

# Dynamic Planet B

## SSSS 2019-2020

Created by anandymous

You will have 50 minutes to complete this 45 question test.

There are 3 parts to this test.

- Part 1: Multiple Choice (20 questions worth 1 point each)
- Part 2: Short Answer (20 questions worth 2 points each)
- Part 3: Essay Questions (5 Questions worth 5 points each)

Partial credit will be given in Parts 2 and 3, but **NOT** in Part 1.

Team Name and Number: \_\_\_\_\_

Team Members: \_\_\_\_\_

Score (out of 85) : \_\_\_\_\_



## Part 1 (Multiple Choice)

1. Who proposed the theory of continental drift?
  - A. Arthur Holmes
  - B. John Tuzo Wilson
  - C. Harry Hess
  - D. Alfred Wegener
2. Who proposed the theory of seafloor spreading?
  - A. Arthur Holmes
  - B. John Tuzo Wilson
  - C. Harry Hess
  - D. Alfred Wegener
3. How many types of plate boundaries are there?
  - A. 2
  - B. 3
  - C. 4
  - D. 1
4. What are active continental margins separated by?
  - A. A mid-ocean ridge
  - B. A subduction zone
  - C. A mountain range
  - D. A fault
5. What type of seismic wave do ocean waves most closely resemble?
  - A. Rayleigh Waves
  - B. Love Waves
  - C. P-Waves
  - D. S-Waves
6. What is the formula for frequency in a wave?
  - A.  $1/\text{Period}$
  - B.  $\text{Wavelength}/\text{Wave Velocity}$
  - C.  $\text{Wavelength}/\text{Period}$
  - D.  $\text{Period}/\text{Wavelength}$

7. What is the SI unit for frequency?
- A. Meters
  - B. Seconds
  - C. Hertz
  - D. Cycles per Second
8. What is the formula for wave velocity in a wave?
- A. Wavelength/Period
  - B. Frequency\*Wavelength
  - C. Wavelength/Frequency
  - D. Period\*Wavelength
9. What is the SI unit for wave velocity?
- A. Cycles per Second
  - B. Kilometers per Hour
  - C. Miles per Hour
  - D. Meters per Second
10. What causes ocean waves to break?
- A. They spin too fast because of the Coriolis effect
  - B. The top moves faster than the bottom due to the ocean floor rising
  - C. The top has less pressure on it so allows the bottom to replace its water
  - D. The bottom has more pressure so the top breaks to get to the bottom
11. How many types of daily lunar tides are there?
- A. 3
  - B. 2
  - C. 5
  - D. 4
12. Where is the Coriolis effect strongest?
- A. 60 degrees south
  - B. The poles
  - C. The equator
  - D. 30 degrees north

13. How many major ocean gyres are there?
- A. 4
  - B. 6
  - C. 3
  - D. 5
14. What do ocean gyres frequently collect?
- A. Garbage
  - B. Wind
  - C. Sand
  - D. Mud
15. When the wind is travelling north, on which of these coasts does upwelling occur?
- A. The west coast of Australia
  - B. The east coast of England
  - C. The west coast of the United States
  - D. The west coast of Chile
16. When the wind is travelling north, on which of these coasts does downwelling occur?
- A. The east coast of Fiji
  - B. The west coast of Mexico
  - C. The west coast of South Africa
  - D. The east coast of Mozambique
17. By how much did the Gulf Stream's net flow decrease from 1957 to 2005?
- A. 35%
  - B. 20%
  - C. 25%
  - D. 30%
18. What is the most common ion in the ocean?
- A. Sulfate
  - B. Sodium
  - C. Chloride
  - D. Magnesium

19. Which of the following is the least common ion in the ocean (of the 4 listed)?

- A. Sulfate
- B. Magnesium
- C. Fluoride
- D. Calcium

20. If the buoyant force of an object is 980 Newtons what is the mass of the fluid that it is displacing?

- A. 1000 kilograms
- B. 100000 grams
- C. 100 pounds
- D. 100 grams

## Part 2 (Short Answer)

1. What is the pycnocline?

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2. What is the halocline?

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3. What is the thermocline?

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4. How does the thermocline affect hurricane formation?

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5. What does SONAR stand for?

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6. What is bathymetry?

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7. How does a seamount become a guyot?

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8. What does ADCP stand for?

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9. What is the only current not affected by continental deflection?

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10. Why has the Gulf Stream's net flow been decreasing (theory)?

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11. Why are gyres non-existent at the equator?

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12. What causes the phenomenon of Ekman Transport? How?

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13. What is the difference between diurnal tides and semidiurnal tides?

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14. What causes mixed tides?

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15. Why are there 2 high tides on Earth at the same time?

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16. Why does an El Niño make farming and fishing conditions worse in South America?

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17. What are coral reefs made of (a mineral)? Why?

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18. What can be inferred when an atoll is noticed?

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19. Over which type of crust would a hotspot most likely occur? Why?

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20. How did the fact that the Earth switches magnetic polarity affect the theory of seafloor spreading? Why?

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## Part 3 (Essay Questions)

1. Explain how the salinity of ocean water relates to its density and pH.

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2. Explain how thermohaline circulation works.

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3. Explain both ways in which upwelling occurs.

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4. Explain the formations of and interactions between longshore currents and rip currents?

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5. Explain how to find amplitude, wavelength, period, frequency, and velocity of a wave when given its graph where the x-axis is distance.

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If you have any questions about the test e-mail me at  
[jaithranag@yahoo.com](mailto:jaithranag@yahoo.com)

## Part 1 (Answer Key)

1. D (Alfred Wegener)
2. C (Harry Hess)
3. B (3)
4. B (A subduction zone)
5. A (Rayleigh Waves)
6. A (1/Period)
7. C (Hertz)
8. B (Frequency\*Wavelength)
9. D (Meters per Second)
10. B (The top moves faster than the bottom due to the ocean floor rising)
11. A (3)
12. B (The poles)
13. D (5)
14. A (Garbage)
15. C (The west coast of the United States)
16. C (The west coast of South Africa)
17. D (30%)
18. C (Chloride)
19. A (Sulfate)
20. B (100000 grams)

## Part 2 (Answer Key)

1. The pycnocline is the part of the ocean in which density rapidly increases with depth. **Writing density in relation to the ocean and writing that density rapidly increases are both worth 1 point.**
2. The halocline is the part of the ocean in which salinity rapidly decreases with depth. **Writing salinity in relation to the ocean and writing that salinity rapidly decreases are both worth 1 point.**

3. The thermocline is the part of the ocean in which temperature rapidly decreases with depth. **Writing temperature in relation to the ocean and writing that temperature rapidly decreases are both worth 1 point.**
4. The thermocline affects hurricane formation by extending its fuel supply; a comparatively steep small thermocline benefits the hurricane less, while a comparatively gentle large thermocline benefits the hurricane more. **Writing how the thermocline affects hurricane formation (1 point) and 1 of the 2 examples (1 point) give the test taker 2 points.**
5. SONAR stands for Sound Navigation and Ranging. **Writing "Sound Navigation and Ranging" gives the test taker 2 points.**
6. Bathymetry is the study of the floor of bodies of water. **Writing something similar to the study of the floor of bodies of water gives 2 points, if ocean instead of body of water is written give only 1 point.**
7. A seamount becomes a guyot when it rises above the sea level, because of this waves erode the part above sea level the seamount has a flat top below sea level and is therefore a guyot. **It must be stated that the seamount rises above the sea level (1 point) and that waves erode the seamount (1 point) to get 2 points.**
8. ADCP stands for Acoustic Doppler Current Profiler. **Writing "Acoustic Doppler Current Profiler" gives the test taker 2 points.**
9. The only current not affected by continental deflection is the Antarctic Circumpolar Current. **Writing "Antarctic Circumpolar Current" gives the test taker 2 points.**
10. The Gulf Stream's net flow has been decreasing because of higher water temperatures at the northern latitudes due to global warming, this decreases the amount of warmer water needed to heat up the cooler water and thus decreases the Gulf Stream's net flow. **Higher temperatures at the northern latitudes (1 point) and less water is needed to heat up cool water (1 point) must be stated for 2 points.**
11. Gyres are non-existent at the equator because the Coriolis force is 0 at the equator, which means ocean water moves in the same direction as the wind. **Must write that the Coriolis force is 0 or that the Coriolis effect is minimal at the equator for 2 points.**

12. The phenomenon of Ekman transport is caused by the Coriolis effect, which makes surface water move 45 degrees right (compared to the wind) in the Northern Hemisphere and 45 degrees left in the Southern Hemisphere deeper water then rises to replace the water that left, this water is affected more by the Coriolis force and less by the wind, so it moves more right, this continues to make the net flow of the water go 90 degrees right/left. Summaries are accepted for full points. **Must write that the Coriolis effect moves surface water 45 degrees (1 point) and that deeper water is more affected by the Coriolis effect to make the net flow of the water 90 degrees (1 point) to earn 2 points.**

13. The difference between diurnal and semidiurnal tides is that there is 1 high tide and 1 low tide in diurnal tides, as opposed to 2 of each in semidiurnal tides. **Must explain what semidiurnal tides (1 point) and what diurnal tides (1 point) are for 2 points.**

14. Mixed tides are caused by shores that are theoretically supposed to have both diurnal and semidiurnal tides. **Must state that there is supposed to be diurnal and semidiurnal tides for 2 points. Saying multiple tides is 1 point.**

15. There are 2 high tides on Earth at the same time because the Moon pulls water on 1 side of the Earth (1st tide) while also pulling the Earth itself, but pulling the water on the other side of the Earth less than Earth itself (2nd tide). **Must write that the Moon pulls water closer to it (1 point) and pulls Earth (1 point) to earn 2 points.**

16. An El Niño makes farming and fishing conditions worse in South America because it reduces the amount of upwelling that occurs (less nutrients in the water and in the land). **Must write the word "upwelling" (1 point) and explain what it is (1 point) to earn 2 points.**

17. Coral reefs are made out of calcium carbonate because polyps make a hard shell around themselves (protection made of calcium carbonate) because they are very soft and vulnerable, these shells come off their bodies to create coral reefs. **Must write the words "calcium carbonate" and "polyps" (1 point) must additionally say why polyps make calcium carbonate (1 point) to earn 2 points.**

18. It can be inferred that there was once an island in the inside of the atoll. **Must write that there was once an island in the inside of the atoll for 2 points.**

19. A hot spot would most likely occur over oceanic crust because it is substantially thinner than continental crust. **Must write that it is more likely over oceanic crust (1 point) and that this is so because it is thinner than continental crust (1 point) for 2 points.**

20. The fact that the Earth switches magnetic polarity helped prove the theory of seafloor spreading, this is because older rocks further away from mid-ocean ridges may have different magnetic polarities, this was proven true by various patterns on the seafloor. **Must write that the Earth switches magnetic polarity (1 point) and that helped prove seafloor spreading when patterns on the seafloor were noticed (1 point) for 2 points.**

### Part 3 (Answer Key)

1. The salinity of ocean water relates to its density by increasing the density of the water as the salinity increases, this is because the salts add unchanged mass to the water, while their volume lessens as they are dissolved, this in turn increases the water's density. The salinity of ocean water relates to pH as various elements in the water help maintain a suitable pH for many organisms (7.4 to 8.3), if the pH was not in between this amount many processes of organisms that live in the ocean would cease to happen. **To earn 5 points the test taker must write that salinity increases the density of water (1 point), why it increases the density (2 points), salinity helps maintain a suitable pH (1 point), and why this is important (1 point).**

2. Thermohaline circulation works because of density, which is controlled by salinity and temperature. In the polar regions ice formed from ocean water leaves behind its salts, this increases the surrounding water's salinity and therefore, its density. This water sinks and then moves to areas of higher temperature/lower salinity. The water then upwells, loses its salinity, and travels with the winds as surface water until it increases its salinity and sinks again, restarting the process. **Must state that density drives the thermohaline circulation (1 point), density is controlled (in the ocean) by temperature and salinity (1 point), and a brief summary of the thermohaline circulation starting from the poles (3 points) to receive 5 points.**

3. The first way in which upwelling occurs is at coastal areas (based on the wind direction) the Ekman transport moves the surface water away from the coast, the cold, nutrient rich water then rises to replace the surface water that moved away. The other way upwelling happens is at the equator when wind moves water right in the Northern Hemisphere and left in the Southern Hemisphere away from the equator, because of this cold, nutrient-rich water rises to replace the water going away. **Must write that the Ekman transport moves water away from coasts (1 point), nutrient-rich water rises to replace it (1 point), Ekman transport happens at the equator (2 points), and that it happens when water moves away from the equator from opposite hemispheres (1 point).**

4. Longshore currents are currents that move close to parallel to the shore while going on and off the shore. They form from energy released by ocean waves hitting the shore; longshores currents can be stronger or weaker based on different aspects of this. Rip currents are currents that flow perpendicular or almost perpendicular to the shore. They form when there is too much water near the shore as a way to get that water back into deeper parts of the ocean. Rip currents decrease the flow of longshore currents by taking water from it and taking it out of the surf zone, this helps stop longshore currents from eroding too much of the shore. **Must write what longshore currents are (1 point), how they form (1 point), what rip currents are (1 point), how they form (1 point), and that rip currents can help slow or stop longshore currents from eroding the shore (1 point).**

5. The amplitude of a wave from its graph can be found by taking the vertical distance between the crests and troughs and dividing by 2. The wavelength of a wave is the horizontal distance between 2 consecutive crests/troughs. The velocity of a wave can be found by dividing the wavelength by the period. The period can be found by dividing 1 by the frequency. The frequency can be found by dividing the wave velocity by the wavelength. **Must write 1 way to find amplitude, wavelength, period, wave velocity, and frequency (from a graph) all of which are worth 1 point to get 5 points.**

Note: This is theoretical as if one does not know the period, wave velocity, and frequency, none of these values can be solved.