County Implementation Award Program (CIAP) Math and Science Lesson

Unit Title: Fall Apple Unit

Lesson Title: Design an Apple Raft for Johnny Appleseed

Author: Gena Rickon

Grade Level: First Grade

Time Frame: 1 hour + (It is suggested to do this lesson as several smaller lessons.)

Targeted Standard(s):

1-LS-1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

K-2-ETSI-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps its function as needed to solve a given problem.

MP.5 Use appropriate tools strategically.

1.MD.2 Express the length of an object as a whole number of length units, by multiple copies of a shorter object end to end; understand that the length of a measurement of an object is the number of same-size units that spans it with no gaps or overlaps.

Short Description of Targeted Phenomenon:
Share the video of a coconut floating (https://www.youtube.com/watch?v=VtzMpjCDA5Y) asking students to share what they notice and wonder.

Note to teachers: Apples are buoyant. There is air inside of apples that helps keep them from sinking. Apples are less dense than water and therefore should float.

Density measures how tight or loose particles are in an object. Objects that are denser than water will sink, and objects that are less dense than water will float.

Exploration/Brainstorming of the Phenomenon: What effect do you think will size and shape have on how apple pieces might float, for example, flat vs. curved? small vs. large? flat vs. curved? flat on bottom vs. flat on top? curved on bottom vs. curved on top? skin vs. no skin?

Three Dimensions of NGSS

Science & Engineering Practice/s (SEP):

- ***Science & Engineering Practice/s (SEP):*** *Constructing Explanations and Designing Solutions*
- *Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.*
- *Use materials to design a device that solves a specific problem or a solution to a specific problem. (1-LS1-1)*

Crosscutting Concept/s (CCC):

- ***Patterns:*** *Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.*
- ***Structure and Function:*** *The shape and stability of structures of natural and designed objects are related to their function(s).*
- ***Connection to Engineering, Technology, and Applications of Science:*** *Influence of Engineering, Technology, and Science on Society and the Natural World:*
- *Every human-made product is designed by applying some knowledge of the natural world and is built by using materials derived from the natural world.*

Disciplinary Core Idea/s (DCI):

- ***LS1.A: Structure and Function:*** *All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)*
- *LS1.D: I**nformation Processing:** Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1-LS1-1)*

We will also engage with:
Developing and Using Models

- Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Develop a simple model based on evidence to represent a proposed object or tool. (K–2-ETS1-2)

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K–2-ETS1-2)

Language Supports:

Define: sink and float (if needed for ELLs)

- raft (a buoyant structure of materials fastened together)
- buoyant/buoyancy (able/ability to float or rise in a liquid or gas)
- gravity (the force that attracts an object toward the center of the earth)
- particles (very small portions of matter that everything is made of)
- density (how tight or loose particles are in an object)
- balance (even distribution of weight enabling something to remain upright and steady)
- drift (be carried by a current of air or water)
- thrust (the force that propels a body through water)
- drag (the force that makes is more difficult to move through water)

Materials Needed:

- **Johnny Appleseed book possibilities:** Johnny Appleseed by Jodie Shepherd, Johnny Appleseed by Patricia Demuth, Johnny Appleseed My Story by Davis Harrison

- apples (1-2 per pair of students depending on the size of the apples)
- 10 toothpicks (per pair of students)
- 5 popsicle sticks (per pair of students)
- ½ sheet of construction paper
- butter knives (plastic knives are too weak)
- Unifix cubes (both for measuring the apple raft and to represent Johnny Appleseed)
- access to water
- large plastic tub (dish tub would work, but bigger would be better)
- teacher knife
- Optional reflection sheet (see Other Resources below)

Objective(s): Students will be able to:

1. Investigate an object's density based on whether it sinks or floats.
2. Work successfully and collaboratively in pairs to design and execute a challenge.
3. Design and build a raft meeting given specifications to perform a specific task.
4. Learn and practice how to measure an object with nonstandard units.

How Math and Science concepts/skills/practices were integrated in this lesson:

- Students grapple with the structure and buoyancy of apples combined with engineering with toothpicks, Popsicle sticks, and paper to solve a given problem.
- Students express the length and width of their apple raft as a whole number of Unifix cubes and understand that the length and width of the raft is the number of Unifix cubes that spans it with no gaps or overlaps.

Possible Challenges /Misconceptions:

- Working in pairs to complete one sketch and one raft.
- Building a balanced raft
- Using too much of one material, making the raft sink
- The primary function of an apple is to distribute the seeds so that new apple trees can grow.
- The structure that we will be learning about it the buoyancy of apples.
- ***Question: How might an apple's buoyancy help it distribute its seeds?***

Formative Assessment:

- Teacher asks questions in the body and the closure of the lesson.
- Student planning page/sketches

Lesson Opening	
Teacher Actions (10min)	**Student Actions**

• Read and discuss a book(s) about John Chapman (Johnny Appleseed). • Discussion should include Johnny Appleseed's inventiveness when facing a dilemma or a problem (i.e. Pages 20-23 in Johnny Appleseed My Story by Davis Harrison, the author describes Johnny making his own snowshoes to survive a storm.) • Also, create interest and question students about how he might get across a river that was too deep and wide to cross on his own.	• Students listen to the story and participate in the discussion. • See if students can come up with the idea of a raft on their own with some guiding questions. • Students share prior knowledge of rafts.
Lesson Introduction	
Teacher Actions (10min) **Introductory Actions** Show video link Sink or Swim https://youtu.be/eQuW8G2QV_Q • Discuss the Language Supports (vocabulary) • Do an exploratory demonstration to see if apples sink or float: whole, cut in half, and cubed, tooth picked together. Also demonstrate the surface area to build a stable raft that will meet the measurement requirements. • Show the two imbedded pictures to show why ducks are buoyant and the forces on movement in water. Act out thrust and drag in water. • Discuss the Language Supports (vocabulary) **Explanatory Actions** • Set up a situational story that in Johnny's travels he comes to a deep, wide river that he needs to cross. (Handout can be projected or posted.) • Give instructions to students. Explain that students will work TOGETHER in pairs to complete the challenge of designing and building ONE raft to carry Johnny across the river. • Give students time to discuss and sketch their design as a team. • Each pair of students will get one (or two) apple(s) (depending on the size of apples available), ½ a piece of construction paper, 15 toothpicks, and 5 Popsicle sticks.	**Student Actions** **Introductory Actions** • Students watch video • Students predict sink or float by thumbs up or down for items in the video. • Students predict sink or float by thumbs up or down for - whole apples, cut in half, and cubed. • Possible extension: experiment with other objects with varying density. **Explanatory Actions** • Students listen and ask clarifying question.

• Demonstrate how to measure with Unifix cubes. Students must measure and record their raft's length and width before testing it on the water. Apple raft must be between 5 and 10 Unifix cubes wide and long. (Students will need access to Unifix cubes for measuring.) • Johnny's raft must stay afloat and be able to travel from one side of the tub of water to the other, and Johnny must be able to stay on his raft to be successful. Students are not allowed to touch their raft to move it across the water.	
Body of Lesson	
Teacher Actions (30-35 min) • Teacher circulates the room and supports students' collaborative work. • **Teacher asks questions:** • How are you going to build/assemble your raft? • What will hold it together and make it stable? • How will you make sure Johnny doesn't fall off? • How will you get the raft across the river? • Show me how you measured your raft? • Do you think having the skin side up or down is better? • What do you think is the most successful part of your design?	**Student Actions** • Students work in pairs to discuss and sketch their designs on one sheet of paper per pair. • Students work together with the materials to build their raft. • Students measure their raft to see if it meets specifications and record their measurement on their sketches. • Students put "Johnny" on the raft. (Use 3 Unifix cubes to represent Johnny.) • Students test their rafts for buoyancy and stability. • Students make modifications if necessary. • Students see if they can get the raft to the other side without touching it. • Students make modifications or improvements.
Lesson Closure	
Teacher Actions (5min) • Facilitate pairs sharing their experiences with the class or in small groups. Possible discussion sentence stems: • What worked well was… • What didn't work very well… • We had to modify… • I learned…. • I noticed…	**Student Actions** • Students share what worked well, what didn't work, what they needed to modify, new learning, and things they noticed. • Optional: Students fill out the reflection sheet.
Summative Assessment: • Students worked cooperatively with peers	

- Students completed the challenge according to specification
- Students accurately measured the raft using Unifix cubes.
- Student drawing of final design
- Optional reflection sheet (see below)

Other Teaching Resources:

- Johnny Appleseed by Jodie Shepherd
- Johnny Appleseed by Patricia Demuth
- Johnny Appleseed My Story by Davis Harrison
- Students instruction page
- Student planning page and recording of measurement.

Lab Safety:

- Always cut away from your fingers.

Extensions (if any):

- Do all apples float?
- Do different varieties of apples float better than others?

To connect back to the Performance Expectation, have students design a solution to a human problem connected to the learning done in this lesson, such as developing ways to help people swim farther or design better boats. Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.)

Solano County Office of Education

Johnny Appleseed Raft

Johnny Appleseed set out West with a bag of apple seeds, bare feet, and a pot on his head.

He comes to a river.

The water is rushing past, and it is too deep and wide to get across!

Help Johnny Appleseed build a raft and get safely across the river.

Materials

- Apples
- 15-20 toothpicks
- 5 popsicle sticks
- construction paper
- tape

Tools

- plastic knives (or butter knives
- Unifix cubes

Rules

- Raft must be between 5 and 10 Unifix cubes long and wide.
- Raft must float.
- Raft must travel from one side of the tub to the other.
- Johnny must be able to stay on his raft.

• **scissors** • **tub or bucket of water**	• **You are not allowed to touch your raft to move it across the water.**

Name _____ **Date** _____

Design a Raft for Johnny Appleseed

Materials

- **Apples**
- **15-20 toothpicks**
- **5 popsicle sticks**
- **construction paper**
- **tape**

Rules

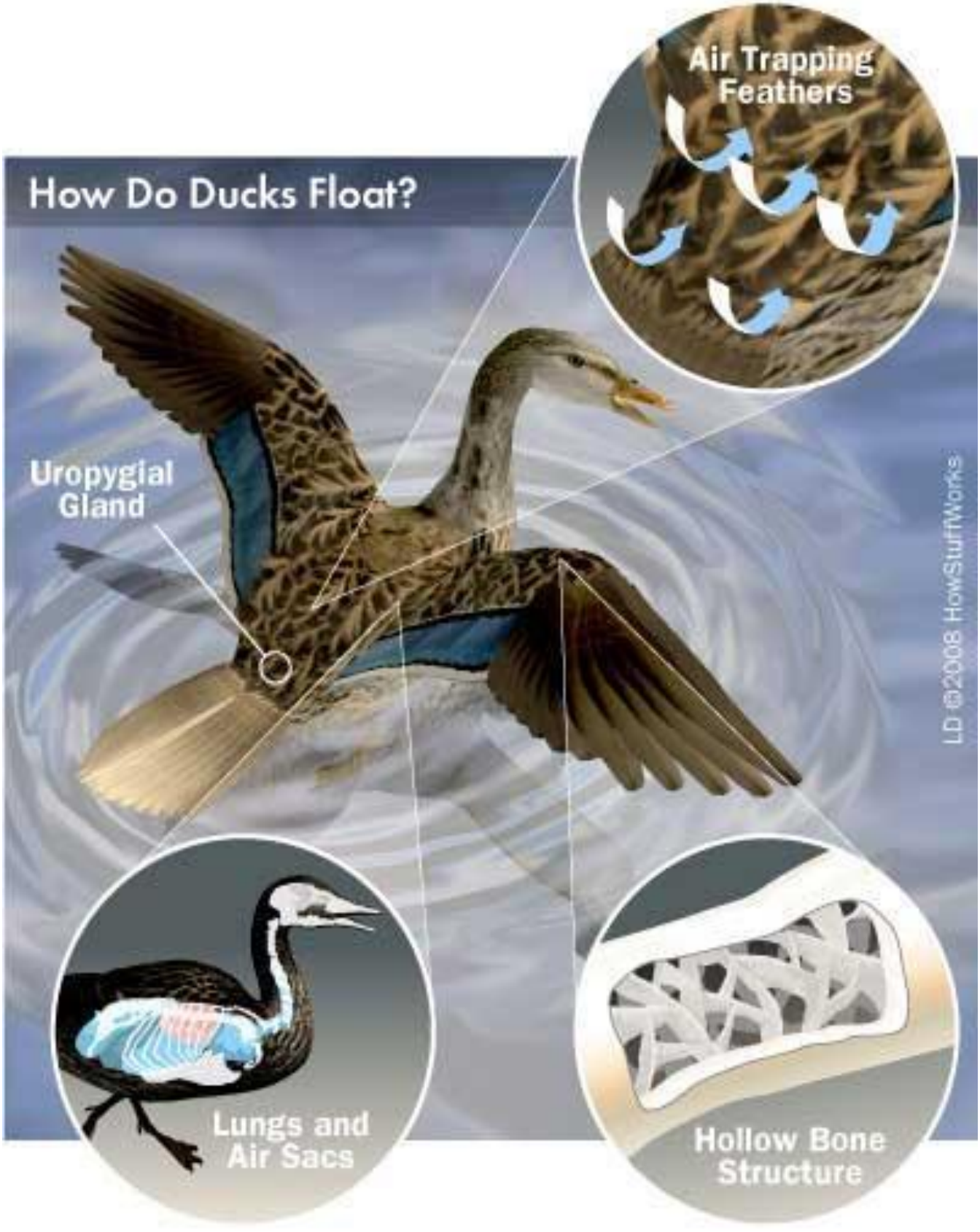
- **Raft must be between 5 and 10 Unifix cubes long and wide.**
- **Raft must float.**
- **Raft must travel from one side of the tub to the other.**
- **Johnny must be able to stay on his raft.**
- **You are not allowed to touch your raft to move it across the water.**

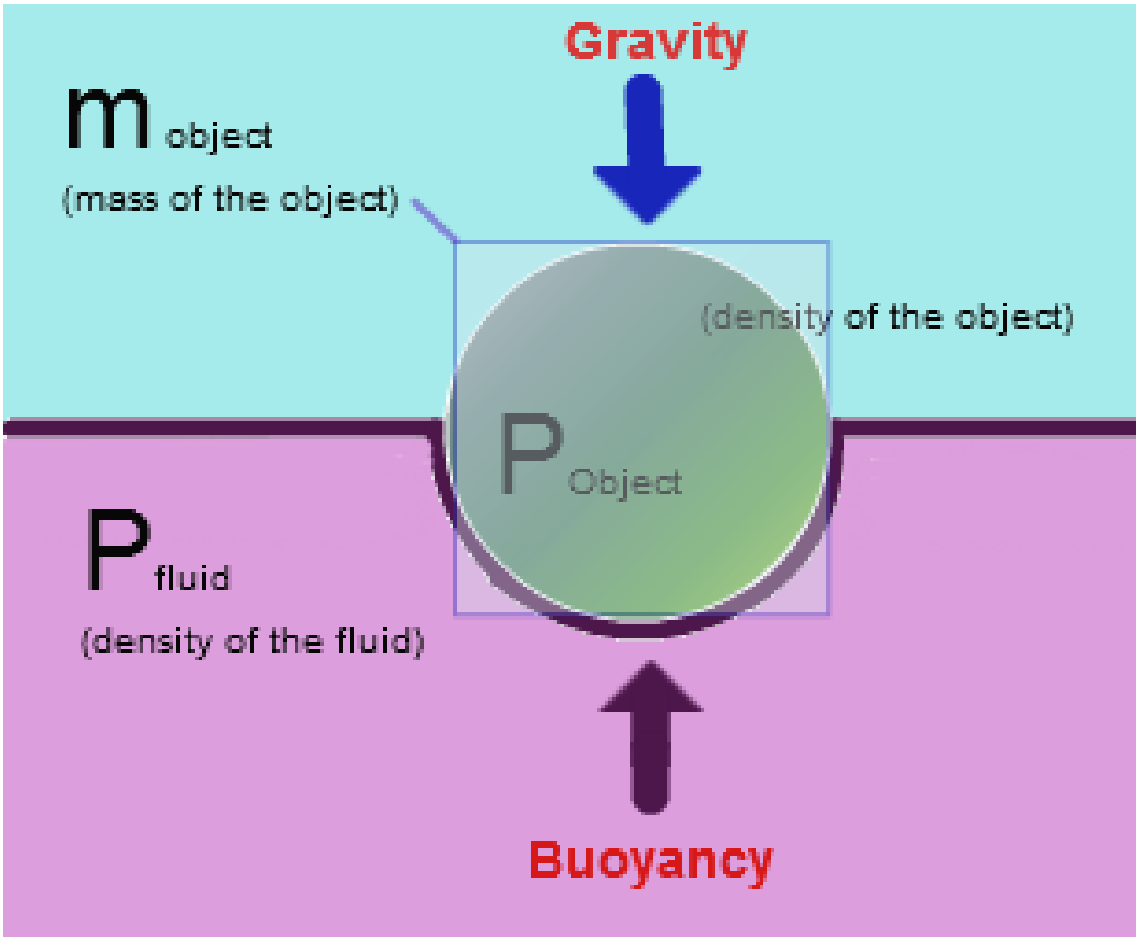
Talk with your partner and sketch your design.

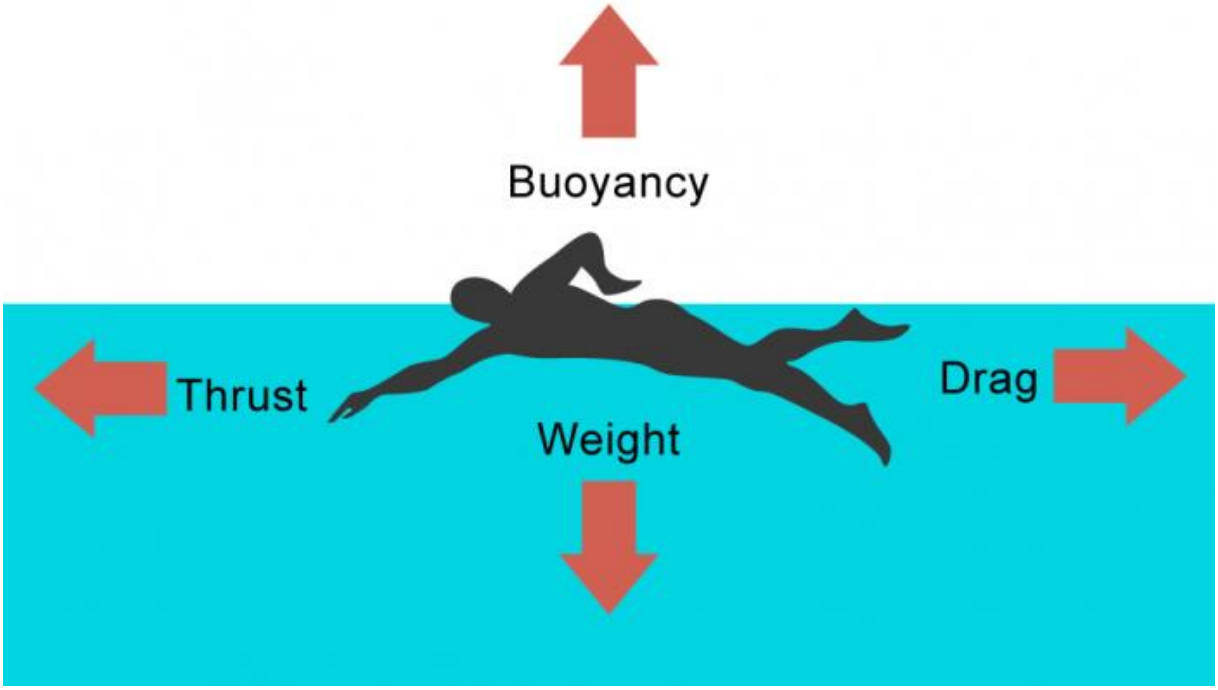
Solano County Office of Education

Our Apple raft measured _____ Unifix cubes by _____ Unifix cubes.

Solano County Office of Education

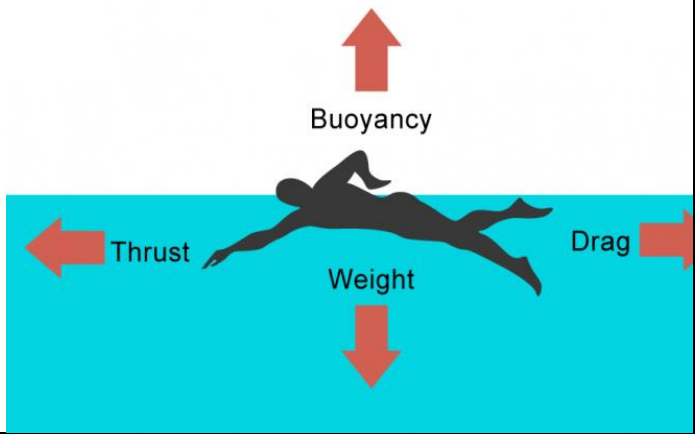



Gravity
m object
(mass of the object)
(density of the object)
P Object
P fluid
(density of the fluid)
Buoyancy



Name _____ **Date** _____

Word Bank: air buoyant weight density particles



Solano County Office of Education

Johnny Appleseed Raft Reflection Sheet

1. Why do ducks float?

Ducks float because _____

_____

_____

_____

2. Why do apples float?

Apples float because _____

_____

_____

_____

3. What part of your raft design was the best?

What worked well was _____

_____

_____

_____

Solano County Office of Education

4. What part of you raft design did you need to improve?

We had to modify _____

_____

_____

_____

I learned _____

_____

_____

I noticed _____

_____

_____