

# Teacher Notes- “Dunking Duckies- Endless Expansion And Contraction”

When students walk into your classroom and see dunking ducks everywhere, each will express their amazement differently. Some will stop in the doorway and stare. Others will get a friend to show. The rest will go to their seat and begin studying the motions of duck. They’ll remember that days like today are why they like science. And for good reason- the dunking duck is fascinating to watch and simple to understand, as it’s presented today (they’ll be explaining to you how it works later on).

The potential topics you can cover with the dunking duck is almost limitless, so don’t feel limited to the discussion that follows. If you’d like to go further, type “dunking ducks” and “drinking birds” into an online search engine. You’ll be in for some very interesting reading.

## **Materials per group of 4 students:**

1-dunking duck  
1-250ml beaker full of water

## **Additional Teacher Materials:**

1-dunking duck  
1-250ml beaker with room temp. water  
Ice- to put in water  
1-lamp with 100 watt incandescent bulb  
(the kind that gets really hot)  
1-stopwatch or timer (optional)  
PowerPoint-  
Student Handout



## **Beforehand:**

1. If you don’t have any dunking ducks, they can be purchased for around \$9 apiece. They’re item #WW6579800 at [sciencekit.com](http://sciencekit.com). You may not need as many as 8 ducks, but have enough so that every student can clearly see what’s going on inside of it. If you have the time and money, pick up a few more than what you think you’ll need. Class sizes change from year to year, ducks break, and some just don’t work as well as others.
2. Assemble the ducks the day before so you don’t have to rush around at the last minute doing all the fine adjustment. Getting them ready that soon will also give you time to tame the feistier duckies that initially refuse to work.
3. This activity can adapt to be used with classes that run 25-45 minutes. It is presented in its barest form, so there’s plenty of room to add to it. At the end is a list of “accessories”, which are further topics you can add on which will lengthen and deepen the discussion.

During class time leave your discussion notes aside, and go where the flow of each class takes you. There's no telling what comment will come from what student at what time, and being open to those comments and going with them are what elevate lessons. You will feel a little vulnerable at the beginning of the talk, but things always end up in the right place, though the road there may curve a little.

**Procedure:** *note- do not give students the handout yet. They need to just focus on the ducky for a while.*

1. The connection between the ducks and the states of matter may not be very obvious at first. Your students will certainly be wondering why, during the chapter on solids, liquids, and gases, these suddenly appeared for discussion:

“I see many of you trying to figure out what these duckies have to do with our chapter on the states of matter. Well, they have *everything* to do with the states of matter. As we go through our day you'll notice that we're going to use the very same words and phrases that we've used with other things, only now they apply to this.”

2. Give students 3 quiet minutes to observe their dunking ducks so they can observe the inner workings closely:

“Students, these duckies didn't just start bobbing up and down just before you came in. I set them up *yesterday afternoon*, 18 hours ago, and I haven't touched them since. He's gone up and down thousands of times all on his own, and without you knowing about it. I'm going to give you 3 quiet minutes to observe it. When the 3 minutes are up I'm going to ask you how it works. Start your observation with what it's doing. Simply observe what's going on inside the ducky, and then how that affects the rest of him. Once you've done that, ask yourself some “why's”. Why does it do this, why does it do that? You may begin observing.\*<sup>1</sup>

3. After the 3 minutes are up start trying to piece together an explanation. Let the students do as much of the talking as possible. Your job is to repeat, clarify, referee, and guide them from one idea to the next:

“Who'd like to try to explain little ducky? Remember, you can start anywhere you want to because there is no beginning and end. And everything you all noticed is a valuable piece that fits somewhere, so I'd like to hear from as many of you as possible.”

4. Hands will go up. Hold yourself back from talking. Just listen at first.
5. “Suzie's” hand raises. She explains that the liquid rises until it fills the head (she'll skip over why it rises, but we'll cover that later), then ducky becomes top heavy and falls into the water. Liquid inside runs back to the bottom, and it stands back up.

6. 30 other faces in the room are agreeing with what she said. Look back at them and give a long pause, which is the familiar sign to students that we've just begun the journey:

“Well said Suzie. Everything you just said is true.

Let's go back to the part where you said the liquid was going into the head. Everyone, watch your ducky while we talk about this. Watch that liquid go up the tube. As the liquid goes up higher and higher, and into the head, it becomes more top-heavy. Another way of saying that is that its center of gravity changes, in this case moving upward. Eventually his top half weighs more than his bottom half, and because he pivots he tips into the water.”

7. After more student comments and observations, delve into the mystery behind the rising ether:

“So, the ether rises, fills the head, causing him to become top-heavy and he tips in. Is that it? Is there anything missing? (no)  
Oh yes there is! Think about it. (*repeat what you just said*)

We still haven't gotten to *why* it rises. Let me ask you a question- at any time during the cycle did the amount of liquid inside change? (huh?)  
Do you see how the liquid goes up into the head then back down? (yes)  
When it goes up, is it because there's more liquid? (not sure)  
Let's do this little test to see- the next time the ether all runs back to the bottom, notice how low it goes. Then compare that with the next cycle.”

Key point in the discussion!

8. Give students a minute to watch the ether in their ducky contract twice:

“What did you see? (it keeps going back to the same place)  
Which means the amount of ether isn't changing.\*<sup>2</sup> Hmm.....  
If the amount of liquid isn't changing, then what could be causing this? (is it expanding?)  
Watch the ether creep up the glass tube and think about this: it's getting bigger. It's expanding.

And what causes liquids to expand? (heat)  
Yes! When they're heated! Heat is energy. Energy causes motion. More motion means it's more active and needs more space- it expands.\*<sup>3</sup>

Good job. Can we move on yet? (obviously not, or why would you be asking)  
Now we need to find the source of heat. Are these battery operated? (no)  
Well, where could the heat be coming from that excites atoms in the liquid, causing them to expand and move up the tube? (the room?)

*(end of Teacher Notes preview)*

Come back and visit [InteractiveScienceTeacher.com](http://InteractiveScienceTeacher.com) and for just .99¢ you can download the entire set of Teacher Notes right now, along with:

◆ PowerPoint- Don't have PowerPoint?


Download it FREE: [Mac](#) / [PC](#)

◆ Student Handout

◆ Quick Notes


But the room is still warm, so...  
 and Ducky stands back up.  
 liquid shrivels back to the bottom.  
 Water cools the head.  
 ..Ducky tips forward.

★Inside Ducky is ether liquid (bottom) and ether vapor (head).  
 Heat from the room excites the ether atoms causing them to become more active and need more space.  
 So ether liquid goes up the tube, squeezing the vapor in the head more.  
 Enough liquid rises past the center of gravity that



Your homework: calculate how many times your ducky has bobbed up and down during the last day.

Name \_\_\_\_\_



Your homework: calculate how many times your ducky has bobbed up and down during the last day.

Teacher **Quick** Notes- "Dunking Duckies- Endless Expansion And Contraction"

**Materials per group of 4 students:**  
 1-dunking duck  
 1-250ml beaker full of water  
 1-caution sign (to keep students' hands off the duckies)

**Additional Teacher Material:**  
 1-dunking duck  
 1-250ml beaker with room temp. water  
 1-250ml beaker with ice water  
 1-tong with 100 watt incandescent bulb (the kind that gets really hot)  
 1-stopwatch (optional)

- Procedure:**
1. Give students 3 quiet minutes to observe their dunking ducks so they can observe even more, and put all other thoughts out of their minds.
  2. Now start piecing together an explanation. Let the students do as much of the talking as possible. Your job is to repeat, clarify, referee, and guide them from one idea the next.
  3. Give students the ducky handout and scrambled explanation (in the Resources folder) to work on.
  4. Assign homework: calculate how many times your ducky has bobbed.

◆ Drawings & Pictures

◆ Caution sign for Duckies



Pic-Additional Teacher Materials



Pic-Faster With Heat And Ice



Pic-Student Materials

Ether inside. Please don't touch.



Ether inside. Please don't touch.