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. Which of the following terms does not mean the same thing as the others?
   A. water table
   B. zone of aeration
   C. vadose zone
   D. unsaturated zone
   E. all of the above terms mean the same thing

2. When referring to groundwater, (1) __________ refers to the volume percentage of a rock made up of open space that can fill with water, whereas (2) __________ refers to the ability of water to flow through the rock.
   A. (1) permeability (2) porosity
   B. (1) permeability (2) infiltration capacity
   C. (1) porosity (2) infiltration capacity
   D. (1) porosity (2) permeability
   E. (1) infiltration capacity (2) permeability

3. Rocks that are saturated in the subsurface form a storage system for water that we call a/an:
   A. reservoir
   B. vadose zone
   C. aquifer
   D. aquiclude
   E. disappearing stream

4. If a hole is dug into an unconfined aquifer, the water will rise up to the level of the:
   A. aquiclude
   B. water table
   C. earth’s surface
   D. perched water table
   E. artesian pressure surface

5. If a hole is dug into a confined aquifer, the water will rise up to the level of the:
   A. aquiclude
   B. water table
   C. earth’s surface
   D. perched water table
   E. artesian pressure surface

6. What activity results in the development of a feature called a cone of depression?
   A. compaction
   B. overpumping
   C. subsidence
   D. saltwater incursion
   E. contamination
7. 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

8. Where is the **zone of accumulation** on a glacier?
   A. at the terminus of the glacier
   B. in the same place as the zone of wastage
   C. where the process of ablation dominates
   D. where the crevasses develop
   **E. at the head of the glacier**

9. Which of the following glacial features is an erosional feature that is created by the glacial process called **plucking**?
   A. U-shaped valley
   B. drumlin
   **C. roche moutonnée**
   D. arête
   E. cirque

10. Which of the following glacial features does not belong in the same category as the others because it is a depositional feature?
    A. roche moutonée
    B. glacial striations
    C. truncated spur
    **D. drumlin**
    E. cirque

11. What is an **arête**?
    A. a bowl-shaped depression on a mountain 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 long ago

12. Which of the following depositional features is best described by the definition: “Rounded hills of till, shaped like inverted teaspoons, with the steep side facing the direction from which the glacier came.”
    A. erratic
    B. esker
    C. kame
    D. varve
    **E. drumlin**

13. Which of the following features is NOT a type of **lake** related in some way to glaciers or glaciation?
    A. kettle lake
    B. proglacial lake
    C. tarn
    D. pater noster lake
    **E. fjord**
14. The type of moraine that accumulates in the middle of a glacier due to two glaciers flowing together is:
   A. lateral
   B. **medial**
   C. terminal
   D. ground
   E. recessional

15. The last ice age that occurred on Earth is commonly referred to as the ___________ ice age.
   A. Pleistocene
   B. Holocene
   C. Carboniferous
   D. Tertiary
   E. Jurassic

16. The ice age described in question 15 above ended about __________ years ago.
   A. 1 million
   B. 100,000
   C. **10,000**
   D. 1,000
   E. 500

17. During the last ice age, global temperatures were actually quite variable but with regular cycles. How often were there major lows in global temperatures during the last ice age?
   A. **every 100,000 years**
   B. every 20,000 – 40,000 years
   C. every 10,000 – 20,000 years
   D. every 10,000 years
   E. every 1000 years

18. What characteristic of the Earth is responsible for the temperature cyclicity described in question 17 above?
   A. precession of Earth’s rotational axis
   B. changes in the tilt of Earth’s rotational axis
   C. magnetic pole reversals
   D. **eccentricity of Earth’s orbit around the Sun**
   E. major volcanic episodes

19. Which of the following statements about the last ice age is **FALSE**?
   A. **about 10% of the Earth’s surface was covered in ice**
   B. there were ~20 cycles of cooling during the last ice age as temperatures repeatedly rose and fell
   C. Moscow, Idaho, was not covered by ice sheets during the last ice age
   D. recessional moraines in the Great Lakes region provide evidence of the extent of ice sheets
   E. there were pluvial and proglacial lakes in North America during the last ice age

20. The ice age period lake in what is now Utah that caused a giant flood to rush downstream along the Snake River towards the end of the last ice age was called:
   A. Glacial Lake Missoula
   B. Great Salt Lake
   C. Finger Lake
   D. **Lake Bonneville**
   E. Lake Provo
21. During the last ice age, **sea level** was:
   A. about 130 m higher than it is today
   **B. about 130 m lower than it is today**
   C. about 10 m higher than it is today
   D. about 10 m lower than it is today
   E. about the same level as it is today

22. The correct definition of the eolian feature called a **ventifact**:
   A. a hollowed out region caused by the process of deflation
   B. a dry lakebed in a desert that is also called a salt pan
   **C. a rock fragment abraded by wind to form several polished surfaces, like a gemstone**
   D. any type of sediment that is transported and deposited by wind
   E. an elongate erosional remnant of rock sticking above a desert surface, like an upturned ship hull

23. The correct definition of the eolian feature called a **playa**:
   A. a hollowed out region caused by the process of deflation
   **B. a dry lakebed in a desert that is also called a salt pan**
   C. a rock fragment abraded by wind to form several polished surfaces, like a gemstone
   D. any type of sediment that is transported and deposited by wind
   E. an elongate erosional remnant of rock sticking above a desert surface, like an upturned ship hull

24. The correct definition of the eolian feature called a **blowout**:
   **A. a hollowed out region caused by the process of deflation**
   B. a dry lakebed in a desert that is also called a salt pan
   C. a rock fragment abraded by wind to form several polished surfaces, like a gemstone
   D. any type of sediment that is transported and deposited by wind
   E. an elongate erosional remnant of rock sticking above a desert surface, like an upturned ship hull

25. The correct definition of the eolian feature called **loess**:
   A. a hollowed out region caused by the process of deflation
   B. a dry lakebed in a desert that is also called a salt pan
   C. a rock fragment abraded by wind to form several polished surfaces, like a gemstone
   **D. any type of sediment that is transported and deposited by wind**
   E. an elongate erosional remnant of rock sticking above a desert surface, like an upturned ship hull

26. The correct definition of the eolian feature called a **yardang**:
   A. a hollowed out region caused by the process of deflation
   B. a dry lakebed in a desert that is also called a salt pan
   C. a rock fragment abraded by wind to form several polished surfaces, like a gemstone
   D. any type of sediment that is transported and deposited by wind
   **E. an elongate erosional remnant of rock sticking above a desert surface, like an upturned ship hull**

27. In a sand dune, sand grains saltate up the (1) __________ and then cascade down the (2) __________.
   A. (1) slip face (2) angle of repose
   B. (1) slip face (2) leeward slope
   C. (1) leeward slope (2) windward slope
   **D. (1) windward slope (2) leeward slope**
   E. (1) leeward slope (2) slip face
28. What type of sand dune is shaped like a croissant and has **horns** that point in the direction TOWARDS WHICH the wind blows?
   - A. barchan
   - B. longitudinal
   - C. transverse
   - D. parabolic
   - E. star

29. What type of sand dune resembles a sea of sand with “waves” oriented perpendicular to the wind direction?
   - A. barchan
   - B. longitudinal
   - C. transverse
   - D. parabolic
   - E. star

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

31. The most dominant control on the creation of the Earth’s tides is:
   - A. the Moon
   - B. the Sun
   - C. the position of the Earth in its orbit around the Sun
   - D. precession
   - E. eccentricity

32. If you lived right next to the beach, when would you expect to experience a **spring tide**?
   - A. only during the day
   - B. only during the night
   - C. **when the Sun, the Moon, and the Earth are all aligned**
   - D. when the Sun, the Moon, and the Earth form an L shape
   - E. at the spring solstice

33. A **longshore current** is CAUSED by:
   - A. the wind and waves hitting the shoreline at an oblique angle
   - B. longshore drift pulling the water along parallel to the shoreline
   - C. rip currents
   - D. waves breaking perpendicular to the shoreline
   - E. the tide coming in

34. What type of depositional feature along a shoreline is a mound of sand that links a small offshore island to the mainland?
   - A. barrier island
   - B. spit
   - C. baymouth bar
   - D. **tombolo**
   - E. pocket beach
35. Erosion along a shoreline can form a flat platform of rock that gets exposed at low tide and is called a (1) _________. If this platform is lifted above sea level by tectonic forces, it is called a (2) _________.
   A. (1) wave-built platform    (2) marine terrace
   B. (1) marine terrace          (2) wave-built platform
   C. (1) wave-cut platform       (2) wave-built platform
   D. (1) wave-built platform     (2) wave-cut platform
   E. (1) wave-cut platform       (2) marine terrace

36. Which of the following processes would create an emergent coastline?
   A. isostatic rebound
   B. rising sea level
   C. tectonic subsidence of the land
   D. all of the above
   E. none of the above

37. A fossil fuel forms from decayed organic matter. Which of the following resources is NOT a fossil fuel?
   A. peat
   B. coal
   C. oil
   D. carbon dioxide
   E. natural gas

38. One category of fossil fuel forms from the remains of marine organisms and is called a hydrocarbon. Which of the following is NOT a hydrocarbon?
   A. peat
   B. crude oil
   C. natural gas
   D. tar
   E. kerogen

39. The highest grade quality of coal is:
   A. peat
   B. subbituminous coal
   C. lignite
   D. anthracite
   E. bituminous coal

40. Which type of renewable energy resource is harnessed with the use of photovoltaic cells?
   A. geothermal
   B. nuclear
   C. solar
   D. wind
   E. tidal

41. Which of the following phenomena is always going to be a geologic risk, no matter where it happens?
   A. an earthquake
   B. a volcanic eruption
   C. a landslide
   D. a tsunami
   E. none of the above
42. Which of the following is NOT an example of a **rapid onset hazard**?
   A. meteorite impact
   B. flash flood
   C. subsidence
   D. tsunami
   E. earthquake

43. Which of the following is a **Kuiper Belt** object that was recently determined to be bigger than Pluto and is now classified as a dwarf planet, similar to Pluto?
   A. Sedna
   B. Eris
   C. Quaoar
   D. Dysnomia
   E. Oort

44. Which of the following statements is **FALSE**?
   A. all 8 planets revolve around the Sun in the plane of the ecliptic
   B. all planets rotate in a counterclockwise direction when viewed from above
   C. the asteroid belt occurs between the planets Mars and Jupiter
   D. Uranus is the only planet with a rotational axis pointing towards the Sun
   E. the terrestrial planets consist of Mercury, Venus, Earth, and Mars

45. The meteorite impact that caused the extinction of the dinosaurs was the Chicxulub meteorite that hit the
   (1) ___________ about (2) ____________ years ago.
   A. (1) Arizona desert, USA (2) 49,000
   B. (1) Arizona desert, USA (2) 66 million
   C. (1) **Yucatan Peninsula, Mexico** (2) **66 million**
   D. (1) Yucatan Peninsula, Mexico (2) 49,000
   E. (1) Tunguska region, Siberia (2) 66 million

46. We see evidence for the Chicxulub impact event in a thin layer of sediment at the K-T boundary that is enriched in the element ___________, which is known to be common in meteorites.
   A. calcium
   B. nickel
   C. **iridium**
   D. uranium
   E. einsteinium

47. The most common type of meteorite:
   A. **stony**
   B. stony-iron
   C. iron
   D. carbonaceous chondrites
   E. all meteorite types are equally common

48. The largest meteorite impact crater, the largest volcano, and the largest rift valley in the solar system can all be found on:
   A. Mercury
   B. **Mars**
   C. Venus
   D. Europa
   E. Earth
49. Which of the following planetary bodies is NOT currently volcanically active?
   A. Earth
   B. Enceladus
   C. Venus
   D. Triton
   E. Io

50. The low-lying dark plains on the Moon are called **maria** and are made up of:
   A. anorthosite
   B. meteorites
   C. granite
   D. **basalt**
   E. peridotite

**BONUS QUESTIONS**

51. When glaciers spread out as they exit a mountainous area, they resemble alluvial fans but are called:
   A. continental glaciers
   B. valley glaciers
   C. **Piedmont glaciers**
   D. ice caps
   E. ice sheets

52. The type of lake that forms 100s of miles away from the edge of an ice sheet during an ice age is called a:
   A. **pluvial lake**
   B. proglacial lake
   C. pater noster lake
   D. finger lake
   E. kettle lake

53. The progression of development for high erosional remnants that stick up above desert areas is:
   A. spire – butte - mesa
   B. butte – mesa - spire
   C. mesa – spire - butte
   D. butte – spire - mesa
   E. **mesa – butte - spire**

54. Which of the following is equivalent to about half the wavelength of an ocean wave?
   A. wave height
   B. **wave base**
   C. wave period
   D. wave crest
   E. wave trough

55. Which of the following states is not one of the states that collectively contain 66% of all the **oil shales** on Earth?
   A. Montana
   B. Colorado
   C. Utah
   D. Wyoming
   E. none of the above