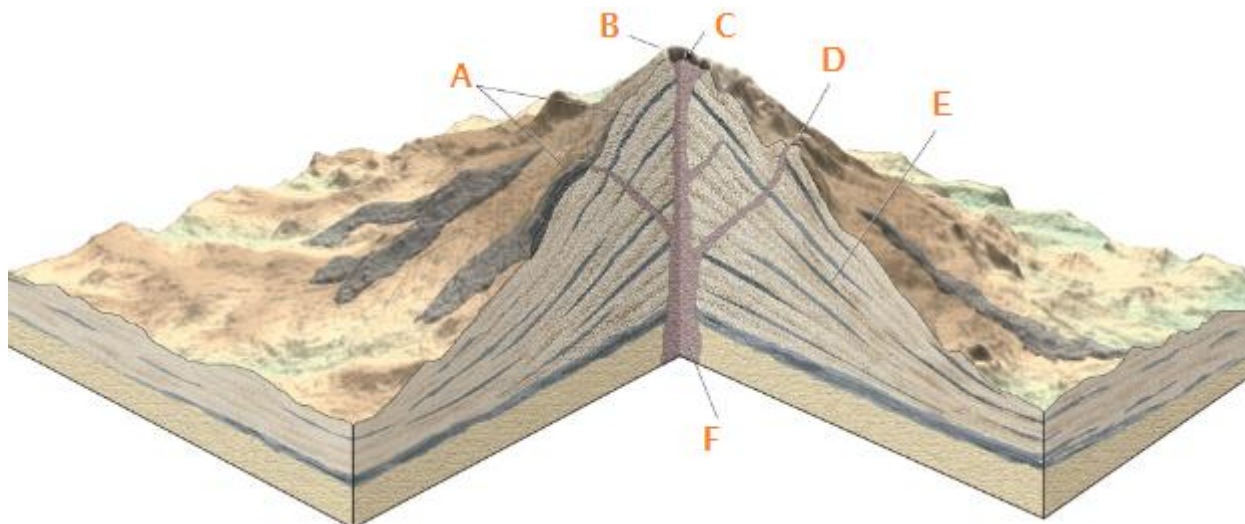
- a) Pyroclastic, Basaltic
- b) Mafic, Gabbro
- c) Intrusive, plutonic
- d) Felsic, quartz

41. An igneous rock with \_\_\_\_\_ texture consists of \_\_\_\_\_ in a light-coloured matrix of \_\_\_\_\_.

- a) Pyroclastic, coarse-grained fragments, volcanic ash
- b) Aphanitic, angular crystals, silica
- c) Pegmatitic, interlocking crystals, volcanic glass
- d) None of the above

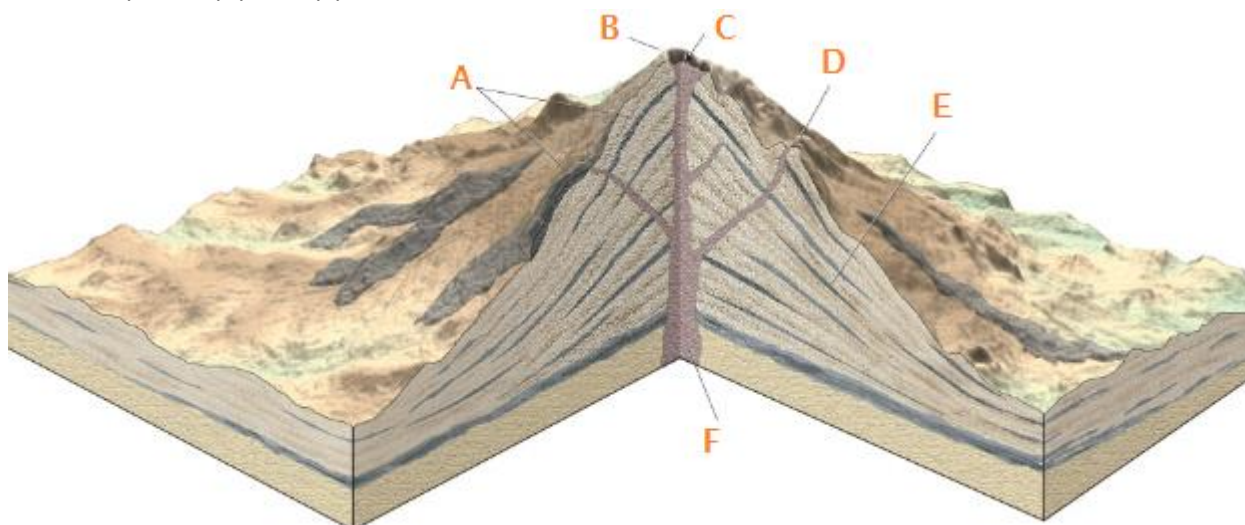
42. Look at the figure showing the anatomy of a volcano. At which location (letter) would you expect to find fumaroles?

- a) E
- b) B
- c) D
- d) F



43. Look at the figure showing the anatomy of a volcano. The internal structure in this image would be most similar to which of the following volcanic features?

- a) Mauna Loa, Hawaii
- b) Mount Fuji, Japan
- c) Yellowstone Park resurgent dome
- d) Both (b) and (c)



44. Look at the image of an igneous rock. How is this igneous texture generated?

- a) Slow cooling, deep underground
- b) Almost instant cooling in an underwater eruption
- c) Slow cooling in a lava flow
- d) Slow cooling deep underground followed by relatively rapid cooling after a volcanic eruption
- e) By a violent volcanic explosion



45. You're a geologist in the field and you come across a rock that interests you. You can see ALL the crystals clearly, it is dark in colour and contains no quartz. What kind of rock did you find?

- a) Granite
- b) Gabbro
- c) Tuff
- d) Basalt
- e) None of the above

46. Which one of the following comparisons between Felsic and Mafic magma is **FALSE**?

- a) Mafic rocks are mostly found on oceanic crust while felsic rock is mostly found on continental crust
- b) Felsic rocks have a lower melting point than mafic rocks
- c) Felsic rocks contain more silica, whereas mafic rocks contain more calcium
- d) Gabbro is a common intrusive, mafic rock, while granite is a common intrusive, felsic rock
- e) None of the above are false

47. What is the rock in the photograph called, and what term can be used to describe its chemical composition?

- a) Rhyolite, granitic
- b) Granite, Felsic.
- c) Gabbro, Basaltic
- d) Diorite, Intermediate



48. Silica is an indicator of how magma will behave. \_\_\_\_\_ magma has a high silica content and is relatively \_\_\_\_\_ which leads to \_\_\_\_\_ volcanic eruptions.

- a) Felsic, fluid, relatively quiet
- b) Felsic, viscous, frequent
- c) Mafic, fluid, highly explosive
- d) Mafic, viscous, catastrophic
- e) Felsic, viscous, highly explosive

49. This mineral is a dominant mineral in granite and has a hardness of 6 on Moh's scale.

- a) Pyroxene
- b) Amphibole
- c) Quartz
- d) Potassium feldspar
- e) Biotite

50. The Earth is a heat engine which utilizes the following PRIMARY sources of heat for its work. Think carefully about this one, it's tricky:

- a) Nuclear fission and fusion
- b) Nuclear fission and tidal power
- c) Nuclear fusion and wind power
- d) All of the above
- e) None of the above