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1. Plate Tectonics is useful in explaining:
  - a. The formation of oceanic trenches
  - b. The distribution of active volcanoes around the earth
  - c. The movement of lithospheric plates
  - d. All of the above
  
2. Active volcanic chains are evidence of:
  - a. Transform plate boundary
  - b. Subduction zone tectonics
  - c. Continental collision
  - d. All of the above
  
3. Transform plate boundaries are characterized by
  - a. Large earthquakes
  - b. Mafic volcanic activity
  - c. Felsic volcanic activity
  - d. Large earthquakes and volcanic activity
  
4. The three types of plate boundaries are:
  - a. Convergent, hot spot, transform
  - b. Convergent, divergent, transform
  - c. Volcanic, divergent, transform
  - d. Submergent, divergent, convergent
  
5. Compared to oceanic crust, continental crust is
  - a. About the same
  - b. Thinner and denser with higher Fe and Mg content
  - c. More brittle and richer in Si
  - d. Thicker, richer in Si, Al, K, and Na
  
6. The Bowen's reaction series describes
  - a. Composition of igneous rocks
  - b. Partial melting
  - c. Sequence of crystallization of intrusive and extrusive rocks from magma
  - d. All of the above

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7. Cleavage of a mineral, such as halite (NaCl), is related to its
  - a. Hardness
  - b. Crystal structure
  - c. Streak
  - d. None of the above
  
8. A glass plate can be scratched by the following mineral:
  - a. Gypsum
  - b. Apatite
  - c. Fluorite
  - d. None of the above
  
9. A light colored, coarse grained intrusive rock is probably a granite
  - a. If it has less than 10% Quartz
  - b. If it is volcanic
  - c. If it has more than 10% Quartz
  - d. If it does not contain any Quartz
  
10. The mineralogy of granite corresponds to the following extrusive rock
  - a. Rhyolite
  - b. Gabbro
  - c. Granodiorite
  - d. Diorite
  
11. Mt. Rainier in the state of Washington is a typical example of
  - a. A subduction zone volcano
  - b. An oceanic shield volcano
  - c. A dome volcano
  - d. A hot spot
  
12. Volcanic activity on Iceland is an example of
  - a. Island arc volcanism
  - b. Subduction zone volcanism
  - c. A hot spot on a mid-oceanic ridge
  - d. Continental volcanism
  
13. Lahar is
  - a. A hot pyroclastic flow
  - b. A hot mixture of water and pyroclastic material

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- c. A welded ash deposit close to the volcano
  - d. None of the above
14. The rate of chemical weathering of silicate minerals decreases as
- a. A function of hardness
  - b. As the number of bonds between the silica tetrahedra increases
  - c. As their crystallization temperature increases
  - d. None of the above
15. Exfoliation or sheet joints are
- a. Parallel to the exposed rock surface
  - b. Formed by unloading and weathering
  - c. Common in granitic rocks
  - d. All of the above
16. Acid mine drainage is caused by
- a. Carbonate dissolution
  - b. Oxidation of iron
  - c. Oxidation of pyrite
  - d. All of the above
17. Chemical weathering of plagioclase produces the following
- a. Hematite and dissolved silica
  - b.  $K^+$  in solution, dissolved silica and clay
  - c.  $Ca^{2+}$ ,  $Na^{2+}$  and silica in solution and clay
  - d. All of the above
18. Saprolite is
- a. A residual soil formed in warm and humid climate
  - b. A term describing the leached zone in a soil profile
  - c. Transported soil deposited in a warm humid climate
  - d. Deeply weathered rock
19. Which of the following is a chemical sedimentary rock
- a. Bauxite
  - b. Limestone
  - c. Saprolite
  - d. Claystone

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20. The strongest cementing agent in clastic or detrital sedimentary rock is
- Clay
  - Silica
  - Feldspar
  - Calcite
21. Shale can be differentiated from claystone by the fact that
- Shale is coarser
  - Claystone is softer
  - It has fissility
  - None of the above
22. Silica-alkali reaction in concrete is caused by
- Limestone in the aggregate
  - Halite in the aggregate
  - Chert in the aggregate
  - All of the above
23. Which of the following is a foliated metamorphic rock
- Schist
  - Marble
  - Quartzite
  - Greenstone
24. Which of the following minerals is most likely to produce slope failures if present along foliation planes
- Feldspar
  - Calcite
  - Quartz
  - Graphite
25. The typical angle of friction for the mineral that could cause sliding in the previous question is
- 30 to 35 degrees
  - Less than 12 degrees
  - 30 degrees
  - None of the above

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26. Which of these minerals is likely to be most abundant in a sandstone
- Pyroxene
  - Feldspar
  - Quartz
  - Muscovite
27. Which of these rocks has been subjected to the highest-degree of metamorphism
- Biotite schist
  - Slate
  - Phyllite
  - Biotite gneiss
28. Lithification is the process of
- Sedimentary rock formation
  - Compaction of sediment
  - Cementation of sediment
  - Consists of all of the above
29. The direction of flow in an ancient stream can be determined from
- Shape of the ripple marks
  - Shape of the particles
  - Roughness of the particles
  - Size of the particles
30. An angular unconformity is
- A contact between two rock units
  - A depositional contact between two rock units where there is a gap in deposition
  - A depositional contact of a sedimentary rock with an igneous rock
  - A depositional contact between two rock units of different age that have different orientations
31. Along which part of a meander would you expect the most erosion?
- On the inside just above the maximum bend
  - On the outside around the maximum bend
  - On the inside at and below the maximum bend
  - All of the above

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32. As sediment is transported downstream, away from its point of origin, the particles become:
- Smaller and rounder
  - Better sorted
  - Dominated by minerals resistant to weathering
  - All of the above
33. The lowest elevation to which a stream channel can erode is defined as its
- Competence
  - Base level
  - Stream gradient
  - Longitudinal profile
34. The absolute age of rocks can be determined from
- Position of adjacent rocks
  - Types of fossils
  - Dating using radioactive minerals
  - All of the above
35. Which radioactive element is best used for dating deposits less than 100,000 years old?
- C-14
  - U-238
  - K-40
  - Rb-87
36. Angle of repose reflects the
- Shape of the particles
  - Frictional properties of the minerals
  - Size of the particles
  - All of the above
37. The stability of a typical slope increases if
- Water pressure increases
  - Water pressure decreases
  - Normal force decreases
  - None of the above

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38. The most common causes of levee failure are
- a. Overtopping
  - b. Piping
  - c. Slope failures
  - d. A and B
39. The probability of a 50-year flood in any given year is
- a. .05
  - b. .025
  - c. .2
  - d. .02
40. The probability of a 100-year flood in 30 years is
- a. 3.3%
  - b. 36%
  - c. 26%
  - d. Not enough information and none of the above

**Make a sketch when appropriate.**

41. Describe the main characteristics of karst and give at least two environmental or engineering reasons why recognizing karst features is important.
42. Use a sliding block analogy to derive the equation for the factor of safety against sliding and used in slope stability analysis.

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43. List at least 3 different types of discontinuities in rocks and explain how they might affect the slope stability of a rock mass.

44. How does the shape of a river affect the velocity of flow?