Dynamic Planet C - Dynamic Planet - Rickards Invitational Div. C - 12-05-2020

Hello there! Welcome to the Rickards Invitational. You have 50 minutes to complete the following test, good luck!

1. (1.00 pts)
Irvin observes an incoming wave on his radar, and he proceeds to investigate its properties, worried that it could be a tsunami. He receives the following properties about the wave. Use this information to answer questions 1-3. What type of ocean wave is this?

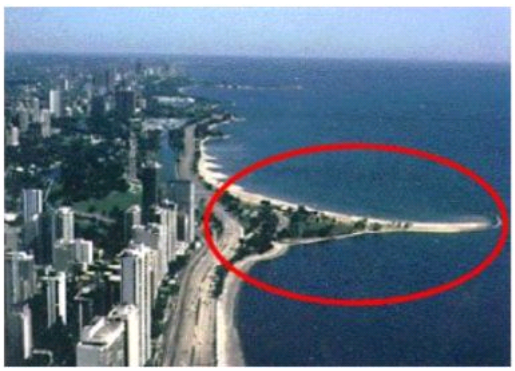
Wave Height	Wave Amplitude	Wavelength	Water Depth (At the given point Irvin records it)
1.0 m	0.5 m	750 m	30 m

- A) Shallow water wave
- B) Intermediate depth wave
- C) Deep water wave
- D) None of the above

2. (2.00 pts) (2 points) What is the wave celerity in meters per second? Show the formula you used and then the answer.

3. (1.00 pts) Should Irvin be worried that this is a tsunami? Explain why using wave speeds as part of your answer.

4. (2.00 pts) (2 points) Refer to the image below. What object is to the right of the city, and how was it formed?



5. (1.00 pts) In terms of concentration, what is the fourth most common ion in seawater? If the answer is say Mg2+, type it as Mg2+

6. (3.00 pts)
(3 points) Say there is a continental/continental convergent plate boundary between two plates, and the edges of the crust start to thicken. What will happen to most of this thickened crust, and why?

7. (1.00 pts) Which of the following relates the least when talking about atolls?

- A) Volcanic island
- B) Guyot
- C) Seamount
- D) Hotspot

8. (1.00 pts)
Let's say that some water has evaporated into the atmosphere near the tropics, and the cloud gets pushed up to about 60 degrees North latitude. Answer questions 8 and 9 using thi information. Which of the following cell(s) transported the cloud? Circle all that apply

(Mark **ALL** correct answers)
- A) Hadley Cell
- B) Mid-Latitude Cell
- C) Polar Cell

9. (2.00 pts) (2 points) What type of heat was transported during this process? How do you know?

10. (2.00 pts) (2 points) Identify all of the conditions that Earth needs to be to get the Proxigean Spring Tide. You must get all conditions to get any points.

(Mark **ALL** correct answers)
- A) 1st/3rd Quarter Moon

- [ ] B) Full/New Moon
- [ ] C) Perigee
- [ ] D) Apogee
- [ ] E) Diurnal Tide
- [ ] F) Semidiurnal Tide

11. (1.00 pts) Which of the following has the greatest impact on water density?

- ○ A) Temperature
- ○ B) Salinity
- ○ C) Pressure
- ○ D) All of the above have an equal impact

12. (1.00 pts) For questions 12 and 13, use the following image below to answer. What is the circled feature shown below?

13. (2.00 pts) (2 points) What will the rock on the right most likely become, and how will it become such?

14. (4.00 pts) (4 points) What are two major methods that can add salts to seawater, and how does each method work?

15. (1.00 pts)

I fire a 30 m/s sound wave directly downwards to see how deep the ocean is. If it took 4.104 minutes for the sound wave to come back up, how deep is the ocean in meters? Have at least 3 significant figures.

16. (1.00 pts) A longshore current's direction moves _____ relative to the shoreline

- A) Parallel
- B) Perpendicular
- C) Skew
- D) Diagonally

17. (3.00 pts)
(3 points) Kristin was observing data about certain properties of seawater at various depths, but she forgot to label what each column of data represented in the table below. She remembers that she was measuring temperature, salinity, and density in non-Imperial units. Determine which property matches up with a, b, and c.

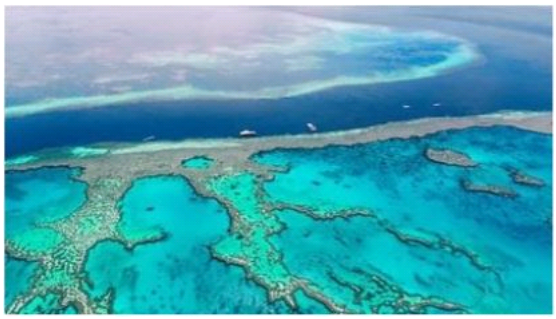
Depth (meters)	a)	b)	c)
300	22	1.0262	35
600	11	1.0273	34.4
900	6	1.0279	34.3
1200	5	1.02798	34.5
1500	4.5	1.02798	34.6
1800	4	1.02798	34.7

18. (1.00 pts) How does the shape of an ocean wave's orbit change as it comes up toward shore?

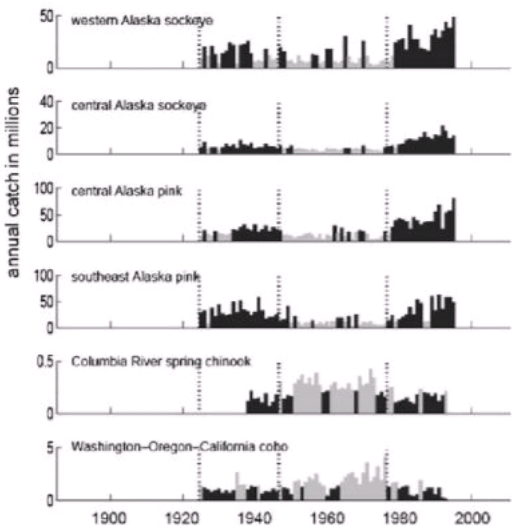
19. (1.00 pts) Which of the following is least likely going to cause hypoxia at the bottom of the water structure?

- A) Salt-Wedge Estuary
- B) Well-mixed Estuary
- C) Partially-mixed Estuary
- D) None of the above

20. (1.50 pts) Identify the type of reef structure shown above. Identifying it exactly will give a bonus 0.5 points.



21. (2.00 pts) (2 points) Explain how a structure like the one shown above formed.



Above is a chart of the catches of various salmon varieties within the North Pacific Ocean area. The black bars indicate how much more fish were caught than the long-term median i that year, while gray bars indicate how much less fish were caught than the long-term median in that year. Use this information to help guide you in the next few questions.

22. (1.00 pts)
The Aleutian Low would help connect some of the pieces as to why there were fluctuations in salmon production, but what other phenomenon/phenomena is/are linked to this?

- A) El Niño–Southern Oscillation
- B) Madden-Julian Oscillation
- C) Pacific Decadal Oscillation
- D) All of the above

23. (3.00 pts)
(3 points) Whenever the phenomenon/phenomena was/were in an above average temperature phase, so were the amount of salmon being caught. Since this cannot be reasoned with upwelling, suggest why this most likely occurred.

24. (2.00 pts)
(2 points) You'll notice that this data starts to disappear around after 1990. In recent years, the phenomenon/phenomena has/have become less useful in predicting whether or not we get a plentiful amount of salmon. What is most likely the ultimate cause of this, and what is its impact?

25. (1.00 pts)
If I were to fire a cannonball from Canada and aimed it directly South, which cardinal direction(s) will apply to the final position of the cannonball relative to the original position? Selec all that apply.

(Mark **ALL** correct answers)

- ☐ A) North
- ☐ B) East
- ☐ C) South
- ☐ D) West

26. (1.00 pts)
The Bay of Fundy is known for its very unique tides, mainly due to one specific phenomenon. With this phenomenon, the tides become even stronger because the applied force on the tides matches up with the natural frequency of the wave. What is the phenomenon called?

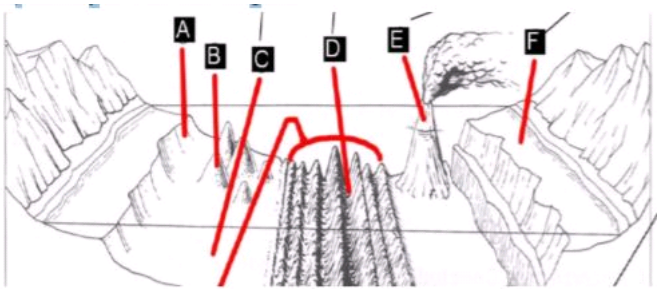
27. (1.00 pts) What gradients usually affect Deep Ocean Circulation?

28. (1.00 pts) What is the part of a CTD that actually collects water for sampling?

29. (1.00 pts) I let a corer fall into the ground, but I didn't really get a viable enough sample with this corer. What corer should I try to use instead?

- A) Gravity corer
- B) Piston corer
- C) Box corer
- D) None of the above will do better than the original corer

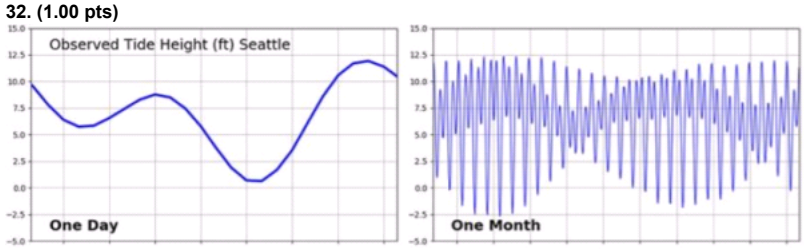
30. (3.00 pts) (3 points) Identify A-F on this diagram



31. (2.00 pts) (2 points) Classify each of the following causes and if they primarily affect relative or eustatic sea level changes.

a) Ice Age
b) Land subsidence
c) Thermal expansion of water
d) Tectonic Plate formation

32. (1.00 pts)



Above is a graph of the tides at Seattle, Washington over two different time frames. Use this data to answer the next two following questions. What kind of tide pattern does it have?

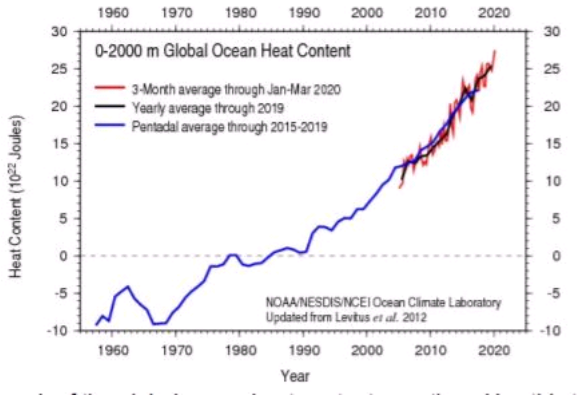
- A) Diurnal
- B) Semidiurnal
- C) Mixed
- D) None of the above/it cannot be determined

33. (1.00 pts) How many full moons did Seattle experience during a month?

- A) 0
- B) 1
- C) 2
- D) 4
- E)

34. (2.00 pts)
(2 points) 570°C is an important temperature for oceanographers when determining ages of oceanic crust. What is the name for this specific temperature and why is it so important?

35. (1.00 pts)



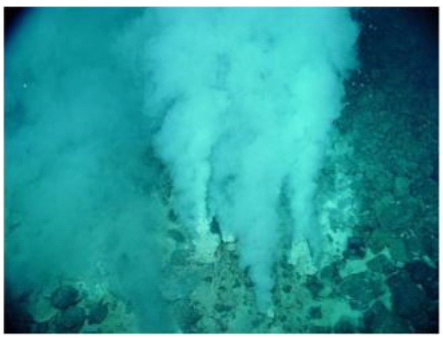
Above is a graph of the global ocean heat content over time. Use this to answer the next three questions. Looking at this, what single word term best explains how the ocean is storing this heat?

36. (1.00 pts) Give the two major molecules that are involved in this rise in global ocean heat content

37. (2.00 pts) (2 points) Does this rise in heat content benefit or harm coral? Why?

38. (2.00 pts)
(2 points) Tammy is swimming near a beach within the Gulf of Mexico when she suddenly feels a strong force pulling her away to sea. She's struggling to swim against this mysterious force. What's going on, and is there a way that she can save herself before imminent demise?

39. (1.00 pts)



Use the image above to help answer questions 39 and 40. Where are you most likely going to find an object like this?

- A) Convergent Plate Boundary
- B) Transform Plate Boundary
- C) Divergent Plate Boundary
- D) Passive Margin

40. (1.00 pts) What does this object produce that helps with ocean circulation?

41. (1.00 pts) In those movies where you see surfboarders riding a wave while water is flying over them, what kind of breaking wave are you most likely observing?

- A) Spilling Breaker
- B) Surging Breaker
- C) Collapsing Breaker
- D) Plunging Breaker

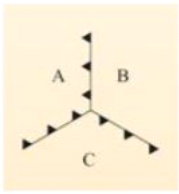
42. (1.00 pts) There are 4 main ways that a tsunami can be caused. Name 2 of them

43. (2.00 pts)
(2 points) As our technology advances, we are currently finding ways to keep more people safe from catastrophic events. We have now created the DART system to help us with one of these events. What event is the DART system used for, and describe the parts that comprise it?

44. (1.50 pts) (1.5 points) Of the seven colors of the rainbow, which ones could you see below 100 meters of the sea level surface?

45. (1.00 pts) How could surface winds help with upwelling?

46. (1.00 pts)



Examine the triple junction of plate tectonics here. Are the odds that this type of triple junction is going to be stable higher or lower than that of a RRR triple junction?

47. (1.50 pts) (1.5 points) Rank the order of the amount of crust that each of the lettered plates will lose in decreasing order

48. (2.00 pts)
(2 points) I was on a flight that went from California to Kuroshio, but as I was flying, I managed to spot two large patches of garbage along the way. What is keeping the garbage from separating, and how is it doing such?

49. (1.00 pts)

Use this image for questions 49 and 50. This is an image of what in South Wales, UK?

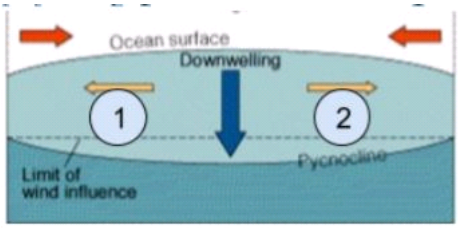
50. (2.00 pts) (2 points) Explain how there is such a steep elevation gradient by explaining how such an object forms.

51. (2.00 pts) (2 points) Explain why in an Ekman spiral, the water moves in various different directions.

52. (2.00 pts) (2 points) In gyres, some water is elevated up higher than other chunks of water, yet gravity can't seem to push it back down. Why is this the case?

53. (2.00 pts) (2 points) If Ekman Suction occurs at a certain area in the ocean, what happens to the thermocline and the sea surface elevation at the area of upwelling?

54. (1.00 pts)



Examine this diagram for questions 54 and 55. What kind of Ekman transport is this?

55. (1.00 pts) If this is an image in the Northern Hemisphere, is the geostrophic current moving toward us from 1 or 2, and how do you know?

Congratulations on finishing! Don't forget to check your answers. Once you do, feel free to submit. Good luck on your other events!