CAN A CARDBOARD BOAT BE BUILT TO FLOAT AND CARRY A PASSENGER?

ABSTRACT

OUR SECOND GRADE CLASS FOUND THE TOPIC OF BUILDING A CARDBOARD BOAT VERY INTERESTING. THEN WHEN WE DECIDED TO MAKE IT LARGE ENOUGH THAT WE (ONE AT A TIME) COULD BE A PASSENGER, WE BECAME VERY EXCITED.

HYPOTHESIS

THE MAJORITY OF THE CLASS BELIEVE THAT WITH HELP, WE CAN BUILD A CARBOARD BOAT THAT WILL FLOAT AND EVEN CARRY A PASSENGER THAT WEIGHTS UP TO 36.29 KILOGRAMS (80 POUNDS). ONE OF OUR CLASSMATES THINKS THIS PROJECT WILL FAIL. HE BELIEVES A CARDBOARD BOAT WILL NEVER FLOAT CARRYING A PASSENGER.

MATERIALS

- ASPHALT EMULSION
- DUCT TAPE
- GLUE GUN
- LATEX PAINT
- LEVEL
- MAXIMUM STRENGTH CARDBOARD FROM A REFRIGERATOR BOX
- RULER
- SCISSORS
- TAPE MEASURE
- TOOTHPICKS

PROCEDURE

- WE FOUND BOOKS ON BUILDING A CARDBOARD BOAT AND, ALSO ON ENGINEERING IN OUR SCHOOL LIBRARY AS WELL AS THE LOCAL LIBRARY.
- WE CHOSE A DESIGN FOR OUR BOAT.
- WE ASKED FOR HELP FROM A FRIEND WHO HAS A BACKGROUND IN ENGINEERING AND HAS ALSO WORKED IN BOAT YARDS.
- WE THEN BEGAN TO ASSEMBLE OUR CARDBOARD BOAT WITHOUT ANY HELP FROM OUR TEACHER OR OUR SPECIAL FRIEND.
- WITH SCISSORS, OUR RULERS AND GENEROUS AMOUNTS OF DUCT TAPE WE SPENT TWO DAYS BUILDING OUR BOAT AND STRENGTHENING ALL INTERIOR AND EXTERIOR SEAMS.
- ON DAY THREE WE PAINTED OUR BOAT INSIDE AND OUT WITH BLACK LATEX PAINT.
- ON DAY FOUR WE TOOK OUR BOAT TO OUR FRIEND'S HOUSE TO HAVE IT REINFORCED AND WE ALSO WATERPROOFED OUR BOAT WITH ASPHALT EMULSION.
- OUR FRIEND HELPED US MAKE EVERY SURFACE WATERTIGHT.
- A FEW DAYS LATER WE FILLED THE BOAT WITH OBJECTS ROUGHLY EQUIVALENT TO THE WEIGHT IT NEEDS TO HOLD, WITHOUT SINKING.
- WE PLACED THE BOAT IN OUR TEACHER'S SWIMMING POOL.
- ONCE OUR BOAT IS LEAKPROOF, EACH SECOND GRADER WILL TAKE A TURN SAILING IN OUR CARDBOARD BOAT.

RESULTS

THE HYPOTHESIS OF ONE PERSON IN OUR CLASS WAS COMPLETELY WRONG. THE MAJORITY OF OUR CLASS WAS CORRECT. WITH HELP, OUR SECOND GRADE CLASS WAS ABLE TO BUILD A CARDBOARD BOAT THAT **DID** FLOAT EVEN WITH A 36.29 KILOGRAM (EIGHTY POUND) SECOND GRADE PASSENGER.

CONCLUSION

TO MAKE OUR CARDBOARD BOAT FLOAT WITH A PERSON WHO WEIGHS ABOUT 36.27 KILOGRAMS (80 POUNDS), WE USED SCIENCE AND CAREFUL PLANNING. BUOYANCY HELPED THE BOAT FLOAT, DISPLACEMENT HELPED SUPPORT WEIGHT, WATERPROOFING KEPT THE CARDBOARD STRONG AND GOOD DESIGN KEPT THE BOAT STABLE. BY UNDERSTANDING THESE SCIENCE IDEAS AND TEAMWORK WE BUILT A CARDBOARD BOAT THAT FLOATS, STAYED STRONG AND SHOWED HOW SCIENCE WORKS IN REAL LIFE.

RESEARCH PAPER

Have you ever wondered how a boat can float on water, even when a person is inside it? This science project explores what it takes to build a cardboard boat that can float while carrying a person who weighs about 36.27 kilograms, or 80 pounds. To do this, we need to understand some important science ideas, including buoyancy, displacement, waterproofing, and strong design.

The famous Greek mathematician Archimedes discovered a key principle related to this: an object submerged in a fluid experiences an upward buoyant force equal to the weight of the fluid it displaces. In simpler terms, if your boat pushes aside (displaces) a weight of water that is greater than or equal to its own weight, it will float. If it displaces less water than its own weight, it will sink. This concept is foundational to anything that floats.

Buoyancy is the force that pushes objects up when they are in water. Water pushes upward on objects placed inside it. If the upward push is stronger than the downward pull of gravity, the object will float. Boats float because they are shaped in a way that lets water push up on them.

For our cardboard boat to float with a person inside, the boat must create enough buoyancy to hold the weight of the person. This means the boat must be wide and stable so the water can push up on a large surface area.

Displacement happens when an object is placed in water and pushes some of the water out of the way. The more water a boat displaces, the more buoyant force it gets. A bigger or wider boat can push more water out of the way, which helps it float better.

To hold a person who weighs 80 pounds, the cardboard boat must displace enough water to balance that weight. Flat-bottom boats work well because they spread the weight evenly and push away more water than narrow boats.

Cardboard is not naturally waterproof. When it gets wet, it becomes soft and weak. This can cause the boat to sink. That is why waterproofing is very important.

Builders can waterproof cardboard boats using materials like duct tape, packing tape, or paint made for water use. The goal is to seal every crack and edge so water cannot soak into the cardboard. A dry boat stays stronger and floats longer. Our class used duct tape, glue, asphalt emulsion and latex paint.

The shape of our boat mattered a lot. A good cardboard boat should have high sides to keep water out and a wide base to keep it from tipping over. Corners and seams should be reinforced with extra cardboard or tape to make them stronger. Our boat was designed four feet (0.0012192 kilometers) long and two feet (0.00061 kilometers) wide.

The person riding in the boat sat low and in the center. This helped balance the boat and kept it from tipping. Good design helped our boat stay safe and stable.

This project helped us understand how real boats float and how science can be used to solve real-world problems.

GLOSSARY

ARCHIMEDES

(C.287–212 BC), GREEK MATHEMATICIAN AND INVENTOR FROM SYRACUSE. HE IS NOTED FOR HIS DISCOVERY OF ARCHIMEDES' PRINCIPLE (LEGEND HAS IT THAT HE MADE THIS DISCOVERY WHILE TAKING A BATH AND RAN THROUGH THE STREETS SHOUTING "EUREKA!"). AMONG HIS MATHEMATICAL DISCOVERIES ARE THE RATIO OF THE RADIUS OF A CIRCLE TO ITS CIRCUMFERENCE AND FORMULAS FOR THE SURFACE AREA AND VOLUME OF A SPHERE AND OF A CYLINDER.

BUOYANCY

THE ABILITY OR TENDENCY TO FLOAT IN WATER, AIR OR SOME OTHER FLUID. **T**HE POWER OF A LIQUID TO KEEP SOMETHING AFLOAT

DENSITY

THE DEGREE OF COMPACTNESS OF A SUBSTANCE

DISPLACEMENT

THE MOVING OF SOMETHING FROM ITS PLACE OR POSITION

ENGINEERING

THE BRANCH OF SCIENCE AND TECHNOLOGY CONCERNED WITH THE DESIGN, BUILDING, AND USE OF ENGINES, MACHINES AND STRUCTURES

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