EXAM 3

Write your name out in full on the scantron form and fill in the corresponding ovals to spell out your name. Also fill in your student ID number in the space provided. Do not include the dash and do not leave any spaces. Make sure you have all 8 pages of the exam.

There are 55 questions. For each question, select the correct answer and fill in your choice on the scantron form. You MUST use pencil on the scantron form!

1. With increasing depth below the Earth’s surface:
   A. rocks get more dense
   B. rocks get less dense
   C. rock density does not change
   D. rock density first increases, then decreases again
   E. rock density first decreases, then increases again

2. As seismic waves pass from a rock layer of a certain density to an adjacent rock layer with a different density, the following is true:
   A. the waves vanish at the interface between the two rock layers
   B. the direction the wave is traveling changes
   C. the wave rays get refracted
   D. both B and C above
   E. all of the above

3. The process whereby seismic waves bounce off a layer boundary back towards the surface is:
   A. wave reflection
   B. wave refraction
   C. wave rays
   D. wave interference
   E. wave shadowing

4. When seismic waves from an earthquake reach the boundary between the mantle and the outer core:
   A. all of the body waves get refracted
   B. all of the body waves get reflected, but none are refracted
   C. all P-waves get refracted and all S-waves get reflected
   D. all S-waves vanish because they cannot move through a liquid
   E. all P-waves speed up as they pass into the outer core

5. One consequence of the outer core being liquid is:
   A. the inner core is liquid
   B. S-wave velocities decrease suddenly at the edge of the outer core
   C. P-waves are unable to pass through the outer core
   D. an S-wave shadow zone occurs more than 103° away from an earthquake focus
   E. a P-wave shadow zone occurs more than 143° away from an earthquake focus

6. In the P-wave shadow zone:
   A. most seismic waves from earthquakes never get recorded by seismometers
   B. S-waves predominate
   C. earthquakes are impossible
   D. the days are darker than usual
   E. geophysicists turn off their seismometers and go to bed early
7. The **Moho** is the boundary between:
   A. the inner core and the outer core
   B. the mantle and the outer core
   C. the lithosphere and the asthenosphere
   **D. the crust and the mantle**
   E. the lithosphere and the low-velocity zone

8. The average thickness of **continental crust** is about:
   A. 1 km
   B. 5–10 km
   C. 8 km
   **D. 35 km**
   E. 100 km

9. The reason the Earth is able to have plate tectonics is because:
   A. the asthenosphere is soft and gooey so the plates can move around on top of it
   B. the lithosphere is brittle so it has been able to break apart to form the plates
   C. convection in the mantle provides a driving force to move the plates around
   D. subduction of old crust makes room for new crust forming at mid-ocean ridges
   **E. all of the above**

10. Continental crust, which commonly forms high mountains, is thicker, and stands higher, than oceanic crust:
    A. because of the principle of isostacy
    B. because continental crust is less dense than oceanic crust
    C. because continental crust is more dense than oceanic crust
    **D. both A and B above**
    E. both A and C above

11. The Earth has a magnetic field because:
    A. **the liquid outer core creates an electric current which induces a magnetic field**
    B. magnetic minerals are common at temperatures above the Curie point
    C. it has a magnetic iron–nickel core
    D. all planets have magnetic fields when they form
    E. the Earth is a giant domino

12. The rocks of **oceanic crust** are typically made up of:
    A. basalt only
    B. gabbro only
    **C. basalt and gabbro**
    D. peridotite only
    E. basalt and peridotite

13. The oldest **oceanic crust** on Earth is only:
    A. 10 million years old
    B. 18 million years old
    **C. 180 million years old**
    D. 3800 million years old
    E. 4600 million years old
14. From the continents towards the ocean basins, **continental margins** are made up of (in order):
   A. continental shelf – continental rise – continental slope
   B. continental slope – continental rise – continental shelf
   C. **continental shelf** – **continental slope** – **continental rise**
   D. continental rise – continental slope – continental shelf
   E. continental slope – continental shelf – continental rise

15. The boundary between continental crust and oceanic crust is underneath the __________:
   A. continental shelf
   B. continental rise
   C. **continental slope**
   D. abyssal plains
   E. ocean trenches

16. Which of the following is NOT an example of an **active continental margin**?
   A. Pacific Northwest
   B. **East coast of North America**
   C. coastal California
   D. the circum–Pacific belt
   E. the coast of Chile, western South America

17. Which of the following is NOT found in the **deep ocean basins**?
   A. abyssal plains
   B. ocean trenches
   C. ocean ridges
   D. **continental shelf**
   E. all of the above are in the deep ocean basins

18. Which of the following is a portion of the world’s longest mountain range?
   A. Marianas trench
   B. Himalayas
   C. Caledonides
   D. Cascades
   E. **mid-Atlantic ridge**

19. Plate tectonics theory suggests that the continents were once all combined into a supercontinent called (1) __________, with the southern part called (2) __________ and the northern part called (3) __________.
   A. (1) Pangea (2) Laurasia (3) Gondwana
   B. **(1) Pangea (2) Gondwana (3) Laurasia**
   C. (1) Pangea (2) Gondwana (3) Eurasia
   D. (1) Gondwana (2) Laurentia (3) Pangea
   E. (1) Gondwana (2) Pangea (3) Laurentia

20. Which of the following is **NOT** one of the lines of evidence that South America and Africa were once joined together?
   A. they both show evidence of tropical climates in the south during the Carboniferous to Permian Periods
   B. the shapes of their coastlines are very similar
   C. they have similar distributions of rocks that are about 550 million years old
   D. they both contain fossils of a type of plant species called **Glossopteris**
   E. they have similar-aged glacial evidence and consistent glacier flow directions
21. Which of the following is NOT considered to be a part of Gondwana?
   A. Africa
   B. India
   C. Australia
   D. Asia
   E. Antarctica

22. Evidence that North America used to be connected to Eurasia is given by the fact that the (1) ________ in North America match up with the (2) ________ in Eurasia.
   A. (1) Rockies (2) Alps
   B. (1) Rockies (2) Caledonides
   C. (1) Appalachians (2) Alps
   D. (1) Appalachians (2) Caledonides
   E. (1) Cascades (2) Appalachians

23. Although the Gondwana continents show evidence of an ice age during the Carboniferous Period, there are no equivalent Carboniferous glacial deposits in the Laurasia continents because:
   A. Gondwana was near the south pole in the Carboniferous, but Laurasia was near the equator
   B. Laurasia was near the south pole in the Carboniferous, but Gondwana was near the equator
   C. the glacial deposits in Gondwana did not form in the Carboniferous after all
   D. Laurasia did not exist during the Carboniferous
   E. we haven't looked hard enough for glacial deposits in Laurasia

24. Africa and South America both contain fossils of a type of freshwater reptile called:
   A. Cynognathus
   B. Glossopteris
   C. Tyrannosaurus
   D. Mesosaurus
   E. Kattenhornus

25. Which of the following statements about paleomagnetism at spreading ridges is TRUE?
   A. there is no clear paleomagnetic signal in rocks at spreading ridges
   B. rocks along spreading ridges show the same paleomagnetic north direction, no matter how old they are
   C. the paleomagnetic pattern on one side of a ridge is the mirror image of the pattern on the other side of the ridge
   D. there is evidence that Earth's magnetic poles reverse every 11 years or so
   E. the paleomagnetic signal next to spreading ridges is still unknown

26. As a result of seafloor spreading:
   A. new ocean crust is generated at ridges to accommodate the spreading plates
   B. continents attached to the plates on each side of the ridge slowly move apart
   C. the age of ocean crust increases with increasing distance away from the ridge
   D. a record of paleomagnetic reversals is recorded in rocks that formed at the ridge
   E. all of the above

27. The fastest spreading ridge on Earth is __________, where the plates move at ~18 cm/year.
   A. the mid-Atlantic ridge
   B. the East Pacific Rise
   C. the Juan de Fuca ridge
   D. the Cascadia subduction zone
   E. the Himalayas
28. What type of plate boundary is represented by a mid-ocean spreading ridge?
   A. divergent
   B. convergent
   C. transform
   D. subduction
   E. strike-slip

29. Ocean basins and mid-ocean ridges are first created when the interior of a continent splits apart and basalt lava starts erupting within the __________ that forms on the continent.
   A. horst
   B. rift valley
   C. normal fault
   D. East African rift
   E. subduction zone

30. At convergent plate boundaries, the volcanic mountain chains that form are called (1) ________ in an ocean-ocean setting and (2) ________ in an ocean-continent setting.
   A. (1) island arcs (2) island chains
   B. (1) island arcs (2) volcanic chains
   C. (1) island arcs (2) volcanic arcs
   D. (1) volcanic arcs (2) island chains
   E. (1) volcanic arcs (2) island arcs

31. At an ocean-continent convergent margin, the (1) ________ plate always subducts beneath the (2) __________ plate because (3) _____________________.
   A. (1) overriding (2) underriding (3) it is less dense
   B. (1) continental (2) oceanic (3) it is thicker
   C. (1) oceanic (2) overriding (3) it is more easily deformed
   D. (1) continental (2) overriding (3) it melts more easily, forming volcanoes
   E. (1) oceanic (2) continental (3) it is denser

32. An example of a transform fault that comes on-land:
   A. Cascadia subduction zone
   B. San Andreas fault
   C. mid-Atlantic ridge
   D. Gulf of California
   E. transform faults cannot come on-land

33. The main driving force behind mass wasting is:
   A. water
   B. ice
   C. wind
   D. gravity
   E. human stupidity

34. What is meant by saltation?
   A. where evaporation of water causes salt crystals to grow
   B. it is a type of erosion caused by rivers
   C. when particles of sediment are suspended in flowing water
   D. where sediment particles bounce along the ground due to wind or water currents
   E. it is a type of erosion caused by wind-blown sediment
35. Which of the following slopes is the **highest** possible **angle of repose** for loose regolith?
   A. 90º  
   B. 60º  
   C. 40º  
   D. 25º  
   E. 5º  

36. The type of landslide that involves sliding of sediment above a concave slip surface is called a:
   A. slump  
   B. rock slide  
   C. mudflow  
   D. debris avalanche  
   E. creep  

37. Which of the following types of landslides is a type of **slurry flow**?
   A. slump  
   B. rock slide  
   C. mudflow  
   D. debris avalanche  
   E. creep  

38. Only 2.8% of all the water on Earth is fresh water. However, about 74% of this fresh water is frozen in glaciers and ice caps, and 99% of the liquid water is:
   A. too polluted to be consumed  
   B. flowing through the Earth’s rivers  
   C. stored in living organisms  
   D. **underground**  
   E. stored in the atmosphere  

39. Which of the following reservoirs typically has the longest **residence time** for water molecules?
   A. living organisms  
   B. atmosphere  
   C. rivers  
   D. groundwater  
   E. **ice sheets**  

40. Which of the following features or processes is **NOT** associated with a meandering stream?
   A. anastomosing flow  
   B. point bars  
   C. oxbow lakes  
   D. cut banks  
   E. lateral accretion  

41. Deltas get their name from the Greek letter, D. What is the only type of delta that really has this triangular shape when viewed from above?
   A. stream–dominated delta  
   B. **wave–dominated delta**  
   C. bird's foot delta  
   D. tide–dominated delta  
   E. all deltas have a triangular shape – that’s why they’re called deltas
42. The edge of a drainage basin is called a:
   A. tributary
   B. continental divide
   C. drainage divide
   D. distributary
   E. drainage margin

43. Type of river drainage that resembles the shape of veins in a leaf:
   A. dendritic
   B. rectangular
   C. trellis
   D. radial
   E. deranged

44. Which of the following processes was responsible for the creation of the Great Salt Lake basin?
   A. a lava dam
   B. glacial retreat
   C. faulting
   D. landslides
   E. evaporation

45. Which of the following statements about ultimate base level is FALSE?
   A. rivers cannot erode deeper than ultimate base level
   B. ultimate base level is always sea level
   C. ultimate base level can change through time
   D. lakes and waterfalls are types of ultimate base levels
   E. all the above are FALSE!

46. Stream piracy is a direct result of the process of:
   A. stream terrace development
   B. downcutting
   C. lateral erosion
   D. headward erosion
   E. incised meandering

47. Which of the geologic sequences listed below is in the correct order for the Palouse area (from oldest to youngest)?
   A. Idaho Batholith granite – Belt rocks – Columbia River flood basalts – Lewiston fold
   B. Belt rocks – Lewiston fold – Columbia River flood basalts – loess deposits
   C. Belt rocks – Idaho Batholith granite – Columbia River flood basalts – Lewiston fold
   D. Columbia River flood basalts – Lewiston fold – Missoula flood – Bonneville flood
   E. loess deposits – Columbia River flood basalts – Idaho Batholith granite – Belt rocks

48. At the unfortunately-named Granite Point, we can tell that the gneiss was exposed at the Earth’s surface for quite some time before the eruption of the Columbia River flood basalts because:
   A. the boundary between them is an angular unconformity
   B. there is a paleosol present between the gneiss and the basalt
   C. the basalt is on top of the gneiss
   D. the gneiss intruded into the basalt at the surface
   E. it erupted into the Snake River
49. The pillow basalts in the Snake River gorge indicate that:
   A. the Snake River already existed in its present location when the lavas erupted
   B. the Columbia River flood basalts formed on the ocean floor
   C. the lavas cooled quickly, forming columnar joints
   D. some of the Columbia River flood basalts erupted into bodies of water
   E. thousands of years passed between the eruption of consecutive lava flows

50. Which evidence below proves that the Missoula floods happened after the Bonneville flood?
   A. Bonneville flood deposits formed an island that sits high above the waterline
   B. the Missoula floods formed the scablands in eastern Washington
   C. the Missoula flood deposits are still unconsolidated
   D. the Missoula flood flowed upstream along the Snake River
   E. Bonneville flood deposits are underneath the Missoula flood deposits

BONUS QUESTIONS

51. Magnetic evidence that tectonic plates have been drifting around through time is given by:
   A. reversals in paleomagnetic poles in rocks alongside mid-ocean ridges
   B. changes in magnetic declination in rocks of different ages occurring at the same geographic location
   C. magnetic declinations in rocks that differ from the current magnetic declination at that location
   D. all of the above
   E. none of the above because paleomagnetism tells us nothing about plate tectonics

52. The types of faults that cause lateral offsets along the mid-ocean ridges are:
   A. normal faults
   B. reverse faults
   C. transform faults
   D. left-lateral faults
   E. right-lateral faults

53. Fossils from an ancient ocean can be found:
   A. in the East African Rift Valley
   B. within ophiolites
   C. in Gondwana
   D. on top of Mount Everest
   E. in the Marianas trench

54. All sediment deposited by rivers is called:
   A. regolith
   B. bar deposits
   C. bed load
   D. alluvium
   E. alluvial fans

55. In which of the following locations is there absolutely no evidence of surface drainage patterns?
   A. Africa
   B. Antarctica
   C. North America
   D. Mars
   E. all of the above show evidence of drainage patterns