**Piedmont IB Middle School Science Olympiad In-school Competition #1 Answer key**

**Division B Dynamic Planet Event (Oceanography)**

Date: 10/4/2014

Student First and Last Name: (1 point) ____Answer Key_____

## Section 1 (17 points)

Give a brief response (1-2 sentences) for each of the following questions.

1. Why is the ocean salty? (1 point)

All water, even rain water, contains dissolved chemicals which scientists call "salts."

(keyword to look for is dissolved. If the student list specific chemicals that are dissolved in the ocean, that is fine as well)

2. List three sources of salt in the ocean. (3 points)

   (Award 1 point for each correct source listed, up to 3 points)

- Gradual processes such as breaking up of cooled igneous rocks of Earth's crust by weathering and erosion/ Chemical weathering of rock from land
- Wearing down of mountains
- Dissolving action of rains and streams which transported mineral washings to the sea
- Salts dissolved from rocks and sediments below its floor
- Solid and gaseous materials that escaped from Earth's crust through volcanic vents or originated in the atmosphere
- Out gassing - due to volcanic eruptions large quantities of water and gas have been emitted during much of geologic time

3. ~~What role does the salinity or the concentration of salt have in regulating global temperature? (1 point)~~

4. Name two typical features of deep-ocean basins. (2 points)

   (Award 1 point for each correct source listed, up to 2 points)

   sediments
   ocean ridges
   deep-sea trenches
   jagged, linear fracture zones
   Aseismic ridges
   Abyssal hills
   Seamounts
   guyots

5. How does a continental margin differ from a deep ocean basin? (1 point)

The continental margin is characterized **by thick (and less dense) granitic rock of the continents**. Near shore the features of the ocean floor are similar to those of the adjacent continents because they share the same granitic basement. **Relatively thin (and denser) basalt forms the adjacent deep seafloor.**

(Deep seafloor = deep ocean basin)

6. Why does water look blue? (1 point)

The clear indigo blue color of tropical waters is an indication of low biologic productivity.

7. How is heat different from temperature? (1 point)

Heat is thermal energy. Temperature is the measurement of average kinetic energy of the particles which compose the matter being tested.

8. What is the unit used to express seawater's salinity? Explain. (2 point)

(If one of the below is listed, award 1 point.)

- $^{0}/_{00}$
- Parts per thousand

(If explanation below is listed, award another 1 point.)

Explanation: x weight unit (usually in pounds) of salt per y weight unit (usually in pounds) of sea water

(Student can give numeric example for the explanation as well)

9. Name two functions of the oceans. (2 points)

   (Award 1 point for each of the following listed up to 2 points. Student can also explain the concept using different words.)

Regulate temperature

Reservoir of Resources

Dissolve excess $CO^2$

Origin of primitive life

Medium of transportation

Receptacle for garbage

10. Name the three layers of the ocean. (3 points)

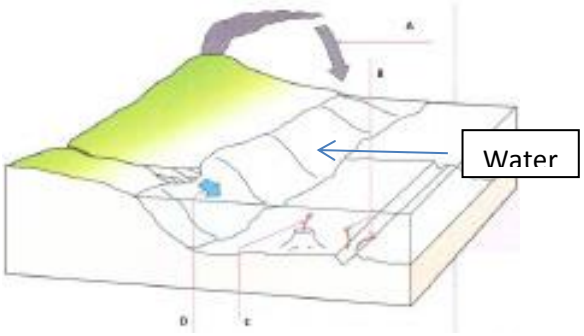
The mixed layer

Main thermocline

Deep water layer

## Section 2 (9 points)

### 11. Input of Ions into Ocean




Match the images shown on the screen with the correct inputs of ions from the oceans indicated in the diagram above.

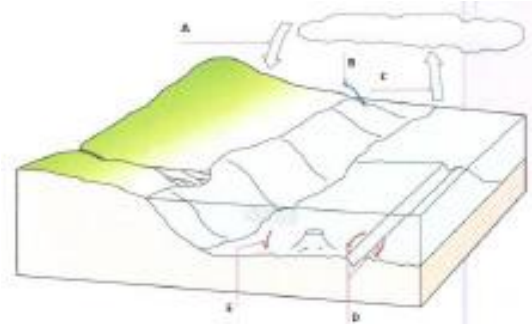
A.__ Volcanic Eruption

B.___Hydrothermal Vents

C.__Undersea Volcanoes

D.__Stream/River Runoff

### 12. Output of Ions from Ocean



Match the images shown on the screen with the correct outputs of ions from the oceans indicated in the diagram above.

A.____precipitation

B.____Sea Spray

C.___Clouds

D.__Infiltration into Crust

E.__Living Organisms

## Section 3 Multiple Choice (14 points)

For questions 13-18, select one of the following answers and write its associated letter on the answer sheet. (1 point each)

A) increases B) decreases C) remains the same

13. At constant temperature, as the salinity of seawater increases, density ___A_____.

14. As depth of seawater increases, temperature _____B_____.

15. As depth of seawater increases, salinity _____A_____.

16. As water cools from 20$^{o}$C to 4$^{o}$C, its density _____A_____.

17. As water cools from 4$^{o}$C to 0$^{o}$C, its density _____B_____.

18. As a block of sea ice melts its temperature _____C_____.

For questions 19–26, circle the correct answer. (1 point each)

19. Where fresh river water joins salty ocean water, it is known as

A. Silted
B. Brackish
C. Polluted
D. Backwash

20. The vertical movement of crust to accommodate additional weight or removal of weight is called

A. isotonic positioning
B. isostatic adjustment
C. isometric rebounding
D. internal expansion
E. interval submersion

21. The reason that ice is less dense than water – which causes ice to float – is due to:

A. the molecular packing of bulky ice crystals
B. thermal contraction
C. slower molecular motion
D. its high latent heat of melting
E. its high latent heat of condensation

22. Which of these is not a greenhouse gas?

A. CFC
B. $CO_2$
C. Methane
D. $O_2$

23. The Earth, maintaining a significantly cooler surface temperature than the Sun, emits _____

A. ultraviolet radiation
B. shortwave infrared radiation
C. longwave radiation
D. visible light

24. In the open ocean, average seawater salinity is…

A. 0.0035 $^0/_{00}$
B. 0.035 $^0/_{00}$
C. 0.35 $^0/_{00}$
D. 3.5 $^0/_{00}$
E. 35 $^0/_{00}$
F. None of the above.

25. Which of the following INCREASES the salinity of seawater?

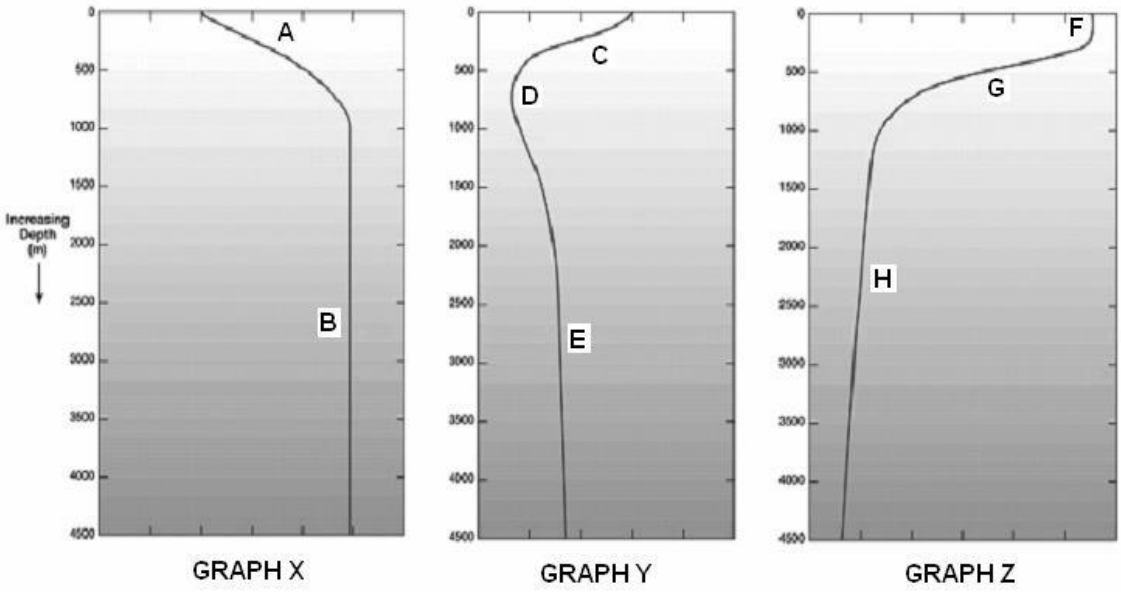
A. Runoff entering the ocean
B. Precipitation into the ocean
C. Icebergs melting in the ocean
D. Evaporation of sea water
E. The first two choices only

26. A layer of rapid change of ocean density with depth is called a

A. Thermocline.
B. Halocline.
C. Pycnocline.
D. Nutricline.
E. Salicline.

## Section 4 (8 points)

For questions 27-31, use the three graphs shown below. All three graphs are associated with mid-latitudes in the South Atlantic. (1 point each)




27. Which graph indicates temperature versus depth?
    Graph Z

28. Which graph indicates salinity versus depth?
    Graph Y

29. Which graph indicates density versus depth?
    Graph X

30. Which letter on the graphs indicates the pycnocline?
    A

31. Which letter on the graphs indicates the thermocline?

    G

For questions 32-34, use the Temperature – Density - Salinity graph shown below to find the answer. (1 point each)

32. According to the graph shown below, what is the density in g/cm$^3$ of a sample of salinity 34.5($^o/_{oo}$) and temperature 7 $^o$C?

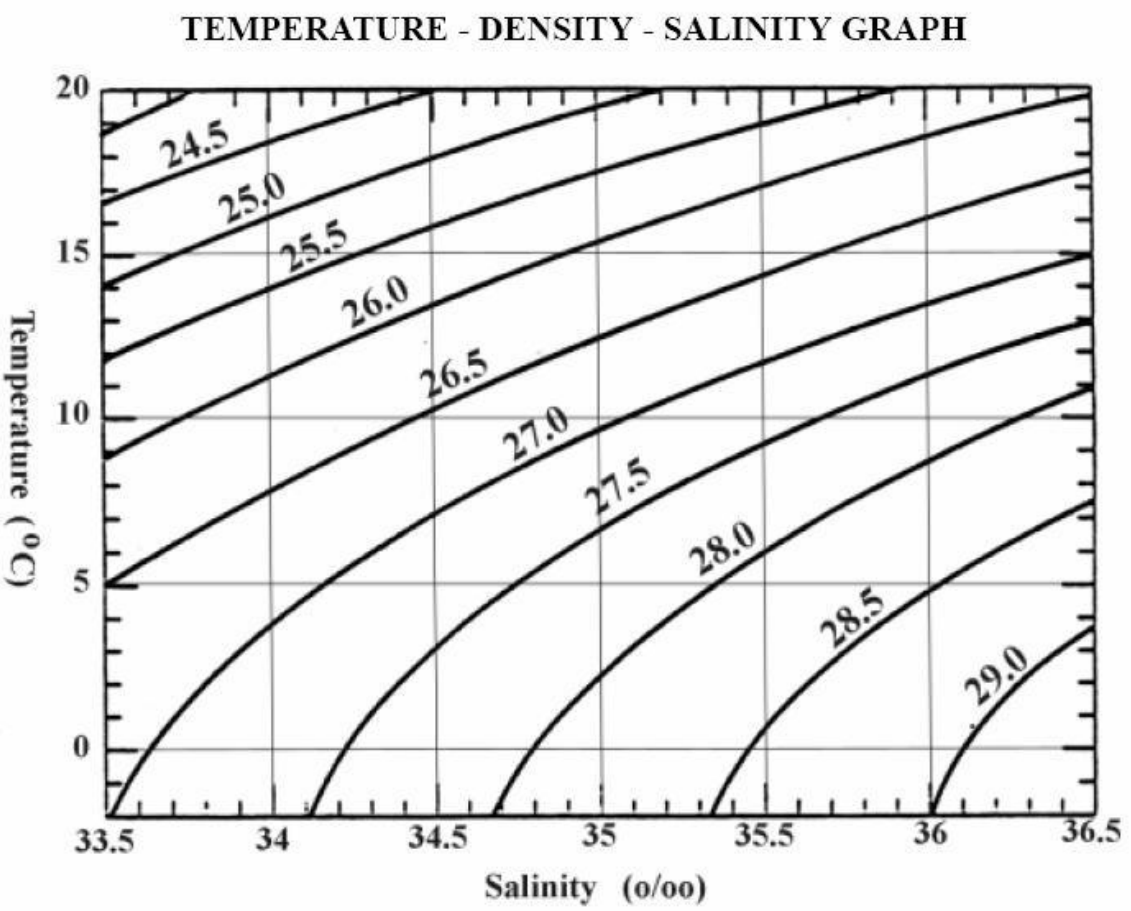
1.027 g/cm$^3$

33. According to the graph shown below, what is the salinity of a water sample with a density of 1.028 g/cm$^3$ at a temperature 8 $^o$C?

36 $^0/_{00}$ (allow ±0.5 margin)

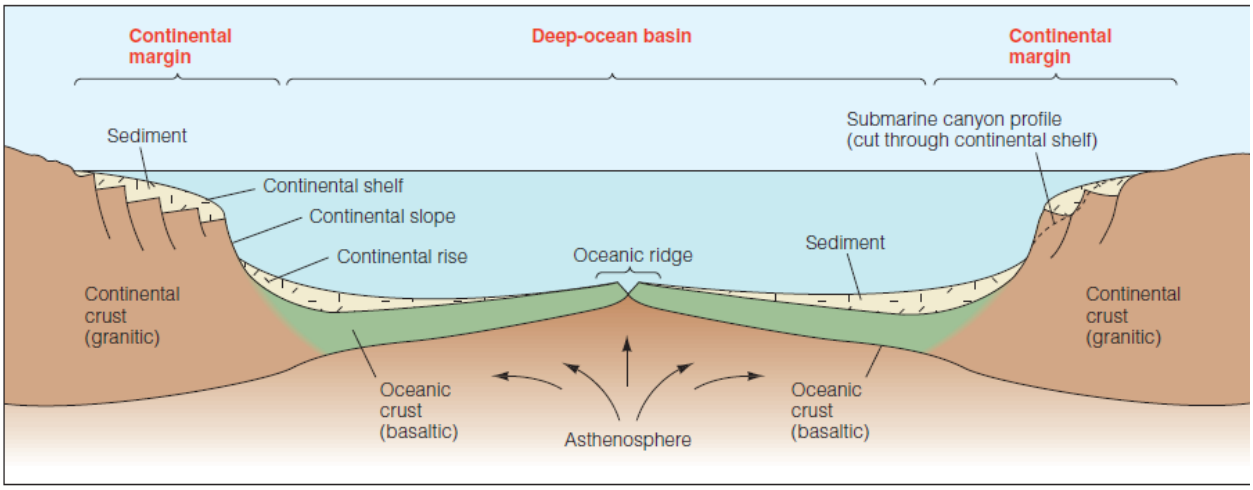
34. What are the units of the salinity scale across the horizontal axis of the temperature-density-salinity graph?

Parts per thousand (or $^0/_{00}$)



## Bonus Section (10 points)

**Draw a rough outline of an ocean basin. Label the major parts.**




1 point for correct drawing

(1 point for each correct label)

Continental margin

Deep-ocean basin

Continental crust

Continental shelf

Continental slope

Continental rise

Oceanic ridge

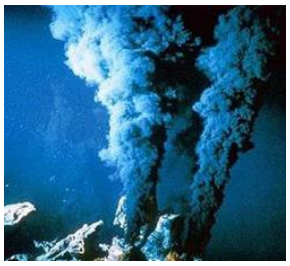
Sediment

asthenosphere

## Images for Section 2

Volcanic Eruption

Living Organisms



Hydrothermal Vents

Clouds

Undersea Volcano

Sea Spray

Precipitation

Runoff

Infiltration Into Crust