

Design a Paddle Boat

Materials: Pieces flat stiff plastic for paddles (e.g. squares cut from lids of strong margarine boxes, small plastic spoons (handles cut back), wine corks (with pre-cut slits to hold pieces of plastic), elastic bands, wooden dowels/pencils, containers-juice carton, aluminum can, plastic bottles, butter boxes, basin of water (test tank).

Challenge: Use the materials to make a small boat with turning paddles that will be able to move under its own power across a tank of water.

Questions to consider when designing your paddle boat:

- What will you use for the body of your boat? Will it float? Will it fit in your test tank?
- How do paddles move through the water? How does someone swim using the 'doggy paddle'? Mime the movements with your hands.
- What materials would be best to use for the paddles? Will shape make any difference - long and skinny, thin and flat, round and fat? Can you have several paddles all pushing into the water one after another?
- How will you attach your paddles to your boat – remember they will have to be free to turn through the water?
- You do not have an engine – how will you turn the paddle wheel without an engine?
- Is there anything in the box that could move on its own after being wound up, stretched or twisted and released?

Find out/Discuss:

- Which direction does the boat move and paddle wheel turn?
- Does the paddle wheel turn in the same direction as you wound it up?
- Does the shape/weight of the container affect the movement of the boat? Re-design with other containers and see!
- Does the boat move faster if:
 - a. the paddles turn partly in the air and partly in water?
 - b. the paddles turn fully immersed in water?
 - c. the paddles turn above the surface of the water?
- Can you modify your design to make your boat faster?

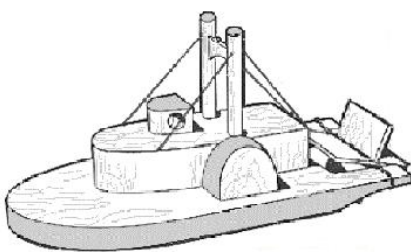


Design a Paddle Boat

Materials:



Pictures of Paddle Boats:



Designing a Paddle Boat - Notes for the teacher

- This activity is best suited to children in 5th & 6th classes.
- The aim is for the children to **devise their own designs** and come **up with their own solutions** for the challenges such as how to construct a paddle wheel, and how to make that paddle wheel move.
- The pictures of different types of paddle boats can be used to give children some ideas as well as the ‘questions to consider when designing your paddle boat’.
- For groups that are struggling with devising a way of turning the paddles the following are some trigger questions that may be useful.
 - Do you have anything in your materials that moves on its own after being wound up, stretched or twisted and released? (*rubber band*)
 - Stretch a rubber band between two hands. Ask someone else to wind the strands of the rubber band around each other. What do you think will happen if you then let the strands go? (*they will unwind*) Try it and see. What do you think would happen if something got caught up in the rubber band? (*it would get spun around with it as the rubber band unwinds*) Try it and see.
- A long plastic window planter box is a very useful test tank for various boat designs. Children need to make sure that their boat will fit in whatever test tank is being used.
- In drawing a diagram of their successful design children should be encouraged to label every part and to add additional information to explain how the boat works.
- Once a basic working paddle boat has been achieved children can be encouraged to improve their design by investigating variations in materials used, e.g. what is the best type of rubber band to use – thin, thick, long, short; what shaped container makes the fastest boat; can additional paddle wheels be added etc.
- For children who are quickly disappointed with unsuccessful initial designs there is a famous quote from Thomas Edison about how we learn from each attempt “*I have not failed 700 times. I have not failed once. I have succeeded in proving that those 700 ways will not work.*” See http://en.wikiquote.org/wiki/Thomas_Alva_Edison for some more excellent quotes.

Curriculum Links - SESE Science

- **Skills development –5th & 6th Classes**
 - Designing and making - Exploring, Planning, Making, Evaluating.
- **Strands – 5th & 6th Classes**
 - **Strand Unit - Forces**
 - The child should be enabled to identify and explore how objects and materials may be moved.
 - **Strand Unit - Properties and characteristics of materials**
 - The child should be enabled to investigate how materials may be used & relate the properties of the material to its use.

Integration – English & SESE Geography

The American author Mark Twain had a great love for the steamboats of the Mississippi River. Steamboats were river boats where a paddle wheel was driven by a steam engine. His pen name ‘Mark Twain’ is taken from the words used by boatmen when the boat was in safe water (2 fathoms (12 feet) deep). His books “Adventures of Huckleberry Finn” and “Life on the Mississippi” contain many references to steamboats on the river.

“When I was a boy, there was but one permanent ambition among my comrades in our village on the west bank of the Mississippi River. That was, to be a steamboatman. We had transient ambitions of other sorts, but they were only transient. When a circus came and went, it left us all burning to become clowns; the first negro minstrel show that came to our section left us all suffering to try that kind of life; now and then we had a hope that if we lived and were good, God would permit us to be pirates. These ambitions faded out, each in its turn; but the ambition to be a steamboatman always remained.

- From *Life on the Mississippi* by Mark Twain

Designing a Paddle Boat - Notes for the teacher



Body of Boat & Paddle Wheel Support

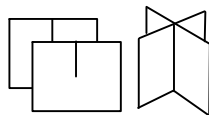
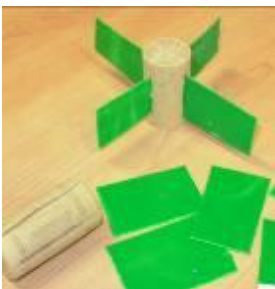


Two sticks firmly attached to either side of the body of the boat provide support for the paddle wheel.

Watch out for:

- Sticks not long enough – paddle wheel hits boat
- Sticks not stuck on firmly enough – paddle wheel rubber band will pull sticks together and wheel won't turn
- Sticky tape not sticky in water – use rubber bands to provide additional waterproof support.

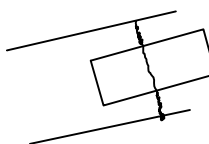
Some Paddle Wheel Designs



Suggestions for what to use for paddle wheel

- Small pieces of hard plastic can be stuck in slits cut from end to end in a wine cork to make a paddle wheel. (Slits need to be pre cut by teacher)
- Two plastic spoons can be tied together with a rubber band.
- A slit can be cut from the edge to the centre in two small squares of hard plastic and the two pieces fitted together to form crossed paddles.
- A single rectangle of hard plastic

Turning the Paddle Wheel



How to turn the paddle wheel

- Insert any material between the two strands of a stretched rubber band and turn at right angles to the rubber band. When the band is tightly twisted release and the material will be turned quickly as the rubber band unwinds.
- Wine cork paddle wheels can be placed between the strands of rubber band and twisted or a rubber band can be threaded through a hole through the centre of the cork.
- For the most basic of paddle wheels simple place a rectangle of hard plastic between the strands of rubber band and twist.

Watch out for:

- Paddle wheel designs which turn without twisting the rubber band – the rubber band must be firmly attached to the paddle or paddle wheel.
- Rubber Bands too thin or too long – not enough power