Review liquid layers

1. Why do different saltwater solutions form layers?

2. Thinking back to the syringe, how does compression affect density?
Review liquid layers

3. Liquids can’t be compressed like gases can (think of what happens if you squeeze a water balloon!), so how could we change the density of a liquid without adding anything to it?
Another density challenge

Today I have a new challenge: Make layers with plain water.
Focus question

• How does heat affect density of fluids?
Predict and record the layers in a successful vial. Explain your prediction.
Describe procedure

- Fill a vial about two-thirds full with room-temperature water.
- Use the bulb pipettes and colored water to create three layers (red, blue, and clear) in the vial.
Describe procedure

1. Come to the water station to get water as you need it.
2. Get how water (red) in one vial and cold water (blue) in a second vial.
3. Take only about half a vial of the hot and cold water.
4. Keep each vial in its own plastic-foam cup.

5. The third vial is the experimental vial. Fill it about two-thirds full with room-temperature water.

6. Create your layers in the experimental vial.
Distribute materials

Each pair of students will need

3  Vials with caps
2  Plastic-foam cups
2  Pipettes
1  Plastic cup, 250 mL
Helpful hints

1. Carefully lower the pipette through the room-temperature water to put the red or blue water exactly where you want it.

2. Dump failed layering attempts in the clear plastic cup.
Helpful hints

3. White paper held behind the experimental vial will make it easier to see layers.

4. Don’t touch a layering experiment in progress.

5. After refilling the experimental vial with room-temperature water, wait a full minute for the water to become still before adding colored water.
Repeat layering

Explain what you did so we can organize it into a procedure.
After you successfully layer the waters, leave the vial undisturbed and observe it for 5 minutes. Discuss with your partner what you observe and compare your observations with other teams. Be sure to draw and explain what happens on your notebook sheet.
Describe observations

1. What happened in your vial after it sat undisturbed for a few minutes?
2. What do you think caused the red water to start to descend?
Develop particle model

Work with your group to come up with an explanation for the layers of hot, cold, and room temperature water.

Compare it to the saltwater-layer investigation.
Develop particle model

1. What happened when the layered vial sat undisturbed for 5 minutes? Explain.

2. What do you think would happen if you put the layered vial in a cup with 2 cm of hot water? Explain.
Heat layered vial

Place the layered vial in a couple of centimeters of hot water. Work with your group.

a. Create the three-layer vial.

b. Put 1 cm of uncolored hot water in a \( \frac{1}{4} \) L container.

c. Place the layered vial carefully in the container of hot water and observe.
Heat layered vial

Make a model in your notebook to explain your observations.

Use colored pencils to make a larger, close-up diagram of the vial. Use arrows to show the movement of the colored water.
Fluid Convection

Convection currents have formed in the tank.
Check liquid layers

Look at the straws. They have not been shaken.

• What property of water particles could cause the salt water to mix like this?

Share your thoughts with a partner.
Check liquid layers

Think about the property of water particles and share with a partner the answer to this question.
Discuss particle model

Visualize the water with its particles moving around randomly.

When we increased the heat of the water, we increased the kinetic energy of the water particles.
Discuss particle model

When particles increase in energy, they move faster and bang into each other with greater frequency and force.

This drives the particles farther apart. When the particles are forced farther apart, the water becomes less dense.
Discuss particle model

1. Tell your partner two ways to change the density of a substance.
2. Is the hot red water more dense, the same density, or less dense than the room-temperature water?
Discuss particle model

3. Why do you think the hot red water sank to the bottom?
4. What happened to the particles in the red water as the water cooled?
View online activity

“Particles in Solids, Liquids, and Gases”
Introduce vocabulary

When a mass of fluid, either liquid or gas, is warmer or colder than the surrounding fluid, the mass will rise or sink in the surrounding fluid.
This motion of masses or streams of fluid, caused by difference in density resulting from temperature, is convection.

Convection is one way heated matter moves from one place to another. It is one way to cause an energy transfer.
Weather and Water Big Ideas

- What big ideas can help us explain weather?
## Weather and Water Big Ideas

<table>
<thead>
<tr>
<th>Energy transfer</th>
<th>Definition</th>
<th>Example</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convection</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Read “Density” on page 41.

Discuss the Think Questions in your group.
Review vocabulary

Spend a few minutes reviewing the vocabulary for this part. Update the vocabulary index and table of contents in your notebook.

• convection
• energy transfer
Answer the focus question

• How does heat affect density of fluids?
Answer the focus question

- To answer the question ___ you need to know that ___ .
- For example, ____ . We observed that ____ .
- The reason this happened was ____ .
Answer the focus question

• What you can’t observe is ____ ; however, the evidence is ____.
• We also learned that ____ . I think these concepts are important because ____ .
Read "Density with Dey" in FOSS Science Resources on page 47.