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.

There are 55 questions (8 pages). For each question, select the correct answer and fill in your choice on the scantron form.

1. Water on the Earth's surface infiltrates into the ground then percolates down through the (1) ______ to the (2) ______ at which point the water has moved into the (3) ______.  
   A. (1) saturated zone; (2) water table; (3) unsaturated zone  
   B. (1) unsaturated zone; (2) water table; (3) saturated zone  
   C. (1) vadose zone; (2) water table; (3) unsaturated zone  
   D. (1) zone of aeration; (2) hydrous zone; (3) capillary fringe  
   E. (1) porous zone; (2) capillary fringe; (3) groundwater

2. The amount of water that a rock can store is dictated by its (1) ______ whereas the ability of a rock to transmit water through it is given by its (2) _______.  
   A. (1) density (2) head gradient  
   B. (1) permeability (2) porosity  
   C. (1) permeability (2) infiltration capacity  
   D. (1) porosity (2) infiltration capacity  
   E. (1) porosity (2) permeability

3. Regions that are underlain by limestone rocks are prone to the development of ______ as a result of dissolution by groundwater.  
   A. artesian wells  
   B. sinkholes  
   C. confined aquifers  
   D. swamps  
   E. marble

4. A cone of depression is:  
   A. when a well near the ocean is contaminated by salt water  
   B. a type of subsidence caused by the compaction of an aquifer  
   C. the path of groundwater flow that feeds rivers from below  
   D. a drop in the water table around a well caused by overpumping  
   E. the inescapable blue funk that falls over you during exam week

5. Contamination of groundwater systems by man-made pollutants is an issue of major concern to environmentalists. An example that is currently in the news is the planned nuclear waste repository site that is being proposed at the following location:  
   A. Yucca Mountain, Nevada  
   B. Idaho Falls, Idaho  
   C. Arctic National Wildlife Refuge, Alaska  
   D. Canyonlands National Park, Utah  
   E. Akron, Ohio
6. The salinity of the ocean is in the range:
   A. 33 - 37 parts per hundred
   B. **33 - 37 parts per thousand**
   C. 33 - 37 parts per million
   D. 33 - 37 parts per billion
   E. 33 - 37 parts per mouthful

7. Ocean currents are driven by (1) _______ and extend down to a depth of about (2) _______.
   A. (1) gravity  (2) 100m
   B. (1) wind   (2) 10m
   C. **(1) wind  (2) 100m**
   D. (1) waves  (2) 10m
   E. (1) waves  (2) 100m

8. When the Earth, Moon, and Sun are in alignment, gravitational forces combine to form a:
   A. flood tide
   B. **spring tide**
   C. neap tide
   D. ebb tide
   E. high tide

9. Which of the following shoreline features is not caused by longshore drift?
   A. spit
   B. baymouth bar
   C. barrier islands
   D. **marine terrace**
   E. recurved spit

10. The three types of erosive processes along shorelines are:
    A. abrasion, corrosion, hydraulic action
    B. abrasion, saltation, hydrologic action
    C. erosion, deposition, abrasion
    D. sea cliffs, wave-cut platforms, headlands
    E. longshore currents, waves, tides

11. Which of the following is arranged in the correct order for how the listed features develop?
    A. sea arch, sea stack, sea cave
    B. **sea cave, sea arch, sea stack**
    C. sea arch, sea cave, sea stack
    D. sea stack, sea arch, sea cave
    E. sea cave, sea stack, see spot run

12. Which of the following processes could result in the development of an emergent coastline?
    A. a drop in sea level
    B. tectonic uplift of the land
    C. isostatic rebound
    D. **all of the above**
    E. none of the above whatsoever

13. Any geologic process that involves the action of the wind is called a/an:
    A. meteorological process
    B. deflation process
    C. **eolian process**
    D. thespian process
    E. loessian process
14. Which of the following features does not result from wind erosion?
   A. yardang
   B. deflation hollow
   C. ventifact
   D. desert pavement
   **E. loess**

15. Cross-beds in sand dunes develop because of sand cascading down the:
   A. leeward slope
   B. windward slope
   C. angle of repose
   D. dune face
   E. horns

16. Which of the following combinations of sand dune types both refer to long, parallel ridges of sand that form parallel to the prevailing wind direction?
   A. parabolic / barchan
   B. barchan / barchanoid
   **C. longitudinal / seif**
   D. transverse / parabolic
   E. seif / star

17. The horns of a (1) _______ dune point towards the direction the wind blows from, whereas in a (2) _______ dune they point in the direction the wind is blowing towards.
   A. (1) transverse; (2) longitudinal
   B. (1) barchan; (2) barchanoid
   C. (1) barchan; (2) parabolic
   D. (1) parabolic; (2) star
   **E. (1) parabolic; (2) barchan**

18. Deserts typically form in the latitude range (1) _____ because (2) ______:
   A. (1) 0°-20° (2) temperatures are just right
   B. (1) 0°-20° (2) cold, dry air descends from high in the atmosphere
   **C. (1) 20°-30° (2) warm, dry air descends from high in the atmosphere**
   D. (1) 20°-30° (2) dry winds lost all their moisture after traveling long distances
   E. (1) 80°-90° (2) snowfall rates are extremely high in polar regions

19. The only two places on Earth that have continental glaciers today are:
   A. the north pole and the south pole
   B. Greenland and Iceland
   C. Alaska and Antarctica
   **D. Antarctica and Greenland**
   E. Siberia and Antarctica

20. Most accumulation on a glacier occurs (1) ______ whereas most ablation on a glacier occurs (2) ____________.
   A. (1) at night (2) during the day
   B. (1) when the glacial budget is negative (2) when the glacier recedes
   C. (1) in the zone of wastage (2) at the head of the glacier
   **D. (1) at the head of the glacier (2) near the terminus of the glacier**
   E. (1) during interglacial periods (2) during ice ages
21. Glacial pavements, glacial polish, and glacial striations are all features produced by the glacial erosive process called:
   A. plucking
   B. abrasion
   C. bulldozing
   D. hydraulic action
   E. frost wedging

22. What is an arête?
   A. a bowl-shaped depression carved out by a valley glacier
   B. a pyramidal mountain peak in a glacially eroded region
   C. a knife-like ridge of rock between two glacially eroded valleys
   D. a U-shaped tributary valley that sits high above a deeper valley
   E. a small lake in a depression eroded out by a glacier that then receded

23. Which of the following features is best described by the definition: “A long sinuous ridge of till that was deposited in an ice tunnel within an ice sheet that subsequently melted away.”
   A. erratic
   B. esker
   C. kame
   D. varve
   E. drumlin

24. Day to day changes in atmospheric conditions refers to (1) ______ whereas long term natural changes in atmospheric conditions of a region refers to (2) __________.
   A. (1) climate   (2) weather
   B. (1) weather   (2) climate
   C. (1) meteorology (2) paleoclimatology
   D. (1) atmospheric pressure (2) atmospheric moisture
   E. (1) temperature (2) global warming

25. During the last ice age, which was called the (1) ________ glaciation, there were global lows in temperature on average every 100,000 years, resulting in (2) _______ cycles of glaciation.
   A. (1) Holocene   (2) 10
   B. (1) Pleistocene (2) 100
   C. (1) Pleistocene (2) 20
   D. (1) Carboniferous (2) 100
   E. (1) Flintstone   (2) 5

26. Which of the following statements about the last ice age is FALSE?
   A. about 30% of the Earth’s surface was covered in ice
   B. there were interglacial periods during the last ice age
   C. Moscow, Idaho, was not covered by ice sheets during the last ice age
   D. the last ice age ended about 2,000 years ago
   E. we see evidence of pluvial and proglacial lakes associated with the ice age

27. _______ is an example of a proglacial lake that formed during the last ice age at the southern edge of the ice sheet in North America:
   A. Lake Missoula
   B. Lake Bonneville
   C. Great Salt Lake
   D. Lake Chad
   E. Lake Placid
28. The two factors that are hypothesized to produce Milankovitch cycles are:
   A. greenhouse gases and chlorofluorocarbons
   B. global warming and ice ages
   C. axial tilt and obsession
   D. meteorite impacts and volcanic eruptions
   E. eccentricity and precession

29. A cube of rock would change into a smaller cube of rock with a higher density if it were subject to the effect of a:
   A. differential stress
   B. uniform pressure
   C. tensional stress
   D. shear stress
   E. geothermal gradient

30. Elastic deformation in a rock indicates that:
   A. the strength of the rock has been overcome
   B. the rock has undergone fracturing
   C. the rock is behaving in a plastic manner, like salt water taffy
   D. the rock can release elastic energy and return to its original shape
   E. the rock will eventually cause an earthquake

31. The outer parts of the Earth’s crust usually exhibit (1) _______ deformation whereas deeper down, rocks usually exhibit (2) ________ deformation.
   A. (1) ductile; (2) brittle
   B. (1) brittle; (2) ductile
   C. (1) brittle; (2) elastic
   D. (1) elastic; (2) brittle
   E. (1) plastic; (2) ductile

32. The speed that deformation occurs inside rocks is:
   A. without exception, extremely slow
   B. about 3 cm per year
   C. called the strain rate
   D. fast enough to observe on a day-to-day basis
   E. very rapid for the case of ductile deformation

33. Tectonic plate boundary faults can be found in (1) _______ whereas an example of a continental interior fault is in the region of (2) _________:
   A. (1) the Pacific Northwest (2) southern Alaska
   B. (1) the Pacific Northwest (2) California
   C. (1) California (2) the Pacific Northwest
   D. (1) California (2) New Madrid, Missouri
   E. (1) New Madrid, Missouri (2) southern Alaska

34. If a fault plane is dipping, the block of rock above the fault plane is the (1) _______ and the block below the fault plane is the (2) _________.
   A. (1) footwall; (2) hanging wall
   B. (1) footwall; (2) fault scarp
   C. (1) hanging wall; (2) footwall
   D. (1) fault scarp; (2) footwall
   E. (1) hanging wall; (2) fault scarp
35. Along any fault, the (1) ________ moves up and the (2) ________ moves down:
   A. (1) hanging wall (2) footwall
   B. (1) footwall (2) hanging wall
   C. (1) reverse side (2) normal side
   D. (1) normal side (2) reverse side
   E. more information about the fault is needed to answer this question

36. Which of the following statements about strike-slip faults is true?
   A. The San Andreas fault is an example of a strike-slip fault
   B. the sense of slip varies depending on which side of the fault you are standing
   C. strike-slip faults typically have a dip of about 60 degrees
   D. the hanging wall always moves up relative to the footwall
   E. strike-slip faults are produced by tensional tectonic stresses

37. In folds, rocks that warp upwards are called (1) _______ and rocks that warp downwards are called (2) _________.
   A. (1) synclines; (2) monoclines
   B. (1) synclines; (2) anticlines
   C. (1) anticlines; (2) synclines
   D. (1) anticlines; (2) monoclines
   E. none of the above

38. The largest amount of recorded uplift of the Earth’s surface ever to occur as a result of an earthquake happened (1) ________ during an earthquake in the year (2) ________.
   A. (1) in New Madrid, Missouri (2) 1811
   B. (1) on an island off the coast of Alaska (2) 1964
   C. (1) in San Francisco (2) 1906
   D. (1) at Borah Peak, Idaho (2) 1983
   E. (1) in the Pacific Northwest (2) 1700

39. Faults produce earthquakes when tectonic stresses exceed the (1) _______ of the faults. However, some faults do not produce earthquakes, but instead slip almost continuously through a slow process called (2) ________.
   A. (1) strength (2) elastic rebound
   B. (1) strength (2) aftershocks
   C. (1) friction (2) elastic rebound
   D. (1) friction (2) creep
   E. (1) friction (2) seismic waves

40. About 95% of all earthquakes occur:
   A. in the continental interiors
   B. along the tectonic plate boundaries
   C. around the Circum-Pacific belt
   D. along the southern coast of Alaska
   E. none of the above

41. The largest earthquake ever felt in the continental United States during historical times was:
   A. in New Madrid, Missouri during the winter of 1811-1812
   B. in San Francisco in 1906
   C. in southern Alaska in 1964
   D. in Charleston, South Carolina in 1886
   E. off the coast of Chile in 1960
42. It is believed that a magnitude 9.0 earthquake hit the continental United States in the year 1700. Where did this earthquake occur?
   A. along the San Andreas fault of California
   B. southern Alaska
   C. in the New Madrid region of Missouri
   D. in the current location of Salt Lake City, Utah
   **E. in the Pacific Northwest**

43. Seismic waves get recorded by an instrument called a (1) _______. The record of the earthquake that this instrument generates is called a (2) ________.
   A. (1) seismograph; (2) seismometer
   B. (1) seismogram; (2) seismograph
   C. (1) seismometer; (2) seismograph
   **D. (1) seismograph; (2) seismogram**
   E. (1) seismogram; (2) seismometer

44. The epicenter of an earthquake is:
   A. the location along the fault where the earthquake rupture starts
   B. the point from which body waves radiate into the surrounding rocks
   **C. the point on the Earth's surface directly above the earthquake focus**
   D. exactly the same as the focus of an earthquake
   E. sometimes at the Earth's surface, but not always

45. The first evidence of an earthquake that can be felt is a vertical jolt caused by the arrival of the (1)_______ which is a type of (2)________.
   A. (1) P-wave (2) surface wave
   B. (1) S-wave (2) surface wave
   C. (1) surface wave (2) seismic wave
   D. (1) body wave (2) S-wave
   **E. (1) P-wave (2) body wave**

46. Three earthquake monitoring stations are needed to constrain the epicenter of an earthquake because:
   A. the more, the better
   B. at least one of the stations could have made a mistake
   C. some instruments cannot measure the P-S time interval
   D. only two stations will produce three potential locations for the epicenter
   **E. three distance measurements from different stations define a point on a map**

47. The amount of energy released during an earthquake is called the:
   A. magnitude
   B. intensity
   C. Richter scale
   D. moment magnitude scale
   E. earthquake hazard

48. The intensity of an earthquake measured at some distance from the epicenter:
   A. is variable depending on the distance to the epicenter
   B. doesn’t change for an earthquake, no matter how far away it was
   C. is measured using the moment magnitude scale
   D. will be the same for all earthquakes with an identical magnitude
   E. none of the above
49. Which of the following definitions of a tsunami is correct?
   A. it is a large boulder deposited far away from any similar types of rocks
   B. it is a type of seismic wave that causes a lot of damage to tall buildings
   C. it is a water wave generated in the ocean as a result of an earthquake
   D. it is a type of landslide triggered in a mountainous region during an earthquake
   E. it is a Japanese dish consisting of raw fish wrapped in seaweed

50. The type of earthquake hazard that causes structures to sink into the ground or topple over is called (1) ________ which results from (2) __________.
   A. (1) quicksand  (2) extremely large surface waves
   B. (1) subsidence  (2) a high water table level during the earthquake
   C. (1) landslides  (2) loose material being shaken loose by seismic waves
   D. (1) liquefaction (2) water-saturated sediment being shaken too much
   E. none of the above

BONUS QUESTIONS

51. Which of the following definitions are correct for the geologic process called creep?
   A. internal plastic flow in a glacier involving sliding along ice crystal planes
   B. a slow, continuous sliding motion along faults that have low friction
   C. a type of mass wasting whereby an entire slope slowly moves downhill
   D. all of the above
   E. I am too clueless to answer this question

52. Glacial erosion forms a (1) ______ whereas glacial deposition forms a (2) ________.
   A. (1) moraine  (2) cirque
   B. (1) drumlin  (2) roche moutonnée
   C. (1) roche moutonnée (2) drumlin
   D. (1) horn (2) U-shaped valley
   E. (1) kame  (2) recessional moraine

53. The largest magnitude earthquake ever recorded had a moment magnitude of:
   A. 9.5
   B. 9.2
   C. 7.9
   D. 10.3
   E. dark green

54. The 1983 Borah Peak earthquake happened along a:
   A. normal fault
   B. reverse fault
   C. strike-slip fault
   D. thrust fault
   E. double fault

55. The most mobile type of sand dune is a:
   A. seif dune
   B. barchan dune
   C. transverse dune
   D. star dune
   E. parabolic dune