# Essential Question: How does the temperature and salinity of water affect density?

Standard:

S6E3c. Describe the composition, location, and subsurface topography of the world's oceans.

S6E3d. Explain the causes of waves, currents, and tides.

# Activating Strategy

With a seat partner, write a short definition for the following terms: temperature, salinity, and density

**Temperature**: the degree of hotness or coldness of an object

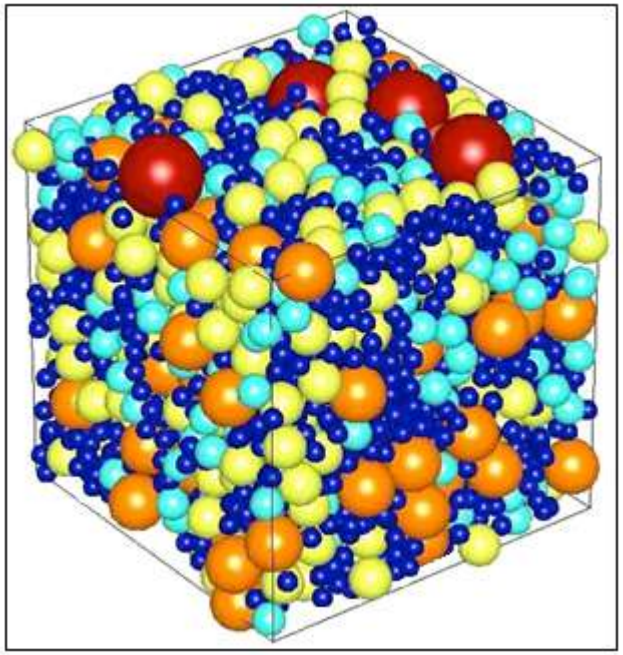
**Salinity**: the dissolved salt content of a body of water

**Density**: the amount of mass in a given space

# Activating Strategy

The diagram to the right illustrates an object that has a lot of density.

How do you think temperature affects density? What about salinity?



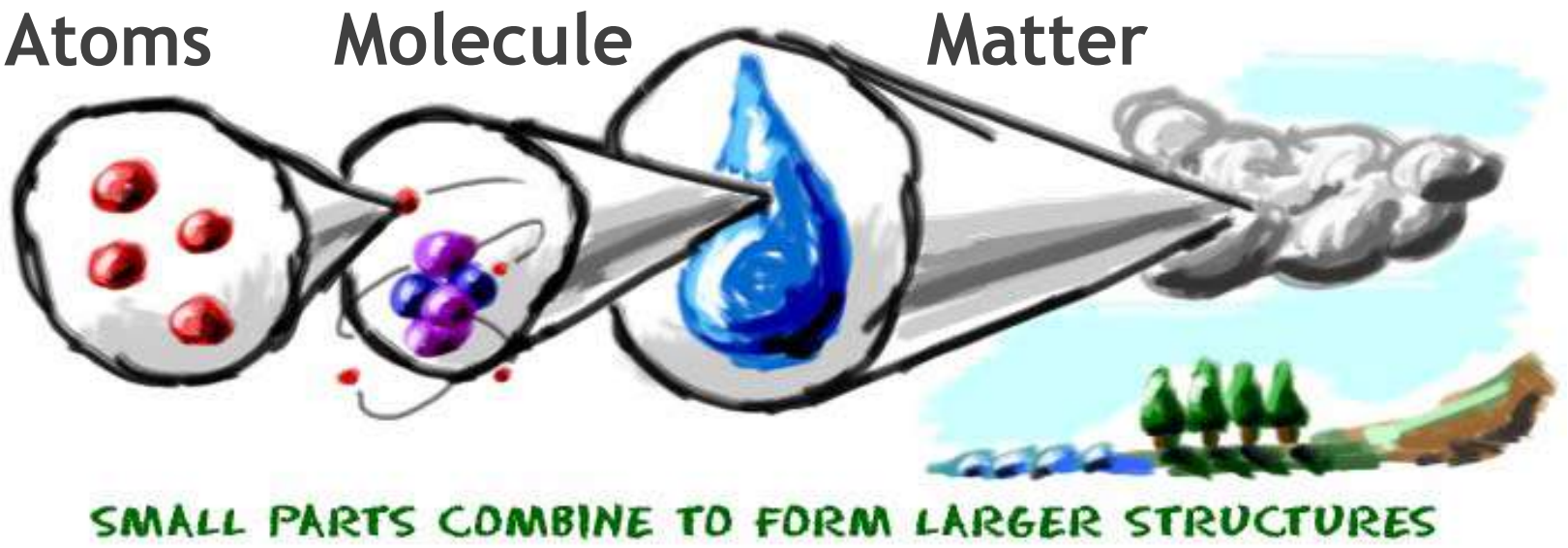
**Temperature**: the degree of hotness or coldness of an object

**Salinity**: the dissolved salt content of a body of water

# Look at the diagram below. What does it illustrate?

# Everything is made up of Matter.

# Matter can be broken down into smaller particles such as atoms and molecules.

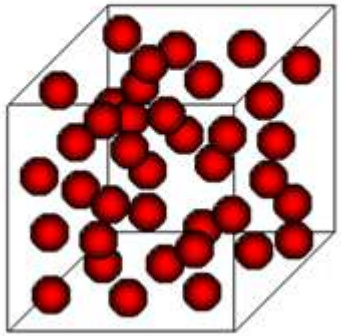


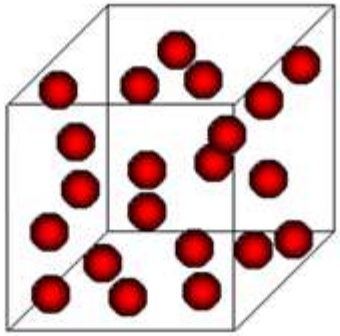
# What is Density?

Density is the amount of matter (mass) in a given space (volume)

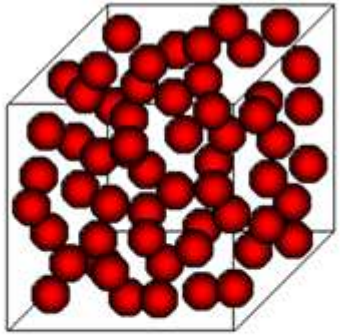
For example, a golf ball and a table-tennis ball have similar volumes. But a golf ball has more mass than a table-tennis ball does. So, the golf ball has a greater density.

Red spots represent atoms with mass

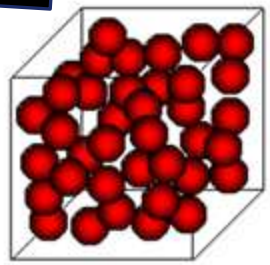




A substance which occupies the same volume but has less matter is <u>less dense</u>.

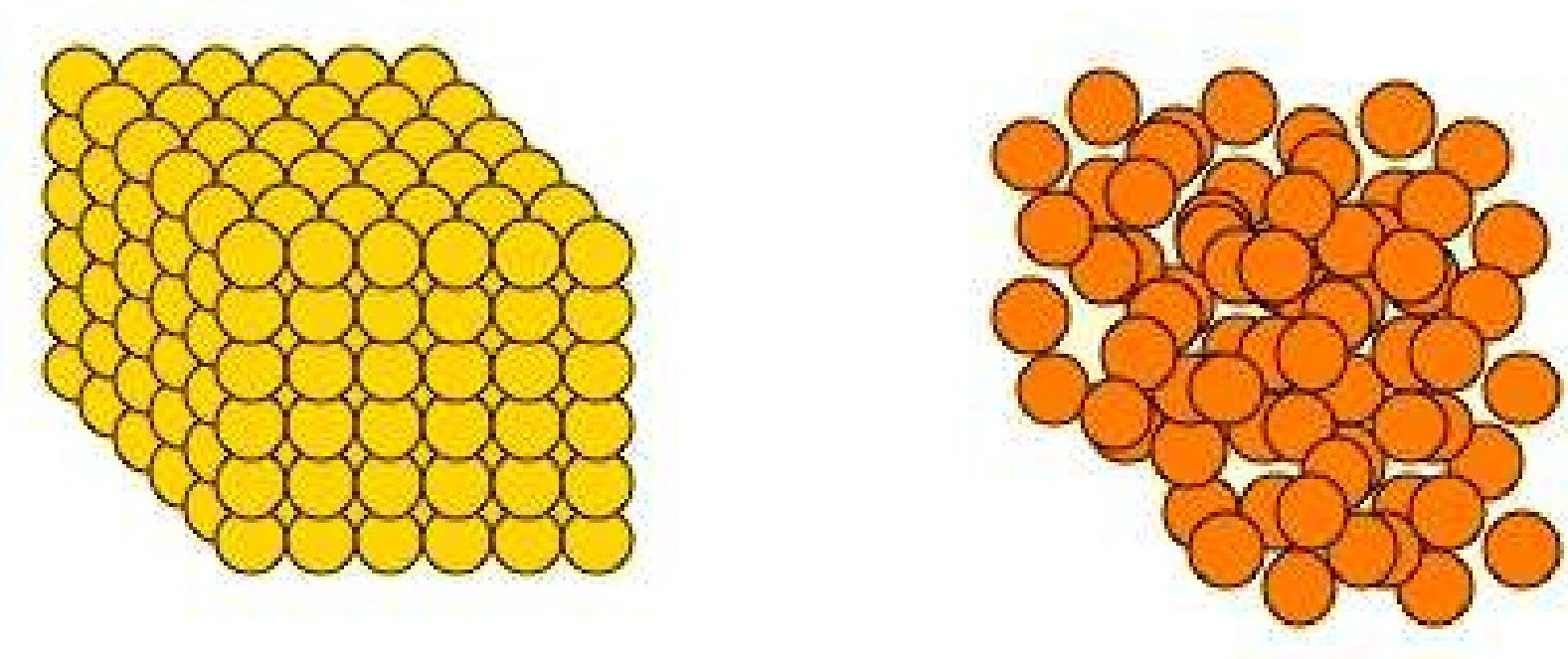


A substance which occupies the same volume and has more matter is <u>more dense</u>.



A substance with the same amount of matter but with a smaller volume is more dense

# Which one has greater density?



Let's apply the concept of Density to Liquids

# Density of Liquids Activity

[see resources]

If you cannot do the activity, see the next slide

# Density of Liquids

* Like all substances, liquids have different densities
* It is easy to see the differences in the density of liquids because more dense liquids will sink and less dense liquids will rise. The same is true for objects in liquids.
* If you pour together liquids that don't mix and have different densities, they will form liquid layers.
* Making Liquid Layers: http://www.youtube.com/watch?v=-CDkJuo_LYs

# Density of Liquids

* Check out this picture. Which layer has the highest density?

* Which layer has the lowest density?

* Imagine that the liquids have the following densities:

  $10 g/cm^3$ $3 g/cm^3$

  $6 g/cm^3$ $5 g/cm^3$

* Which number would go with which layer?

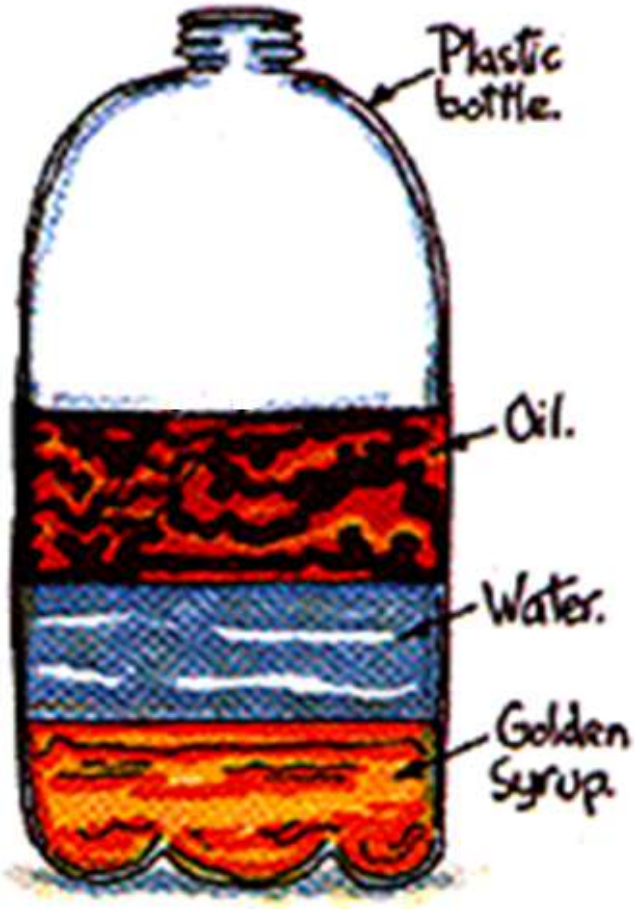
# Density of Liquids

Try with your neighbor!

*Which liquid has the highest density?

*Which liquid has the lowest density?

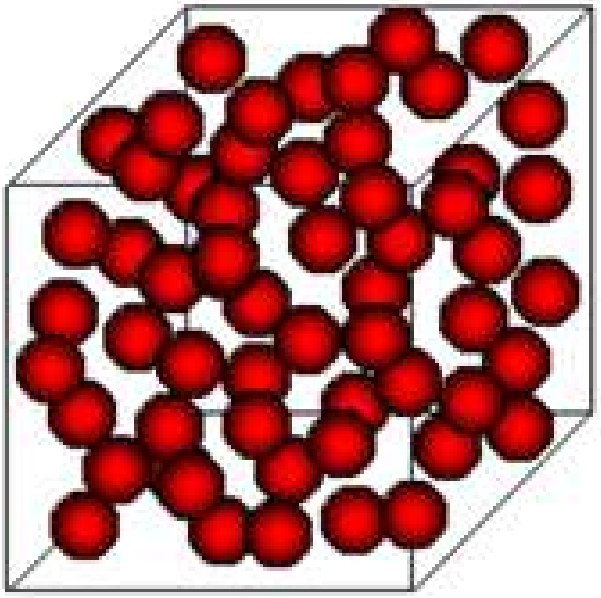
*Which liquid has the middle density?



# Density: Float or Sink

http://www.youtube.com/watch?v=dcQR6vV1Sqo

# Relationship between Density & Temperature



# What is temperature?

Temperature is the degree of hotness or coldness of an object.

For this lesson, we are going to look at temperature more closely.

**The temperature of a substance is related to the speed of the substance's particles.**

http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks3/science/changing_matter/changingmatter.swf

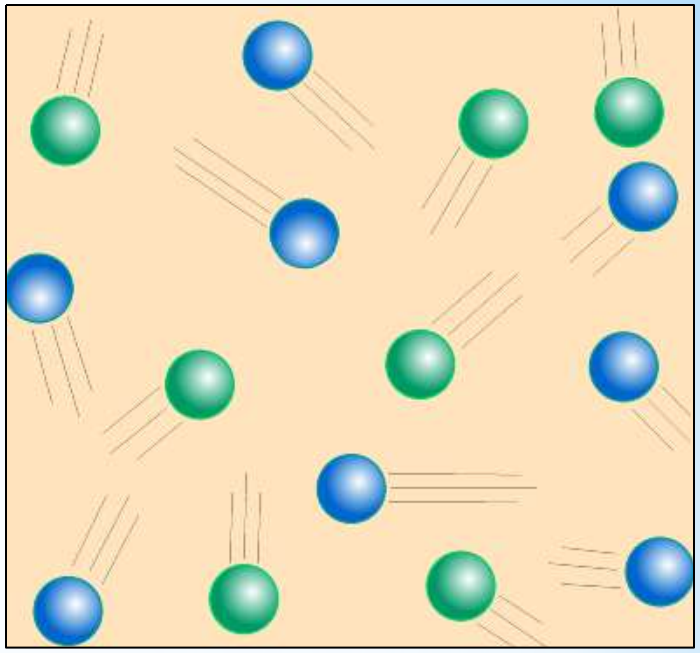
**What happens to the particles in an object or substance when its temperature is increased?**

**As the temperature of a liquid increases, the particles in the liquid move faster.**

**As the temperature of a liquid decreases, the particles in the liquid move slower.**

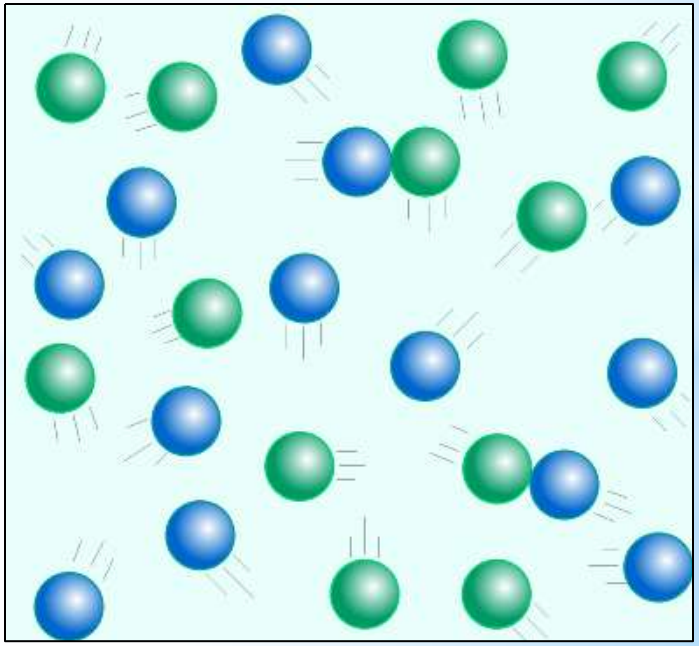
When an object or substance is warmer, its particles move faster and get further apart

(Tip for remembering: they are warmer and want to get cooler by moving away from one another)



When an object or substance is cooler, its particles move slower and are closer together

(Tip for remembering: they are cold and want to get warm by getting closer together)



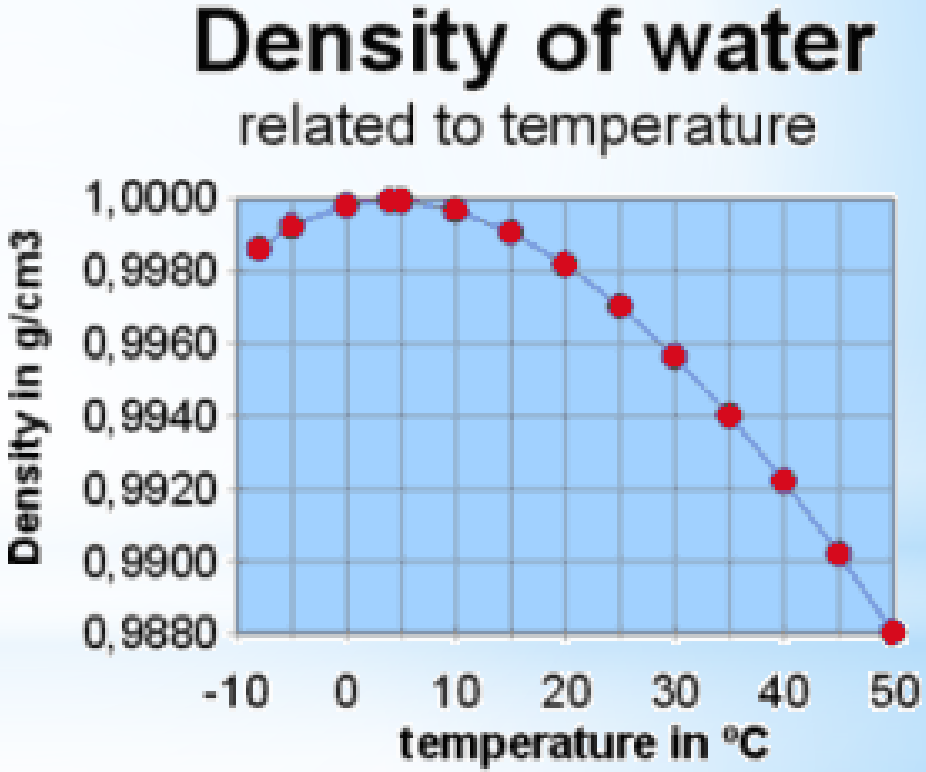
# Relationship between Temperature and Density

http://www.youtube.com/watch?v=1dx-Tx5dPKk

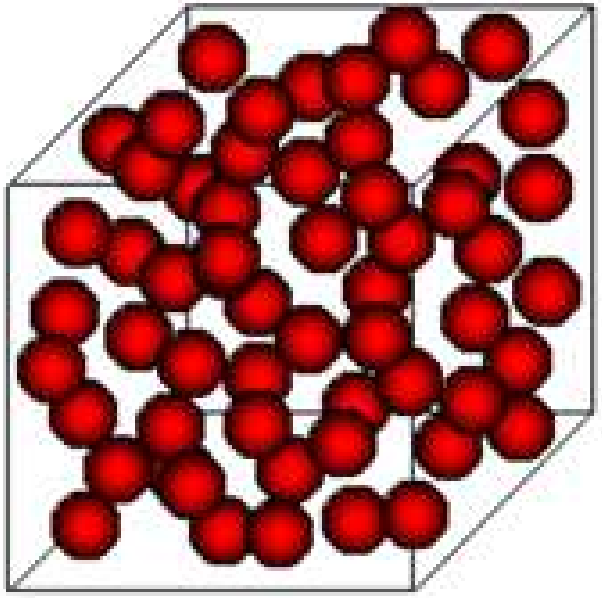
Ice Cube Demonstration:
http://www.youtube.com/watch?v=I8kToTROCHA

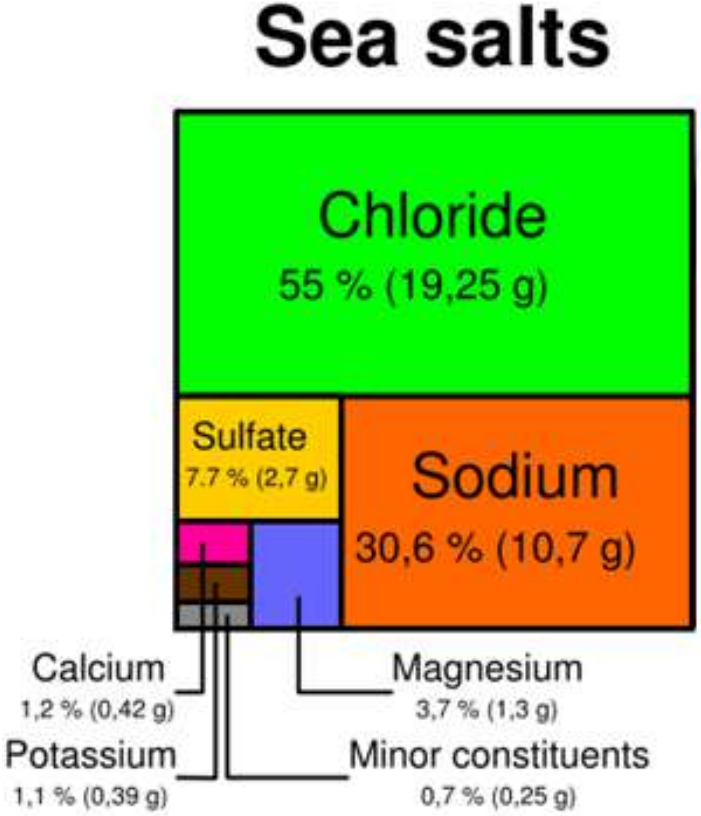
# Relationship between Temperature and Density

As temperature increases, density decreases.



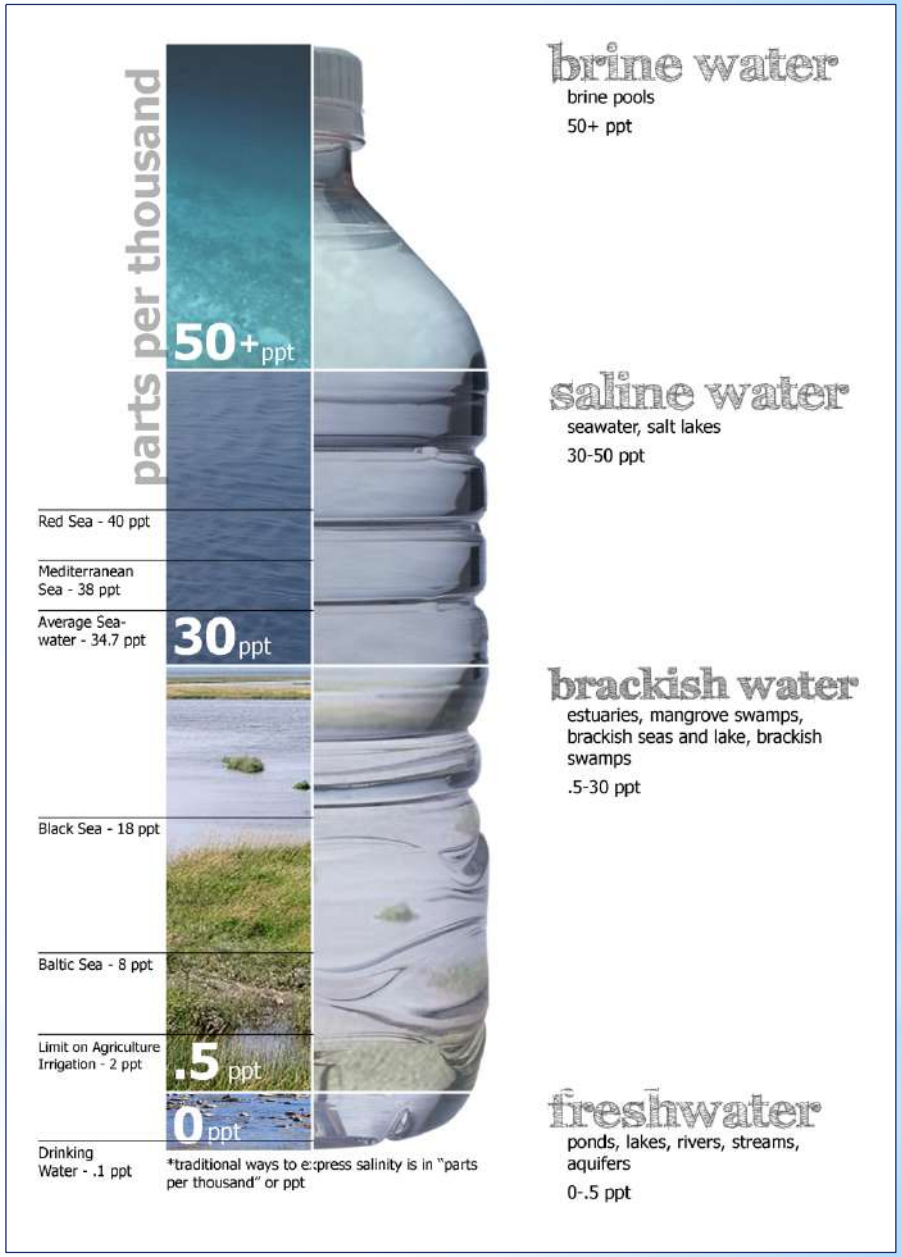
# Relationship between Density & Salinity





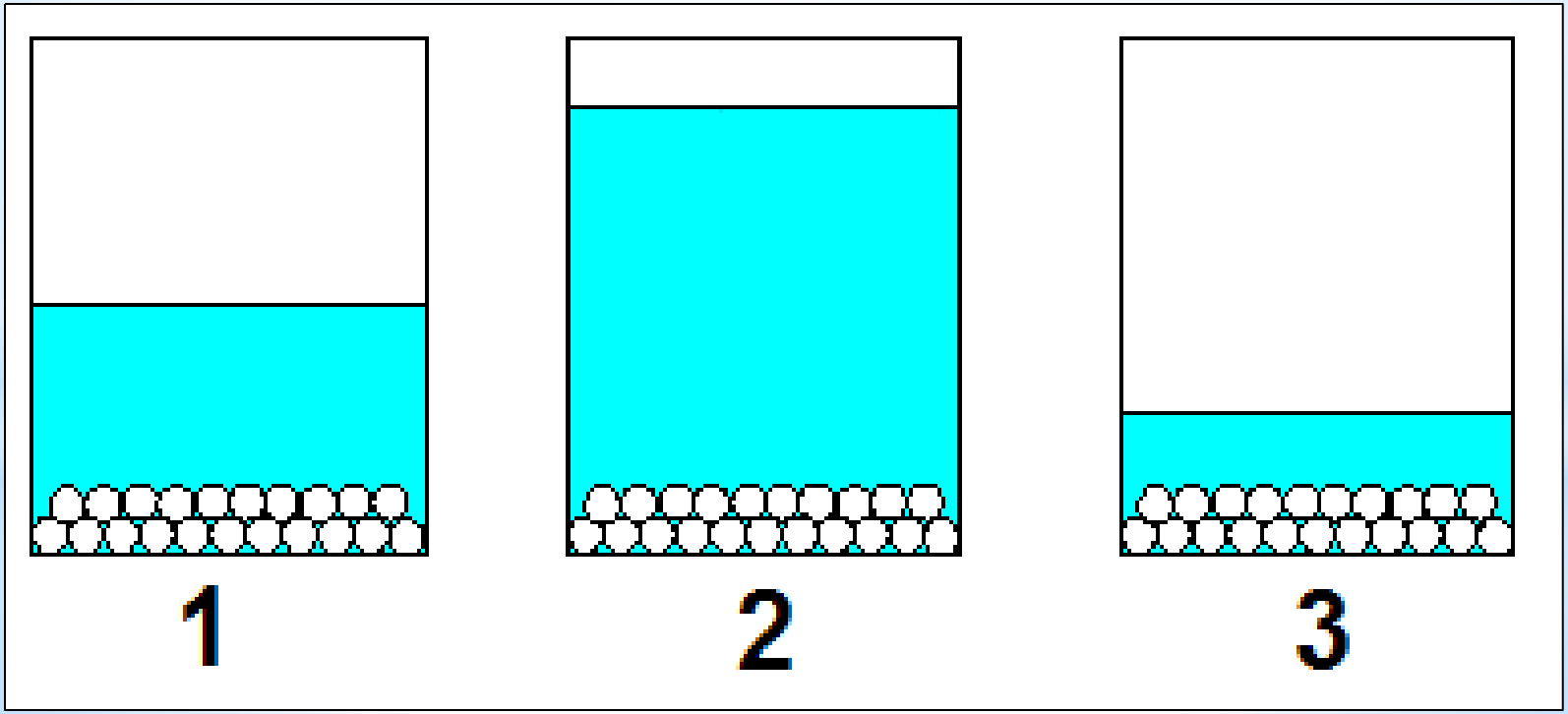
# What is salinity?

* Salinity is the dissolved salt content of a body of water
* Look at the diagram to the right showing the varying degrees of salinity in water



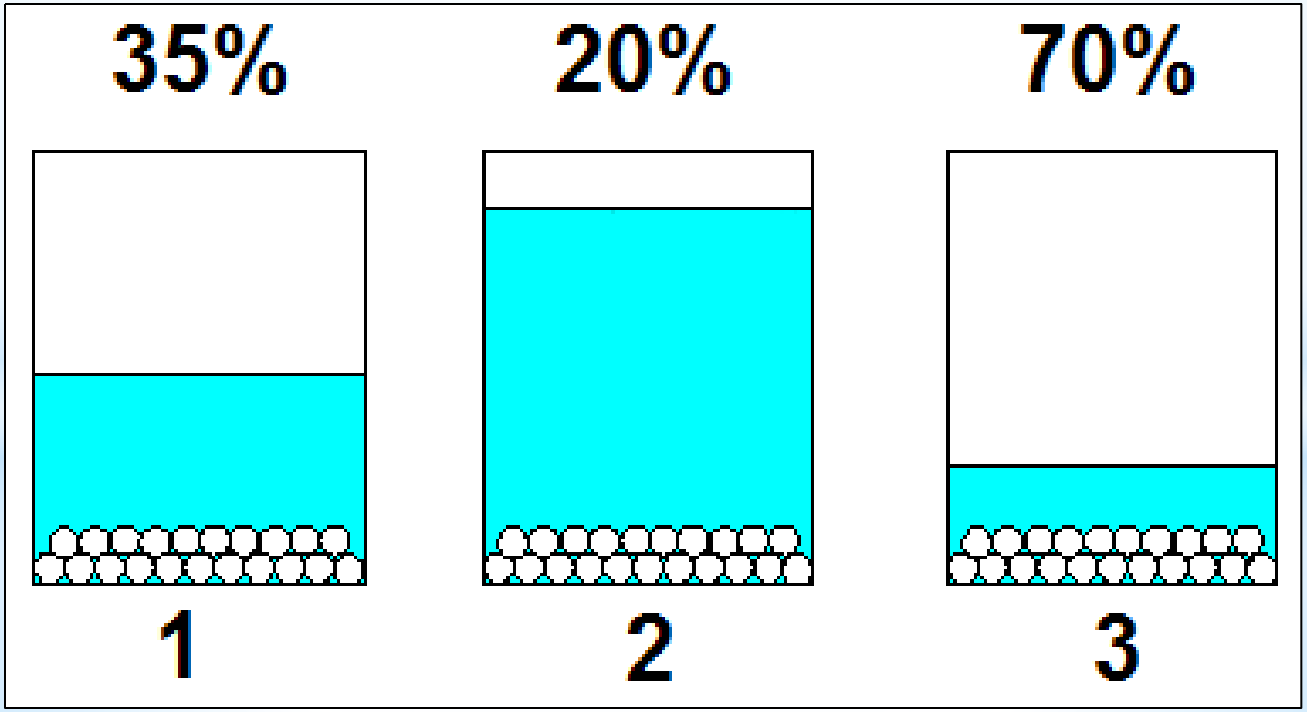
# Salinity

Look at the three diagrams below. Which one do you think has the highest salinity? Why?



# Salinity

Number 3 has the highest Salinity because it has more salt particles than water particles per unit.



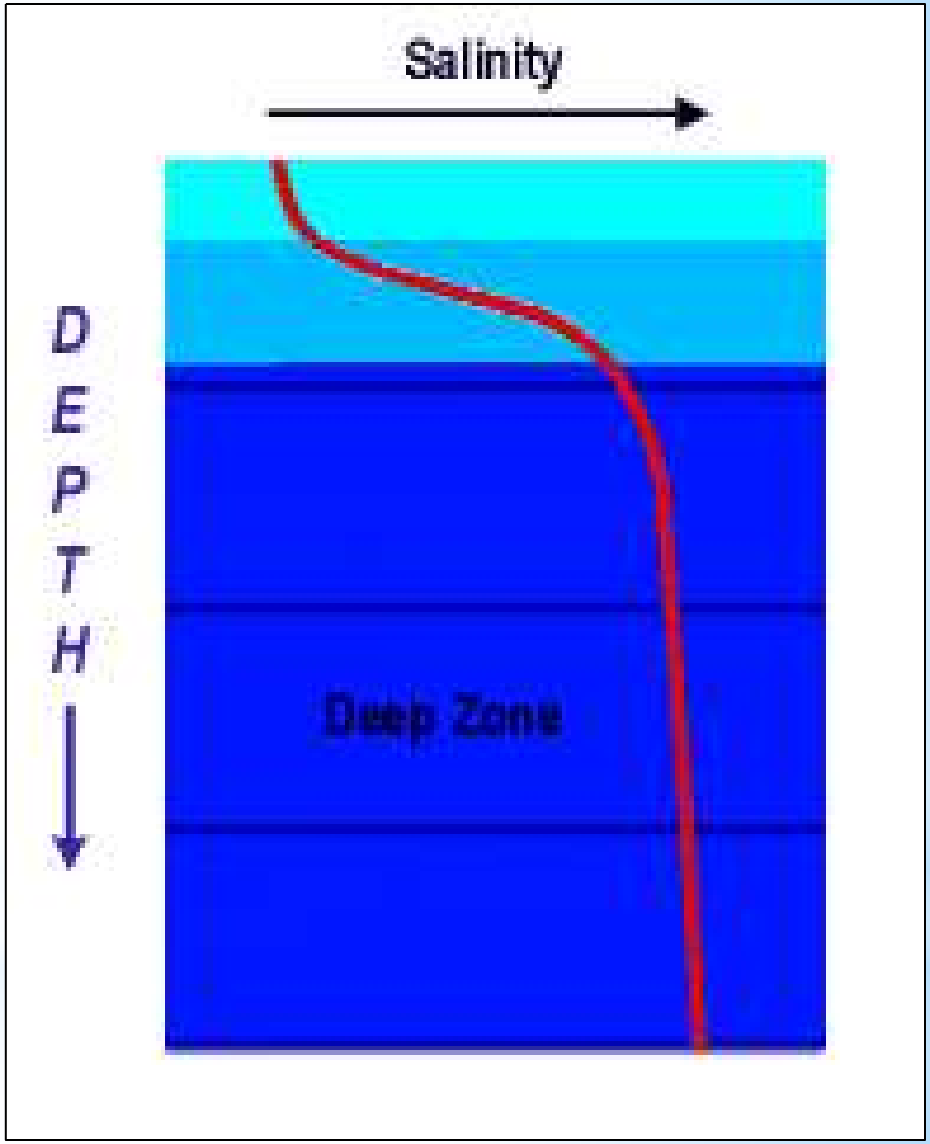
# Density and Salinity

* As Salinity [the amount of salts in the water] increases, Density increases.
* Salinity can increase [increasing density] from the freezing of polar ice. Why?
* Salinity can increase [increasing density] from evaporation. Why?
* Salinity can decrease [decreasing density] from the melting of polar ice. Why?
* Salinity can decrease [decreasing density] with the addition of freshwater.

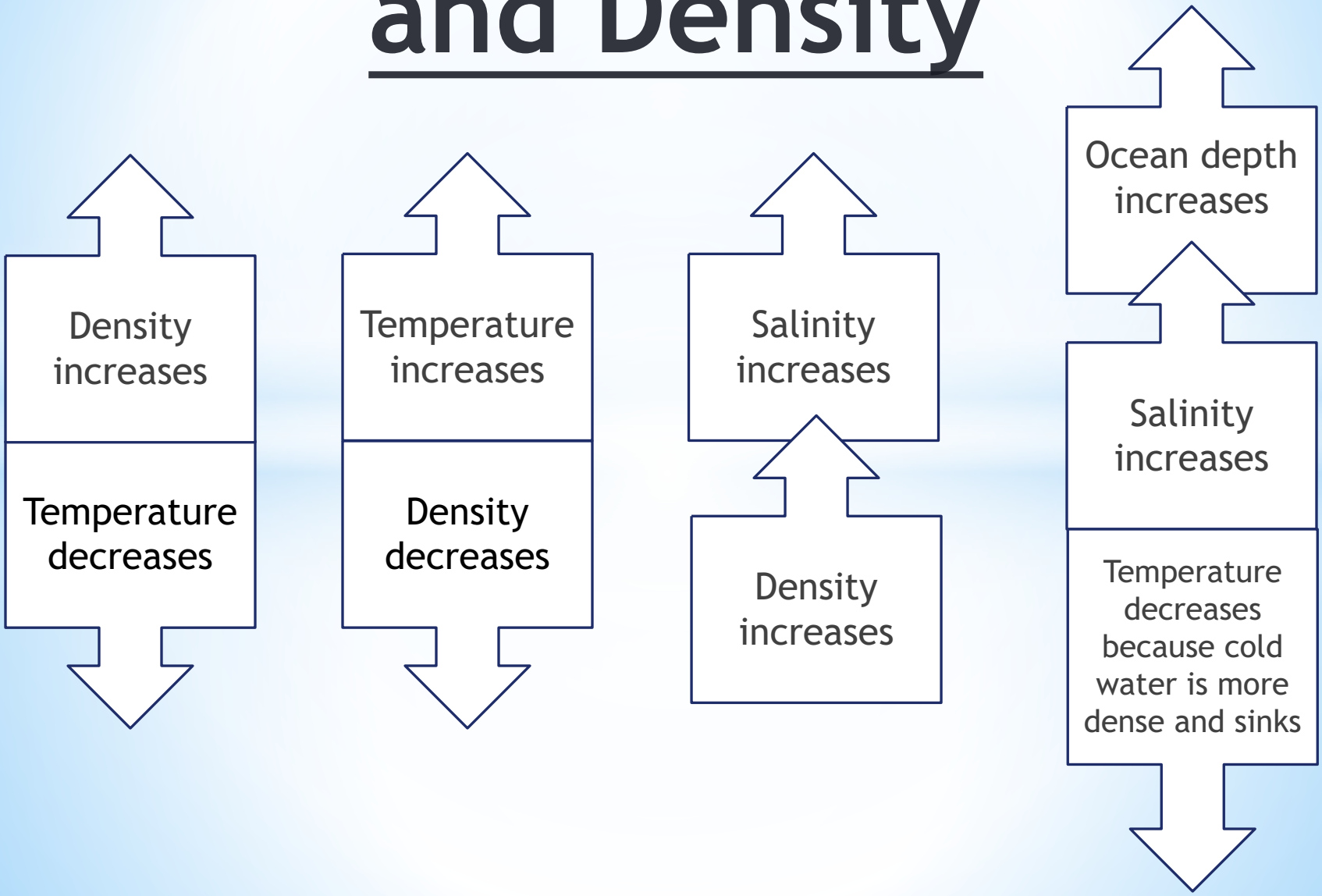
Look at the graph to the right. What does it tell us about Salinity and depth of the ocean?

Salinity increases as ocean depth increases.

What happens to temperature as ocean depth increases? Why?



# Temperature, Salinity and Density



# Summarizing Strategy:

## Answer the lesson essential question

**How does the temperature and salinity of water affect density?**