Dense Experimentation*

How Science Makes Sense

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*with Lab Report

Dense Experimentation – the real scientific method right from the beginning

Question

Hypothesis

Our goal?

From an early age, children should learn how the real scientific method works. This involves **systematic thinking and action to gain knowledge**, with a focus on experimentation. We illustrate our principle using a series on density and solubility as an example, because this topic is suitable for young children, but of course it can also be applied to many other topics.

Why is this our focus?

Fake news and conspiracy theories are unfortunately part of our everyday lives. The internet in particular is riddled with false claims of all kinds. Unquestioning belief in authority is often just as harmful as “overly critical thinking,” where everything from the fact that the earth is a sphere to the Nazis being politically right-wing is questioned. **We want to combat fake news! Not by teaching children “correct” facts, but by teaching them the right methodology for gaining (scientific) knowledge from an early age.** In this way, we enable them to draw their own conclusions depending on the situation, to trust the right experts, and to form their own opinions competently in the long term.

Material

Testing

How does this work?

Even at a young age, children can understand the steps of the scientific method—**question, hypothesis, testing, conclusion**—and act accordingly if it is a **central part of their education**. This is not about teaching methodology on an abstract level, but rather about repeatedly applying it in the classroom. There is a **high experimental component**, but this is not just about showmanship or excitement; rather, it is about perceiving experiments as a genuine means of scientific process. In this way, scientific thinking is gradually internalized.

Observation

measurements

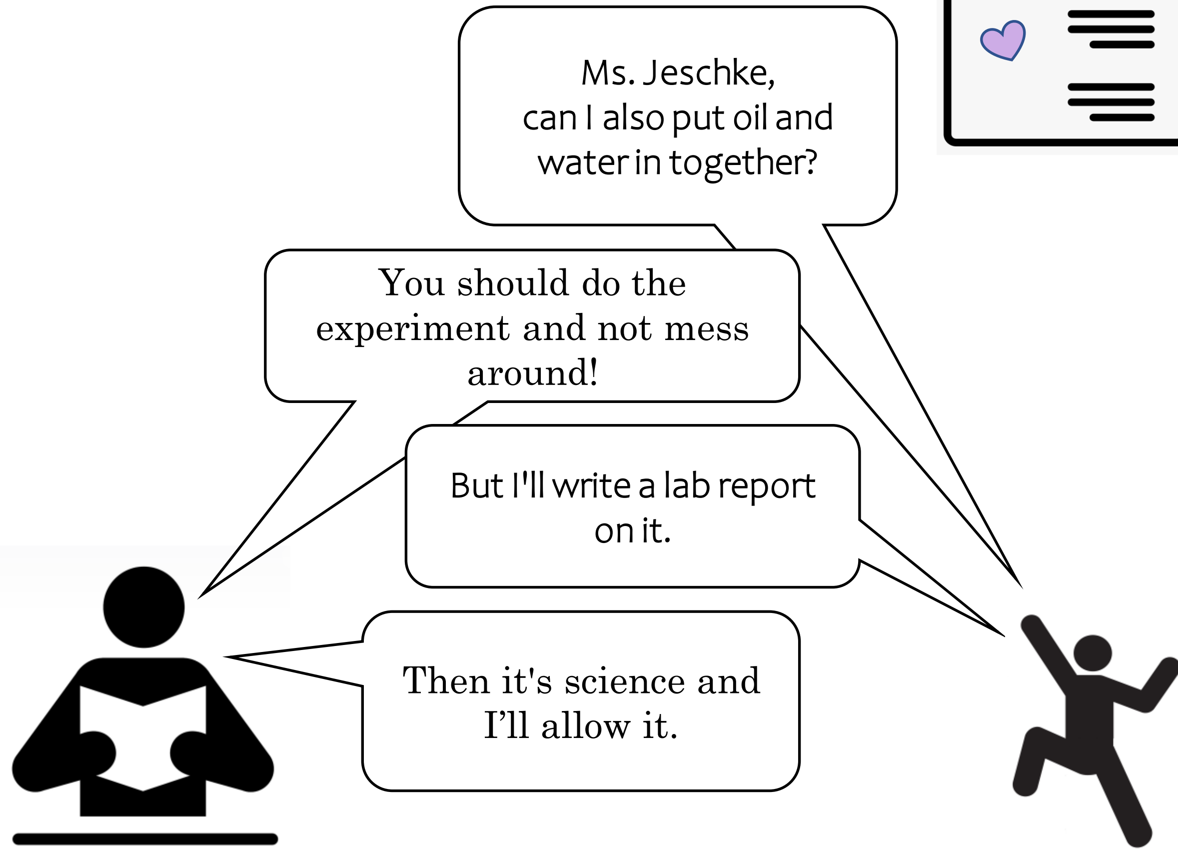
What does that look like in concrete terms?

First, the bad news: **we write a lot of lab reports**! But while this may seem very tedious at first, it soon helps the children in so many ways. It gives them structure (in their notebooks and in their thinking), promotes self-confidence in acting as “real scientists,” impressively demonstrates the repeatability and thus objectivity of science, supports language skills, documents their own learning progress over the long term, and so on and so forth**... The prerequisite for success is that the steps of discovery in each experiment are so small that the children can really draw them on their own.** This creates a sense of achievement rather than the unpleasant feeling of “How are you supposed to figure that out?!”

conclusion

knowledge

We really write a lot of lab reports — but we love it!

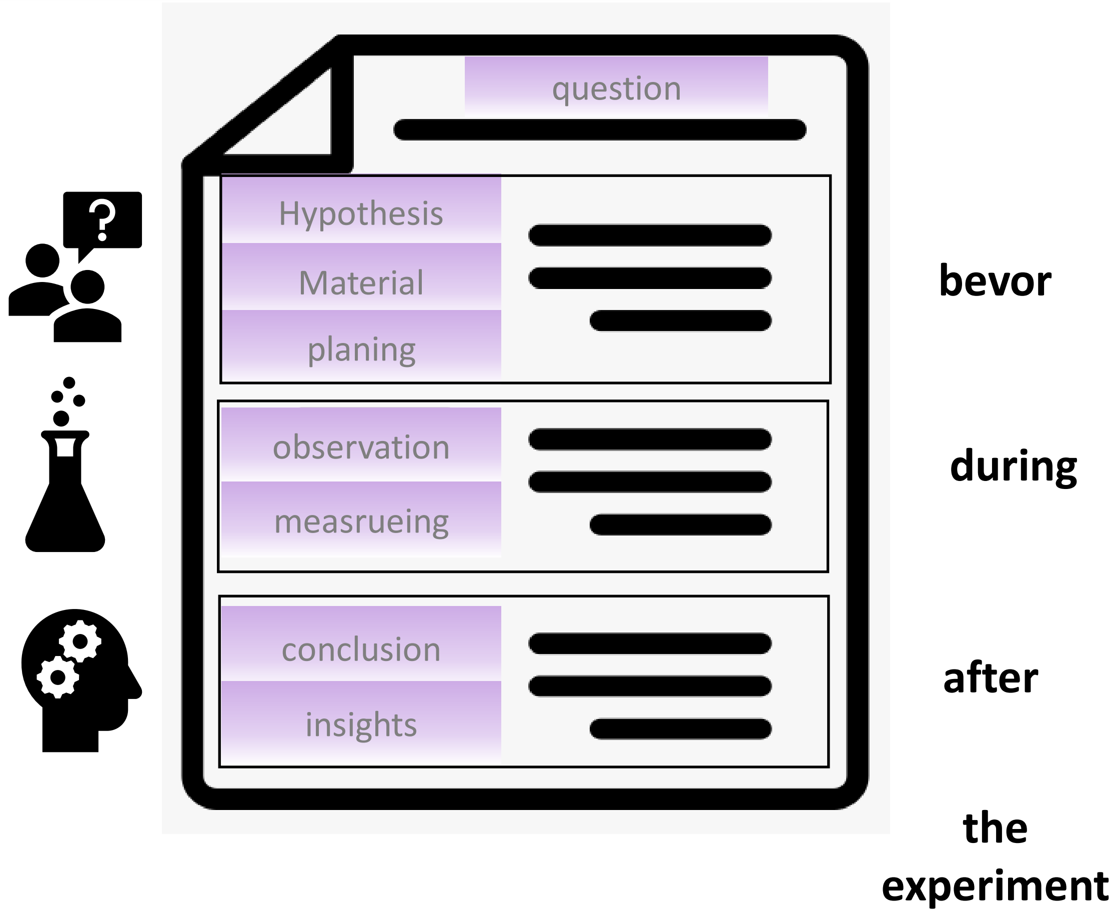


Why are lab reports so important to us?

Children are curious and have lots of great ideas. If we encourage them from an early age, we can preserve this wonderful ability for a long time. Unfortunately, the framework curriculum rarely allows us the time to fully pursue the children's interests.

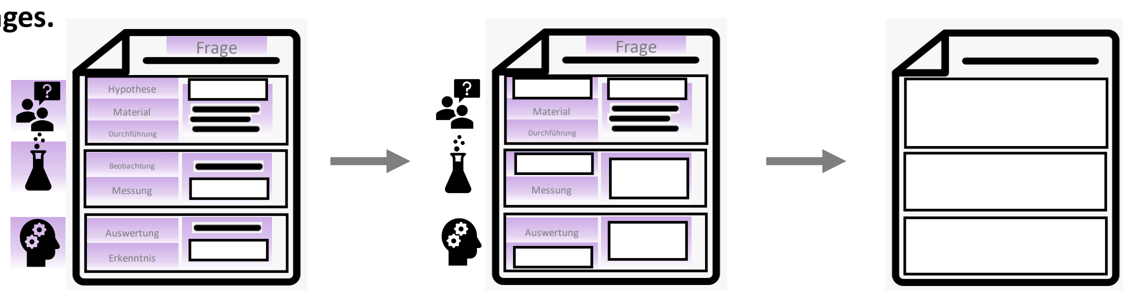
In many cases, however, children come up with exactly the questions that the teacher would have asked anyway. The perfect opportunity! **We allow children to investigate their own questions. As long as they do so systematically and according to the scientific method, "playing around" is not a waste of time but science.** After all, there are real papers by real scientists on the perfect technique for carrying a full coffee cup, the question of whether dead trout can still swim, and the discovery that some plants imitate artificial plants. And so, in many cases, a systematic investigation of one's own (but seemingly strange) question is much more meaningful and sustainable than an experiment that only serves as an introduction to the new topic or to capture attention. And when in doubt, the following applies: **every application of the scientific method internalizes it and encourages children to think in a systematic, fact-based way.**

Are proper protocols too difficult and time-consuming for little ones?



How do lab reports succeed?

We admit it: **most of our experiments are more like mini-experiments. But that's a good thing, because then the protocols are also mini and not a big hurdle.** And lab reports anyway only ever consist of three parts: what you do before, during, and after the experiment. We start with this clear structure and maintain it for each experiment. It serves as a framework that you can follow and is only adapted slightly for specific experiments if necessary. Admittedly, during the first experiments, the children still need help with almost every step. It is therefore not uncommon to use a “protocol scaffolding” with only a few gaps that the children still have to fill in.
But faster than expected, the guidelines become fewer, the children's independence grows, and the reports are no longer created from pre-printed forms but from blank pages.



Why do we have more than 30 Mini-Experiments?

Dynamic growth processes of experiment collections?

It started with a few simple “mini-experiments” to learn how to experiment. But children are curious, and so questions often arose as to whether X or Y could also be tested. Why not? And so, every year, a slightly longer collection of mini-experiments was created. Three principles are particularly important here:

1. In every experiment, **the learning step must be small enough that most children can manage it on their own**.
2. We use **inexpensive materials** from the children's everyday lives to carry out the experiments.
3. Real life is not divided into school subjects and topics. **Connections with other topics** arise sometimes automatically and sometimes when you least expect them.

Topic: Volume, mass, density

Volume
- Volume units
- Volume formula and cuboid
- Convert units

Density 1: Volume, mass and density
- What is density?
- How is density determined?

Density 2: floatint or not
- Density formula
- Examples of densities
- Floating of solids due to density differences

Density 3: layer on layer
- Density of liquids
- Layering of liquids

Warm and cold ballons
- Changes in volume and density of gases due to temperature changes
- Hot air ballon

Frozen oil
- Changes in volume and density due to changes in aggregate state
- Cross-linking at melting temperature and floating of solids

Thema: Löslichkeit

Lösungen
- Stoffe lösen sich in Wasser und bilden Lösungen
- Stoffe verschwinden dabei nicht

Löslichkeitsgrenze
- Löslichkeitsgrenze von Salz und Zucker in Wasser
- Dichteveränderung bei Lösungen

Project work

Bermuda-triangle
- Medium densities and floating
- Building a boat

Lava lamp and hot air ballon
- Density differences between gases and liquids, including those caused by temperature changes
- Building a hot air ballon

Dense Water
- Density differences due to concentration changes
- Schichten eines Salzcocktails

Mass, Volume, Density – Systematically (Difficult project)
- Archimedes‘ principle
- Systematic investigation of density and volume in salt solutions

And this is what it looks like in the class room – some highlights

Fill empty tea light holders with water or oil and freeze them.

What we planed to do...

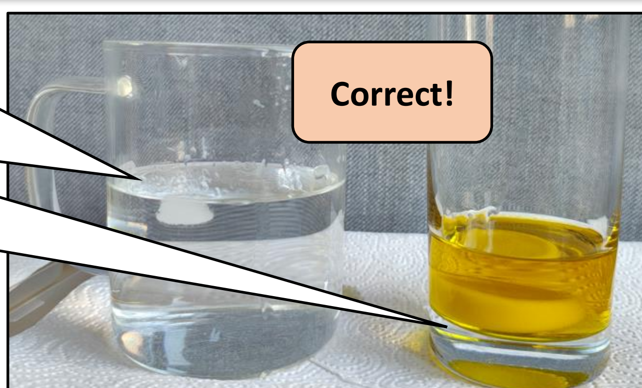
Water expands when it freezes and becomes less dense.

What happend then...

- ice floats on water due to lower density
- Melting temperatures vary depending on the material
- A lot of hypothesis
- A larger collection of experiments for the next year

Huh? Why is sunflower oil liquid again and water isn't?

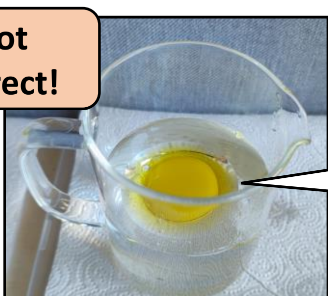
But if it is less dense, does that mean frozen oil does not float like ice?



Correct!

They look completely different when frozen. If I don't know what kind of oil it is, I freeze it.

Not correct!



Does frozen oil sink in water?

And this is what it looks like in the class room – some highlights

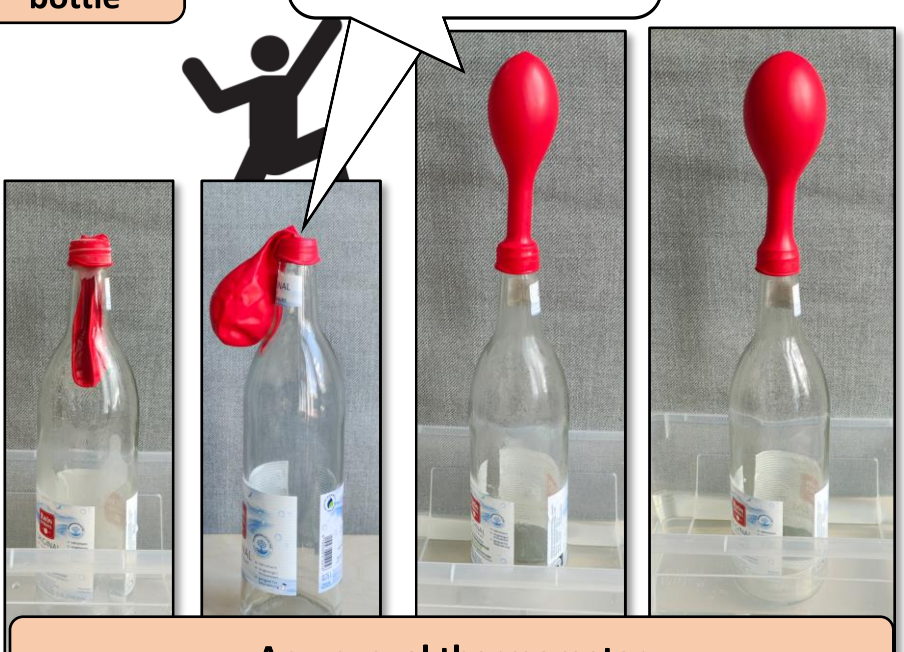
What we planed to do...

Gases expand at higher temperatures and contract at lower temperatures.

What happend then...

- States of matter, water vapor in the air
- An unusual thermometer
- Reversibility of changes in states of matter
- A larger collection of experiments for the next year

Ice in the bottle



An unusual thermometer

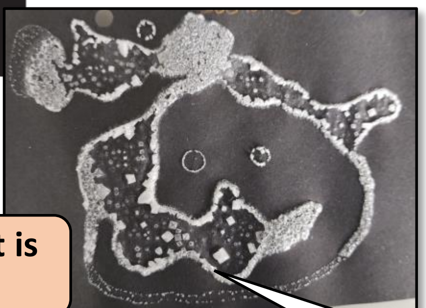

And this is what it looks like in the class room – some highlights

Dissolve as much salt as possible in 100 ml of water until you reach the solubility limit.

What we planed to do...

There is a solubility limit. For salt, this is around 30g per 100ml.

Is the salt just gone?



The Salt is back!

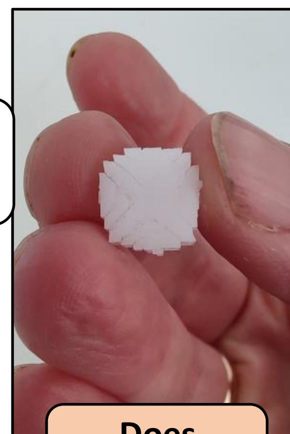
What happend then...

- Salt pictures when water evaporates
- Lots of crystals
- Doesn't work becomes, doesn't work that way
- Exciting (still open) questions
- A larger collection of experiments for next year

Why are the crystals square shaped??

Does it work with sugar as well?

Doesn‘t work!

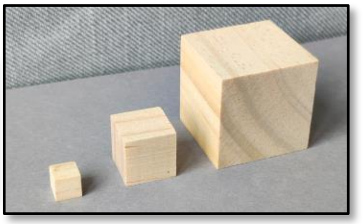


Does work!

They all look different!

But they‘re all rectangular!

Volume –
is not only loudness



Thought through!

1. Name units in which length can be measured.
2. Describe how to calculate the area of a rectangle. Name units in which area can be measured.
3. Give the formula for calculating the area of a rectangle.

Volume indicates the space occupied by a body. A cube measuring $1cm \cdot 1cm \cdot 1cm$ has a volume of:
$V = 1cm^3$. The unit is called "cubic centimeter".

Material

- Approx. 25 wooden cubes (1 cm edge)
- Min. 6 folding rulers (per group)
- Painter's tape
- 12 straws
- Scissors

Build – The cubic centimert cm^3

- Build a cuboid measuring 2 cm wide, 3 cm long, and 4 cm high using wooden cubes. Determine the volume of the cuboid you have built.
- By building different cuboids, determine a rule that can be used to calculate the volume of cuboids.

Game – The cubic meter m^3

- Compete against each other in groups of about 5 people.
- The goal is to build a cubic meter out of the folding rulers.
- Use the painter's tape to connect the folding rulers to each other. The fastest group wins. Good luck!

Craft – The cubic decimeter dm^3

- Build a cube with an edge length of 10 cm out of straws.
- Work together to figure out how many of these cubes would fit into one cubic meter. Explain your reasoning!
- Work together to figure out how many small wooden cubes would fit into one cubic decimeter. Explain your reasoning!

Thought ahead!

1. The contents of bottles are not measured in cm^3, dm^3 or m^3. Name the units that are used instead.
2. One liter (and one milliliter) corresponds to one of the units of volume above. Match them up to the right units above.

Volume, mass, and density

Thought through!

1. Describe what volume indicates.
2. Describe what mass indicates!
3. Name the units in which mass is measured and name the measuring device.
4. * Describe how the measuring device for mass works.

Material

- Wooden cubes, sponges, eraser cubes, etc. in various sizes, roughly rectangular in shape
- Scales, ruler
- Large bowl with water
- Calculator (or laptop)
- Screw-top jar with lid
- Sand, plastic beads, etc.

Estimating and measuring – Volume and mass

- Sort the objects into a row according to their volume.
- Now estimate the masses of the objects in your row.
- Then measure the masses using the scale.
- Were your estimates correct?

Experiment – To Float or not to Float

- Sort or objekts by Volume. Make a guess as to which objects in your row can float in water.
- Test your guess experimentally.
- Is there a connection between the order of your row and whether an object floats?
- Reorder your row again, this time according to the measured mass. Is there a connection now?

Calculating and measuring – density

- Calculate the volume for each object. (What values do you need to measure for this?)
- Now calculate the density for each object. **To do this, divide the mass by the respective volume.**
- Arrange the objects in a row according to their density. Is there a connection to the objects floating?

Thought ahead!

1. What determines the density of a body? Decide and justify your answer based on the results of your experiments.
   a) On its mass?
   b) On its volume?
   c) On its material?
   d) On the shape of the body?
2. When you open a box of cereal, the nuts often “float” on top of the oats.

Recreate this in your model:

- Fill some plastic beads in a jar. Then cover them with sand. Shake your jar.
- The objects only “floated” when the jar was shaken. But are the molecules in real water shaken? (Think of the particle model!)
- Explain why the nuts “float” in the cereal (Brazil nut effect).

Sink or float – not quite a boat

Thought through!

If a stone and a sponge have the same volume, they have different weights. We say that the density of the stone is greater than the density of the sponge.

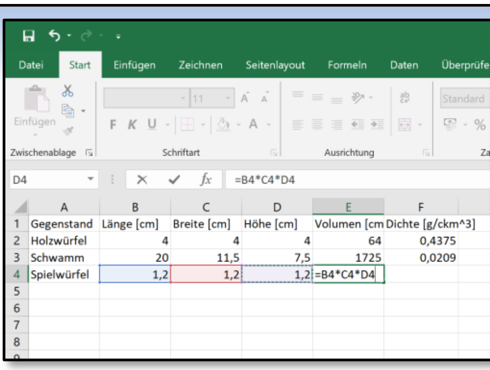
Density is a physical quantity. Every substance has a specific density. For example, the density of water is $1\frac{g}{cm^3}$. Density ϱ can be calculated using:

$$\varrho = m : V$$

1. Name the physical quantities that appear in the formula.
2. Conclude from the formula in which units the density can be expressed.

Material

- Various rectangular objects made of different materials (waterproof)
- Ruler
- Calculator (or laptop)
- Large bowl
- water
- Sealable box
- Sand



	A	B	C	D	E	F
1	Gegenstand	Länge [cm]	Breite [cm]	Höhe [cm]	Volumen [cm	Dichte [g/ckm^3]
2	Holzwürfel	4	4	4	64	0,4375
3	Schwamm	20	11,5	7,5	1725	0,0209
4	Spielwürfel	1,2	1,2	1,2	=B4*C4*D4	

Experiment part 1 – Determine density

- Measure the height, length, and width of various objects that are roughly cuboid in shape.
- Use these measurements to calculate the volume of each object.
- Determine the density of the objects. (What additional measurement do you need to take?)

Note: It may be helpful to calculate density and volume using a computer (e.g., Excel).

Experiment part 2 – does it float?

- Make a guess (hypothesis) as to whether the stone, sponge, and wooden cube (etc.) will float in water. Test your guess by conducting an experiment.
- Now make hypothesis for the remaining objects and then test them.

Experiment part 3 – Competition in levitation

- Compete against each other in small groups. Fill the transparent box with just enough sand so that it floats in the water, i.e., it doesn't sink to the bottom but doesn't float either. The group that does this best wins!

Thought ahead!

1. Fasse in einem Satz zusammen, wann ein Stoff im Wasser schwimmt.
2. Look up the densities of the following substances: iron, gold, air, mercury, oxygen, cooking oil, carbon dioxide.
3. Give examples of substances that would float in mercury, cooking oil, or carbon dioxide.

Layer on Layer

Thought through!

1. With liquids, it is of course not possible to measure the height, width, and depth to determine the volume.
    a) Name the measuring device used to determine the volume of liquids.
    b) Describe how you would determine the density of a liquid.
2. Make an assumption as to whether liquids can also float on liquids. Justify your answer!

Material

- A tall glass
- Water
- Cooking oil
- Liquid honey or syrup
- Table tennis ball, a stone, a shell, a match, (a piece of chalk, a walnut, etc.
- Effervscent tablets

Experiment part 1 – layers

- Pour some water, some oil, and some honey into the glass one after the other.
- Describe what you observe.
- Explain your observation using your knowledge of density.

Experiment part 2 – does it sink?

- Carefully drop the stone into your glass with the prepared layers.
- Describe your observations.
- Formulate a hypothesis about what will happen when you drop the other objects into the glass. Then carry out the experiment.
- Describe your observations.
- Describe what conclusions you can draw from your observations about the densities of the objects and liquids.

Thought ahead!

1. Emmi is a chemist.
    a) Find out what she means by “decanting.” Note: This is not about wine.
    b) Describe how this relates to Experiment part 2.
2. What happens to your layers if you leave your glass alone for a long time?
    a) Formulate a hypothesis
    b) Justify your hypothesis.
    c) Test with an experiment.

Warm and cold balloon – not quite empty bottles

1

Thought through!

1. An empty bottle is not really empty, is it? Name substances that are in a seemingly empty bottle.
2. Estimate the temperatures:
   a. in the freezer
   b. at room temprature
   c. of boiling water

3. Check the answers by experiment research

Material

- Glass bottle
- balloons
- Freezer
- Large bowl
- Hot water
- Ice cubes (optional)

Experiment part 1 – Preparation (day 1)

- Place a balloon (without inflating it) over the opening of a bottle.
- Put the bottle in the freezer for several hours..

Experiment part 2 – Test (day 2)

- Describe what the balloon looks like when the bottle is taken out of the freezer.
- Now leave the bottle at room temperature for a while. Describe the changes you observe.
- Place the bottle in a bowl. Fill the bowl with hot water. Describe your observations again.
- Make a guess about what will happen to the balloon if you replace the hot water with cold water and ice cubes. (Check your hypothesis.)

Thought ahead!

1. The balloon fits tightly over the neck of the bottle so that no air can escape. Which physical quantity changes during the experiment?
   a. The mass of air?
   b. The volume of air?
   c. The density of air?
   d. The substance that air is made of?
2. Explain your observations from the experiment.
3. In a hot air balloon, the air in a large balloon is heated. Then the balloon lifts off the ground. Explain why the balloon flies.

2

1: https://pixabay.com/de/photos/person-mensch-m%C3%A4dchen-lange-haare-1351977/
2: https://pixabay.com/de/photos/abenteuer-hei%C3%9Fluftballon-himmel-1840310/

Doesn‘t taste good – frozen oil

Thought through!

1. What do volume and mass indicate?
2. In what units are volume and mass measured?
3. What quantity can be calculated from volume and mass, and in what units is it measured?

Material

- 3 empty tea light holders
- Permanent marker (for labeling)
- Various cooking oils
- Freezer, water

Experiment part 1 – Preparation (day 1)

Note: Label your tea light holders before filling them!!

- Label one of the tea light holders with your name and the word “water.” Then fill it to the brim with water.
- Fill two more containers with cooking oil and label them accordingly.
- Carefully carry the containers to the freezer and freeze them.

Experiment part 2 – Observe and evaluate (day 2)

Note: When oil thaws, it quickly leaves stains. Take care of your belongings and keep a rag handy for emergencies.

- Describe how the appearance of the fabrics changed as a result of freezing. Pay particular attention to changes in volume.
- Decide whether the mass of water and oil may have changed as a result of freezing. Justify your answer using the particle model.
- Based on your observations, conclude how the density of the water and oils has changed as a result of the change in state.

Thought ahead!

1. *Not all substances thaw at the same rate. Make an educated guess as to why this is the case.
2. You know that solid water floats on liquid water. But what about solid oil on liquid oil? Make an educated guess.
3. Test your guess from 2 by doing an experiment!

I have a solution – When problems are (dis)solved

Thought through!

When you add sugar to your tea, it seems to disappear. We say that the sugar has dissolved in the tea. The tea has thus become a sugar solution. If, on the other hand, you throw a stone into your tea, you simply have a stone in your tea. The stone does not dissolve. In a solution, it is no longer possible to see that it consists of more than one substance. A solution is always clear, even if, like tea, it may have a color.

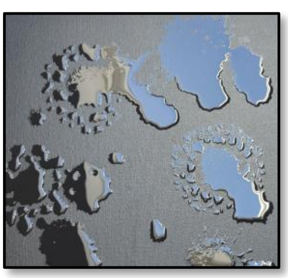
Material

- Several Glasses
- Various materials, e.g., sugar, stones, salt, chalk, paper, etc.
- Salt, preferably without iodine, fluoride, etc.
- Black construction paper
- Pipette (or paintbrush)
- Everyday liquids, water

*Experiment 1 – What dissolves in water? (long-term experiment)

- Pour some water into a glass. Then add a few teaspoons of sugar and observe whether a solution forms.
- Repeat the experiment with different substances. Carefully examine whether the substances dissolve in water or not.
- Collect ideas together about which substances you can test and leave the experiment to stand for a while if it takes longer for the substance to dissolve.

Experiment 2 – kind of water color (long-term experiment)



What happens to the substance that dissolves in water? Does it simply disappear?

- Dissolve 25g of salt in 100ml of water.
- "Paint" a picture on black construction paper using this solution. Use a pipette or paintbrush to do this.
- Leave your picture in a safe place to dry overnight.
- *Note: Your "paint" is very fluid. Your picture will therefore be somewhat abstract, but that's not a problem.*

Thought ahead!

When salt dissolves in water, water is the solvent.

1. Check whether salt, sugar, etc. can also dissolve in another solvent (e.g., oil).
2. Some salad dressings consist of vinegar and oil. Check whether a solution can be formed from both substances. Check other liquids as well.
3. Decide and explain whether milk is a solution.

Solubility limit – or not?

Thought through!

Does a solution form when you add two spoonfuls of sugar to a cup of water? What about 20 spoonfuls to a cup, or 200? Make a guess as to whether any amount of sugar (or salt) can be dissolved in water.

When the solubility limit of salt in water is reached, no more salt dissolves. The solution is said to be saturated.

Material

- Screw-top jars with lidsScale
- (a lot of) salt
- (a lot of) sugar
- spoon

Experiment part 1 – (too)much salt in Water

- Conduct an experiment to determine how many grams of salt dissolve in 100 ml of water.
- Compare your results with the rest of the class. Explain why there may be slight differences.

Experiment part 2 – sugar instead of salt

- Formulate a hypothesis as to how much sugar dissolves in 100 ml of water.
- Test your hypothyesis experimentally.

Experiment part 3 –sugar solution (long-term experiment)

- Fertigt eine Zuckerlösung an, die in etwa der Löslichkeitsgrenze entspricht, die ihr in Teil 2 ermittelt habt. (Am besten in einem Schraubglas mit Deckel)
- Fügt jetzt noch einen Löffel Zucker mehr hinzu.
- Lasst das Glas über Nacht stehen und beschreibt, was geschehen ist.

Experiment part 4 – class experiment (long-term experiment)

- Does sugar even have a solubility limit? And if so, what is it? Find out!
- Everyone in the class fills a screw-top jar with 100 ml of water. Now everyone adds a different amount of sugar to their jar. **Make a list beforehand of who is adding how much sugar to the jars!**
- Leave your jars standing for a long time and stir regularly. How can you find the aswer that way?

Thought ahead!

1. Do the volume, mass, or density also change when salt or sugar is dissolved in water? Make a guess and justify it with your observations from parts 1 to 4.
2. Find out how much sugar is in different sodas. Compare to the solutions from 4.

Bermuda-Triangle

Thought through!

1. Spot the mistake! “Table tennis balls are made of plastic. Plastic has a higher density than water. That's why table tennis balls don't float.”
2. Explain why table tennis balls do float using the principle of average density.

Material

- Plasticine Narrow glass jar
- Water
- Effervscent tablets
- Material for the project

Experiment part 1 – The dough boat in distress calls SOS

- Take a piece of modeling clay and shape it into (roughly) a ball.
- Test experimentally whether the ball floats.
- Now shape the same piece of modeling clay into a boat.
- Test again experimentally whether the modeling clay boat floats.

Experiment part 2 –in the Bermuda Triangle

- You'll need the plasticine boat again!
- Fill a narrow glass with **warm** water.
- Let the boat float in the water.
- Now put the effervescent tablet in the water and watch what happens.

Thought ahead and project!

1. Explain the observations from the experiments.
2. Research what is meant by the Bermuda Triangle. Explain why ships have sunk there.
3. Explain why a container ship can float on the sea even though it is made of metal.

[1]

4. Project: Build a boat that can carry as much mass as possible.
    - Think about what materials you could use beforehand.
    - Your boat must weigh no more than 100g.
    - Your boat must be able to withstand light waves and wind.

1: https://pixabay.com/de/photos/containerschiff-container-transport-6631117/

The Lava lamp* and the hot air ballon
*contains nether lava nor a lamp

Thought through!

1. The air above a candle rises. Rotating wooden pyramids use this effect as a driving force. Explain why the air rises.
2. In the past, zeppelins were built instead of hot air balloons. These were not filled with hot air, but with hydrogen gas. Explain why zeppelins were still able to fly.

Material

- Small glass bottle or screw-top jar
- Water
- Cooking oil
- Foood coloring
- Effervscent tablets
- Garbage bags
- Hair dryer
- Material for the project

Experiment part 1 – Lavalampe

1

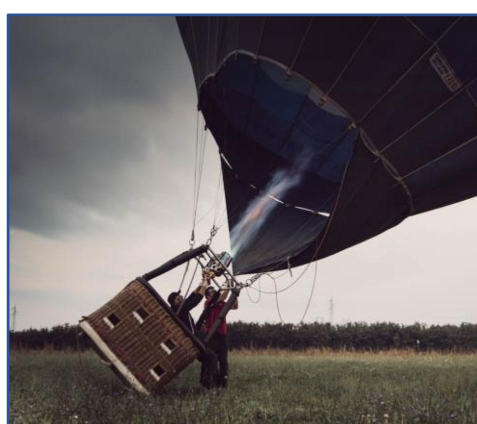
- Fill the bottle about one-third full with water and color it with food coloring.
- Then fill the bottle with oil until it is almost full.
- Put a small piece of the effervescent tablet into the bottle and screw the cap on.

Experiment part 2 – hot air balloon

- Take a thin plastic garbage bag and fan it out to its full size.
- Blow air into the garbage bag with a hair dryer. Try to make the bag fly.

Thought ahead and project!

1. Explain the observations from the experiments.
2. A purchased lava lamp functions somewhat differently. Research and explain.
3. Project: Build a hot air balloon powered by a heat source that flies with it.
   - Think beforehand about what would be a good propulsion system for your balloon.
   - **Only launch the balloon under the supervision of a teacher!**



2

1: https://de.wikipedia.org/wiki/Lavalampe#/media/Datei:Lavalampe.jpg
2: https://pixabay.com/de/photos/hei%C3%9Fluftballon-ballon-ballonfahren-5979187/

Dense Water

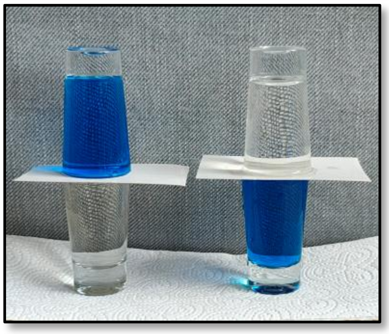
Thought through!

1. The salt content of the water in the Dead Sea is much higher than in the Atlantic Ocean or the Baltic Sea. People can simply float in the water without sinking. Make a guess as to what the reason for this might be.
2. **Take photos and/or videos of your observations during all of the following experiments!**

Material

- Two small identical glasses
- scale
- Salt
- Food coloring
- a piece of cardboard
- Material for the project

Experiment part 1 – Mehr Salz und Meerwasser



- Prepare a salt solution with 30g of salt per 100ml. Add some food coloring.
- Fill one glass to the brim with water.
- Fill the other glass to the brim with your salt solution.
- Cover the water glass with a piece of cardboard.
- Now carefully turn the glass upside down and place it on top of the glass containing the salt solution.
- Carefully pull the cardboard out from between the glasses.

Experiment Teil 2 – waterfall under water

- Repeat the experiment. This time, however, place the glass with the salt solution on top and pull the cardboard out just a little bit and very slowly.
- Describe your observations!

Thought ahead and project!

1. Explain the observations from the experiments.
2. Research what is special about the Dead Sea and how this affects swimming in it.
3. Project: Make a colorful salt cocktail with as many layers as possible. Note:
    - Use water, salt, and food coloring.
    - Take photos of your results and interim results. (Why is this particularly important here?)
    - Make a salt cocktail without coloring in which a hard-boiled egg can float!

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1: https://pixabay.com/de/photos/trinken-cocktail-sommer-urlaub-4288602/

Mass, volume, density – systematic and somewhat more challenging

Thought through!

1. Explain the difference between bodies and materials.
2. Describe the shape of the surface of water in a measuring cylinder and how to correctly read the volume.

Material

- Measuring cylinder
- Cuboid object that does not float (e.g., eraser)
- (erasable marker)
- Other non-cuboid objects
- Material for the project

Experiment part 1 – caldculate

- Calculate the volume of a rectangular object that does not float. (What dimensions do you need to measure?)

Experiment part 2 – measuring

- Fill a measuring cylinder about halfway with water. Mark the water level with a wipeable marker (or make a mental note of it).
- Add your object.
- Calculate the volume by which the water level has risen.

Experiment part 3 – Rule, hypothesis, testing

- Compare the results from both tests!
- Formulate a hypothesis for a rule and test it on other objects.

Experiment part 4 – Non-angular volume

- Describe how you can determine the volume of objects that are not cuboid using an experiment.
- Measure the volume of three objects that are not cuboids.
- Describe the limitations and obstacles of this measurement method.

Thought ahead and project!

1. Explain the observations from the experiments.
2. Research what is meant by Archimedes' principle and what it has to do with a crown, a naked man, and the word “eureka.”
3. Project: Conduct a systematic investigation into the influence of the salt content of a salt solution on the volume, mass, and density of the solution.
4.

- Take 100 ml of water and dissolve different amounts of salt in it.
- Determine the mass, volume, and density of the salt and water before dissolving and of the salt solution after dissolving.
- Use two graphs, show how the volume and density change with the salt content.