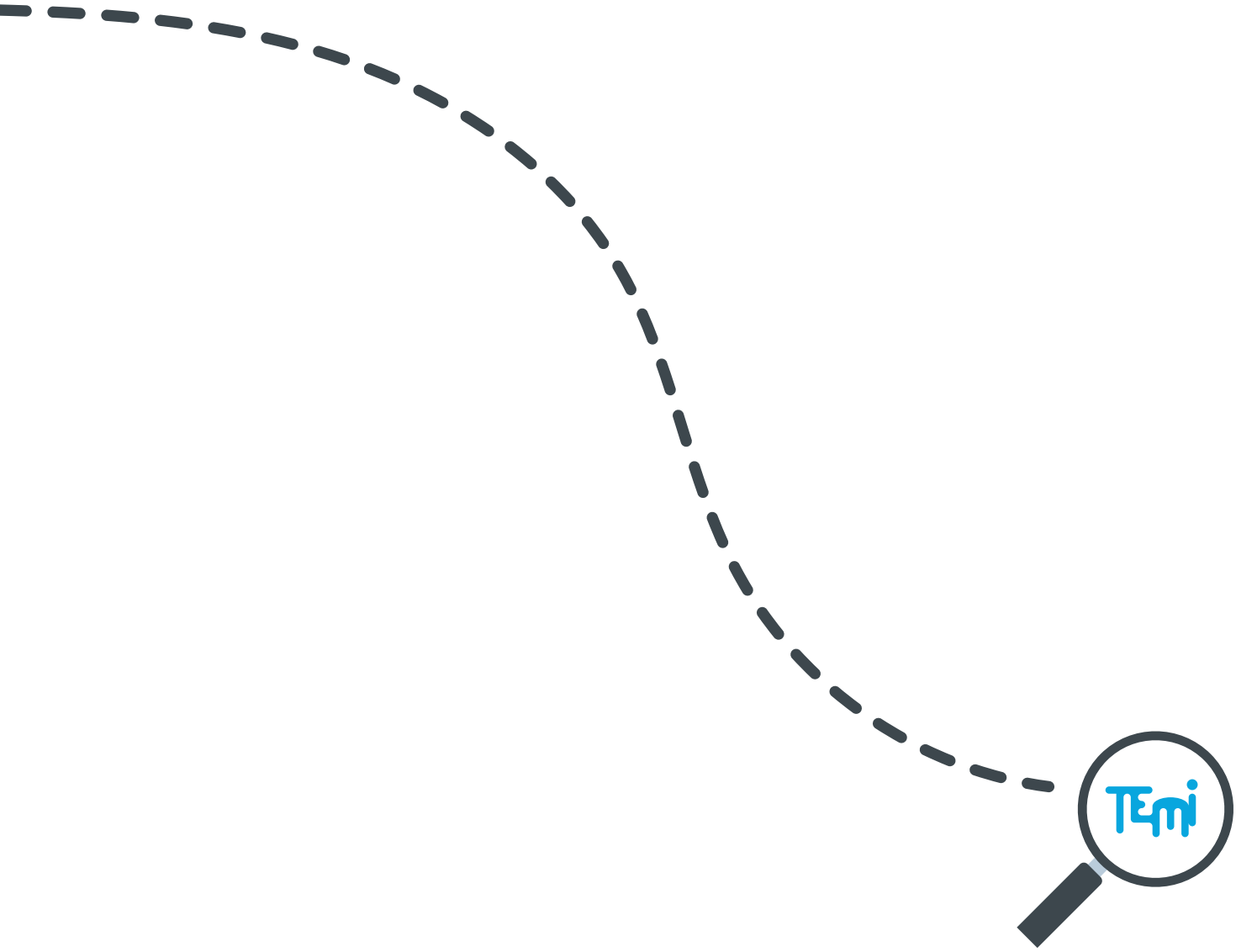

# Mysterious eggs

CLASSROOM SCIENCE ACTIVITY TO
SUPPORT STUDENT ENQUIRY-BASED LEARNING




**This classroom-tested teaching plan uses the four innovations of the TEMI project, as detailed in the Teaching the TEMI Way (TEMI, 2015).**

You should read this companion book to get the most from your teaching. The **TEMI** techniques used in this teaching plan are: **1)** productive science mysteries, **2)** the **5E model** for engaged learning, **3)** the use of presentation skills to engage your students, and **4)** the apprenticeship model for learning through gradual release of responsibility. You might also wish to use the hypothesiser lifeline sheet (available on the **TEMI** website) to help your students document their ideas and discoveries as they work.

To know more about **TEMI** and find more resources **www.teachingmysteries.eu**

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**teachingmysteries.eu**

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# Mysterious eggs

## What's the mystery?

This is a mystery that allows the students to make a hypothesis based on the old advice saying that a rotten egg floats when it is put into fresh water while a fresh egg sinks.

### DOMAIN(S)

Chemistry.

### SUBDOMAIN KEYWORDS

Density, Archimedes, buoyancy.

### AGE GROUP

**13** to **15** years old.

### EXPECTED TIME FOR THE MYSTERY

Approximate time for teacher preparation:
**One hour.**

Approximate time in classroom:
**One hour.**

### SAFETY/SUPERVISION

If a burner is used, students must be supervised properly.

**Disclaimer:** the authors of this teaching material will not be held responsible for any injury or damage to persons or properties that might occur in its use.

### PREPARATION AND LIST OF MATERIALS

- Butane burners
- Tripod
- Measuring cylinder
- Weight
- Matches
- Salt
- Eggs
- Other variants are also possible.

### LEARNING OBJECTIVES

Explain what density is and why something floats. Conduct experiments and find sources of error (science concept).

# Guidance notes for teachers

## THE 5E MODEL

### Engage

CAPTURE STUDENTS' ATTENTION

The teacher tells the following story to the students. A farmer is selling eggs at a market and he is demonstrating that his eggs are fresh by placing them in freshwater and the eggs sink. He is selling many eggs, so a farmer in the neighbouring market stall becomes envious. He challenges the farmer by claiming his eggs are rotten. As evidence, he takes one egg and puts it in a solution which he claims is pure water. The egg floats and the customers are worried they have been deceived. Who is deceiving whom?

### Explore

COLLECT DATA FROM EXPERIMENTS

Students design their activity to test their hypothesis. Which of the farmers is cheating?

Formulate testable ideas. Possible examples include, but are not limited to, the following:

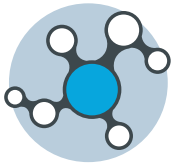
What is the reason or reasons for the different results? Are the liquids different or is it the egg? If the students believe that the composition of the water is different, how can this be measured? This mystery is all about density. Depending on the students' prior knowledge, guide them towards measuring volume and weight.

Some of the measurement may have a wide margin of error, so it might be necessary to repeat the experiments. Take care to discuss margin of error and the validity of the results.


### Explain

WHAT'S THE SCIENCE BEHIND THE MYSTERY?

Tell the students to describe their experiment so they can solve the quarrel between the farmers. Who is tricking whom? Discuss possible sources of error. Make sure students use scientific terminology. Did the envious farmer add salt to the water to make it denser, thus making the egg sink? Yes!



### Extend

WHAT OTHER RELATED AREAS CAN BE EXPLORED?

Boats made of wood and steel float equally well. However, from the previous investigation, it should be clear that dense objects sink. How is it possible that a boat made of steel does not sink? Discuss or experiment with objects (e.g. model clay) to find out how this can be the case. Explain what happens (requires knowledge of the concept of buoyancy).

Let the students think about if it´s easier to swim in a lake than in the ocean and what it is that cause something to float. Is it the floating object or the medium it floats/sinks in?

## Evaluate

CHECK THE LEVEL OF STUDENT SCIENTIFIC UNDERSTANDING

The students could write a report from the experiment explaining their findings with proper scientific terminology.

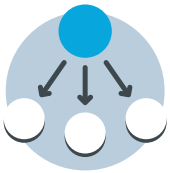
The teacher could also start group discussions debating the following questions: what is the difference between 'dense' and 'heavy'? Why is it easier to float in the ocean than in a lake? When inhaling while swimming, it is harder to dive. Why?

## THE 5E MODEL

## Showmanship

TIPS ON HOW TO TEACH AND PRESENT THIS MYSTERY

Tell the story engagingly. You could put on a hat and bring a couple of eggs in a basket with you? The story may also be enacted with the help of another teacher or students. In order to increase engagement, emphasise the conflict between the two farmers.



## GRR

TEACHING SKILLS USING GRADUAL RELEASE OF RESPONSIBILITY

This enquiry is a guided enquiry (level 1), where the students make their own experiment based on the story told by the teacher. They also have to collect information about other materials where a phase change is evident due to temperature variations. These experiments can easily be fine-tuned to different levels of enquiry. The best performing students can be given a large degree of freedom when it comes to designing their own experiments, while others might need a concrete hypothesis to test.

Give the students an instruction on how to handle the butane burner safely before they start their experiments.

## Resources

This website describes the principles of buoyancy: http://hyperphysics.phy-astr.gsu.edu/hbase/pbuoy.html

# Mysterious eggs

**STUDENT WORKSHEET**

It is a well-known fact that fresh eggs sink in pure tap water, while rotten eggs float.
It is also known that eggs have a density between that of salt water and freshwater.
Let us find out who is deceiving whom in this mystery!

## Engage

WHAT'S INTERESTING?

**Task:** A farmer is selling eggs at a market and he is demonstrating that his eggs are fresh by placing them in freshwater. He is selling a lot of eggs, so the farmer in the neighbouring market stall is getting envious. He challenges the farmer by claiming his eggs are rotten. As evidence, he takes one egg and put it in a solution which he claims is pure water. The egg floats and the customers are worried they have been deceived.

Who is deceiving whom?

## Explore

WHAT'S HAPPENING?

**Task:** Both farmers cannot be right: one of them is cheating in some way. Can you describe an experiment in which you investigate this matter? In order to get started, think about the following: Is it easier to swim in the ocean or a lake?

What makes things float? The object or the medium it floats/sinks in?

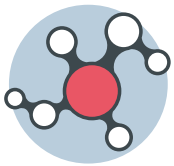
Useful equipment might be a weight, measuring cylinder, hot plate, and salt.


## Explain

WHAT'S CAUSING IT?

**Task:** Describe your experiment and how it can cast light on the quarrel between the farmers. Who is tricking whom?

Discuss possible sources of error.



## Extend

WHAT'S SIMILAR?

**Task:** Boats made of wood and steel float equally well. However, from the previous investigation, it should be clear that dense objects sink. How is it possible that a boat made of steel does not sink?

Discuss or experiment with objects (for example, model clay) in order to find out how this can be the case.

Take a look at this animation: http://www.bigs.de/BLH/en/images/stories/physik/anim/wssab01.swf

Explain what is happening in this simulation (very difficult: requires a knowledge of buoyancy).

Does the salt evaporate as well as the water?

Use the Hypothesiser Lifeline to design a new experiment to test this.

## Evaluate

### WHAT'S MY UNDERSTANDING?

**Task:** Answer the following questions:

Make sure you know the difference between the terms 'heavy' and 'dense'.

After conducting this investigation, why do you think it is easier to float in the sea than in a lake?

When you inhale while swimming, it is difficult to dive. Why?

How would you improve your experiment?