

junior tech challenge

The practical
side of
science and
tech

Student Handbook

Intended for:
Intensive ESL Project, Elementary Cycle 3
Science and Technology Program, Elementary Cycle 2 & 3

Name:

Partner(s):

Name of Prototype:



A program of

YOUR MISSION

Ahoy, Matey! Our treasures are in danger! Have you heard that the sea levels are rising? The loot we spent so many years gathering onto the island may be lost underwater at any moment, and we don't have enough ships to load all our precious cargo! Arr! But, it seems that you, young mate, are quite clever. If you help me, you will be greatly rewarded! I need you to build the lightest watercraft possible to support the most amount of treasure. Let's get to work! We are getting into deep water! My socks are already getting wet!

Your Challenge

To build a floating prototype that can support the greatest number of standard-size marbles (*about 1.5 cm in diameter and a mass of 5 g*).

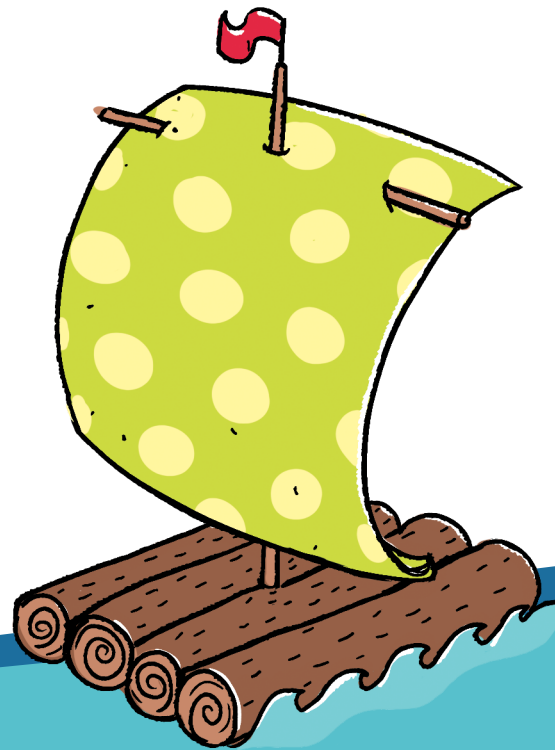
Material needed to build the base of the prototype:

The team must use a plastic sheet of approximately 25 cm x 25 cm.

Starting Object:

A starting object must be placed into the prototype before the marbles are deposited.

- Cycle 2: A ping-pong ball
- Cycle 3: A tennis ball



GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY

(ACTIVE DISCOVERY PROCESS) IN PRIMARY SCHOOL

Context related
to everyday life



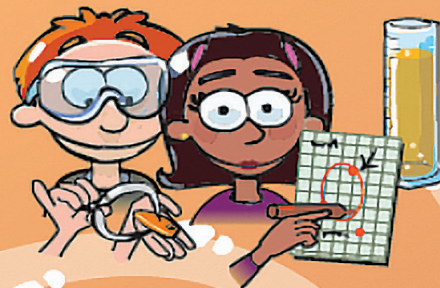
Your Challenge:
Design and Build a
floating Prototype.



Initial ideas
and hypothesis

- Your ideas to
create an efficient
floating Prototype.
- Your sketch

Planning and carrying out



- You Build
- You test
- You improve
- You Compete

Outcome



- Your successes
- Your suggestions for
improvement



Part A: Before the Challenge

Your challenge is to build a floating prototype. Before we dive into the different tasks required to complete this challenge, I'd like to know whether you agree or disagree with the statements below. Place an X in the appropriate box.

Part B: After the Challenge

Now that you have built your floating prototype and put it to the test, answer the same questions in the appropriate boxes.

Agree or Disagree?	Before the Challenge		After the Challenge	
	Agree	Disagree	Agree	Disagree
<i>An object floats because it is light.</i>				
<i>An object sinks because it is heavy.</i>				
<i>A cruise ship is a heavy object.</i>				
<i>A cruise ship floats.</i>				
<i>A cruise ship is a heavy object that floats.</i>				
<i>A paperclip is a light object that sinks.</i>				



Buoyancy refers to the tendency of an object to float when submerged in liquid.

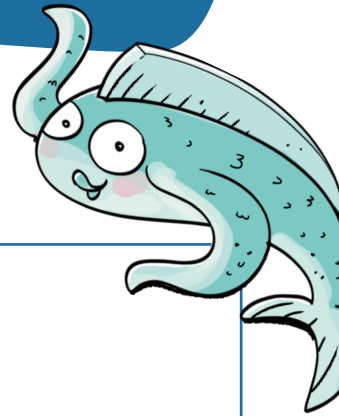
Part A: A Clay Ball

Materials

- Water
- Container
- Oil-based clay



What will happen when we place a clay ball into a container filled with water?



Hypothesis

I think ...

because ...

Observations

Complete the diagram to show what you observed.



My Conclusion

I conclude that:

Part B: A Clay Boat

Materials

- Water
- Container
- Oil-based clay



Will the clay float if it is shaped into a boat?

Procedure

- Mold the clay into the shape of a large bowl.
- Place your clay bowl into the container of water.



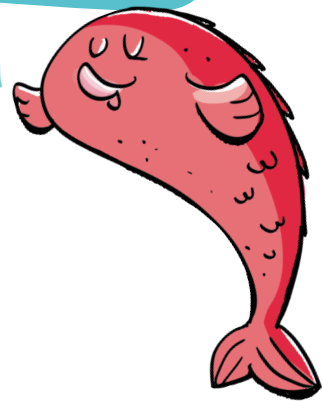
Observations

Complete the diagram to show what you observed.







My Conclusion

I conclude that: _____



Part C: A Clay Bowl

Materials

- Water 
- Container 
- Oil-based clay 
- Marbles 

Using the same amount of clay, which size bowl will hold the most marbles?

Hypothesis

I think ...

because ...

Results

Number of marbles before sinking.



Small



Medium



Large

Conclusion

I conclude that:



Good Pirates were sailors

who had to know how to distribute their treasure aboard their ship without making it keel over. In order for pirates to learn the ropes, they would play two pirate games.



Before you start playing, answer the following questions. Put an X in the box that best matches your hypotheses.

	I agree	I disagree
<i>It doesn't matter where I place the cargo aboard the ship. What's more important is to load the ship with lots of cargo.</i>		
<i>It does not make a difference whether I place the cargo in the center of the ship or along the sides of the ship.</i>		
<i>All cargo in every pirate ship has the same mass.</i>		
<i>I should always start by placing heavy cargo along the sides of the ship.</i>		



Materials

- Game board (graph and cardboard)
- Paper coffee cup
- 30 identical treasures (game pieces)



Part A: Pirates Attack!

Your pirate ship has just attacked the Royal Navy. You must board their ship and load as much of their treasure as possible onto your own ship without it keeling over.

Prepare to Play

With a mate:

- Glue the graph game board onto a sheet of cardboard.
- Balance the game board onto the paper cup.

Rules of the Game

- Each player takes a turn placing a treasure at an intersection on the game board.
- If you tip the game board, you and all the treasure will fall into the water and get eaten by a hungry shark! Try again.
- Record the maximum number of treasure you placed on the game board without it tipping over.
- You will be asked to discuss and share your observations with the class.



Part B: The Pirate Treasure and the Secret Island

You and your mate must unload the treasure from the ship and hide it on a secret island.

Prepare to Play

Repeat the procedure in Part A or...

- Place the game board flat on a table or on a desk.
- Place all 30 treasures at different intersections on the game board.
- Carefully balance the game board onto the paper cup.

Rules of the Game

- Each player removes one piece of treasure from the game board without tipping it over.
- If you tip the game board, you and all the treasure will fall into the water and get eaten by a hungry crocodile! Try again.
- Take note of where on the board you removed the piece that made the board tip over.
- You will be asked to discuss and share your observations with the class.



A PIRATE GAME

Activity 3



Now that you have played A Pirate Game, let's see **if your answers are still the same!**

	I agree	I disagree
<i>It doesn't matter where I place the cargo aboard the ship. What's more important is to load the ship with lots of cargo.</i>		
<i>It does not make a difference whether I place the cargo in the center of the ship or along the sides of the ship.</i>		
<i>All cargo in every pirate ship has the same mass.</i>		
<i>I should always start by placing heavy cargo along the sides of the ship.</i>		

What strategy did you use to balance the game board?

How will this strategy help you design your prototype for the S.O.S. Pirates! Challenge?

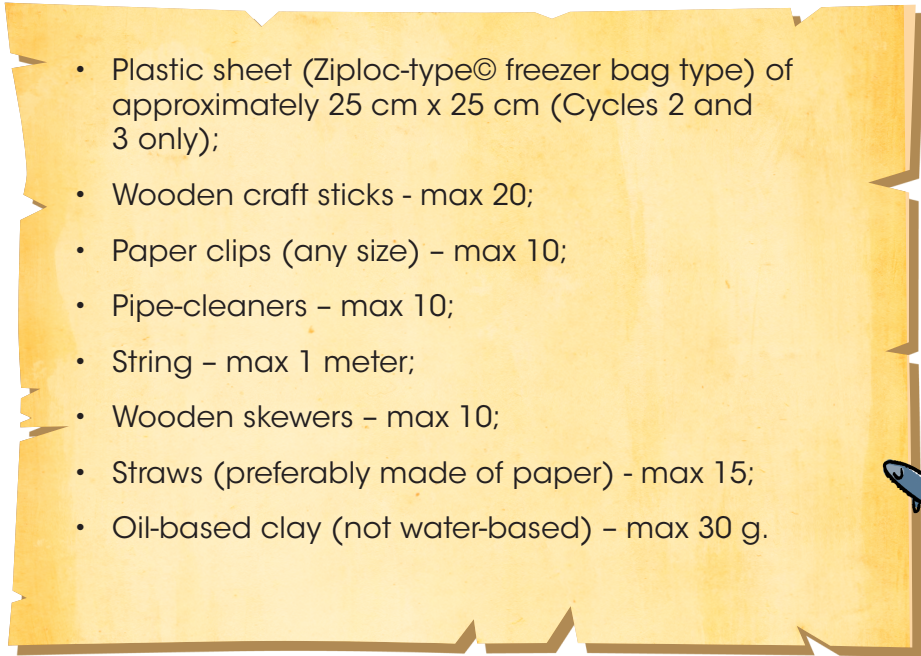
PREPARING TO MEET THE CHALLENGE

BATTEN DOWN THE HATCHES!

Reviewing the Challenge

Before we set sail, let's make sure everything is shipshape. We must verify that we followed all the rules. I wouldn't want to go back home swimming. Especially since I can't swim!

- Teams may use only the following materials:

- 
- Plastic sheet (Ziploc-type® freezer bag type) of approximately 25 cm x 25 cm (Cycles 2 and 3 only);
 - Wooden craft sticks - max 20;
 - Paper clips (any size) - max 10;
 - Pipe-cleaners - max 10;
 - String - max 1 meter;
 - Wooden skewers - max 10;
 - Straws (preferably made of paper) - max 15;
 - Oil-based clay (not water-based) - max 30 g.



- The prototype cannot exceed 30cm in length and 15cm in width. There are no height restrictions.
- The starting object and the marbles must be deposited into the prototype and cannot be fastened to it.
- No part of the prototype can rest on the basin.

PREPARING TO MEET THE CHALLENGE



BATTEN DOWN THE HATCHES! (CONTINUED)

Design It

Imagine designing a prototype based on the information you gathered from the previous activities.

Before building your prototype, sketch your design. Identify the names of the main parts, their dimensions and the materials you will use.



Build It!

Once your teacher has approved your sketch, you can **start building your prototype!**

Appropriate description of the problem	A	B	C	D
Formulation of complete and relevant solutions.				

TESTING MY PROTOTYPE

ALL HANDS ON DECK!

For each trial, note or draw your observations and the changes you will make to improve your prototype.

You are free to run more trials than the 3 trials proposed.

My trials will test...

- ☐ If my prototype floats;
- ☐ If my prototype is able to carry the starting object;
(Cycle 2: ping-pong ball, Cycle 3: tennis ball);
- ☐ If my prototype is able to carry the marbles.



Trial	Number of marbles	Problems encountered	Proposed modifications
1			

TESTING MY PROTOTYPE – ALL HANDS ON DECK!

Trial	Number of marbles	Problems encountered	Proposed modifications
2			
3			

When you have completed the challenge, go back to page 4 and complete Part B.

Application of an appropriate procedure	A	B	C	D
Readjustment of the design made during the testing phase				
Appropriate use of tools, instruments and techniques	A	B	C	D
Appropriate handling of tools and instruments				

THE COMPETITION



ADVENTURE AND TREASURE AWAIT US, MATEY!

You are satisfied with your awesome floating prototype. You are excited to show your captain that they were right to believe in you and your creative abilities. You are now ready to set sail!

It's time to carry out the final test of your prototype.

The points will be calculated in this way:

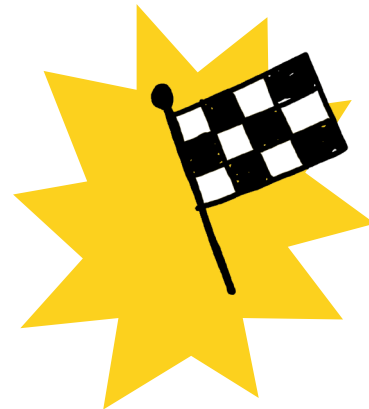
The number of marbles deposited on board your prototype	X	5 points	=	Total points
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During the competition:

- At the teacher's signal, the team will place their prototype into the basin;
- The team will deposit the starting object first (remember that the starting object and the marbles cannot be fastened to the prototype);
- The team will deposit the marbles, one at a time, on board the prototype;
- The team cannot touch the starting objects or the marbles that are already on board;
- The team's turn will end if the prototype sinks, if an object on board falls out or if the prototype touches the bottom of the basin;
- The team that deposits the most marbles on board their prototype, without sinking it, is the winner.

The number of marbles deposited on board your prototype	X	5 points	=	Total points

REVIEW AND REFLECT



BACK TO PORT!

1. What was the best idea you had when planning or building your prototype?

My best idea was:

Explain why.

2. How will you modify or adjust your prototype to improve it?

I will:

Explain why.

Appropriate use of scientific and technological knowledge	A	B	C	D
Produces explanations and uses terminology specific to Science and Technology				