UNIVERSE SIMPLIFIED FOUNDATION

Empowering For Innovation

Water Rocket

Conventions used in this document:

Blue: Questions from facilitator to children
Brown: Children's anticipated response
Black: Comments, notes, and plan for the facilitator

Session flow

Sr. No.	Activity	Talking points	Time allotted
1	Introduction	• What are we going to make today? • How do you thing rockets work	15 mins
2	Group formation and worksheet distribution	Assuming you have already explained to them how to use the worksheet. If not please refer to 'General instructions for the facilitator'	15 mins
3	Ideation and Material gathering	Students will come up with the design of the project and list of the material required for the completion of the challenge. Here children should have filled the worksheet till the material list.	15 mins
4	Project making	During this time, children will build the project.	120 mins
5	Worksheet completion	It will be difficult for children to complete the worksheet while making the project. So give them extra time to complete the worksheet once the project is completed.	15 mins
6	Final Discussion	Working of water rocket	15 mins

The above mentioned is the minimum time you need to give children. Feel free to change the time allotted as per the requirement of the class. This is typically a 3 - 4 hr project. You can extend it up to 5 hrs.

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Introduction

Ask them to go through the instruction sheets first.
They will read the following,

Challenge 1

- *Design a rocket from a PET bottle that uses water and air as fuel.*
- *Design a stand or a support structure to launch the rocket safely.*

What are we going to make today?
Rocket

What do you think you are going to use as the body of a rocket?
PET bottle

What do you know about rockets?
Something is launched in space/ sky
Goes outside Earth
Here children will give various answers, and the facilitator has to decide what they want to accept.

Have you seen any rocket launches? (You can show them a video here. Link to the video here)
Yes/ No

Give them a picture of a rocket and ask what are the parts of the rocket and how it works according to them?
They should be able to identify the launcher, nose, nozzle, and body of the rocket. You can help them if they aren't able to do it. You can find pictures here.

What will you use to make a launcher?
PVC pipe

You can get into your groups and design the rockets and create the material list.

How to help children when they are stuck using the Inquiry driven approach

1. Locking mechanism

Children most probably will be unable to figure out how to create a locking mechanism. You can ask them,

Why do we need a locking mechanism?
Something to hold the bottle in place while we are pumping the air in to create pressure in the bottle.

So you need something that will keep the rocket in place till you launch it?
Here you need to give them some hints. Show them a picture of the locking mechanism or show them how they can attach zip ties to construct a locking mechanism.

2. Bulging of pipe

When they attach the pipe to a water-filled bottle, children will see that the water is leaking. If the water leaks before you intend to launch or while you are pumping in the air, then the rocket will not launch with enough force.

You can ask children to come up with ways to stop the water rocket. They can choose to tape or create a bulge on the pipe or come up with their own unique solution.

Why the project may not work

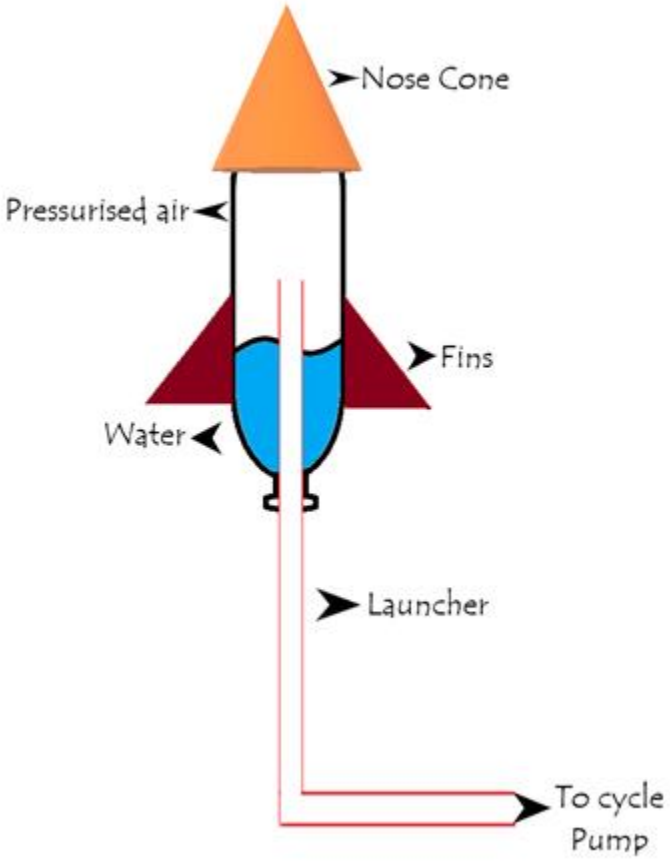
1. The cycle pump has leakage or is not working properly. This will create a lack of pressure in the bottle and the rocket won't launch properly.
2. Make sure the locking mechanism is in place and doesn't slide off.
3. The bottle has a hole from where the air is escaping.
4. Important to pump air faster so the water leakage doesn't take place or excessive water isn't lost.

Working

The main principle behind the working of a water rocket is Newton's 3rd law of motion. It states that every action has an equal and opposite reaction.

The air is pressurized within the bottle with the help of a cycle pump. After creating enough pressure, the rocket is launched. The neck of the bottle acts as a nozzle. After the launch due to the air pressure, water within the bottle gets pushed out with a certain force. This exerts an equal and opposite force on the bottle (rocket) that lifts it up.

What are the basic shapes and functions of various parts of a water rocket's body?



The main parts of a rocket are:

1. **Nose**: The nose of the rocket is triangular in shape with a rounded end. This helps to make the rocket aerodynamic and reduces drag. A broad nose increases the pressure drag on the rocket, making it lose more energy and speed due to friction.

2. **Wings/ Fins**: Wings on the rocket stabilize its motion and help decrease any major deviations from the ideal flight path. They are often located near the nozzle.

3. **Nozzle**: The nozzle of a rocket is located in the extreme behind of a rocket and is the exit through which propellant (or fuel) escapes the rocket. It has a narrow exit because that increases the thrust with which the water (or fuel) is propelled out.

4. **Body**: The main body of the rocket is designed to be aerodynamic to reduce friction by drag during flight. It is basically cylindrical in shape with a pointed nose and a narrow nozzle.

Resources:

Reading:
https://www.grc.nasa.gov/WWW/K-12/rocket/rockpart.html
http://waltonaero.wikidot.com/part-a

Video:
https://youtu.be/2R8V68viXqk
https://youtu.be/4AyRsck014I

What is a rocket and how does it work?
Resources:

Reading:
https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-a-rocket-k4.html
https://www.grc.nasa.gov/www/k-12/rocket/TRCRocket/rocket_principles.html
https://www.explainthatstuff.com/spacerockets.html

Video:
https://www.youtube.com/watch?v=QQB1Iw3zJbc

Third law of Motion:

For every action, there is an equal and opposite reaction". Putting it simply, consider you have two interacting objects, Object A and Object B. If Object A exerts the force on Object B, then Object B will exert an equal and opposite force on Object A as well.

In the context of the Water rocket:
Pressurized air pushes water down through the nozzle of the bottle. When the water is pushed down through the nozzle, the bottle moves in the opposite direction.

Final Discussion:

What did you observe?

When the water is released through the nozzle the bottle goes up.

In which direction did the air/ water be pushed through the nozzle and which direction did the rocket move?

They will point out the direction and you can inform them about Newton's third law of motion.

After completing the explanation, you can ask them where else they have seen Newton's third law of motion in practice.