PAVILHÃO DO CONHECIMENTO
CENTRO CIÊNCIA VIVA

ROPE CLIMBING TOY

Experimental protocol

Families

Physics

From 90 min to 2 hours

Build a toy that will entertain both kids and adults. With creativity and dexterity, practice manual arts and build a toy that goes up a rope when you pull on its base.

Materials	• Rope: 70 cm of length, 2 mm of diameter (approximate values) • Cardboard / wood / plastic packaging / CD / soft metal • Toothpicks / match sticks / skewer sticks • Thin elastic band • White glue / hot glue / superglue • Nail / screw / other to drill • Scissors / box-cutter • Ruler • Pencil

BACKGROUND

The action of playing has a fundamental role in the development of the human being. From early age in the cradle with simple toys that stimulate vision, hearing and motor coordination, to more elaborated toys such as puzzles or model kits, toys serve both to distract and to educate, fostering skills for adult life.

Until the beginning of the XX century, toys were made at home or handcrafted. Nowadays most are made in factories, on a large scale. This activity proposes the construction of a replica of an old toy, usually made of wood.

QUESTION

- How does the toy go up?

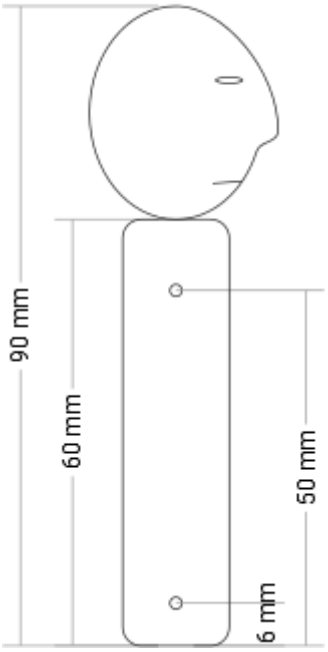
EXPLORE

Sequence of steps to build then rope climbing toy (adult help is needed, as it will be necessary to use sharp materials):

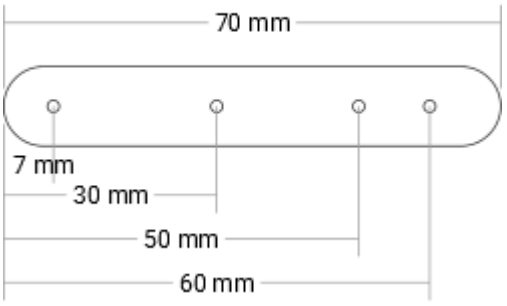
1. Start by cutting out the body parts of the toy. You can shape body, legs and arms of the toy as you wish. You just have to respect the measures shown below.

   Note: If you use thin cardboard, you may have to join and glue several identical pieces together to obtain greater rigidity.

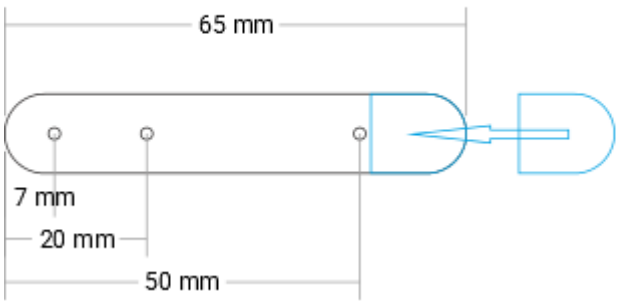
Body



Legs

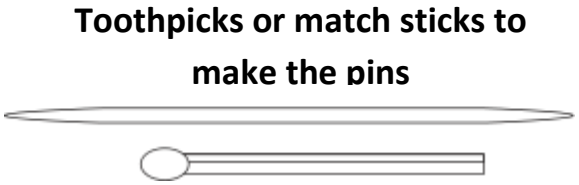


Arms

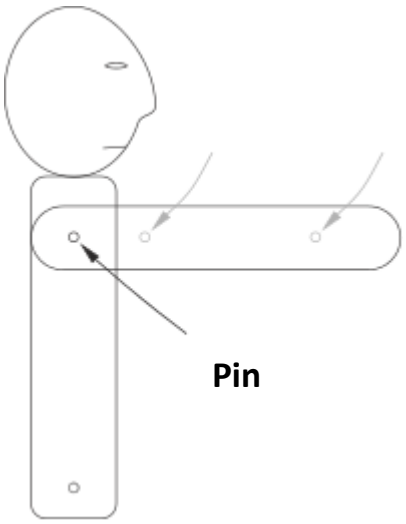


Piece for the rope to pass through tightly

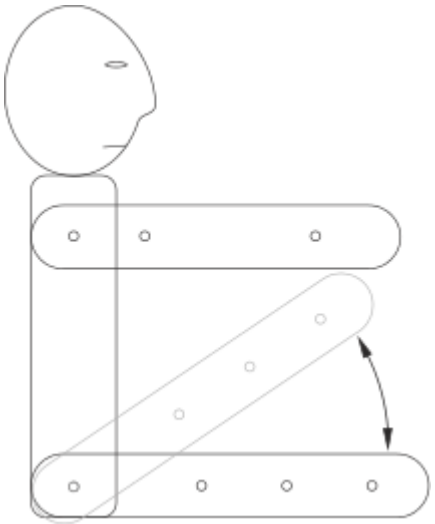
2. Drill the holes according to the diameter of the material you are going to use to make the pins, respecting the measures.



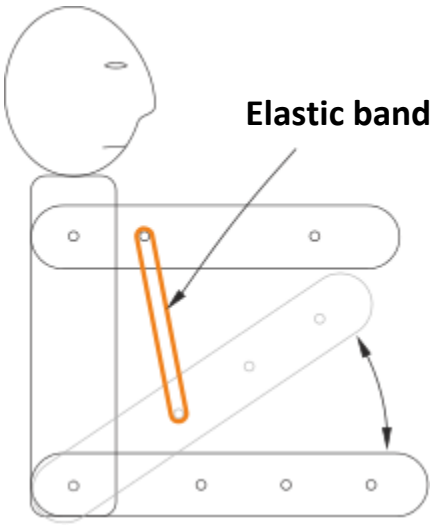
3. Fix an arm to the body with the pin. Glue it and insert the remaining pins.

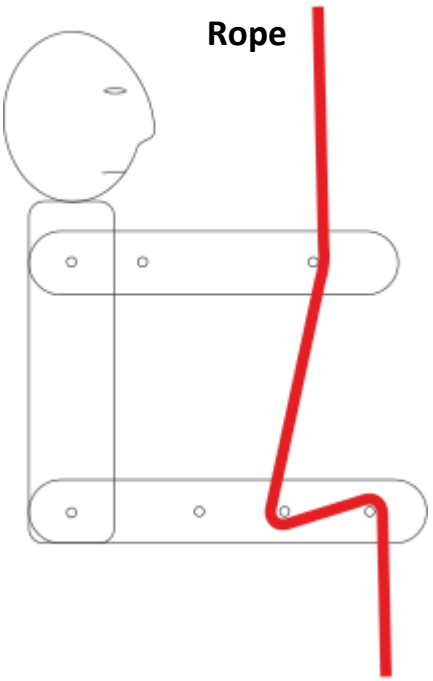


4. Add one leg to the body and insert the pins.

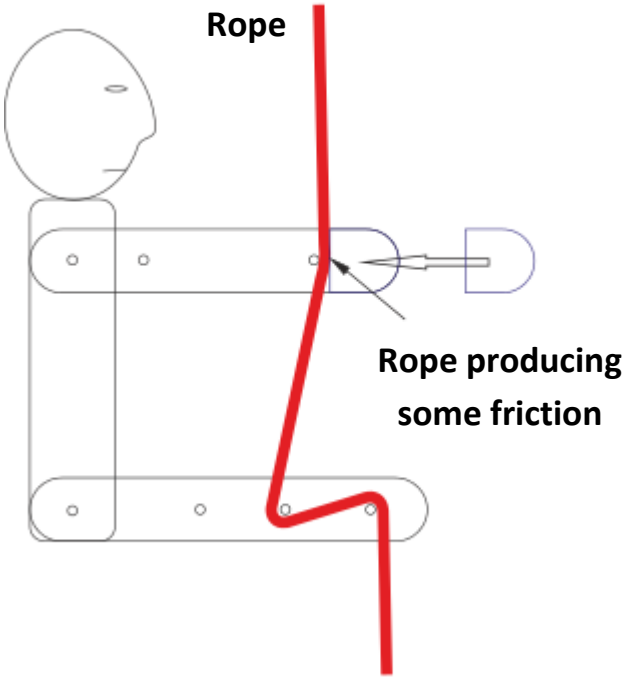


5. Add the elastic band and the rope, according to the diagrams. Put some tension to the elastic band until the leg is close to the hand. If the elastic band is too long, you can twist it or make a knot to ensure tension.

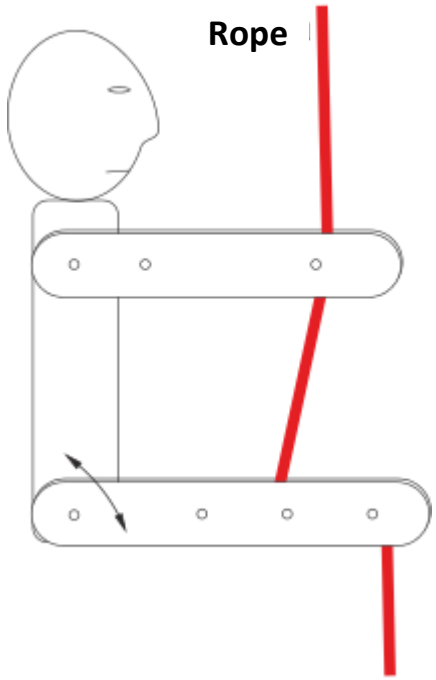




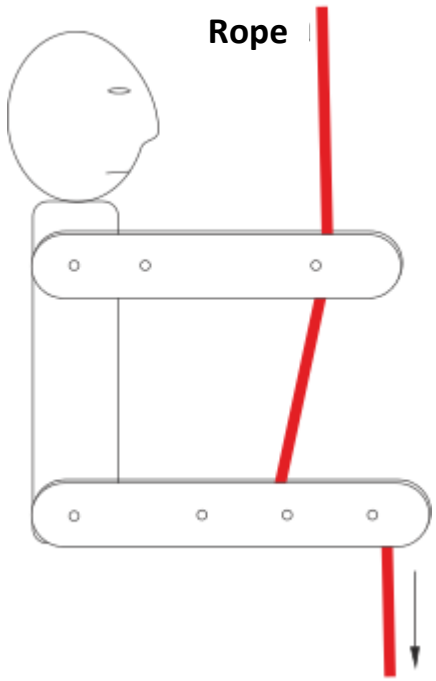
6. Glue the adjustment piece so that when the rope is pulled, it gives some resistance to movement.



7. Add the remaining arm and leg. Fix the arm with glue, being careful not to stick the rope. Glue the leg pins, leaving it free to rotate. Trim the pins so that they keep at the top.



8. To see the rope climbing toy in action, hold the top end of the rope with one hand and slowly pull the bottom end with the other hand.



EXPLAIN

From the 3 parts that build up the rope climbing toy (body, arms and legs) only the legs are mobile, due to the presence of the elastic band.

Analysing the forces acting on the climber, the following is observed:

• Standing climber> The toy's weight is compensated by the friction between the arms and the rope.

• Moving climber> When the rope is pulled, the particular arrangement of the pins tries to straighten the legs. This causes the body to stretch, in which case the rope is tense, resulting in a small rise in the body. As soon as the pressure on the string is released, the piece in the arms provides enough friction for the toy to hold on to the rope while the legs are lifted by the elastic band, moving the rope to a new position.

LEARN MORE

For information on other versions of the Mountaineer, we suggest you the following educational resources:

Rope Climbing Toy - https://www.youtube.com/watch?v=bFrB8gY39v4&t=208s

Climbing Monkeys - https://www.instructables.com/id/Climbing-Monkeys-3D-Printed-Vintage-inspired-Toys/