

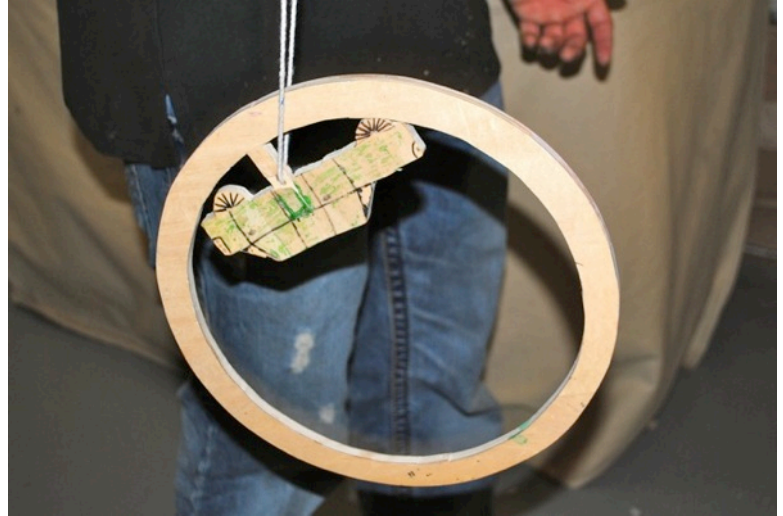
Bouncing Yo-Yo

Category: Physics: Force & Motion

Type: Make & Take

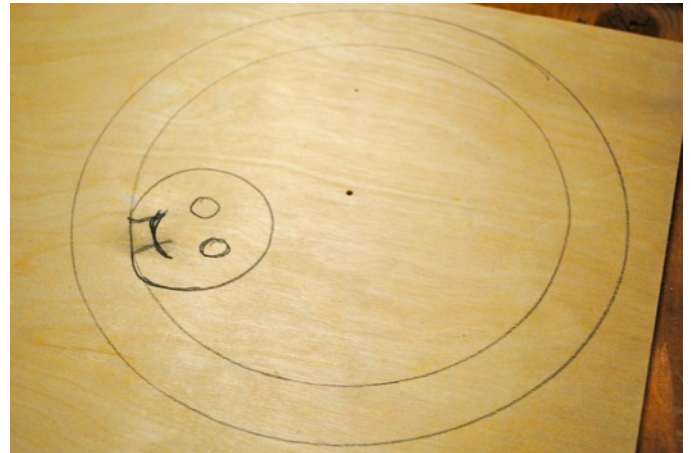
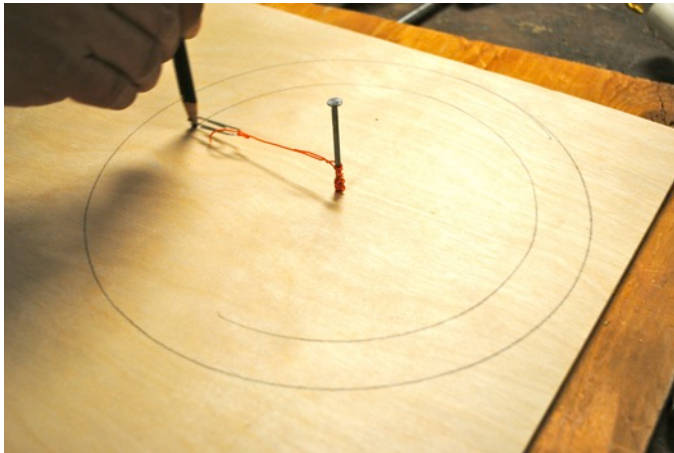
Rough Parts List:

1	Piece of thin wood
3'	String
1	Nail
1	Pencil
1	Paperclip
6-12"	Wire or string
	Drill



Video: <http://youtu.be/3kFLJx2dbQE>

How To:



Draw 2 circles on a piece of wood.

Draw whatever shape you like along the inside of the circle.



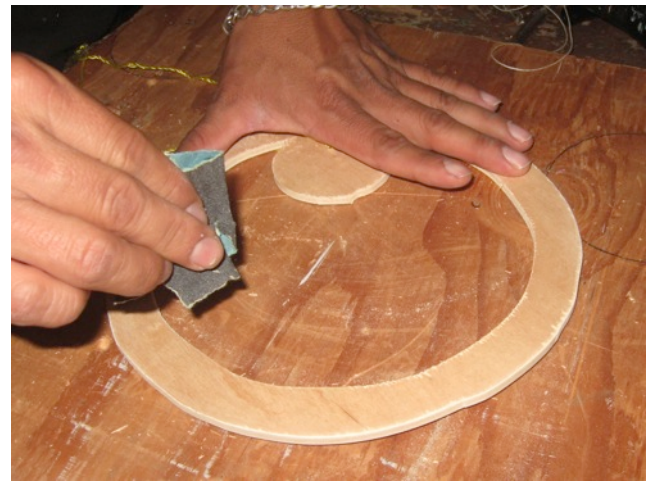
Cut out the outer circle.



Cut along the inner circle and the shape you have drawn.



Drill a hole in the shape you drew.



Use sandpaper to get rid of any rough edges.



Loop a piece of string through the hole.

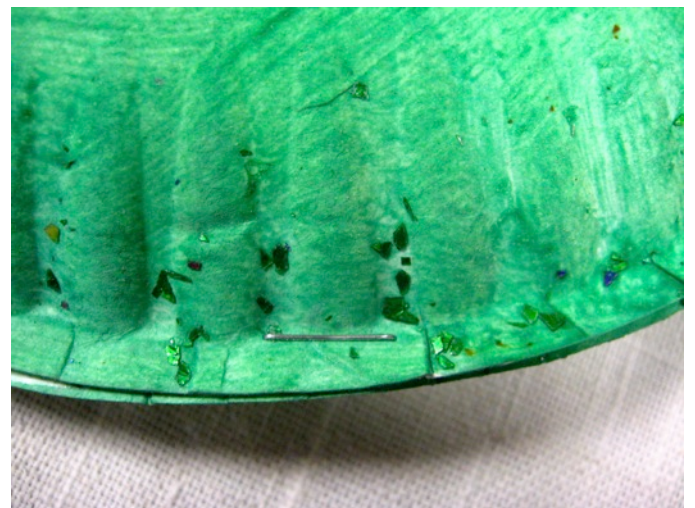


Spin the Yo-Yo.

Option 2: Paper Plate YoYo



Decorate two paper plates.
Punch a hole through each plate,
connect a piece of string to the plates.



Staple the plates together.



Bounce the yoyo.

Fine Points:

- The ring is only to make it more interesting; a solid circle would also work.
- Any small burrs or rough edges will affect the smooth spinning of the yo-yo.
- We've seen commercial ones with lights and sound.
- It is also possible to make one from two paper plates sandwiched together.

Concepts Involved:

- Angular motion
- Center of gravity
- Energy

Elaboration:

Normal yo-yos spin as they go up and down. This one also spins and goes up and down, but faster, going up and down once with each turn. You have to pull up on normal yo-yos every time they reach the bottom, and the same is true with this one, though it reaches the bottom much more often. After you play a while with this one, you may notice that there is only a certain rate of pulling that works, that is, you can't make it go up and down a lot faster or slower. This is called its resonant frequency. Normal yo-yos have this frequency also, though you can throw them or pull them hard to change the frequency a small bit.

If you put the string through at the very center of the yo-yo, it would spin happily forever, and you would have no yo-yo. You only get the bounce because the string is not in the center of gravity of the yo-yo, so that when you stop pulling, the yo-yo's heavy side stays on the bottom and it comes quickly to stop. From this you can see that your pull provides the energy that lifts that heavy side up over the top of the support point.

Links to k-12 California Content Standards:

Grades k-8 Standard Set Investigation and Experimentation

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:

1.0 Students make decisions about how to approach problems:

1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

1.2 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:

2.1 Use estimation to verify the reasonableness of calculated results.

2.2 Apply strategies and results from simpler problems to more complex problems.

2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students move beyond a particular problem by generalizing to other situations:

3.1 Evaluate the reasonableness of the solution in the context of the original situation.

3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.

3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Grade 2 Standard Set 1. Physical Sciences (Energy & Matter)

1.c Students know machines and living things convert stored energy to motion and heat.

Grade 8 Standard Set 2. Forces:

Unbalanced forces cause changes in velocity.

2.a Students know a force has both direction and magnitude.

2.e Students know that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction).

Grade 9-12 Physics Standard Set 1. Motion & Forces

Newton's laws predict the motion of most objects.

1.e Students know the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.