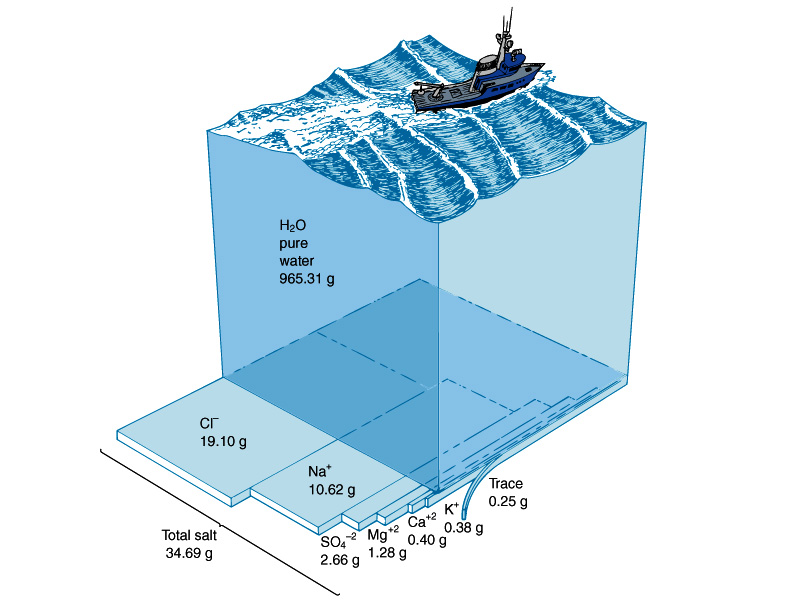
Name: Section:

**Properties of Ocean Water Unit**

**A. Composition of Ocean Water:**

Ocean water is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_

and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dissolved in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**1. Gases:**

**2. Solids:** \_\_\_\_\_% dissolved minerals like:

**3. Disassociate into ions:**

**+**

**-**

**B. Salinity:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Measured in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (ppt or o/oo) (#g/1,000g = #g/L).

1. \_\_\_\_\_\_\_\_\_\_\_\_\_ is the major salt in the world ocean.

2. \_\_\_\_\_\_\_\_\_\_\_\_\_ is the second most abundant salt in the ocean.

3. The average salinity of the ocean is \_\_\_\_\_\_\_ ppt. Salinity ranges from \_\_\_\_\_\_\_ to \_\_\_\_\_\_ ppt depending

on evaporation and fresh water input.

**4. Source of Salts: Where did the Oceans get their salt?**

a/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the Oceans release H2O, Cl- and CO2 Original oceans were \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!

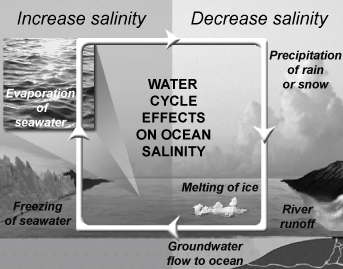
b/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of rocks release minerals Na, Mg, K, Ca

Rivers are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).

c/ Billions of years ago…. Rivers (base) reacted with oceans (acid) in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

reaction to form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!

d/ Salinity is currently \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**5. What factors influence the variations in salinity in the world’s oceans? *Use diagram.***

**a/ Lower salinity occur where more fresh water enters the oceans.**

1/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Seasonal.

4/ Groundwater flow to ocean

**b/ Higher salinity occurs where fresh water is removed**

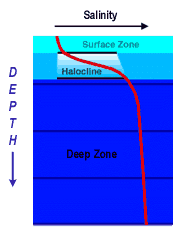
**and less fresh water enters the oceans .**

1/ Hot oceans where there is little precipitation or runoff and a lot of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ leaves behind \_\_\_\_\_\_\_\_\_\_\_\_\_\_. Seasonal.

**1**

**6. Salinity Profile (Variations with depth).**

a/ Salinity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with depth.

b/ Salinity Layers:

1

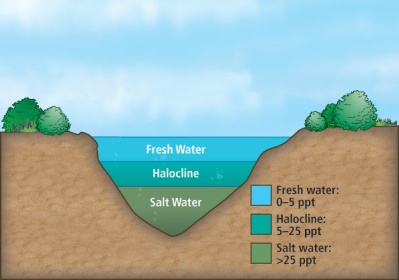
**1/Surface Zone:**

2

**2/Halocline:**

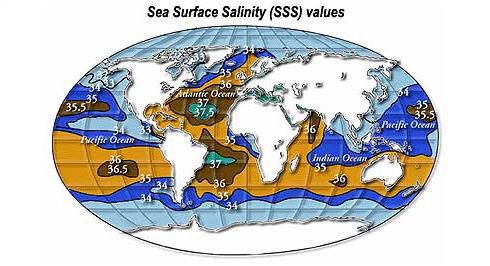
3

**3/Deep Zone:**



c. Salinity influences ocean water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**7. Sea Surface Salinity** Use diagram to describe variation in surface Salinity across Earth’s Oceans.



Equatorial (around 0o):

22oN and S:

Polar (60-90oN and S):

Mediterranean Sea:

**1b**

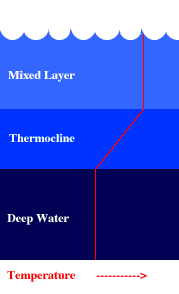
**C. Ocean Temperature**

1/ Ocean temperature varies with the amount of solar radiation received. The amount of solar radiation

received depends on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2/ The temperature of the surface layer varies from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3/ Sea water with an average 35 ppt salinity freezes at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4/ Average Temperature of surface waters is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

5/ Surface waters are warmer at the equator and colder at the poles.

6/ Ocean waters are warmer near the surface and colder with depth.

7/ **Temperature Profile:**

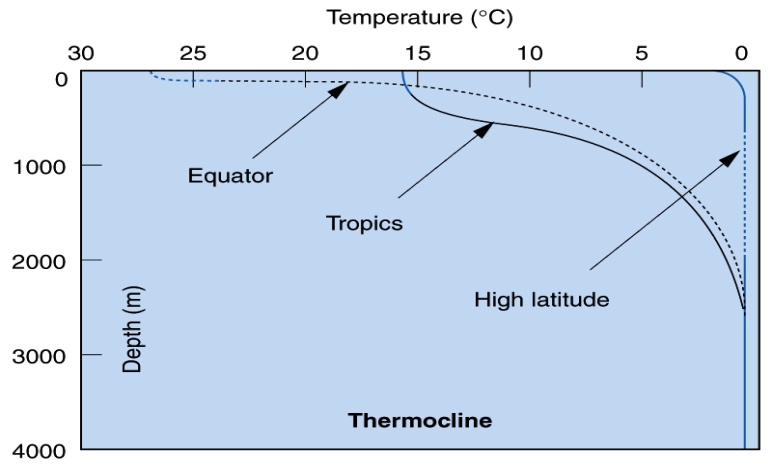
**Mixed Layer(surface):** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Thermocline:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_­­­­­\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Deep water:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. The Thermocline

a/ Changes with latitude:

1/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the Equator.

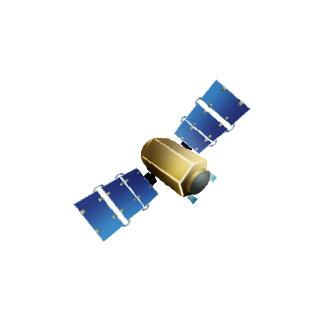
2/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

at higher latitudes.

b/ The thermocline creates a barrier between kinds of marine life.

9. The Deep Layer is very cold!

a/ **\_\_\_\_\_\_\_** of all Ocean water lies beneath the thermocline.

 b/ The deep ocean layer is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and consists of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.

c/ The deep layer is very cold all around the world **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

10. Satellite System - Argos

A system of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the surface \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and

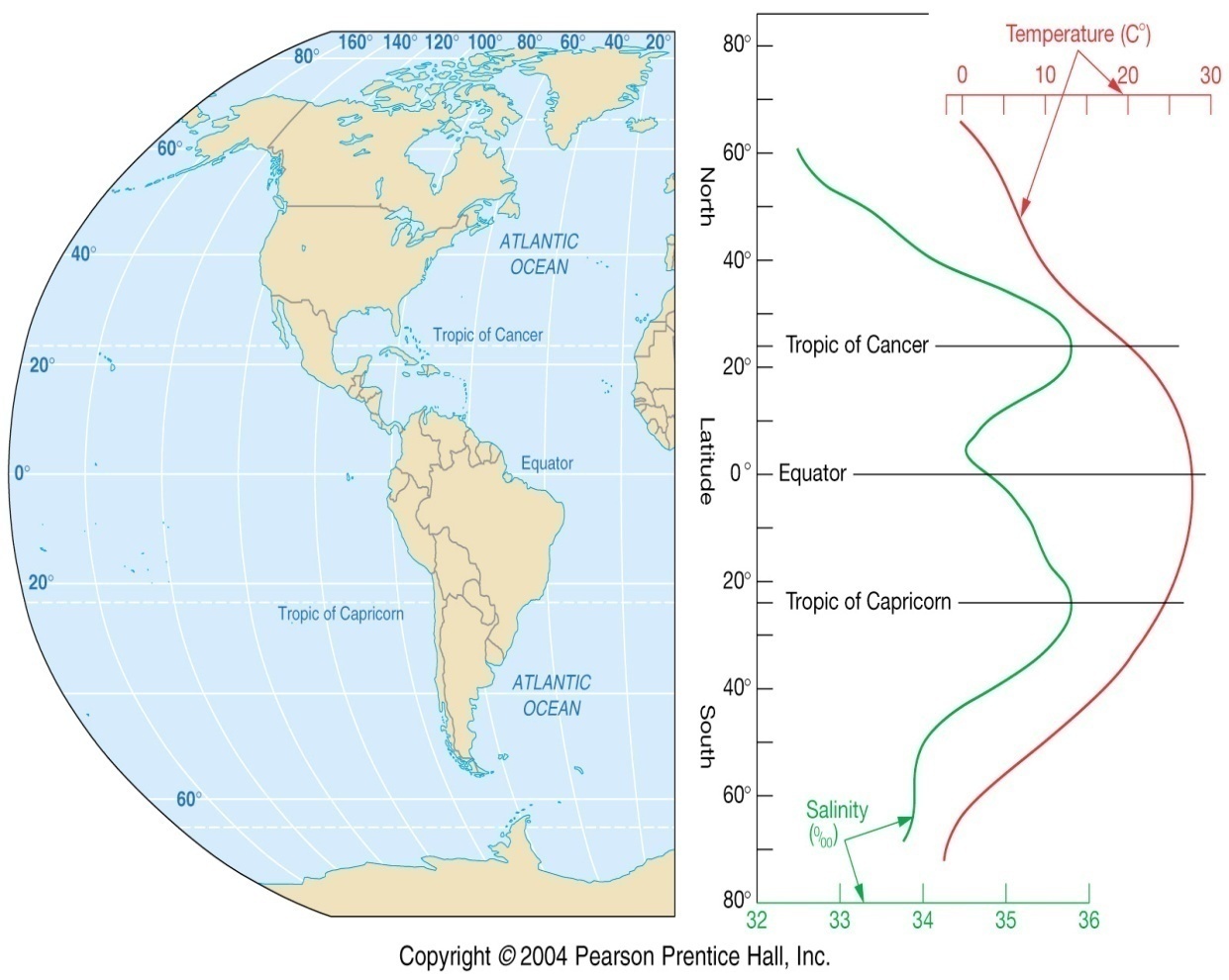
\_\_\_\_\_\_\_\_\_ over time \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ giving us \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the layers of the sea.

**2**

**D. Sea Surface Salinity and Temperatures ANSWER Part D using this image**

1/ At what latitude is sea surface temperature (sst) the highest?



2/ At what latitude(s) are sea surface temperature (sst) the lowest?

3. At what latitude(s) are sea surface salinity (sss) the highest?

About what ppt?

4. Why isn’t the Equator the highest salinity?

5. Why are the highest salinities where they are?

6. Which polar region has the lowest salinity? Why do you think this is the case?

**E. Density of Ocean Water**

1. Density = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Density of pure water is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. The average density of ocean water is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_g/cm3. It ranges from \_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_

4. Denser ocean water \_\_\_\_\_\_\_\_\_\_\_\_\_\_!

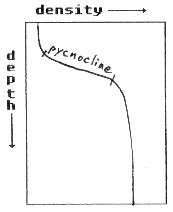
5. Ocean water density depends on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6/ Density of water is mostly determined by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

7/ Cold water \_\_\_\_\_\_\_\_\_\_\_\_\_\_. Warm water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

8/ Density is also effected by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Salty water is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ … \_\_\_\_\_\_\_\_\_! Less saline water is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ... \_\_\_\_\_\_\_\_\_\_\_

9/ Ocean Density Profile

a/ Density \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

b/ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_water at surface and

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ water in the Deep.

c/ The region of rapid density change is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

It acts as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between deep and surface waters.

**2b**

10/ Density in Polar Waters (High Latitudes)

a/ Cold, salty waters in the polar regions have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pycnocline.

They start out dense and stay dense all the way down to the bottom.

b/ These waters \_\_\_\_\_\_\_\_\_\_\_ to the deep zone driving \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!

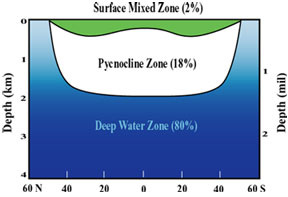
They bring \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ down with them.

**F. Ocean Layers**

1/ The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

are related and act as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_between the **Deep Zone** and the **Mixed-Surface Zone**

of the ocean. This intermediate region is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**2/ Surface (mixed) Zone:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**3/ Transition Zone:** Located where **\_\_\_\_\_\_\_\_\_\_\_\_\_-**, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-**,

and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** occur.

Acts as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between Deep and Surface Zone

\_\_\_\_\_\_% Ocean.

**4/ Deep Zone:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**5/ High Latitudes (Polar):** Little to no Surface or Transition Zones!

\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ waters enriched with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

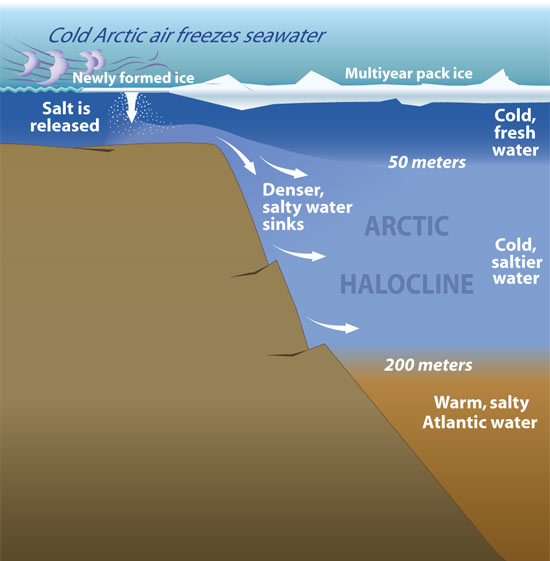
to the ocean deep. This drives deep ocean circulation!

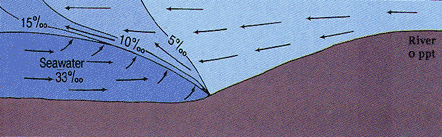
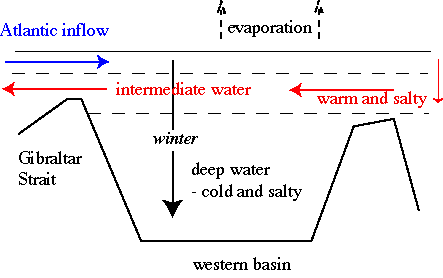
**G. Case Studies:**

1**. Saltwater wedging** in Estuaries like the Delaware and Chesapeake Bays.

2. **Mediterranean Sea** – underwater haline currents under the Mediterranean Sea and the Straits of

Gilbraltar.

3**. Polar haline currents** drive deep sea currents.



**3**

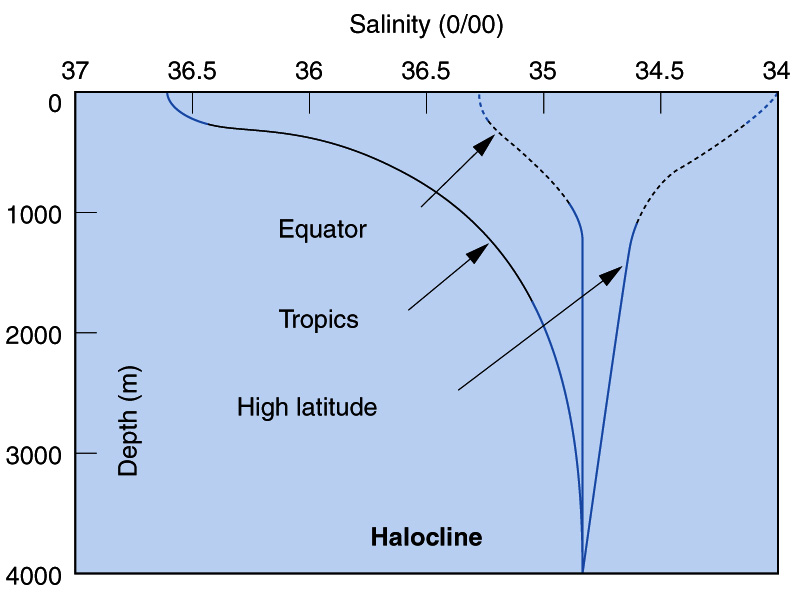
**Halocline, Thermocline, and Pycnocline at Different Latitudes:**

Doldrums:

Polar:

Horse Latitudes:

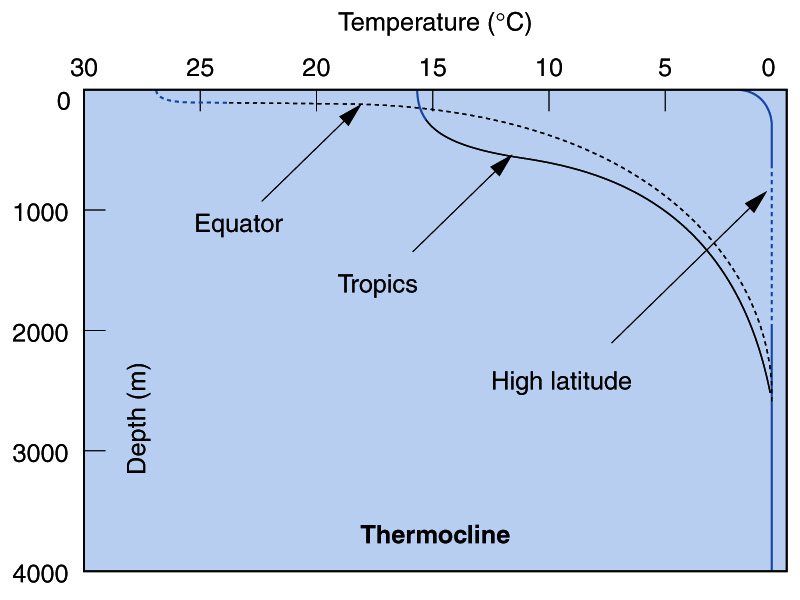
**3b**

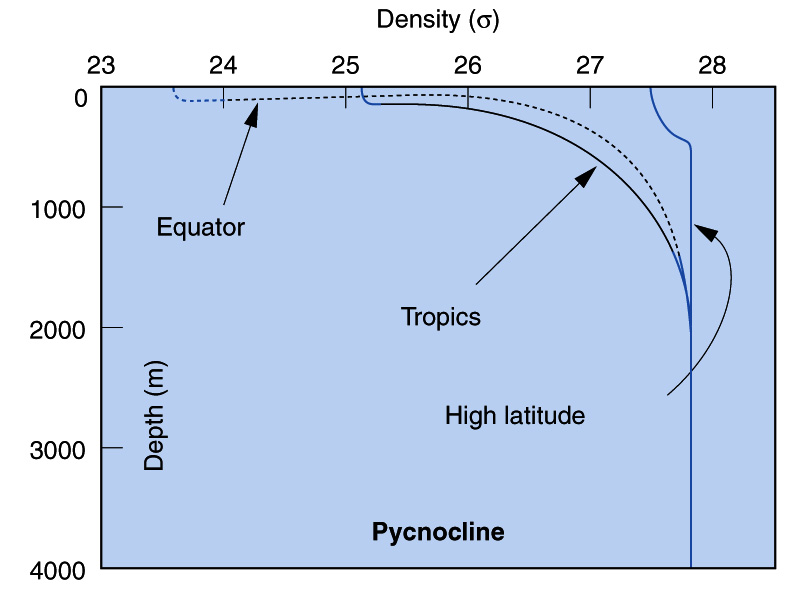


Melting Ice:

Freezing Ice:

Salinity is influenced by temperature, water input, and water output (freezing and evaporation).

****

****

Polar:

Polar:

Temperature decrease with depth.

Density increases with depth.

Name: Section: Date:

**Studying the Halocline at Different Latitudes**Karcewski/Ocean1/2010

Plot the following salinity readings with depth for each of the following locations: Equator (0oLat), Tropics (22oN and S Lat), and High Latitude (70oN Lat). When finished analyze and conclude. Use Red, Green, and Blue color pencils to draw lines.

**Blue**

**High Latitude (70oN Lat)**

0’ = 34.0

100’ = 34.1

200’ = 34.2

500’ = 34.4

1000’ = 34.6

1500’ =

2000’ = 34.7

3000’ =

4000’ = 34.8

**Red**

**Tropics (22oN/S Lat)**

0’ = 36.7

100’ = 36.6

200’ = 36

500’ = 35.6

1000’ = 35.2

1500’ = 35.1

2000’ = 35.0

3000’ = 34.9

4000’ = 34.8

**Green**

**Equator (0oLat)**

0’ = 35.4

100’ = 35.4

200’ = 35.3

500’ = 35.1

1000’ = 34.9

1500’ = 34.8

2000’ = 34.8

3000’ = 34.8

4000’ = 34.8

On a lined piece of paper write out an analysis and possible explanation (summary) for each color line below. Make sure to use complete sentences and concepts learned/discussed in class.

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1000

**Depth in meters**

34

**Salinity 34 to 37 ppt**

4000

3000

2000

1500

200

100

500

0

37

36

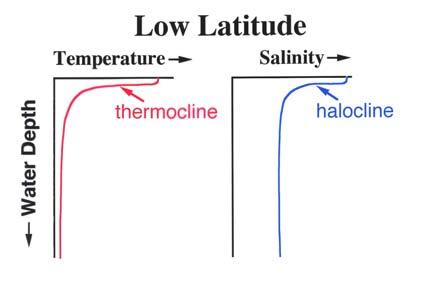
35

**4**

**Salinity and Temperatures Profiles** Name:

Ocean1 2010 Karcewski

Use the following depth profiles for salinity and temperature to answer the following questions.

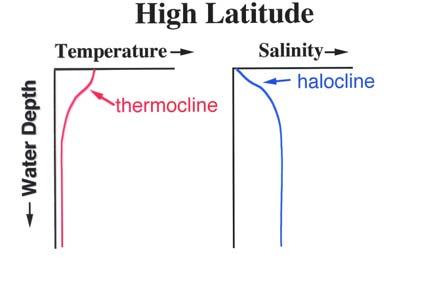


1/ What latitude is this? Is it near the Poles or Equator?

2/ How does the temperature change with depth?

3. How does the salinity change with depth?

4/ Why is the salinity greater at the surface?



5/ What latitude is this? Is it near the Poles or Equator?

6/ How does the temperature change with depth?

7/ How does the salinity change with depth?

8/ Why is the salinity less at the surface?

9/ Looking at the thermo and halocline lines, what conditions do you observe that would lead to the

formation of an arctic ice cap?

10. How does the thermocline at higher latitudes compare to the thermocline at lower latitudes?

11. How does the Halocline at higher latitudes compare to the halocline at lower latitudes?

**4b**