Name: _____

Grade 5

The Inquiry Project

Seeing the world through a scientist's eyes

Science Notebook

Investigating Water Transformations

Keeping Track of Water

TERC

Dear student scientist,

The science notebook is a scientist's essential tool for doing science and it's yours too! Scientists always keep their notebooks open and at their side and remember to record the date before they begin to work. You'll do this too.

What you write depends on where you are in an investigation. You might record a prediction, report an observation or some measurements, make a claim and describe the evidence you think backs it up. Your notebook is a place to write down things you wonder about or questions you have so you don't forget them.

Your notebook will contain different kinds of writing. You might make a numbered list to describe steps in a procedure, make a data table to organize your measurements, create a drawing with labels and notes to explain what you think is going on when something is too small to see.

Your notebook is for you, to help you remember what you were thinking, what you did, what you found out. Scientists' notebooks – and yours - are for others too, in case they want to replicate a procedure, compare their findings, or understand what another scientist was thinking or reasoning.

In the back of this notebook, you'll find suggestions for annotated drawings and different ways to represent data.

Time for science: open your notebook, enter the date, and fill it up with your ideas, questions, drawings, measurements, claims, and explanations!

Why are these ships in a field?

Staecker, via Wikimedia Commons

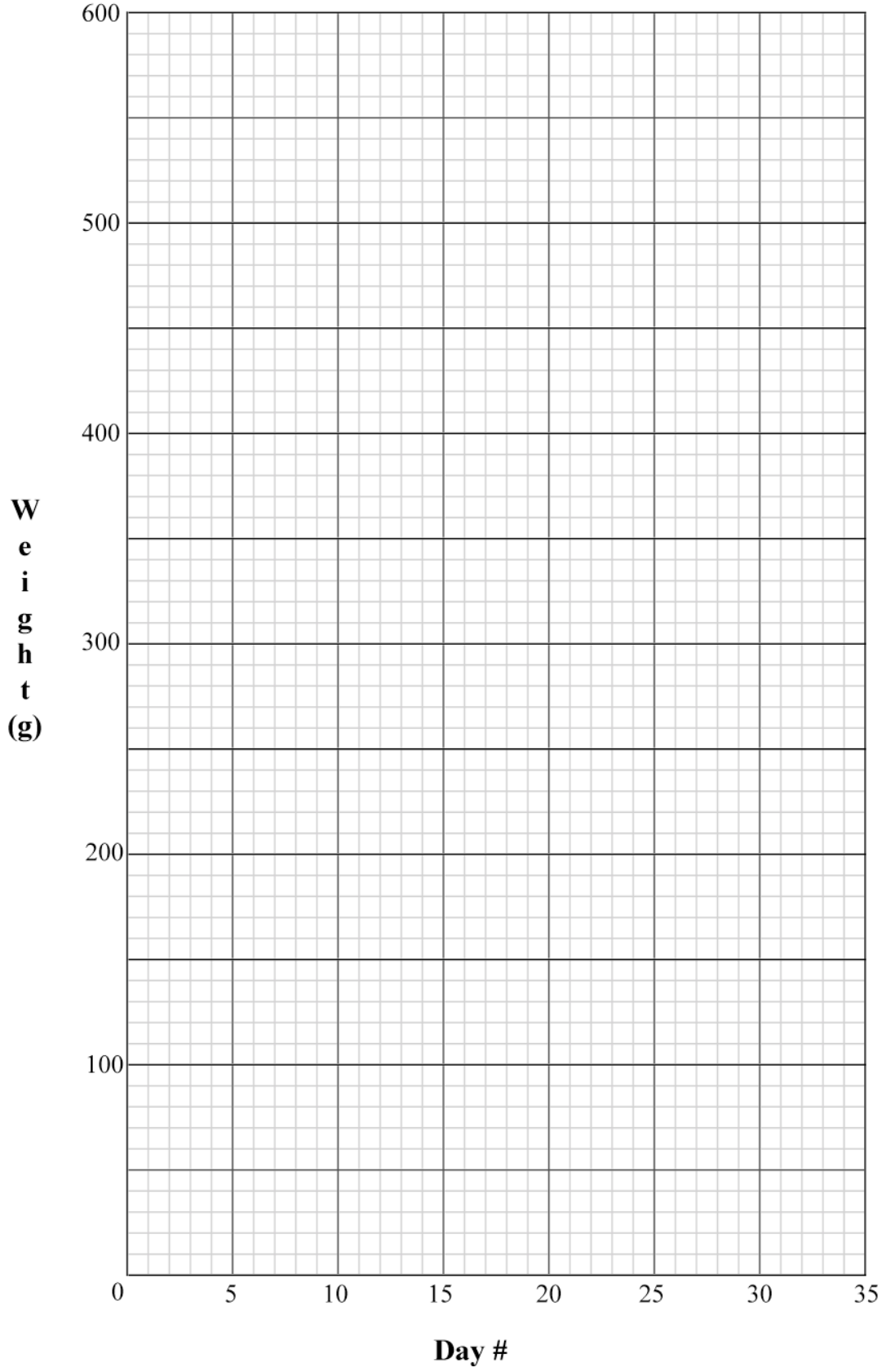
Staecker, via Wikimedia Commons

Why are these ships in a field?

Gilad Rom, via Wikimedia Commons

TwoWings, via Wikimedia Commons

Weight of mini-lake over time



Data Table: Weight of mini-lake

Date	Day #	Weight of mini-lake (grams)	Notes

Data Table: Weight of mini-lake (continued)

Date	Day #	Weight of mini-lake (grams)	Notes

Date: _____

Date: _____

Making mini-lakes

Mini-lake components:

Weight of empty vial with cap (tare weight): _____

Estimate of volume of sand (Investigation 2) _____

Component	Weight (grams)	Volume (cubic centimeter) (Investigation 2)
sandwich box and cover		
sand only		
gravel only		
rocks only		
water only		
Sum of Weights		

Weight of completed mini-lake (Investigation 2): _____

Date: _____

Making mini-lakes

Procedure:
Measure volumes and assemble mini-lake

Record estimate and measurements in Making mini-lakes table.

1. *Estimate* and record the volume of sand
2. Measure and record the volume of sand
3. Measure and record the volume gravel
4. Arrange the gravel, sand, and rocks in the sandwich box
5. Measure and record the volume of water
6. Add water to the mini-lake and mark the water level on a piece of tape
7. Name your mini-lake. Write the name on a piece of tape on the cover.
8. Put on the cover so it's tight.
9. Weigh the completed mini-lake and record the weight.

Date: _____

Reflection:
When we compared the Sum of Weights of the components of our mini-lake with the completed mini-lake, we found:

_____

_____

_____

_____

_____

I would expect the Sum of Weights and Weight of complete mini-lake to be (the same or different) because:

_____

_____

_____

_____

_____

_____

As we measured and arranged materials in our mini-lake, I was surprised that:

_____

_____

_____

_____

_____

Date: _____

Weight and volume data

Leila, Deneb, Tomas, and Fern measured the weight and volume of a sample of material, and recorded their measurements in a data table. Two of the samples were water. They forgot to write down the kind of material they used.

	Material	Weight of sample	Volume of sample
Leila		42 g	41 cc
Deneb		28 g	20 cc
Tomas		178 g	178 cc
Fern		76 g	59 cc

The two people who used samples of water are:

Reasons are:

Date: _____

Date: _____

Reflecting on the weight of small bits of matter

If a 1 cubic centimeter dropper filled with water made 100 drops, I think a single drop would weigh:

Reasons are:

My ideas about the weight of a single grain of sand are:

Date: _____

What happens when salt dissolves in water?

Put a strip of masking tape on the cup and mark the water level before adding the salt.

Weight Data:

Water:

Weight of water and cup: _____

Weight of empty cup (tare weight): _____

Weight of water **only:** _____

Salt:

Weight of salt and cup: _____

Weight of empty cup (tare weight): _____

Weight of salt **only:** _____

Weight of water **only** and salt **only** | |

Water and Dissolved Salt:

Weight of cup and water and dissolved salt: _____

Weight of empty cup (tare weight): _____

Weight of water and dissolved salt **only** | |

Date: _____

What happens when salt dissolves in water?

Volume Data:
Drawings to show the water level before and after dissolving salt.

What happens when salt dissolves in water?

Claim:
_____

_____

_____

_____

Evidence that supports the claim (use weight and volume data):

_____

_____

_____

_____

Procedure:
Adding salt to the mini-lake

1. Weigh your mini-lake and record the weight
2. Put 2 spoons of salt into the water in your mini-lake (don't stir)
3. Weigh your mini-lake again and record the weight

Date: _____

What happens to drops of water?

Observations:
Observations of water drops placed on a paper towel.

Observations of water drops in mist sprayed on the outside of the plastic cup.

Date: _____

What happens to drops of water?

Explanation:
Annotated drawing to explain what happened to the water drops sprayed onto the outside of a plastic cup.

Date: _____

Uncovering the Mini-lakes

I predict that when we take off the cover of our mini-lake:

_____

_____

_____

_____

Reasons for my prediction are:

_____

_____

_____

_____

Evidence needed to test the prediction is:

_____

_____

_____

_____

_____

_____

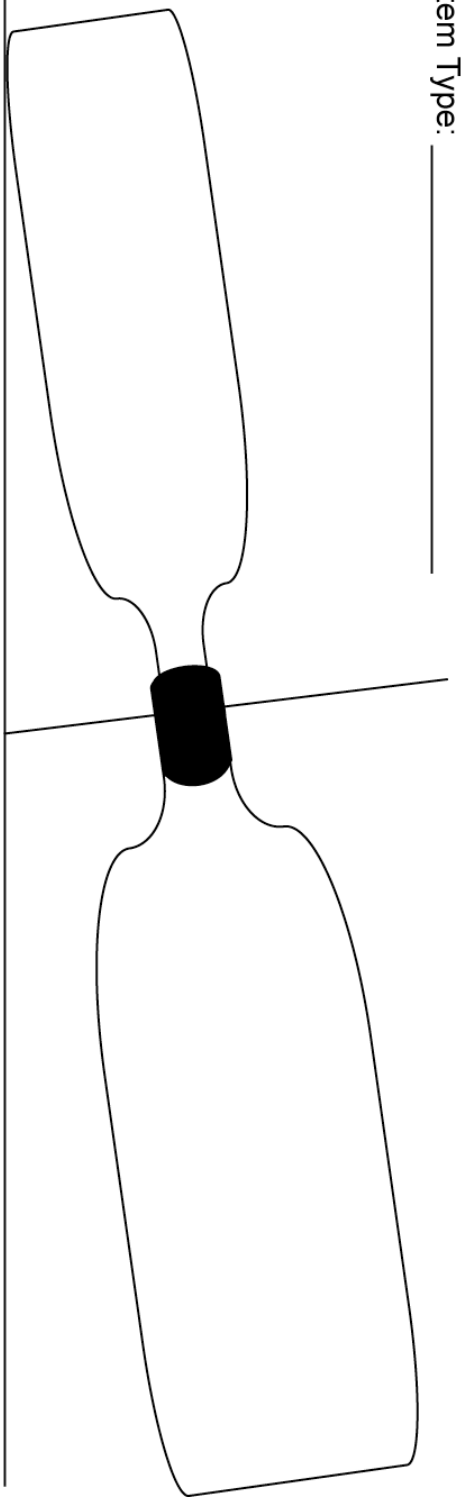
_____

Date: _____

Date: _____

2-bottle closed systems – Initial Observation

System Type: _____



Notes/Observations:

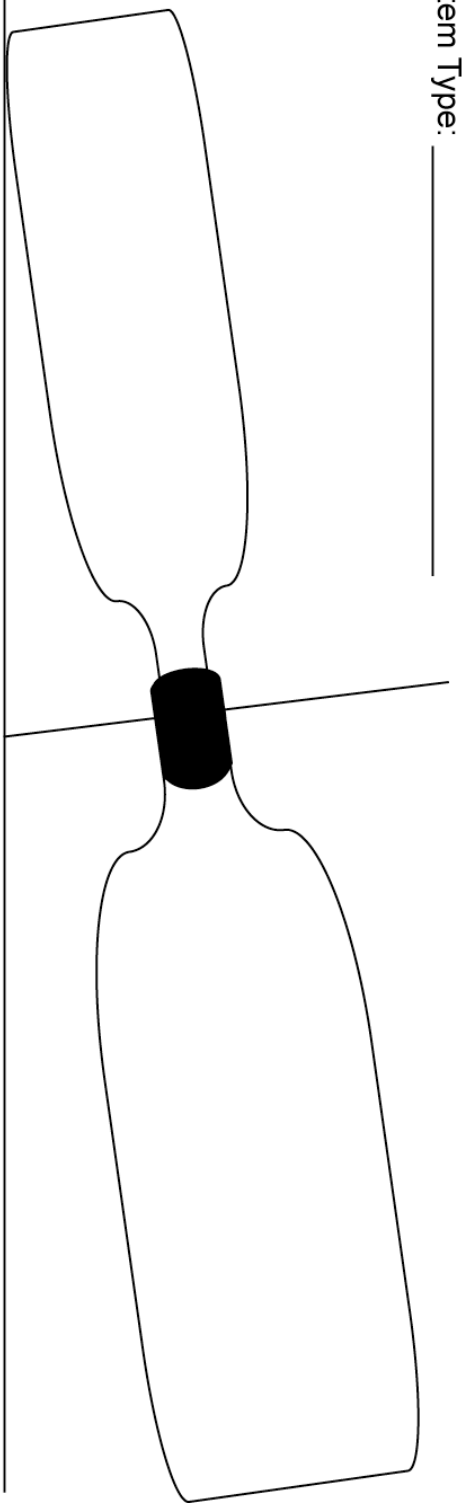
Date: _____

Investigation 7

Date: _____

Predict what will happen in the 2-bottle system?

System Type: _____



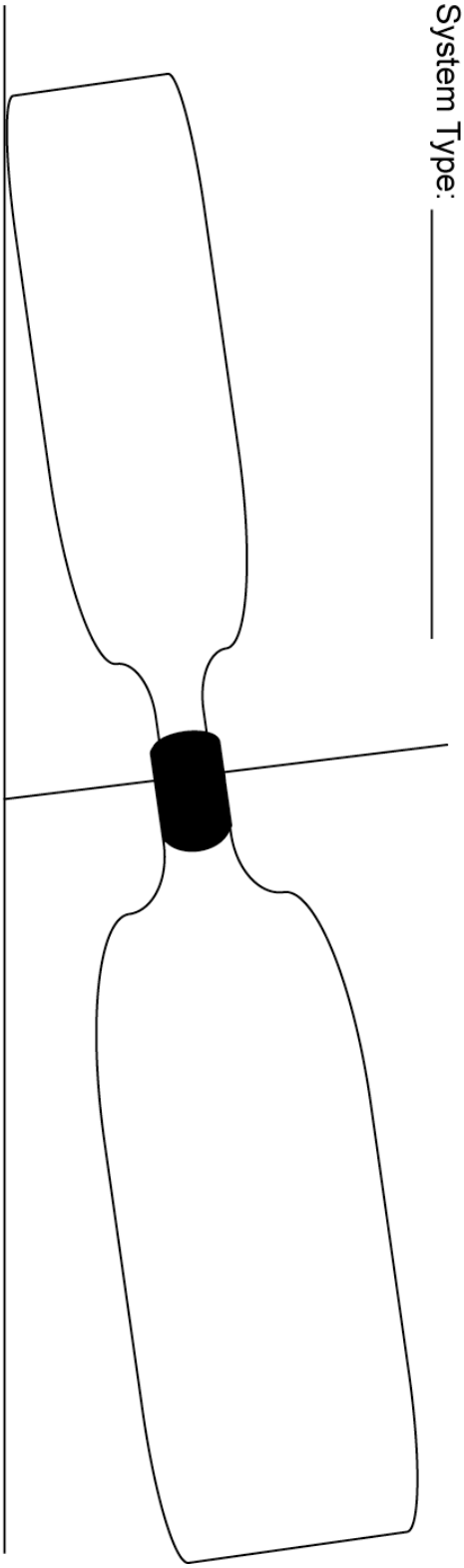
Notes/Observations:

Date: _____

Date: _____

What is happening in the 2-bottle system?

System Type: _____



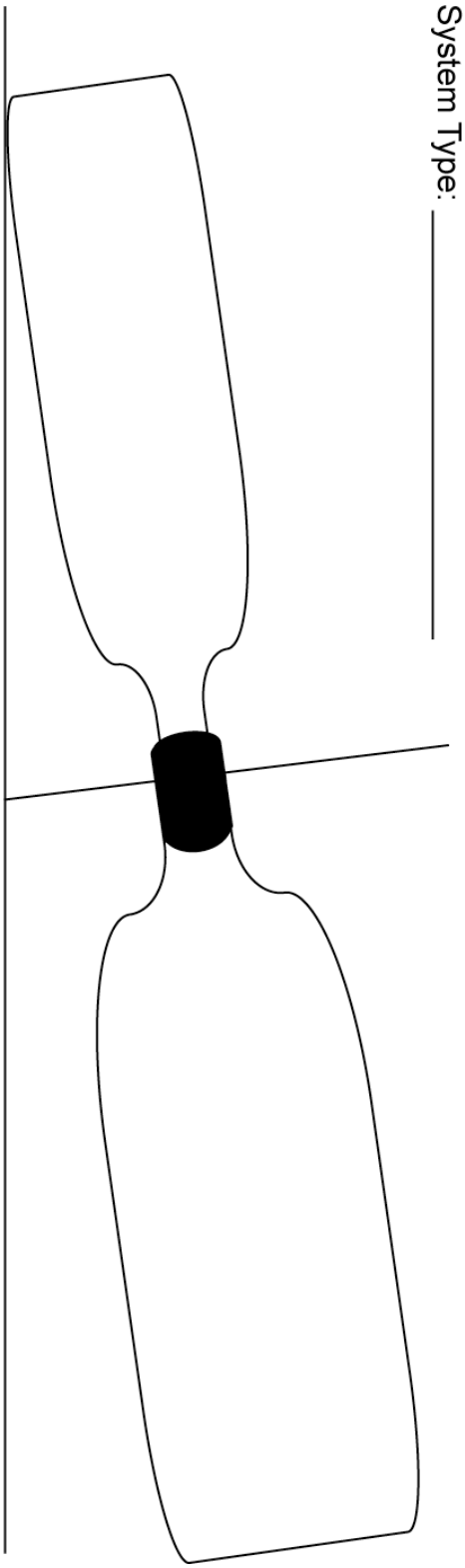
Notes/Observations:

Date: _____

Date: _____

What is happening in the 2-bottle system?

System Type: _____



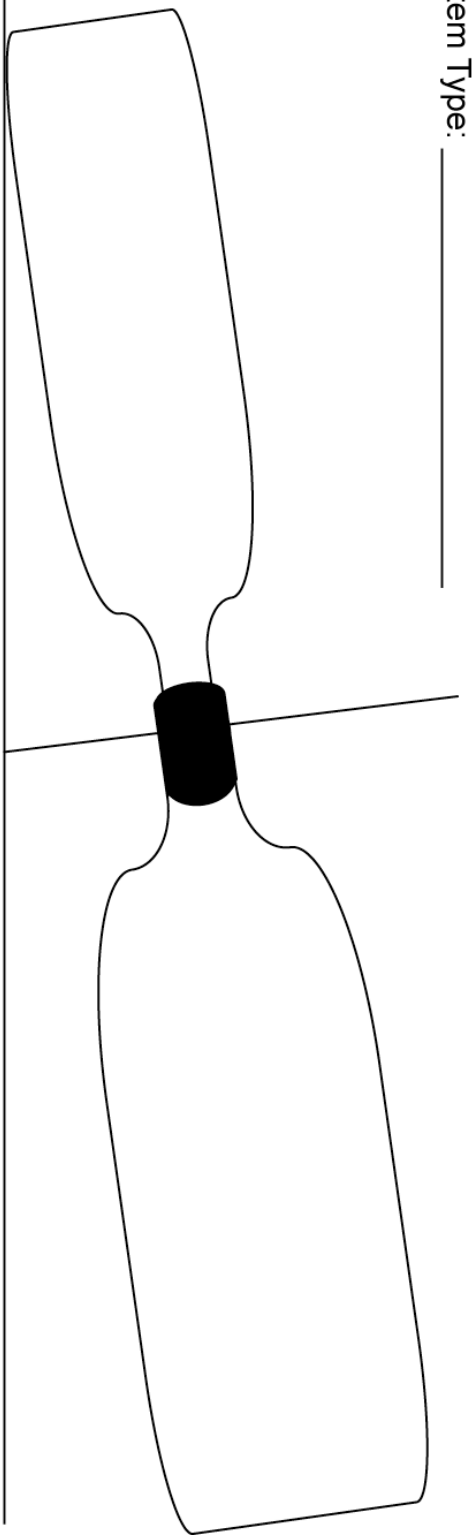
Notes/Observations:

Date: _____

Date: _____

What is happening in the 2-bottle system?

System Type: _____



Notes/Observations:

Date: _____

Date: _____

Notes about the 2-bottle system

Date: _____

Comparing ice and water

Same	
Different	
Ice	**Water**

Date: _____

Predictions about freezing water

What will happen to weight when water freezes?
Prediction (and reasoning):

_____

_____

_____

_____

_____

_____

What will happen to volume when water freezes?
Prediction (and reasoning):

_____

_____

_____

_____

_____

_____

Procedure:
Freezing water samples

1. Place a strip of masking tape vertically on the outside of water bottle.
2. Write your initials on the tape.
3. Mark the water level. If necessary, adjust the water level to align with the mark, using the pipette.
4. Weigh the water bottle and water and record the data in the table, *What happens to weight and volume when water freezes and ice melts?*

Date: _____

What happens to weight and volume when water freezes and ice melts?

Data:

Inv #	Bottle of (water or ice)	Weight (grams)	Volume (use labeled drawings)
10			
11			
12			

Date: _____

What happens to weight and volume when water freezes?

Reflections:
A comparison of my prediction and our findings:

_____

_____

_____

_____

_____

_____

If there are differences, some possible reasons are:

_____

_____

_____

_____

_____

_____

Questions I have about water freezing:

_____

_____

_____

_____

_____

_____

Date: _____

What changes and what stays the same as ice melts?

Claim about what changes and what stays the same when ice melts (and the evidence to support the claim):

_____

_____

_____

_____

_____

_____

_____

I think the most convincing evidence for the claim that water and ice are the same kind of matter is:

_____

_____

_____

_____

_____

_____

_____

Date: _____

Particle Magnifier
ice and water particles

As the temperature of ice or water changes:

- Does the size of the particles change or stay the same?
- Does the motion of the particles change or stay the same?
- Does the space between the particles change or stay the same?

_____

_____

_____

_____

_____

_____

_____

Compare the particles of ice and water:

- Is the size of the particles the same or different?
- How does the motion of particles compare?
- How does arrangement of particles compare?

_____

_____

_____

_____

_____

_____

_____

Date: _____

Does air takes up space?

Observations of coupled syringes:

Claim (air does or doesn't take up space):

_____

_____

_____

Evidence that supports the claim.

_____

_____

_____

_____

_____

_____

Date: _____

Does air have weight?

Observations of air in balloons:

Claim (air does or doesn't have weight):

_____

_____

_____

Evidence that supports the claim.

_____

_____

_____

_____

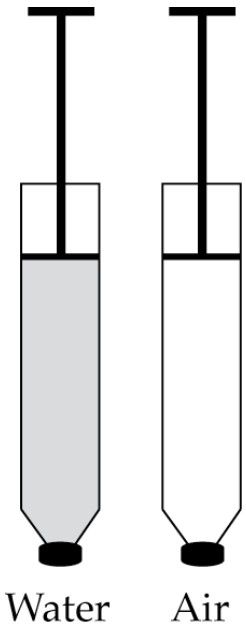
_____

_____

Date: _____

Predicting the compressibility of water and air

Predictions:
Imagine the plungers of these **sealed** syringes are pushed.



Water syringe
I predict:

_____

_____

_____

Air syringe
I predict:

_____

_____

_____

I think so because:

_____

_____

_____

_____

Date: _____

Observing the compressibility of water and air

Observations:
When the plunger is pushed in the air syringe:

_____

_____

_____

_____

_____

When the plunger is pushed in the water syringe:

_____

_____

_____

_____

_____

Date: _____

Date: _____

Explaining the compressibility of water and air

Annotated drawing to explain observations:

- How do you explain the difference in the compressibility of air and water?
- What would you see at the particle level to explain what is going on?

Date: _____

Particle Magnifier
air particles

When the air is heated:

- Does the size of the particles change or stay the same?
- Does the motion of the particles change or stay the same?
- Does the space between the particles change or stay the same?

_____

_____

_____

_____

_____

_____

_____

_____

_____

When the air is cooled:

- Does the size of the particles change or stay the same?
- Does the motion of the particles change or stay the same?
- Does the space between the particles change or stay the same?

_____

_____

_____

_____

_____

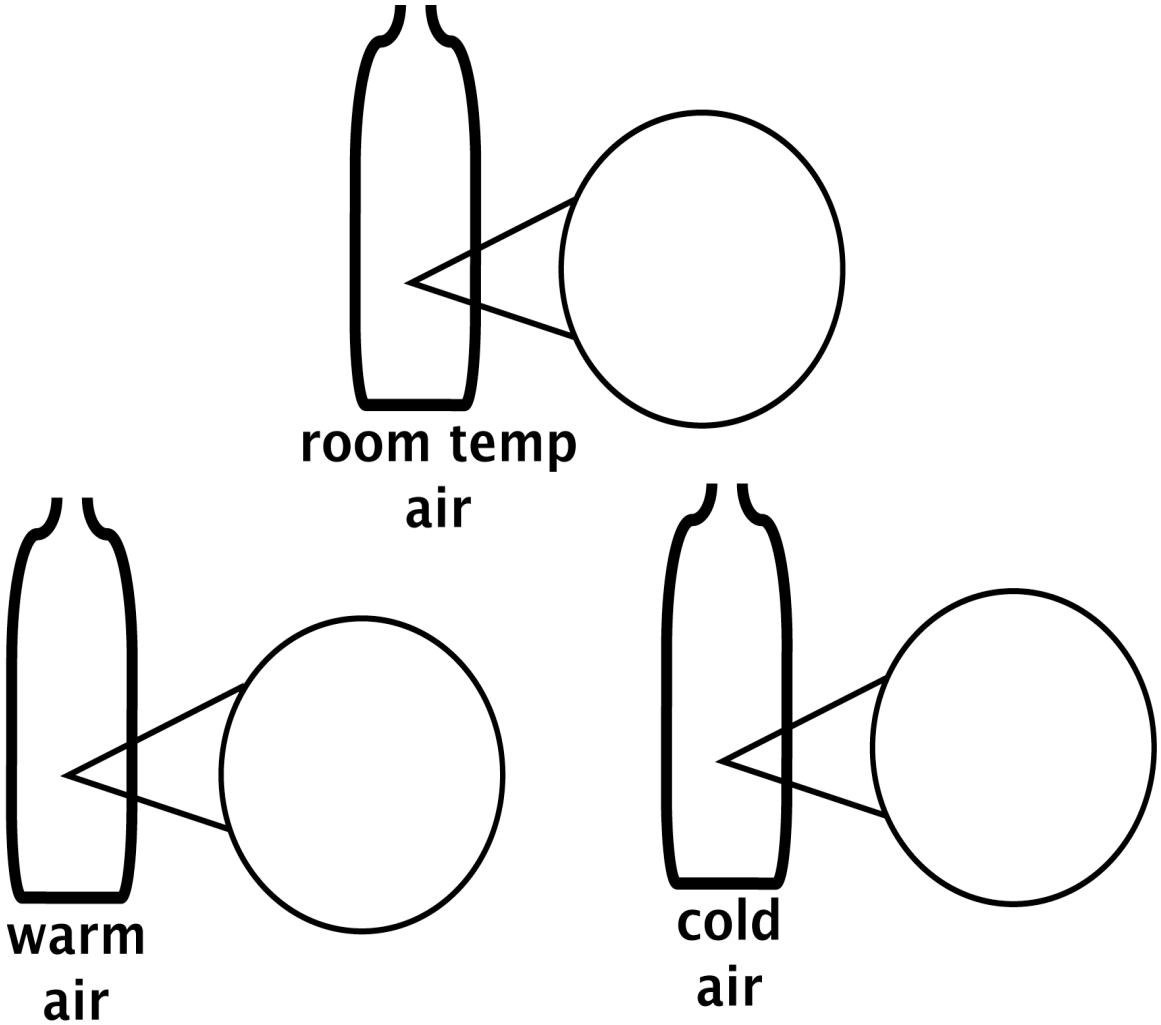
_____

_____

Date: _____

Heating and cooling air

Annotated drawing to show what happens when a bottle of room temperature air was placed in warm water and cold water – observations and explanations:

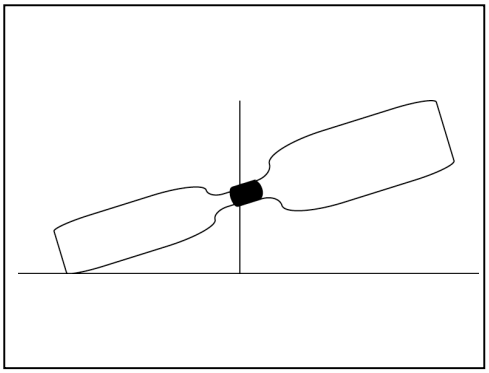


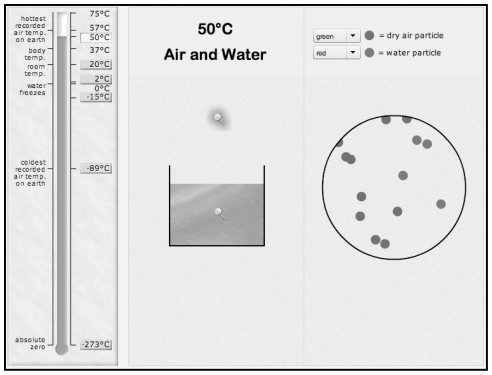
Date: _____

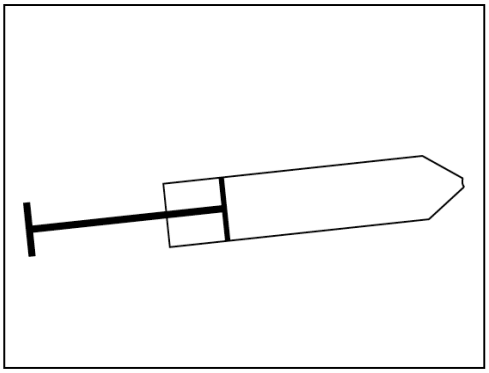
New Ideas

In the real world, water is constantly transformed from liquid to vapor (gas) or ice (solid) and back again. Here's what I learned from each of the following to help understand these transformations.

Date: _____




hottest recorded air temp. on earth
body temp.
room temp.
water freezes
coldest recorded air temp. on earth
absolute zero
75°C
57°C
50°C
37°C
20°C
2°C
0°C
-15°C
-89°C
-273°C
50°C
Air and Water
green
= dry air particle
red
= water particle



Date: _____

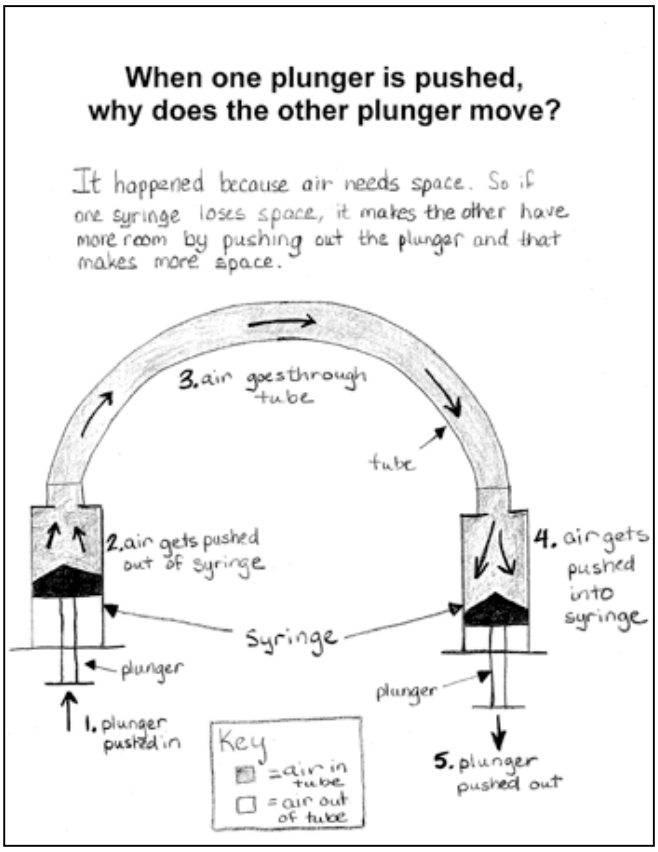
Reference

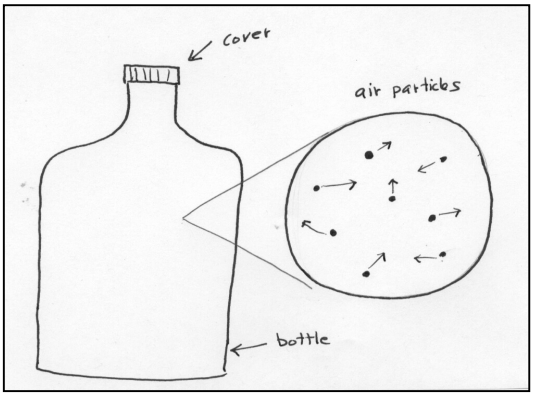
Annotated Drawings

Annotated drawings explain a scientific process or answer a scientific question. They help communicate your ideas to others. These are not finished products – as your ideas change, you can make changes to your annotated drawing!

An annotated drawing should:

- Provide an explanation.
- Use simple outline drawings.
- Use labels, arrows, and a color key.
- Have notes that explain important ideas.





To draw something you cannot actually see, draw an imaginary “magnifying lens” to zoom in and make visible something that is invisible to the human eye.

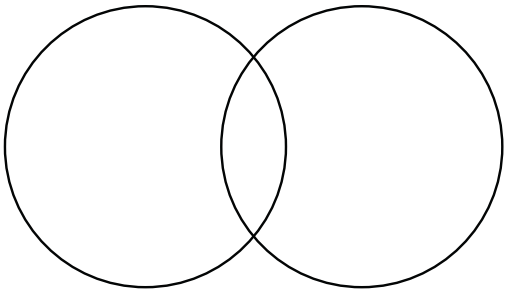
Questions for Reviewing Annotated Drawings

1. What is the drawing trying to explain?
2. Is there anything that you don’t understand and would like clarified?
3. If you compare two annotated drawings, how are they the same? How are they different?

Data Representations

Compare

Same
Different



List

Ordered

1) _____
2) _____
3) _____
4) . . .

Bulleted

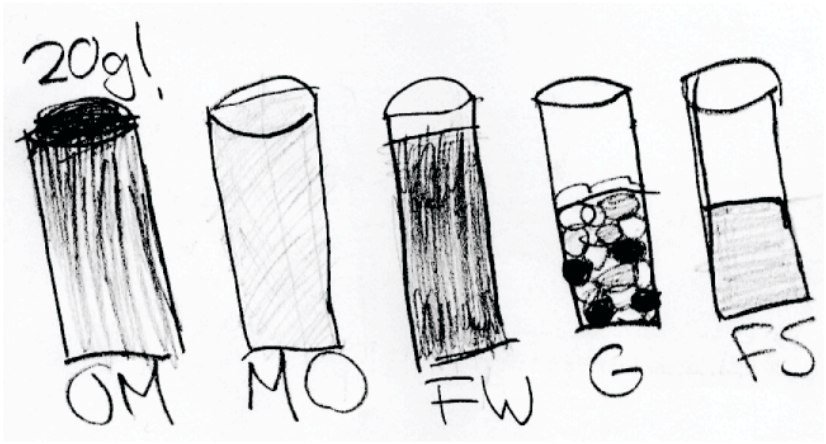
- _____
- _____
- _____
- . . .

Table

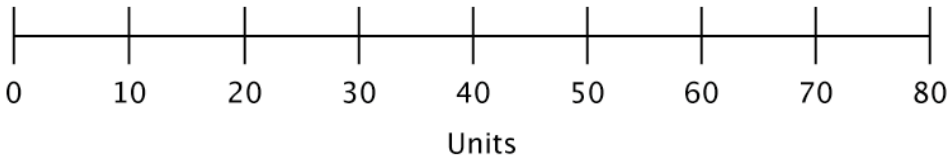
Case	property #1	property #2	...
case #1			
case #2			
case #3			
...			

Data Representations

Labeled Drawing



Measure Line



Graph