

# mtlin11's and kman1234t's Dynamic Planet Test

## Dynamic Planet Division C 2020: Oceanography



Name(s): \_\_\_\_\_

School: \_\_\_\_\_ Team #: \_\_\_\_\_

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Score: \_\_\_\_ / 200

## Rules and Misc.

1. Turn off all cell phones and smart devices and submit them to the proctor for the duration of the test
2. Each team may bring: one 2 inch binder, and 2 calculators of any type.
  - a. A binder is measured by the interior of the rings, and all sheets **MUST** be attached by all three rings of the binder. If the binder is in violation of this, the team may be disqualified, to the proctor's discretion
  - b. No papers may be removed from the binder at any point during this test.
3. This test can be separated at the proctors discretion.
4. A bonus point: what is the title of the picture on the front? Write in the space below, under the breakdown.  
For a secondary point, what is the mountain featured?
5. Write legibly. Illegible or cryptic answers will be discarded.
6. When time is up, then the time is up.
7. Tiebreakers are identified with a (\*) on the exam. They also count towards the overall score.
8. There is no guessing penalty.
9. Moking, inappropriate, and/or nonsensical answers will result in a penalty.
10. Do not worry if you do not finish. The test-maker apologises for any and all wrong answers and bad questions.

**GOOD LUCK!**

# Multiple Choice Section (35 points)

Some questions have multiple answers. Choose the best answers.

## General Knowledge and Oceanography

1. What is oceanography?
  - a. The graphing of oceans
  - b. A branch of science which studies the physical and biological properties of the oceans.
  - c. The study of transport across oceans
  - d. The worst event in Science Olympiad
2. What is a beach?
  - a. The part of the coast below the low water line, which is constantly submerged
  - b. a deposition landform in which an island is attached to the mainland by a narrow piece of land
  - c. Sediment seaward of the coastline through the surf zone
  - d. A rocky outcropping detached from the shoreline
3. What is coral?
  - a. A group of anthozoans that exist as individuals or in colonies
  - b. A type of rock that is deposited on islands and shipwrecks.
  - c. A plant that grows in crevices and builds up rings, like a tree
  - d. a marine mollusk that has an oval flattened body with a shell of overlapping plates.
4. What is a guyot?
  - a. The eroded center of an atoll
  - b. A flat topped seamount
  - c. A tablemount
  - d. A seamount which has yet to surface
5. What is a neap tide?
  - a. a tide just after a new or full moon, when there is the greatest difference between high and low water.
  - b. a tide just after the first or third quarters of the moon when there is least difference between high and low water.
  - c. The difference itself between high and low water
  - d. None of the above
6. What are the three main clines?
  - a. Hadalcline
  - b. Halocline
  - c. Thermocline
  - d. Pycnocline
  - e. None of the above are one of the main clines.
7. What is the correct order, from deepest to shallowest?
  - a. Bathypelagic, Hadopelagic, Mesopelagic, Epipelagic, Abyssopelagic
  - b. Abyssopelagic, Hadopelagic, Bathypelagic, Mesopelagic, Epipelagic
  - c. Hadopelagic, Abyssopelagic, Bathypelagic, Mesopelagic, Epipelagic.
  - d. Epipelagic, Bathypelagic, Mesopelagic, Hadopelagic, Abyssopelagic
  - e. None of the above are in the correct order.
8. What are the 2 major sources of salt in the ocean?

- a. Animal Waste
  - b. Land erosion
  - c. Volcanic activity
  - d. Cosmogenous sources
9. What type of magma is the seafloor formed from?
- a. Rhyolitic
  - b. Basaltic
  - c. Andesitic
  - d. None of the above
10. What kind of environment does coral prefer?
- a. Dark, turbid seas
  - b. Highly saline seas
  - c. Clear, warm seas.
  - d. None of the above
11. Compared to continental lithosphere, oceanic lithosphere is:
- a. Thinner and less dense
  - b. Thinner and denser
  - c. Thicker and denser
  - d. Thicker and less dense
12. The oldest large scale oceanic crust is how old?
- a. 400 my
  - b. 200 my
  - c. 100 my
  - d. 50 my
  - e. Even younger
13. How did the horse latitudes get their name?
- a. From the horses that were thrown overboard
  - b. It was a misspelling; sailors used to get sick and become *hoarse* in these latitudes
  - c. Horses were discovered in these latitudes
  - d. There is no such thing as the "horse latitudes".
14. What is the barycenter?
- a. The apex of the orbits on the Earth-Moon System
  - b. The center of rotation in the Earth-Moon system
  - c. The center of the tides on Earth
  - d. The center of a hurricane or another barometric system
15. What is the accumulation rate of red clay?
- a. 0.1 - 0.5 cm/1000 years
  - b. 0.1 - 0.5 cm/100 years
  - c. 0.1 - 0.5 cm/year
  - d. None of the above
16. What are some sources of food or energy in the abyssal depths?
- a. Whale fall
  - b. Marine snow

- c. Hydrothermal vents
- d. Solar energy/light
- e. The rock itself

17. Sea walls:

- a. Have no effect on erosion
- b. Decrease erosion
- c. Increase erosion

18. Marquet's Principle states that:

- a. The ratio of ions in seawater to each other is nearly the same, no matter what
- b. The residence times of all ions is always the same
- c. The overall salinity of the ocean will remain the same, no matter what
- d. The carbonate supply is always greater than the amount of dissolution

19. If you wanted to trace oceanic processes, which of the following ions or compounds would be best suited for your task?

- a.  $\text{CaCO}_3$  (Calcium Carbonate)
- b.  $\text{K}^+$  (Potassium)
- c.  $\text{F}^-$  (Fluorine)
- d.  $\text{Na}^+$  (Sodium)

20. Oceanic to Oceanic convergence causes:

- a. Shallow focus earthquakes
- b. Deep focus earthquakes
- c. Plate suturing
- d. High levels of volcanism

21. Ocean waves are classified as:

- a. Longitudinal waves
- b. Transverse Waves
- c. Orbital Waves
- d. Rotational Waves
- e. Medial Waves

22. At the poles, the thermocline is

- a. More or less vertical / nonexistent
- b. Extremely shallow
- c. Moderately steep
- d. None of the above

### **Scientists and Important People**

23. Who first observed the Gulf Stream?

- a. Ponce De Leon
- b. Benjamin Franklin
- c. Ferdinand Magellan
- d. Jacques Costeau

24. Who came up with the idea of Continental Drift?

- a. Alfred Wegener
- b. Harry Hess

- c. Harold Jeffries
  - d. J. Walter Gregory
25. Who discovered the concept of Seafloor Spreading?
- a. Louis Agassiz
  - b. Harry Hess
  - c. Robert Dietz
  - d. Alfred Wegener
26. Who has gone to the bottom of the Mariana Trench? (\*)
- a. Don Walsh
  - b. James Cameron
  - c. Jacques Costeau
  - d. Jacques Piccard
  - e. Robert Mallard
  - f. None of the above
27. Who first described the concept of atoll formation?
- a. James Hutton
  - b. Nicholas Steno
  - c. Benjamin Franklin
  - d. Charles Darwin
28. Who found the Titanic? (\*)
- a. James Cameron
  - b. David Mearns
  - c. Dr Robert Ballard
  - d. Clive Cussler
29. Who was the first scientist to analyse ocean water?
- a. Antoine Lavoisier
  - b. Joseph Gay-Lussac
  - c. Louis Marsilli
  - d. William Dittmar
30. Who is known as the “Father of Modern Oceanography”?
- a. John Dalton
  - b. Aristotle
  - c. Matthew Maury
  - d. Andreas Rechnitzer

### **Tools**

31. What is a Nansen Bottle?
- a. A water sampler for approximate depths in the column. Requires end over end movement.
  - b. A water sampler for approximate depths in the column. Does not require end over end movement.
  - c. A water sampler designed for use in shallow water
  - d. This instrument does not exist.
32. What is a Niskin Bottle?
- a. A water sampler for approximate depths in the column. Requires end over end movement.
  - b. A water sampler for approximate depths in the column. Does not require end over end movement.

- c. A water sampler designed for use in shallow water
- d. This instrument does not exist.

33. What is a Niskin Grab?

- a. A sediment sampler that preserves strata
- b. A sediment sampler for hard bottoms
- c. A sediment sampler for unstratified sediments
- d. This instrument does not exist.

34. What is an Ekman Grab?

- a. A sediment sampler for soft bottoms
- b. A sediment sampler for hard bottoms
- c. Captures sediment, but with much disturbance
- d. This instrument does not exist.

35. What is a gravity - assisted corer?

- a. A sediment corer that uses gravity to bring it to the bottom and collect sediment
- b. A corer that uses gravity to suck up sediments from the bottom
- c. A corer that uses gravity ONLY to bring it to the bottom.
- d. This instrument does not exist.

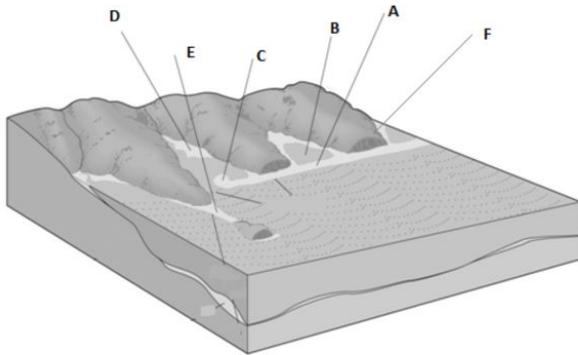
# Fill in the Blank Section (58 points)

Each question's answer is only a few words or less, other than abbreviations.

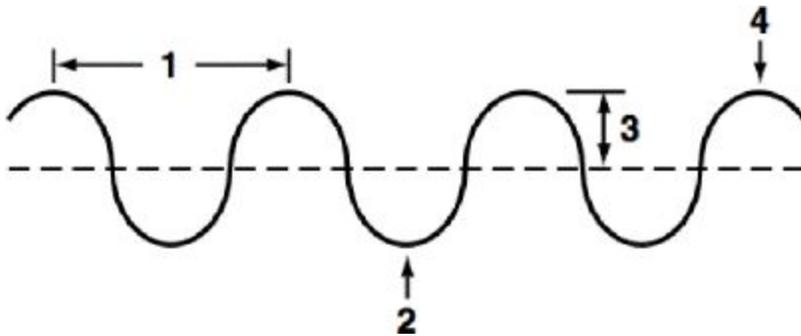
**KISS; keep it simple, stupid**

**LABELLING (each one of these labels is worth 1 point, cause it's easy) (14 total)**

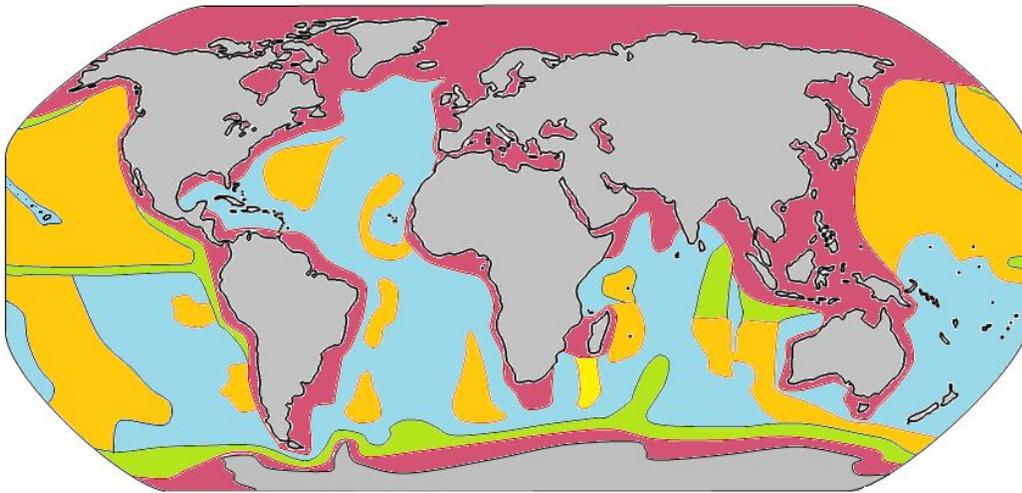
Label the following. Write your answer in the corresponding blank on your answer sheet.



1.



2.



3.

a. Red is 1, Yellow is 2, Green is 3, Blue is 4

**Proper Fill in the Blank: (each worth 2 points) (40 tot)**

4. What does CTD stand for?
5. Does upwelling increase or decrease biologic production?
6. What is the single most common ion in seawater?
7. What is the quantity of those ions dissolved in the ocean by unit mass? Hint, in parts per thousand.
8. Subsidence will cause which, relative sea level RISE or FALL?

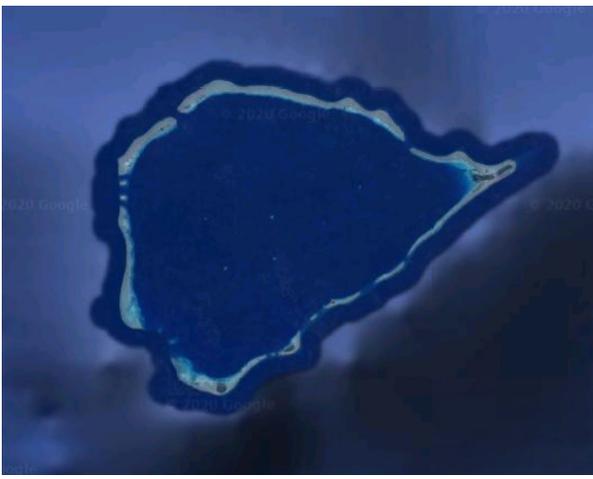
9. What about uplift? RISE or FALL?
10. Is the rock that forms the seafloor felsic, mafic or ultramafic? (\*)
11. Ocean waves can be depicted in the shape of a \_\_\_\_\_ wave.
12. Below a depth of  $1/___$  of the wavelength, the wave energy has no effect on water. (Integer 1-20)
13. Which grows faster, mid-ocean ridges or rises?
14. A \_\_\_\_\_ is a standing wave in a lake or enclosed body of water.
15. ENSO stands for \_\_\_\_\_.

**For the following questions, name the correct term for the given definition.**

16. A narrow, flat area at the base of a sea cliff
17. The leading edge of the tide forms a wave of water that travels up a river or narrow body of water.
18. The measurement of the ocean's depth, or the oceanographic equivalent of topography.
19. The eastern boundary current of the South Atlantic Tropical Gyre.
20. Biogenous sediment on the deep ocean floor made up of in part by  $\text{CaCO}_3$ .
21. A type of hydrogenous sediment, they are rock concretions containing concentric layers of iron and manganese around a core.
22. A partially enclosed body of brackish water with a connection to both open sea and a source of freshwater.
23. Geologic deposit of a turbidity current.
24. Primary reason for man-caused increased salinity in the ocean.
25. The term for the fact that the increase in salinity of water lowers its freezing point.
26. The average pH of surface ocean waters.
27. List of the top 4 ions in ocean water by weight.

## Free Response Section ( 107 points)

1. Draw the halocline, thermocline, and pycnocline at the equator. Label all parts and graphs.(3)
2. What is a chemocline? Provide an example, and its impact. (2)
3. What was the old definition of chlorinity? What is the current definition? Why did they change it? (3)
4. What is the SOFAR channel? Describe how it works and its importance. (4)
5. The CCD: (10)
  - a. Describe the CCD, and why it exists. What does it stand for? (3)
  - b. Why is the CCD deeper in the Atlantic? Be sure to mention the lysocline. (4)
  - c. What is the difference between the CCD and the ACD? (1)
  - d. What ramifications does this have for the fossil record? (2) (\*)
6. How do the controls on silica deposition differ from carbonate deposition? (2)
7. Describe and illustrate the stages of reef formation. (2)
8. What is the OMZ? What depth does it occur at? What impact might this have on life in the area? (4)
9. How can we reconstruct plate movement using marine sediments? (4)
10. What is geostrophic balance? How does it affect ocean gyres? (2)
11. What is the Ekman Spiral? At what depth does it have negligible effects? How does it work? (3)
12. What causes upwelling along the equator? How is this important for Peru? (3)
13. Describe the concept of residence time. What does this have to do with Marquet's Principle? (3)
14. Where is one most likely to find downwelling? For what reason? (4)
15. Illustrate and label the Wilson Cycle. (3)



16. Reefs: (4)

- a. What kind of reef is depicted above? (1)
- b. How do you know? (1)
- c. What are 2 hallmarks of this kind of reef? (2)

**TOOLS**

17. What is a secchi disk? What purpose does it serve? (2)

18. Name and describe the tools depicted below. What use are they for?

- a. 1 point for identification, one point for each explanation correct. 10 total.



i.



ii.



iii.



iv.



v.

19. If one had to sample a gravelly bottom, which sampler might one choose, and why? Explain why this, compared to the others, is the best one. (5)

- a. Choose between a Van Veen grab, Ekman Grab, and a bottom dredge.

**Math:**

**Give all answers to three significant figures. Give units in each question, otherwise they will be completely wrong. Your work and the general formula are all worth points.**

20. A simple math problem. You are using SONAR. Assume that the depth of the water has no effect on speed, and assume the speed is the same as it is in surface waters. If you send a pulse, and it takes 0.433 seconds to return, how far away is the object it reflects off of? (3) Use a speed of sound in water of  $1.50 \times 10^3$  m/s.
21. What is the celerity of a wave with a wavelength of 20.55 meters, and a depth of 5.651 meters? (4)
22. What is the speed of sound in seawater at 25 degrees C, 35 ppt salinity, and a depth of 1000 meters? (5)
23. A 2.00 km deep ocean basin is filled to sea level by sediments over a long period of time. Assuming isostatic equilibrium is maintained, how deep will the sediments be? Use these densities: water (1.00), sediment (2.40), asthenosphere (3.20). All units are in  $\text{g/cm}^3$ . (5)

**Climate:**

24. The ocean is the single most important body on this planet in regards to weather and climate. How did the Antarctic Circumpolar Current form and how does it play an important role in regulating the Earth's climate and keeping it at the state it is now? Be as detailed as possible in your answer. (4 points)
25. Global warming is pretty depressing. The gulf stream is very important to humans in Europe for one major reason. What is that? What will happen to the gulf stream and Europe if global warming gets worse? (5 points)
25. Explain how sea ice forms. Be as detailed as possible. What is the salinity of sea ice when it is newly formed? Why? After a year or so? Why? (8 points)