| **Lesson Planner Template (Launch, Explore, Summarize)**  Topic: Plankton Lesson: Plankton Races (adapted from [Cosee Plankton Races](http://www.cosee.net/best_activities/activity/Plankton_Races.pdf)) Lesson Length: 50 mins |
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| **Part One: Goals and Objectives** |
| *What are the big ideas of the investigation?* |
| * Plankton are marine organisms which can’t swim against the current * While plankton can’t swim against the current, they can move through the water column and locally to seek light, prey, and to hide from predators. * Phytoplankton-photosynthesizing plankton-begin and drive the marine food web because they are rich in sugars and lipids * Phytoplankton use gas exchange and lipid concentration to control their placement in the water column |
| *What will students know or be able to do when this investigation is completed?* |
| Understand neutral buoyancy and how challenging it is to achieve.  Understand how the ratio of surface area to volume plays a role in buoyancy. |
| **Part Two: Teaching Model** |
| **Launch (5-10 minutes)** |
| *How will I launch this problem?* |
| Challenge- where do plankton live? If they can't swim, how do they stay in their zone? How hard do you think it is to create an object which can float in the middle of the water column? |
| *What prior knowledge do my students need?* |
| What a plankton is  Balanced vs unbalanced forces  Positive and negative buoyancy |
| **Explore (15 - 45 minutes)** |
| *How will I organize the students to explore this problem?*  *(Individuals/Groups/Pairs)* |
| *What materials will students need to encourage diverse thinking and problem solving?* |
| Lots of craft materials  Cloth  Pipe cleaners  Styrofoam shapes  Beads  Felt  Straws  Toothpicks  Screens or meshes of various sizes  Tape  Large container or aquarium filled with water (at least 10 inches water depth) |
| *What are different strategies I anticipate them using?* |
| Big vs small surface area  Wings  Counter weights  Feathers and fluffy things  Tape to waterproof things |
| *What kinds of questions can I ask?* |
| Why are you doing that?  Why are you choosing those materials?  What do you expect to happen?  Did you get the result you expected?  What are you going to do next?  What are you noticing?  Out of your whole design, what is the most important part? |
| **Summarize (15-25 minutes)** |
| *How can I orchestrate the discussion so the students summarize the thinking in the problem?* |
| What worked for you? What didn’t work?  Was it consistent?  What would you add?  How do all these organisms in the water column do what you find so challenging?  How do we control altitude with a hot air balloon or a submarine? Are plankton using any of those strategies?  *For older students, you could shake a bottle of salad dressing and ask them what they observe. Then, consider what nutritional value we get from plants - are plants manufacturing only sugars? What about the copepods that right whales are eating? How can such a tiny organism support the life of a whale?*  *Perhaps drop a dollop of solid shortening in the water and ask the students to observe. What connection can they make back to the plankton?* |
| *What scientific knowledge and processes need to be drawn out and emphasized?* |
| How do plankton really maintain neutral buoyancy? Gasses and lipids that the plankton are constantly adjusting.  You could include some solid cooking shortening or Vaseline for the kids to apply to portions of their plankton, and retest. |
| **Next Steps - additional problems, homework, independent projects** |
| *Which investigations are appropriate for my students to do after the investigation?* |
| Research the defensive behaviors of plankton.  Investigate the differences between holo- and mero- plankton |