

Balloon Powered Car

Students explore the concepts of science, engineering and arts as they build a toy car powered by balloons.

Materials

Necessary materials

Food stick
Plastic/paper straw
Construction paper A5 sheet
Balloon
Bottle caps
Masking Tape
Scissors

Optional materials

Thread
Cardboard
Rubber bands
Popsicle sticks

Note: Underlined materials are to be shared among the students

Curiosity

Get students curious about the activity they are going to do. Provide them a prompt that provides context for this activity and presents students with a problem to solve. Because we shall be working with simple, non-electric materials in this session, setting up such a context in the story can be helpful. An example of story is as follows:

"In a village, people are terrorized by a monster who, at the end of each month comes to the village and eats the animals and people in there. One day the villagers make a deal with the monster that on the last day of each month they will deliver a cartful of delicious food to the monster's cave. In return the monster will not terrorise the villagers.

All the villagers are happy about it but then suddenly someone asks - "but who will go to deliver the food?"

The villagers are worried once again as the monster might eat the person or animal who goes to deliver the food."

Activity

Sketching ideas

Give students some time to go through this lesson in the student guide.

Then ask them to do a quick sketch of the balloon powered car they want to build.

Scaffolding

Support students whenever they seem stuck. Ask leading questions or hint at ideas for starting. Some

examples are given below:

- How many wheels do you want your car to have? What kind of shape will you give to your car?
- How is your car getting the power to move?
- What difference would the position of a balloon make to the car?

Point out the good ideas generated so that other students can learn from it. Connect groups that are struggling with the groups that have overcome that specific challenge.

Experimentation

Encourage students to experiment through structures to fill or through questions, to support their thinking.

- I wonder what happens if _____
- What do you want to try next?
- What might happen if you used more than one balloon to power the car?
- Do you think the number of wheels makes a difference to how this car works?
- Would you like to find out what happens if you used larger wheels?

Suggestions for the facilitator

We found these insights and tips to be helpful while facilitating this session.

- Some students start with an ambitious model with multiple balloons and get frustrated when their ideas don't work. You can ask them to start with something simple and add to its design eventually.
- The friction between the axle (food stick) and the chassis (construction paper) is one of the major barriers to be overcome in the activity. Many students struggle with this. Inserting food sticks inside the plastic straws is one way to solve this problem.
- It might be difficult for students to poke holes in the plastic bottle caps. An easy technique to do so is to place the caps on the desks such that the empty region is placed downward. Then use a food stick to press hole in it by pushing it vertically downwards.
- Students often don't consider the inflated balloon while designing their car. As a result they later encounter problems when the inflated balloon touches the floor or the wheels. They can solve this problem by properly positioning their balloon on the car's body.

Thinking

Reflection

Ask questions to help students reflect on their learning.

- How did the design of your balloon powered car evolve throughout the session?
- What role did feedback play in your project?

You can also provide structures to support their thinking.

- Two things I learnt are _____
- I used to think _____ and I now think _____

Think like a ...

Ask thought provoking questions to make students think from the perspective of a professional.

Think like a physicist

- Why does the speed of the car increase when the balloon is about to run out of air?
- Balloons are made of rubber. Can plastic or cotton be used to make balloons? Why?

Think like an engineer

- Why is it necessary to place the food sticks inside plastic straws?
- What role does the thickness of wheels play in the functioning of the car?
- What similarity and difference do you see in the working of a balloon powered car and a rocket?

Concepts and skills

Some concepts and skills students explore in this lesson are:

- **Newton's third law of motion**
The air being pushed out of balloon exerts a reaction force on the balloon, causing the car to move
- **Friction**
Inserting the food stick axles within plastic straws reduces the area of contact, thus reducing the friction and making car move easily
- **Prototyping**
Making designs and models before building the actual project helps get better ideas and identify mistakes quicker

Sample lesson plans

1. A 60 minute class

Learning Objective

To get students to playfully explore the concepts related to forces and motion by building a toy car powered by balloons. The emphasis is on getting them to understand the scientific concepts and skills associated with this activity.

Classroom context

This sample lesson is designed for grade 8 students. The time available is 60 minutes.

Lesson Flow

Curiosity (5/5 mins)

Divide students into groups of 2 or 3. Ask students to think about some unconventional ways to power a vehicle. Get their responses and tell them that today they'll be building a vehicle powered by air.

Activity (45/50 mins)**Necessary reminders**

Before handing them the material packs, warn them about food sticks and scissors. Emphasize on safety concerns.

Building the prototype

Give them 20 minutes to build their car. Talk to students who aren't engaged and try to help them participate better.

Provide suggestions and ask questions to support groups who are struggling more than others.

- Let's start by designing the body of the car. What shape would you like to give to it?
- Where do you want to place the balloon? What difference would its position make?

Walk up to groups and observe their work. Help them iterate using guiding questions.

- What might be preventing the car from running smoothly? How can you solve this problem?
- How can you make the car travel faster and farther?

Thinking (10/60 mins)

Ask questions from the "Think like a ___" section to get them to think critically.

- Why does the speed of the car increase when the balloon is about to run out of air?
- What similarity and difference do you see in the working of a balloon powered car and a rocket?

2. Two 45 minutes classes**Learning Objectives**

To get students to experience the play based learning approach by building a toy car powered by balloons. The emphasis is on getting them to create something and play with it.

Classroom context

This sample lesson is designed for grade 5 students. The time available for the lesson is two 45 minutes classes, not necessarily consecutive.

Lesson Flow**Class I****Curiosity (10/10 mins)**

Divide students in groups of 2-3 each. Ask them to think of some unconventional ways to power vehicles. After discussing the responses, inform them that today's class involves something similar.

Activity (30/40 mins)**Safety precautions**

Before handing materials, remind students about safe use of sharp, pointed objects such as food sticks and scissors. Distribute materials to the students.

Sketching ideas

Ask students to go through this lesson in the student guides. Before they start building, ask them to sketch the design of their cars. Give them 10 minutes for this. Inform them that the drawing need not be realistic or good, but needs to be neat and easy to understand. To emphasize on drawing over writing, limit their use of words in the sketch to three.

Building

Give them 15 minutes to build their Balloon powered car.

Many groups will not be able to complete their project in this class. Inform them that they shall continue in the next class. If there is a storage space in the classroom or school, ask students to leave their projects there.

Thinking (5/45 mins)

Ask questions to help students reflect on their learning experience.

- What challenges did you face while building your car?
- What wonderful ideas did you have while building your balloon powered car?

Class II

Recalling (5/5 mins)

Get students to sit in the same groups from the last class. Ask them to discuss among group members and recall their work from the previous class.

Activity (30/35 mins)

Completing the project

Ask students to get the designs of their balloon powered cars. Give them 15 minutes to complete their project.

Additional challenges

Provide students who have completed their projects with additional challenges. Some ideas for challenge are:

- Ask students to improve the efficiency of their car so that it can carry heavier weights for a longer distance.
- Ask students to investigate a scientific phenomenon associated with the car. Some ideas are:
 - When does the car run the fastest (it happens towards the end of its run)? Why might it be so?
 - Most cars tend to move in a curved path rather than a straight one. Why might it be so?
- Ask guiding questions to support their thinking.
 - What difference would multiple balloons make to this car?
 - Complete this sentence: I wonder what happens if _____

Encourage students to reach out to peers for assistance and ideas.

Thinking (10/45 mins)

Ask questions to help students reflect on their learning experience.

- How was the experience of converting a sketch design into a working prototype?
- Share any two things you learnt while working on the balloon powered car.