## STEAM Lessons (geared to elementary students)

| **SCIENCE** | TECHNOLOGY | ENGINEERING | ART | **MATHEMATICS** |
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| • Data analysis<br>• Data collection<br>• Discussion<br>• Display<br>• Experiment<br>• Hypothesis<br>• Measurement<br>• Prediction<br>• Research<br>• Technology use | • Display data (graphs/charts)<br>• Input data<br>• Printing<br>• Research via Internet<br>• Using tools with precision<br>• Word processing | • Building to understand buoyancy<br>• Repeating process seeking improved buoyancy<br>• Using tools with precision | • 2D shapes into 3 D forms<br>• Using tools with precision<br>• Visual display of data in an aesthetic manner | • Counting<br>• Graphing<br>• Measurement<br>• Prediction<br>• Using tools with precision |
| GEOGRAPHY | LANGUAGE ARTS | | | |
| • Environment, habitat<br>• Physical differences | • Comprehension<br>• Main idea<br>• Speaking/listening<br>• Supporting details | | | |

*Modify unit lesson pieces to meet content area/grade level requirements. You may find additional standards (including state level) that apply to the activities, feel free to add them to your documentation.*

**What is Buoyancy?** *Science* inquiry focus, uses *math* skills in an inquiry lesson with an experiment component allowing students to work in cooperative groups, pose questions, construct responses, observe, measure, investigate, create, use tools, count, discuss, use technology, gather and display data in a safe, fun way.

**Materials**

- Access to A Whale's Tale (http://bluesteam.org/video/)
- Data sheets
- Large & small paper clips
- Small paper clips
- Rulers, inches/centimeters
- Pencils
- Containers with several inches of water
- Foil
- Scissors
- Computer access

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| **High order questions:** | • Who are the main characters? (Literature component)<br>• Who is telling the story?<br>• What information do you think is important in this video?<br>• What are the important characteristics of this habitat?<br>• How is technology being used by the scientists?<br>• How can a heavy object like a ship float?<br>• Why are they telling the story? (Literature components, point of view)<br>• Where did the story take place? (Literature component)<br>• What is the story about? (Literature component)<br>• How do you think the scientists felt when they tagged Wyatt and Wendy?<br>• Why do you feel that way? (Literature components, summarizing and supporting)<br>• Why do the whales come to the surface and then dive under the water?<br>• What is buoyancy?<br>• Why do whales need to control their buoyancy?<br>• How do whales control their buoyancy? |
| **Engage** | **Begin KWL chart to acquire background knowledge**<br>• Complete Knowledge section of chart<br>• For buoyancy focus= KWL: Know – What do you know about whales?, W- What would you like to learn about whales?, L – What did you learn about whales?<br>• For career focus = KWL: Know – What types of technology do scientists use?, W – What would you like to learn about scientist use of technology?, L – What types of technology did you learn scientists use?<br>**Set focus for video viewing** (to meet content requirements), Watch ***A Whale's Tale: Wyatt's Antarctic Adventure with the Scientists*** – available at http://bluesteam.org/video/<br>**Continue KWL - What I do I what to know – questions from students** (add more questions if they arise during experiment) |
| **Explore** | • Buoyancy is important to animals that live in the ocean.<br>• Discussion - Questions<br>• Divide students into groups of 3 - 4 students<br>• **Begin A Whale's Tale Data Sheet (attached at the end of lesson plan)**<br>• Describe, measure and record information for paper clips (centimeters or inches)<br>• High order questions: Do paperclips float? (small/large). Does foil float?, Will a foil whale float?, Will paperclips piled on foil/whale cause it to sink?<br>• Each group (or the class) writes hypothesis about what they think will happen during the experiment.<br>• Hypothesis question examples that can be rewritten: Which size paperclip will cause the whale to sink quicker?, Does the height of my whale's body impact how many paper clips it can hold?, Does piling all of my paperclips at one end of the whale impact how many paperclips it can hold?, Does shape impact buoyancy? |

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| | • Students measure and cut out rectangles in foil. Each student will need 3 rectangles to create 3 whales. Sheets of foil should be cut to the same size. (suggested size = 4"x6",the bigger the rectangles the more paper clips required) Modify as needed.<br>• Whales must have tails and curved heads. Eyes and blow holes can be draw on each whale with permanent marker. Caution – the blow hole should be drawn on, not poked out. Student name should be on each whale to eliminate confusion during the experiment.<br>  ○ Students create 1 flat whale cut out of foil – do not bend; a simple pattern can be used.<br>  ○ Students create 1 foil whale by bending the foil (2D shape becomes a 3D form). (wait to make 3rd whale)<br>• Predict how many paper clips can be placed onto each whale before it sinks (small clips/large clips). Each student should make their own predictions.<br>• Do the experiment. Find out how many small paper clips each whale can hold prior to sinking. Repeat with larger paper clips. Record the data in the appropriate section of the data sheet. *Paperclips should be placed carefully on whales, one at a time, and counted to see how many clips each whale can maintain prior to sinking.*<br>• Discuss observations with group.<br>• Students create 3rd foil whale choosing shape based on prior experiments.<br>• Repeat procedure. Count number of paper clips 3rd whale can hold. Record the data. |
| **Explain** | • Discuss observations with small/large groups.<br>• Questions:<br>  ○ Why did one whale support more clips than the other?<br>  ○ Did the whales hold more small or large clips?<br>  ○ What could you do to the foil to increase its buoyancy?<br>  ○ What might happen to a ship if freight was only added to the back of the boat?<br>• Input data to computer and create a graph(s) with group/class results. If not age appropriate or available create graphs by hand. |
| **Elaborate** | • Share graphs, post on wall.<br>• Write statement about what they learned about buoyancy.<br>• Share acquired information in visual format.<br>• Questions<br>  ○ Why did one whale support more clips than the other?<br>  ○ Did the whales hold more small or large clips?<br>  ○ What could you do to the foil to increase its buoyancy?<br>  ○ What might happen to a ship if freight was only added to the back of the boat?<br>  ○ How do you think whales maintain and change their buoyancy? *Research will be needed here.* |

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| **Evaluate** | • Post graphs and discuss findings.<br>• Students reflect on personal and group learning.<br>  ○ What was observed?<br>  ○ What conclusions can you make?<br>  ○ Were your predictions correction?<br>  ○ Why did one whale support more clips than the other?<br>  ○ Did the whales hold more small or large clips?<br>  ○ What could you do to the foil to increase its buoyancy?<br>  ○ What might happen to a ship if freight was only added to the back of the boat?<br>  ○ How do you think whales maintain and change their buoyancy? Research will be needed here.<br>• **Complete KWL - What I learned section** with information they learned from the lesson and activity<br>• Plan next step for future learning. |
| **Extend** | • Read **A Whale's Tale - Wyatt's Antarctic Adventure: Tagged by Scientists** (narrative available at http://bluesteam.org/books/)<br>• Read **Color Wyatt the Humpback Whale and his Antarctic Friends** (coloring book available at http://bluesteam.org/books/)<br>• Conduct additional research about scientific careers and/or the use of technology.<br>• Word list/crossword puzzles (available at http://bluesteam.org/activities/)<br>• Complete other art/craft projects<br>• Read literature about Antarctica<br>• Research marine life, habitat and/or geography.<br>• Complete other integrated units in the series (available at http://bluesteam.org/resources/):<br>  ○ *Who Lives in Antarctica?*<br>  ○ *When Should I Care for the Earth?*<br>  ○ *Where in the World is Antarctica?*<br>  ○ *Why is This Whale Talking?*<br>  ○ *How Can I Build That?* |

## Based on 'A Whale's Tale'

| **Next Generation Science Standards Grades K-5**<br>**Science and Engineering Practices**<br>Planning and Carrying Out Investigations, Analyzing and Interpreting Data | **Next Generation Science Standards Grades K-5**<br>Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering and Technology |
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| **Kindergarten**<br>**Describe and compare measurable attributes.**<br>CCSS.Math.Content.K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.<br>Count to tell the number of objects.<br>CCSS.Math.Content.K.CC.B.4 Understand the relationship between numbers and quantities; connect counting to cardinality.<br>CCSS.Math.Content.K.CC.B.4.a When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. | **Kindergarten**<br>**Comprehension and Collaboration:**<br>CCSS.ELA-Literacy.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.<br>CCSS.ELA-Literacy.SL.K.2 Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood. |
| **1st Grade**<br>**Represent and interpret data.**<br>CCSS.Math.Content.1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in category than in another. | **1st Grade**<br>**Comprehension and Collaboration:**<br>CCSS.ELA-Literacy.SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.<br>CCSS.ELA-Literacy.SL.1.2 Ask and answer questions about key details in a text read aloud or information presented orally or through other media. |
| **2nd Grade**<br>**Measure and estimate lengths in standard units.**<br>CCSS.Math.Content.2.MD.A.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.<br>Represent and interpret data.<br>CCSS.Math.Content.2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems1 using information presented in a bar graph. | **2nd Grade**<br>**Comprehension and Collaboration:**<br>CCSS.ELA-Literacy.SL.2.1 Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.<br>CCSS.ELA-Literacy.SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. |
| **3rd Grade**<br>**Represent and interpret data.**<br>CCSS.Math.Content.3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets. | **3rd Grade**<br>**Comprehension and Collaboration:**<br>CCSS.ELA-Literacy.SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.<br>CCSS.ELA-Literacy.SL.3.2 Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. |
| | **4th Grade**<br>**Comprehension and Collaboration:**<br>CCSS.ELA-Literacy.SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. |
| **5th Grade**<br>**Convert like measurement units within a given measurement system.**<br>CCSS.Math.Content.5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. | **5th Grade**<br>**Comprehension and Collaboration:**<br>CCSS.ELA-Literacy.SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.<br>CCSS.ELA-Literacy.SL.5.2 Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. |

**A Whale's Tale Data Sheet for Group # _____**

**Size of large paper clip = _____ Describe this object: _____**
**_____**

**Size of small paper clip = _____ Describe this object: _____**
**_____**

**List each student in your group. Predict how many paper clips you think whale #1 can support without sinking. Write the actual number in the next box. Repeat procedure for whale 2 and whale 3.**

| Names | Prediction for Flat Whale #1 – large paper clip | Prediction for Flat Whale #1 – small paper clip | Prediction for 3D Whale #2 – large paper clip | Actual for 3D Whale #2 – small paper clip | Prediction for choice Whale #3 – large paper clip | Actual for choice Whale #3 – small paper clip |
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| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |

| Names | Prediction for Flat Whale #1 – large paper clip | Prediction for Flat Whale #1 – small paper clip | Prediction for 3D Whale #2 – large paper clip | Actual for 3D Whale #2 – small paper clip | Prediction for choice Whale #3 – large paper clip | Actual for choice Whale #3 – small paper clip |
|---|---|---|---|---|---|---|
| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |