Science Inquiry - Informing Engineering Design

What is Scientific Inquiry?

Scientific inquiry refers to:

- diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work.
- activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world (NSES, 2002)

Inquiry is best when student driven

- **How do you get students to ask inquiry questions that lead to investigations?**
- **Do some of the ideas about inquiry seem idealistic? Do most students enter class with all sorts of questions? Is this realistic?**
- **One way to do this is to provide an example of a phenomenon and seek students' input on how the phenomenon occurred.**
- **…then make them prove it through constructing questions, making inferences and observations, conducting investigation and use data driven evidence.**

Scientific Inquiry

- “Scientific inquiry includes the traditional science processes, but also refers to the combining of these processes with scientific knowledge, scientific reasoning, and critical thinking to develop scientific knowledge” (Lederman, Lederman, Antink, 2013)

Neutral Buoyancy in Nature

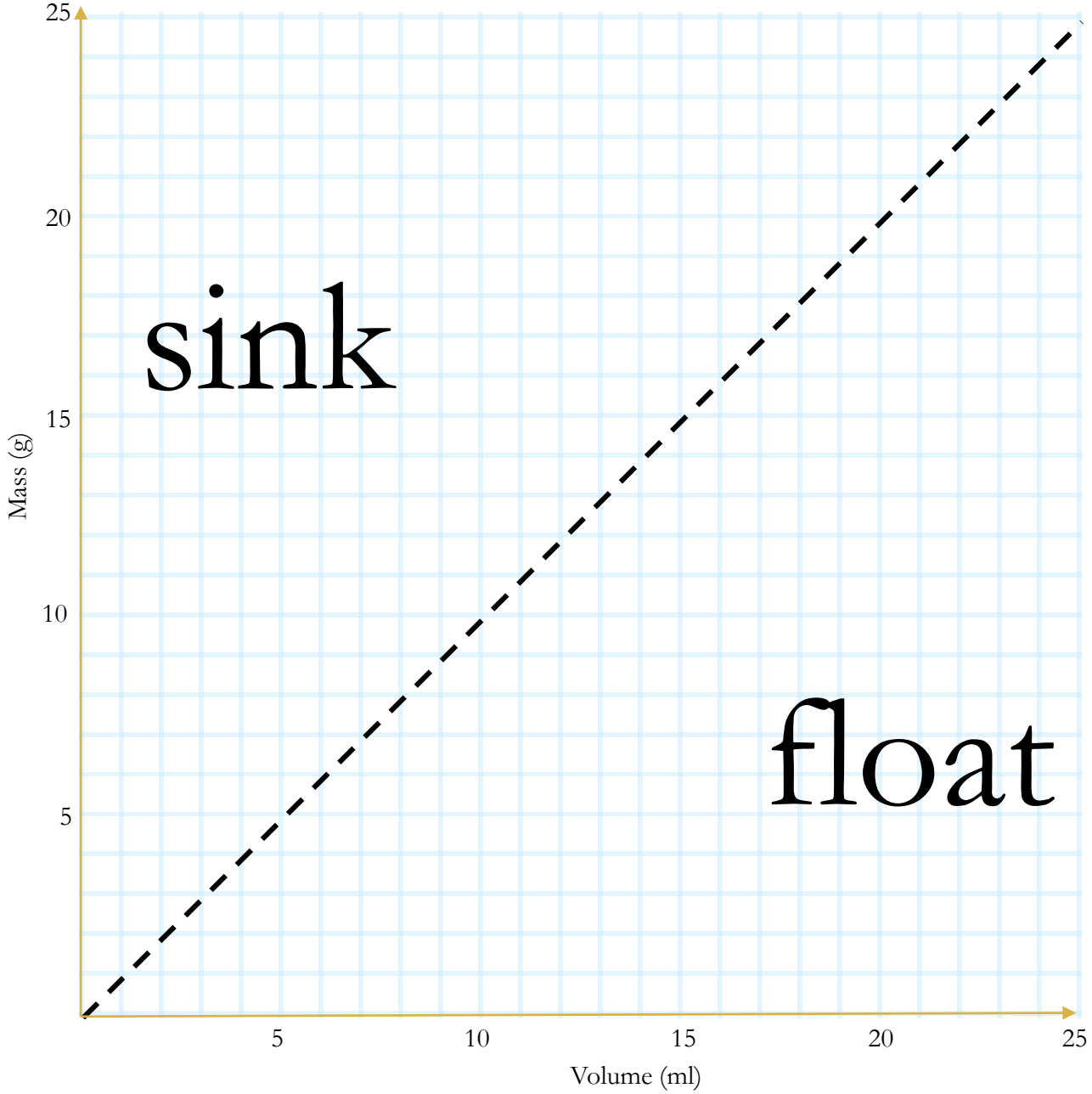
- https://www.youtube.com/watch?v=kwNLLcjliOY

What questions do you have?

- **What type of questions do you have about this phenomenon?**
- **KWL – What do you know, what do you want to know, what have you learned ?**
- **What type of science is at work within this phenomenon?**
- **How could you find out?**
- **What evidence would you need?**
- **What investigations would you do?**
- **Any data would you collect?**

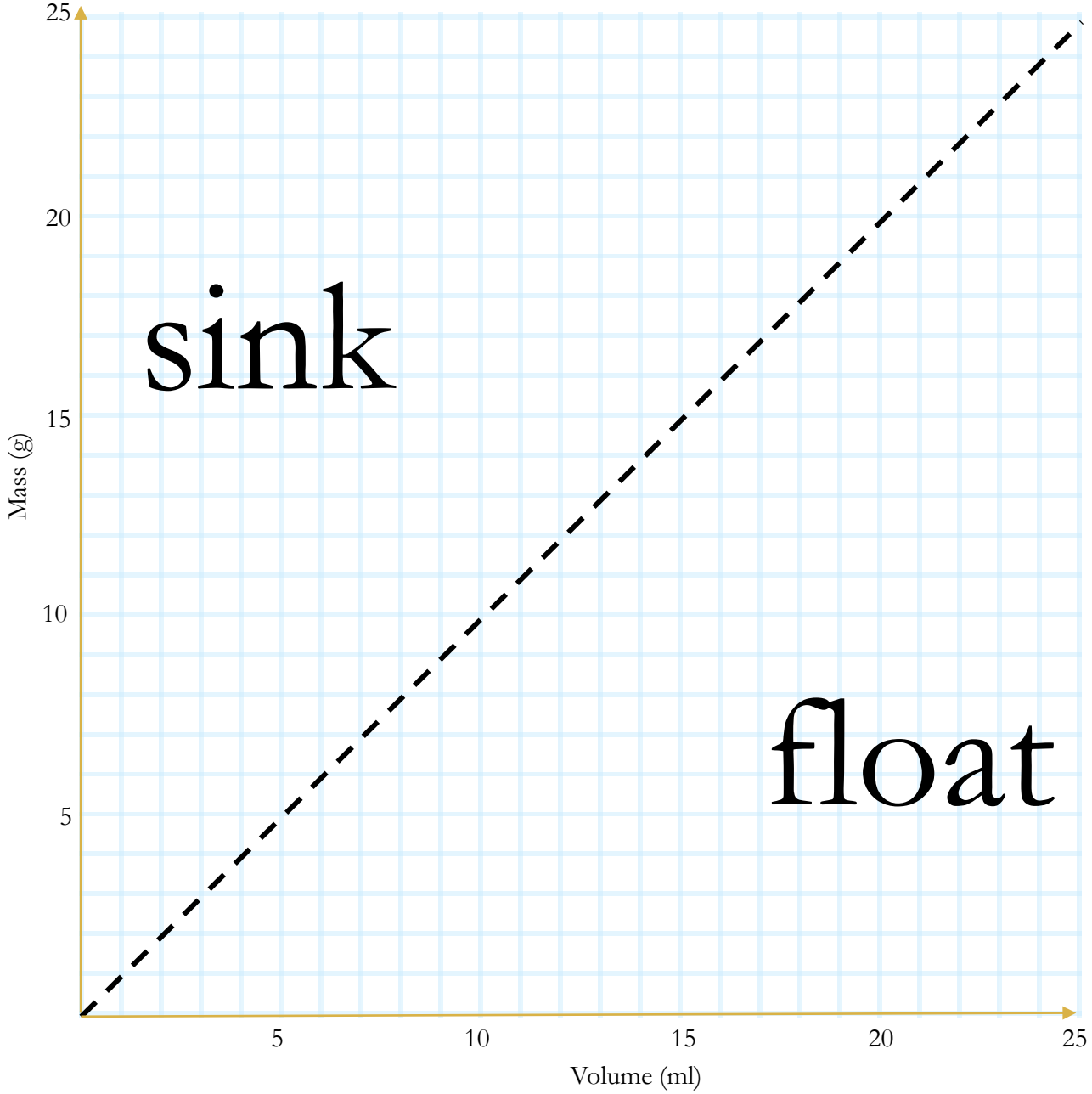
All of this would need to be done before designing anything.

How to make a naturally buoyant fishing lure?

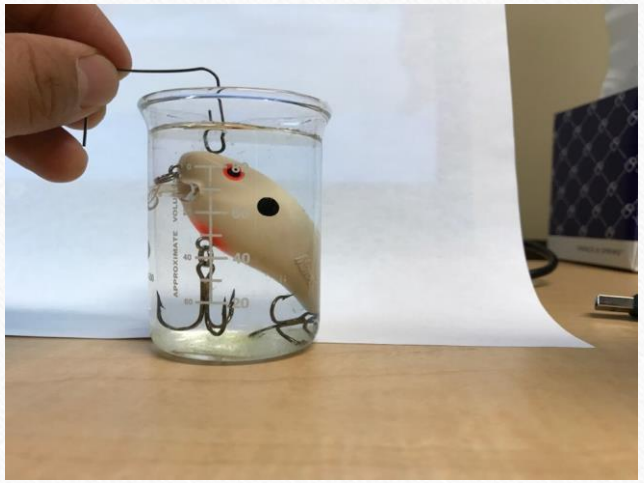


What is the weight of the lure?

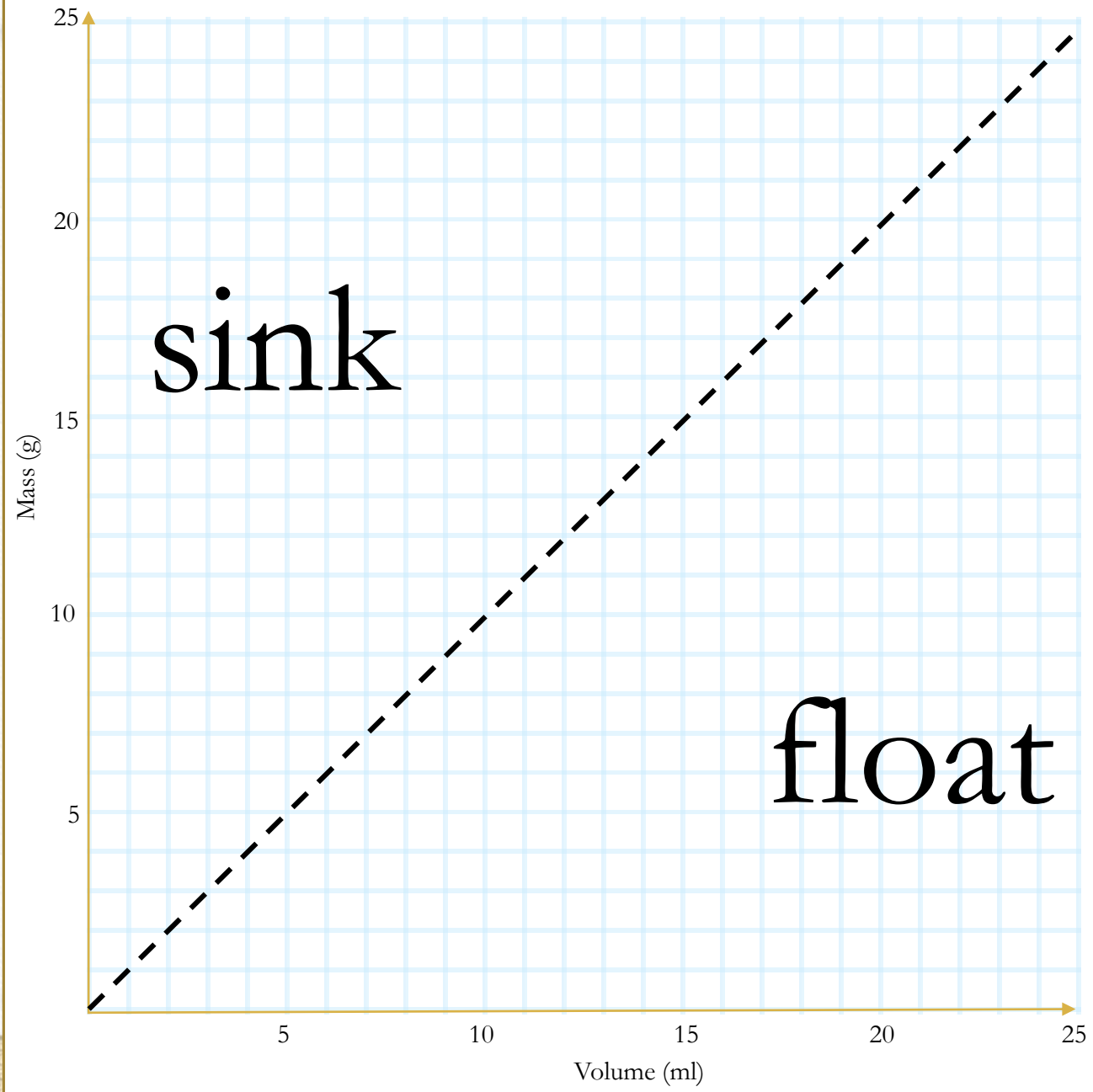
$m_{lure} = 13\ g$



What is the volume of the lure?



$V_{lure} = 16\ ml$

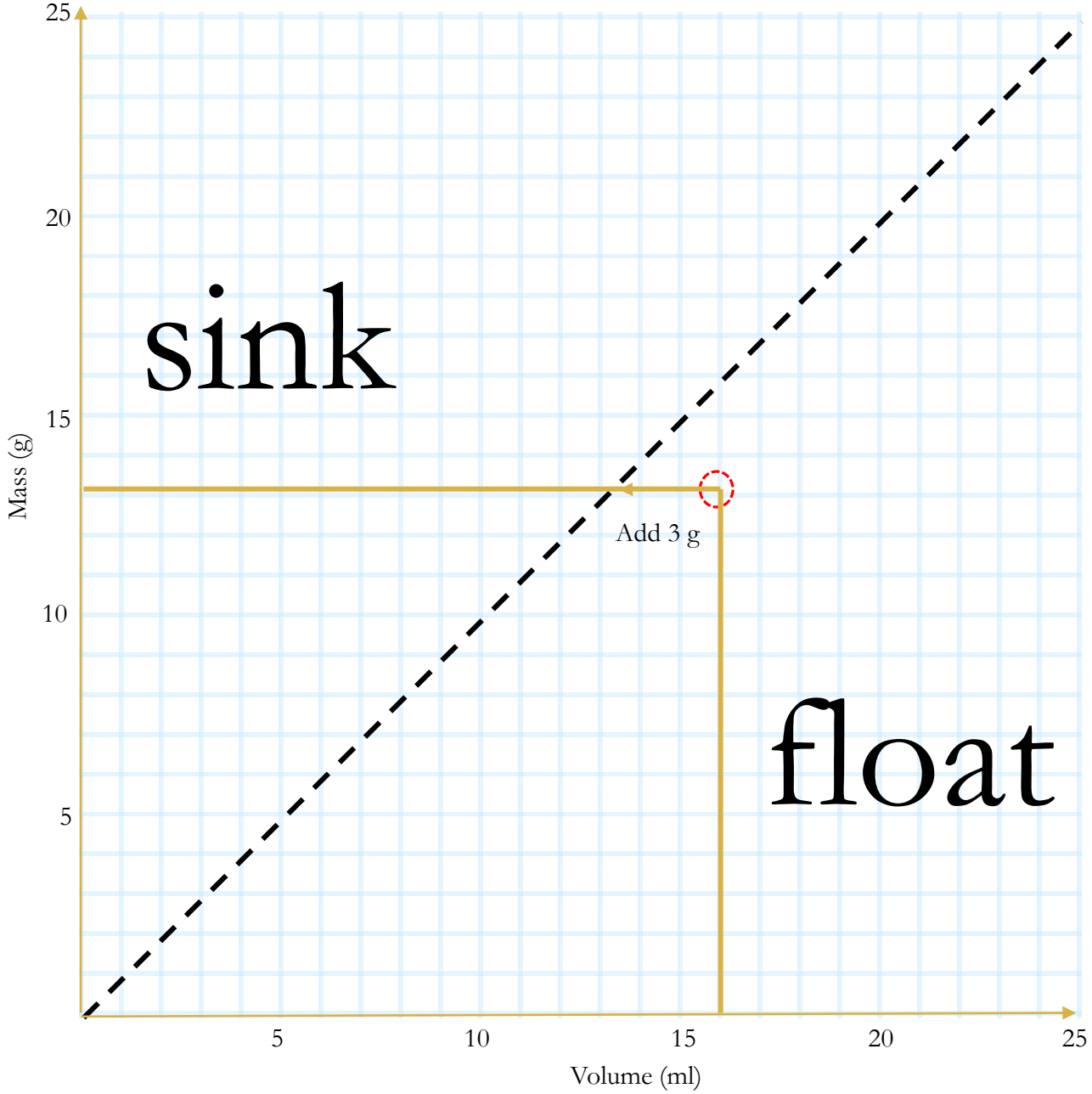


What is the density of the lure?

$m_{lure} = 13\ g$

$V_{lure} = 16\ ml$

$D_{lure} = \frac{13}{16} g/ml$

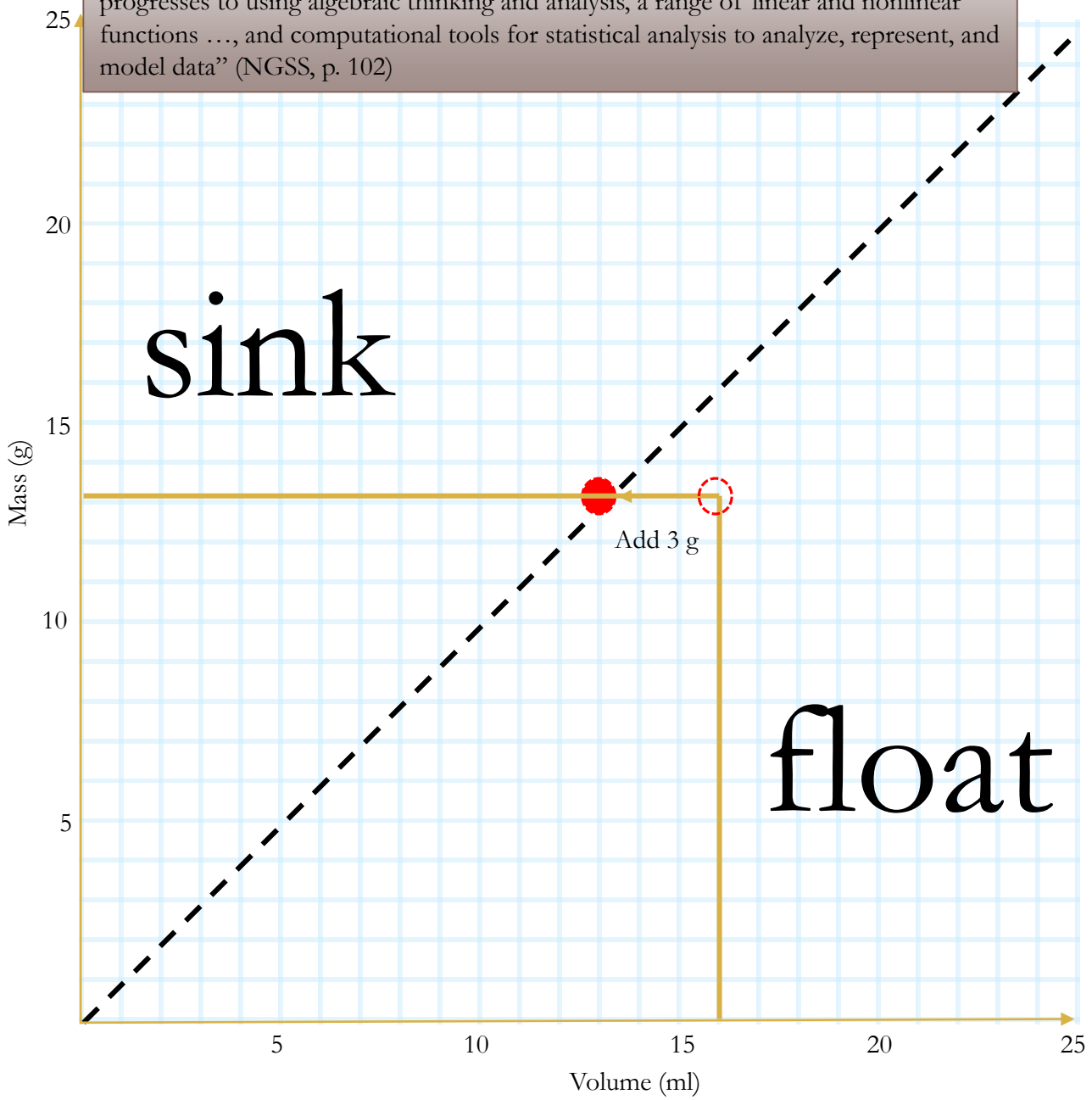


How much weight needs to make the lure neutrally buoyant?

$$m_{lure} = 13\ g$$
$$V_{lure} = 16\ ml$$
$$D_{lure} = \frac{13}{16} g/ml$$
$$1 g/ml = \frac{13+x}{16} g/ml$$
$$x\ g = (16 - 13)\ g$$
$$x = 3$$

Test it out!

"Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions …, and computational tools for statistical analysis to analyze, represent, and model data" (NGSS, p. 102)



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https://www.youtube.com/watch?v=tAI5p5FPXKQ&t=209s

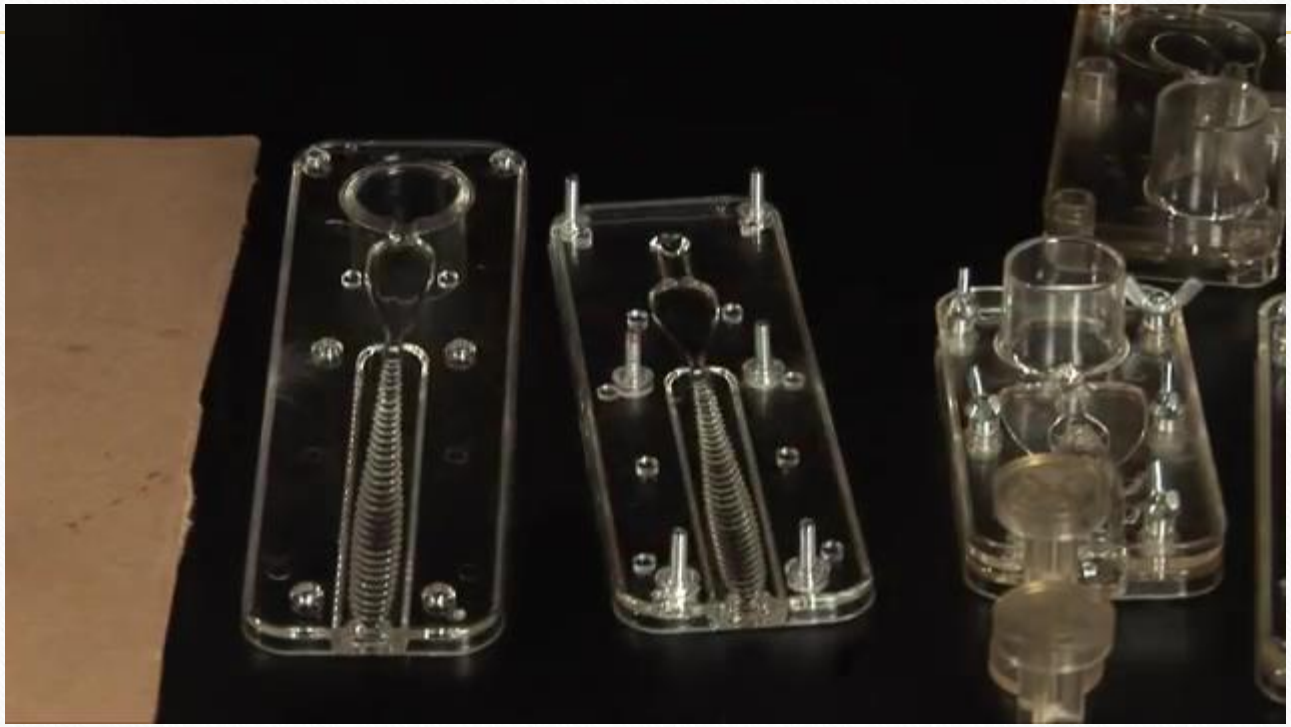
Neutrally Buoyant Lures

- https://www.youtube.com/watch?v=gr11-sfnyiE&t=107s

Current Product Designs

- Current Lure products on the market either add **additional weight** or they make soft baits hollow and **allow water** to be added to the bait or they **inject air** into the bait to make them buoyant.

Soft Bait Lure Making



- https://www.youtube.com/watch?v=3dgizrO0ZZU

Questions?

- What questions do you have about the project?
- Visit: www.purdue.edu/trails