Dynamic Planet C - Dynamic Planet C - UT C - 03-27-2021

Welcome to Dynamic Planet at UT Regionals! You will have 50 minutes to take this test.

Per Texas Science Olympiad rules, you must have printed notes for this event. If you are communicating with your partner through a voice or video call, please start it before you begin the test itself.

Significant time spent outside of the browser window is grounds for a penalty or disqualification per TSO policies.

1. (1.00 pts) 1) What explains the difference between the heat of vaporization and the heat of fusion for water?

- A) The number of covalent bonds that need to be broken
- B) The number of hydrogen bonds that need to be broken
- C) The temperature difference is different between the two phases
- D) The entropy change between the two states of matter in each case
- E) None of these

2. (1.00 pts) Most representations exaggerate the difference between the continental slope and the continental shelf. Why is this misrepresentation so common?

- A) a. Because of the difference in crustal thickness between the continental shelf and the continental slope
- B) b. To emphasize the difference in composition of the seafloor sediments between the continental shelf and the continental slope
- C) c. Because the ocean is often several thousand kilometers wide, but only on average 4 kilometers deep, a significant vertical exaggeration is needed to make the difference clear
- D) d. The slope is meant to show an erosional surface
- E) None of these

3. (1.00 pts) What stops the oceans from drying up as a result of the transfer of water through the atmosphere?

- A) the net transfer of water vapor moves towards the oceans so the water lost is more than replenished
- B) despite the net loss in water vapor, the ocean gains the same water back from liquid water leaving the continents
- C) the ocean loses the exact same amount of water as it gains as a result of atmospheric water pressure
- D) the ocean loses a significant amount of water due to evaporation, but it gains this same amount back from precipitation
- E) none of the above

4. (1.00 pts) The oldest oceanic crust on earth can be found where?

- A) In deposits on land near locations of former subduction zones
- B) In the portion of the Pacific Ocean furthest from the East Pacific Rise
- C) In the portion of the Pacific Ocean closest to the East Pacific Rise
- D) In the Mediterranean Sea
- E) None of these

5. (1.00 pts) What is an advantage of making a water sampling bottle out of plastic instead of metal

- A) It allows for data collection at a deeper depth do to metallic thermal properties
- B) It eliminates the need for a messenger
- C) It allows for a lower contamination of the water sample that is being gathered
- D) There is no advantage, scientists as moving away from the use of plastic
- E) All but d are correct

6. (1.00 pts) Where are internal waves most likely to form?

- A) Near the bottom of the water column
- B) In areas of interference between intersecting wave trains
- C) Along the compensation depth
- D) Where there are enclosed bodies of water
- E) Near the surface around 100 m in depth
- F) Along the pycnocline

7. (1.00 pts) What is the result of the process of caballing?

- A) Overturned stratification of the ocean in a particular area
- B) A water mass with a lower oxygen content than all surrounding water masses
- C) A water mass with a lower salinity than the water mass it rests on top of
- D) A water mass less dense than the two that came together to form it
- E) A water mass denser than the two that came together to form it

8. (1.00 pts) What property is shared by tombolos, barrier islands, deltas, and tidal deltas?

- A) they all form as a direct result of tidal action
- B) They all form due to longshore currents
- C) They are all erosional features
- D) All of them are largely composed of sediment particles less than 2 mm in diameter
- E) They all form where rivers meet oceans

9. (1.00 pts) Which of the following is a mechanism that transfers energy from the equator to the poles?

- A) Ocean Surface currents
- B) The meridional overturning circulation
- C) Hurricanes
- D) the global wind system
- E) All of the above
- F) None of the above

10. (1.00 pts) Why is the meteorological equator not in the same location as the geographic equator?

- A) a. The world's oceans are not evenly distributed, with more water in the northern hemisphere than the southern, dragging the meteorological equator north
- B) b. The world's oceans are not evenly distributed, with more water in the southern hemisphere than the norther, dragging the meteorological equator north
- C) c. The world's oceans are not evenly distributed, with more water in the northern hemisphere than the southern, dragging the meteorological equator south
- D) d. The world's oceans are not evenly distributed, with more water in the southern hemisphere than the norther, dragging the meteorological equator south
- E) e. The thermal output of the midocean ridges is larger in the north than the south, dragging the meteorological equator north
- F) f. The thermal output of the midocean ridges is larger in the south than the north, dragging the meteorological equator north

11. (1.00 pts) Which of the following is NOT true about the vertical structure of the ocean?

- A) a. At the mid latitudes, the structure is heterogenous during the entire year, with the mixed layer changing thickness depending on the season
- B) the thickness of the surface layer depends on the latitude
- C) The are latitudes that lack distinct thermoclines during some portions of the year
- D) At a latitude near the equator, the temperature of the ocean around 2000 m is significantly warmer than the same depth near the latitude of Seattle, Washington
- E) Near the equator, there is very little seasonal variation in the thickness of the mixed layer

F) None of these

12. (1.00 pts) Which of the following is true about tsunamis?

A) The majority of underwater earthquakes cause tsunamis
B) Tsunami wave speed is the same in all portions of the deep ocean
C) The occurrence of tsunamis is generally evenly distributed between the world's oceans
D) The height of a tsunami is related only to the size of the earthquake or disturbance that triggered it
E) None of these

13. (1.00 pts) Which of the following is true regarding subpolar gyres?

A) They form around areas of low pressure
B) They rotate counterclockwise in the northern hemisphere
C) They contain a lower amount of biologic activity compared to the surrounding ocean in general
D) A and B above only
E) All of the above
F) None of the above

14. (1.00 pts) Where in the ocean would the tidal range during a spring tide be the same as the tidal range during a neap tide?

A) At the amphidromic points
B) In the centers of all gyres
C) Anywhere with mixed tides
D) At the antipodes
E) Nowhere

15. (1.00 pts) Which location is likely to be the least effected by an El Nino event?

A) The coast along the Gulf of Mexico
B) The northeastern coast of the United States
C) Southeastern Asia
D) Off the shore of Peru
E) All of these would be effected by El Nino

16. (1.00 pts) What process is responsible for the generation of a longshore current?

A) Wind blowing parallel to the coastline
B) Wind blowing perpendicular to the coastline
C) Wave motion and backwash
D) Deep ocean currents encountering the continent
E) None of these

17. (1.00 pts) If you drilled a core from the middle of an atoll, what would you find?

A) A layer of coral on top of a layer of salt
B) A layer of volcanic rock on top of a layer of coral
C) A layer of salt on top of a layer of coral
D) A layer of limestone on top of a layer of volcanic rock
E) Any of these would be possible, depending on the atoll

18. (1.00 pts) Which of the following is true about the elements in the ocean that can be described as scavenged elements?

- A) An example of a scavenged element is strontium
- B) They are often attached to the surfaces of particles, sinking quickly out of the water column
- C) These elements are more depleted in the deep water of the Indian and Pacific Ocean than in the deep water of the Atlantic Ocean
- D) B and C above
- E) All of the above
- F) None of the above

19. (1.00 pts) Which of the following elements is significantly more abundant in the continental crust than in the oceanic crust, influencing where it enters the ocean system?

- A) Iron
- B) Magnesium
- C) Calcium
- D) Potassium
- E) All of these occur in the same amounts in both crustal types

20. (1.00 pts) Which of the following does not match the device with the function of the device?

- A) Secchi disk - water clarity
- B) Radiometer- information regarding surface temperature
- C) Reversing thermometer - temperature at depth
- D) Salinometer - Salinity
- E) Echo sounder- speed of sound in the ocean

21. (1.00 pts) Which of the following is generally true about upwelling and downwelling in the ocean?

- A) Generally speaking, either in the large scale or the small scale, currents diverging from a central location leads to downwelling
- B) b. Generally speaking, either in the large scale or the small scale, currents diverging from a central location leads to upwelling
- C) c. Upwelling can bring more nutrient poor water to the surface along coastlines and in other locations that it occurs
- D) d. Downwelling can bring more nutrient poor water to the surface along coastlines and in other locations that it occurs
- E) There is little pattern to upwelling and downwelling in the ocean
- F) None of these

22. (1.00 pts) 22) The atmosphere gets a lot denser in the lowest portion of the atmosphere as a result of gravity. Why isn't this the case in the ocean?

- A) a. The ocean is thinner, so the deepest portions of the ocean don't experience the same gradient than the atmosphere
- B) b. The ocean is closer to the earth's core, changing the interaction with gravity
- C) c. The ocean is composed largely of water, which is largely incompressible limiting the degree to which density can increase, unlike air, which compresses readily
- D) d. The difference in density in the constituent parts of the atmosphere is more significant than in the ocean, increasing the stratification effect in the atmosphere but not the ocean
- E) None of these

23. (1.00 pts)
23) Because of the presence of the _____ near the equator, there is a near-constant band of clouds and precipitation that leads to the region within a few degrees of the equator to have more precipitation than evaporation, decreasing the salinity of the ocean there

- A) Trade winds
- B) Doldrums

C) Horse Latitudes
D) Farrell Cell
E) Hadley Cell
F) None of these

24. (1.00 pts) 24) If the direction of the Earth's rotation was reversed (so as to rotate at the same speed but in the opposite direction), the effect on surface currents would be:

A) a. Subtropical gyres would continue to rotate in the same direction, but the rotation of subpolar gyres would be reversed
B) b. The western boundary currents would be even stronger than they are now, with the eastern boundary currents becoming even wider and weaker
C) c. There would be intensification of the equatorial counter currents, but no influence on the eastern or western boundary currents
D) d. The western boundary currents would be significantly weakened, while the eastern boundary currents would be strengthened
E) All ocean currents would cease to operate in such a situation
F) The ocean currents would be unaffected in such a situation

25. (1.00 pts) 25) The chain of seamounts that makes up the Emperor Seamount chain was formed by:

A) a. A hot spot that is moving through the mantle under the Pacific plate
B) b. A series of hot spots that have formed under the Pacific plate over time
C) c. A hot spot that has remained in a fixed location while the Pacific plate moved over top of it
D) d. An oceanic-oceanic convergence zone that is no longer active, with only remnant volcanism occurring now
E) e. None of these

26. (1.00 pts)
the closest analog to a submarine fan on land is a(n) _____ where a river exits a mountain range and spreads out over the land, dropping sediments

A) Alluvial fan
B) discharge fan
C) land delta
D) subaerial fan
E) None of these

27. (1.00 pts) In which of the following locations would it be unlikely to have an atoll form in time if there was a hot spot that produced a chain of volcanic islands?

A) The Atlantic Ocean, near the Puerto Rico trench
B) The Pacific ocean, near the Tonga trench
C) The Southern Ocean, on the Scotia Plate
D) The Mediterranean Sea, near Italy
E) All of these would likely have atoll formation over time

28. (1.00 pts)
28) The ocean overturning circulation takes approximately _____ years, meaning that since the ocean formed, the ocean could have overturned approximately _____ times since its formation if it always overturned at the same rate.

A) a. 100, 3.8 X 10^7
B) b. 100, 4.5 X 10^7
C) c. 1000, 3.8 X 10^6
D) d. 1000, 4.5 X 10^6
E) e. 10000, 3.8 X 10^5
F) f. 10000, 4.5 X 10^5

29. (1.00 pts) Which of the following is the consequence of a passing tidal bore?

- A) An abrupt change from flood tide to slack water
- B) an abrupt increase in the water height
- C) An abrupt change from ebb tide to slack water
- D) An abrupt decrease in water height
- E) An abrupt change in tidal resonance
- F) None of these

30. (2.00 pts) Select all of the following features that are erosional features

(Mark **ALL** correct answers)

- [x] A) sea stacks
- [ ] B) tombolos
- [ ] C) Barrier islands
- [x] D) coastal terraces
- [ ] E) spits
- [ ] F) tidal deltas

31. (2.00 pts) 31) Which of the following is the correct action to take if you find yourself in a rip current?

- A) a. Swim toward shore as fast as you can, the current is too wide for you to swim out of
- B) b. Let the current carry you out to sea, then allow a secondary current to carry you back
- C) c. Swim parallel to shore, sine the rip current is generally not that wide, you will be able to escape the current hen swim to shore
- D) d. The way to deal with a rip current depends on where you are: in some cases, you swim parallel to shore, in some case you swim toward shore.
- E) None of these

32. (2.00 pts) Select all of the following that correctly match the feature with the portion of the ocean it would be found in

(Mark **ALL** correct answers)

- [ ] A) Manganese modules - continental shelf
- [x] B) Axial ridge - abyssal plain
- [ ] C) Fracture zone- continental slope
- [x] D) Submarine fans- continental rise
- [x] E) Submarine Canyon- continental shelf and continental slope
- [ ] F) shelf break- continental shelf

33. (1.00 pts) 33) When two oceanic plates collide, which of the following correctly describes what happens?

- A) a. The older, less dense plate subducts under the younger heavier plate
- B) b. The younger, less dense plate subducts under the older heavier plate
- C) c. The older, more dense plate subducts under the younger lighter plate
- D) d. The younger, more dense plate subducts under the older lighter plate
- E) e. Neither plate subducts, pushing up to create large mountains instead
- F) f. The plates both subduct creating a deep trench where they collided

34. (2.00 pts) 34) Select all of the following that can influence the height of ocean waves generated in deep water

(Mark **ALL** correct answers)

- [x] A) a. The wind speed that is generating the waves
- [ ] B) b. The direction of the wind generating the waves
- [ ] C) c. The temperature of the air above the generated waves
- [x] D) d. The duration the wind blows over the ocean
- [x] E) e. The fetch of the wind blowing over the ocean
- [ ] F) f. The salinity of the ocean where the waves are being generated

35. (2.00 pts) Select all of the following that are compounds in ocean water that do NOT follow the principle of constant proportions

(Mark **ALL** correct answers)

- [x] A) Strontium
- [x] B) Nitrate
- [ ] C) Sodium
- [ ] D) Potassium
- [x] E) Phosphate
- [ ] F) Sulfate

36. (2.00 pts) 36) Select all of the coasts that would be described as emergent

(Mark **ALL** correct answers)

- [ ] A) a. A coast that is experiencing the effect of melting glaciers around the world
- [x] B) b. A coast that is experiencing the effect of post-glacial rebound
- [x] C) c. A coast that is experiencing the effect of tectonic uplift
- [ ] D) d. A coast that is experiencing the effect of adjustment of the coastline from increased compaction from flood control efforts reducing sediment deposition along the coast
- [ ] E) e. A coast that is experiencing the effect of thermal expansion of water as a result of an increase in global temperature

37. (2.00 pts) 37) Which of the following is true of longshore transport (select all)?

(Mark **ALL** correct answers)

- [ ] A) a. It carries sediment and water perpendicular to the shore
- [ ] B) b. It carries only water parallel to the shore
- [x] C) c. It carries sediment and water parallel to the shore
- [x] D) d. It can affect the shape and location of \barrier islands
- [x] E) e. It can be disturbed by groins and jetties
- [ ] F) None of these

38. (1.00 pts) The occurrence of which of the following elements in the ocean is generally associated with the deposition of dust from wind blown sediments?

A) Magnesium
B) Potassium
C) aluminum
D) Silicon
E) Manganese
F) None of these

39. (1.00 pts) Which of the following is most likely to have a reverse estuary?

A) An arid area
B) A polar region
C) A mid-latitude region along a passive margin
D) A mid-latitude region along an active margin
E) Along the equator
F) None of these are more likely to have a reverse estuary than the others

40. (2.00 pts) 40) Select all of the following that are true about the tidal waves

(Mark **ALL** correct answers)
A) a. The particles move in paths such that they move further horizontally than vertically
B) b. The wave motion does not extend all the way to the bottom of the ocean
C) c. Tidal waves can have their direction influenced by the Coriolis effect
D) d. The tidal crest rotates clockwise around the ocean basin in the southern hemisphere
E) e. Tidal crests do not move around ocean basins in any systematic manner

41. (1.00 pts) For each _____ meters deep in the ocean one goes, the pressure increases by the equivalent of 1 atmosphere

A) 5
B) 10
C) 15
D) 18
E) 20
F) 25

42. (1.00 pts) Because of the Coriolis effect, there is a slight _____ in the center of subtropical gyres, leading to _____

A) Pile up of water, upwelling
B) Deficit of water, downwelling
C) Pile up of water, downwelling
D) Deficit of water, upwelling
E) Increase in velocity, whirlpools
F) Increase in velocity, eddies

43. (1.00 pts) Which of the following water masses is the most saline?

A) the North Atlantic Deep Water
B) The Antarctic Bottom Water
C) The Antarctic Intermediate Water

D) the South Atlantic Surface Water

E) The Mediterranean Intermediate Water

F) All of these have the same salinity

44. (1.00 pts) the heat being introduced to the ocean along a mid-ocean ridges and other sources of volcanism is derived from:

A) The Sun

B) Heat generated by asteroid impacts

C) Heat generated by fusion of light elements in earth's core

D) Heat generated by fission of radioactive elements throughout Earth's interior

E) A combination of the above

F) None of the above

45. (1.00 pts) Ocean basins open, grow, shrink, and close in a cyclic process referred to as:

A) The Wilson Cycle

B) The Supercontinent Cycle

C) Continental Drift

D) The Theory of Uniformitarianism

E) The Accretion Cycle

F) None of these

46. (1.00 pts) Because deep ocean wave speeds are dependent on wavelength, deep water waves will sort themselves by wavelength, in a process generally referred to as:

A) Succession

B) Precession

C) Dispersion

D) Wave training

E) Dissociation

F) None of these

47. (1.00 pts) The _____ is an effect that can influence regional sea level in the Atlantic through the reverse barometer effect

A) South Atlantic Oscillation

B) North Atlantic Oscillation

C) Central Atlantic Oscillation

D) Eastern Atlantic Oscillation

E) Western Atlantic Oscillation

F) None of these

48. (2.00 pts) The ocean currents carry a large amount of water)and therefore energy) throughout the ocean system, so why aren't ocean currents used as a source of energy?

(Mark **ALL** correct answers)

A) They move too slow for them to be efficiently harnessed

B) they occur over too broad an area to be of use

C) The energy that could be generated from the ocean currents with our current technology is worth less than it would cost to capture it

D) the currents are unreliable and don't flow all the time

E) The main surface currents are too far offshore to be useful

49. (2.00 pts) Which of the following is NOT a feature of a primary coast?

(Mark **ALL** correct answers)

- [x] A) Deposits of limestone from ocean evaporation
- [ ] B) Sand dunes deposited from winds along the coast
- [ ] C) Sand produced by erosion of lava flows from a terrestrial volcano
- [x] D) Sediment that has been highly transported by a longshore current and then redeposited
- [ ] E) A river dominated delta

50. (1.00 pts) 50) The polar regions tend to have a higher concentration of dissolved oxygen in their surface water because:

- ○ A) a. There is a higher amount of biological activity producing oxygen through photosynthesis in those regions compared to the other portions of the ocean
- ○ B) b. The atmosphere over the poles has a higher concentration of oxygen than in the atmosphere over the equator and mid-latitudes
- ○ C) c. There is less biologic activity in the polar regions, so less oxygen gets used up by cellular respiration
- ○ D) d. The higher wave action in the area leads to more bubble injection
- ◉ E) e. Gases dissolve more readily into colder water compared to warmer waters
- ○ F) f. None of these

51. (3.00 pts) 51) Erosion generally works to make coastlines _____ as a result of concentration of erosion on _____ and away from _____.

straighter | headlands | bays

52. (1.00 pts) 52) The deepest places in all the oceans except the _____ Ocean are formed along convergent plate boundaries

Arctic

53. (1.00 pts) 53) _____ can result in the formation of rogue waves, waves that are significantly higher than the average wave height

Constructive Interference

54. (1.00 pts)
54) The _____ Ocean has the most well-studied water mass structure of all the oceans because of the easy differentiation between the various water masses and the shape of the basin.

Atlantic

55. (1.00 pts)
55) The _____ of a chemical in the ocean that is a conservative element is typically much, much greater than the time it takes the ocean to turnover

residence time

56. (1.00 pts)
56) The nature of slip during _____ along transform faults near mid-ocean ridges provided important confirmation of some elements of the theory of plate tectonics

earthquakes

57. (1.00 pts)
_____ can be used to measure the depth of the ocean by pulsing the ocean with compressive waves and measuring the travel time for the wave to travel from the surface, to the seafloor and back.

echo sounder

58. (1.00 pts)
58) The theory of _____ was an important precursor to the modern theory of plate tectonics which was confirmed after measurements of magnetic reversals along the mid-ocean ridges

seafloor spreading

59. (1.00 pts) 59) If the dominant movement of water is toward the shore, there will be overall _____ along the coast

downwelling

60. (2.00 pts) 60) The _____ in the South Atlantic is a warm current, serving the same function in the gyre as the _____ in the North Atlantic.

Brazil Current | Gulf Stream

61. (1.00 pts) _____ reefs are separated from the island they surround by a shallow lagoon

barrier

62. (1.00 pts) 62) The Chlorinity of a sample is 20 ppt. This means that the salinity of the sample is _____ ppt, rounded to one decimal place.

36.1

63. (1.00 pts) 63) The continental shelf, continental slope and continental rise are all underlain by _____ crust.

continental

64. (3.00 pts)
64) There are cyclic variations in the arrangement of tidal bulges that are related to the angle between the _____ at zenith and the Earth's equator (which takes 18.6 years to cycle). In Equilibrium tidal theory, if they Moon and Sun are both directly overhead of the equator, the entire planet would experience _____ tides, with tidal range decreasing with _____ latitude.

Moon | diurnal | increasing

65. (1.00 pts)
65) The three-layer structure is fundamentally _____, with forces of gravity and buoyancy returning the system to its current arrangement when it is disturbed

stable

66. (1.00 pts) 66) The tide generating forces used in equilibrium tidal theory and dynamic tidal theory are different, leading to the difference in their predictions of tidal behaviors

○ True ◉ False

67. (1.00 pts) The oceans store a large volume of carbon dioxide and this storage will remain unaffected as the temperature increases as a result of global climate change

○ True ◉ False

68. (1.00 pts) 68) Tsunami generation is evenly distributed throughout the ocean basins

○ True ◉ False

69. (1.00 pts) 69) The variation in spreading rate along mid-ocean ridges can strongly influence the kind of topography they develop

◉ True ○ False

70. (1.00 pts) 70) Satellite imaging can be used to view the bottom of the ocean directly

○ True ◉ False

71. (1.00 pts) 71) Satellite imaging can be used to gain useful information about the bottom of the ocean

◉ True ○ False

72. (1.00 pts) 72) Rip currents are formed where two currents come together and are forced to flow out to sea

◉ True ○ False

73. (1.00 pts) 73) Unlike the Mediterranean water in the Atlantic, there is no noticeable water mass that can be traced to the Red Sea in the Indian Ocean

○ True ◉ False

74. (1.00 pts)
74) Because the speed of sound in the ocean varies within the ocean, there is a minimum velocity zone, in which sound waves can get stuck and travel for thousands of kilometers

◉ True ○ False

75. (1.00 pts) 75) The pH of the ocean increases with depth, leading to the CCD occurring at (on average) about 4.5 km depth

○ True ◉ False

76. (1.00 pts) 76) Collapses along the continental slope having been linked to the occurrence of tsunamis

◉ True ○ False

77. (1.00 pts) 77) A tidal delta is another term for a tide-dominated delta

○ True ◉ False

78. (1.00 pts) 78) Human activities have little to no influence on the shape of our coastlines

○ True ◉ False

79. (1.00 pts) 79) Waves break randomly as they approach shore, with no relationship existing to predict the behavior of waves approaching the shore

○ True ◉ False

80. (1.00 pts) 80) The principle of the continuity of flow says that since the volume of the ocean is roughly the same at all times, there must be ocean currents in the ocean

○ True ◉ False

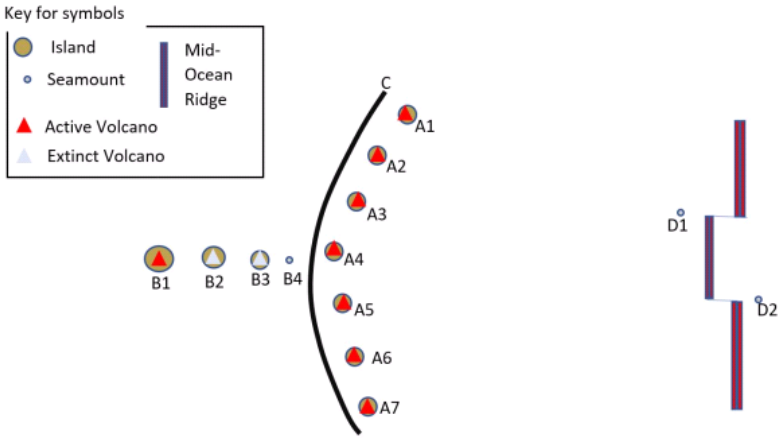
81. (10.00 pts)

81) Based on the following diagram, answer the following questions:

a. Where is there most likely a hotspot? How did you come to this conclusion?

b. What feature or features is/are likely found along line C? Why do you think this?

c. You are making assumptions based on limited information. Provide four pieces of information that could be gathered by a scientific study that would help verify your conclusions



Expected Answer: a. at island B1, based on the arrangement of the islands from one with an active volcano to ones with extinct volcanoes to a seamount b. A trench. The arrangement of islands in group A appears to be an island arc, indicating that one the other side there should be a trench along the subducting plate c. Multiple answers, including: Ages of Islands in group A, Ages of Islands in group B, earthquake locations, bathymetric maps, GPS motion information from islands in group B, etc.

Congratulations on taking this test! Wishing you the best of luck on your future tests! If you have any feedback about any of the exams at this tournament, please let us know through this form: https://tinyurl.com/utreg21feedback (https://tinyurl.com/utreg21feedback)