



FLYING CUP GLIDER

Create a fantastic flying machine in seconds and marvel at its erratic flight!

Materials

- Two cups (paper, plastic or foam)
- Rubber bands
- Tape

Safety First!

- Before launching your flying cup glider, make sure you have plenty of space around and in front of you – it's usually safest to do all your launches outside.
- Wear safety glasses or other eye protection when launching your glider.

Instructions

1. Tape the two cups together at the base.
2. Make a chain of rubber bands. Start with two rubber bands overlapping each other, then loop one of them back through itself to join and pull to secure. Repeat until you have a chain long enough to comfortably wrap around the middle of your cup glider (around 15-20cm).
3. Find a safe launching area. Hold the cups in one hand, and use your thumb to hold one end of the rubber band chain against the join in the cups. With your other hand, wind the rubber bands firmly around the cups once, stretching them a little as you go. Hold the other end of the rubber band chain. You're ready to launch!
4. Hold the cups horizontally in front of you, with the hand holding the rubber band chain slightly forward. Make sure the rubber band chain is coming out from underneath the cups, not over the top. Pull the cups back and angle your other hand up, as though firing a slingshot. Then let go of the cups at the same time as you pull the rubber band chain forwards. The chain should unwind from around the cups, spinning them in the process, which will make your amazing flying machine go!

Further investigation...

- It might take a few tries to get the hang of launching your glider. Flicking your front hand forwards as you launch can make the cups spin faster and improve your glider's air time.
- Try making gliders from different types of cups and see which ones stay in the air the longest. You could also try cutting the cups into different sizes or shapes, or making a paper 'lid' for one or both cups to see how these changes affect its flight.
- Experiment with different lengths of rubber band chain. Does wrapping the band around more times before launching make a difference to how well it flies?



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What's happening?

There are four forces acting on any flying or gliding object as it moves through the air:

- **Lift** pushes the glider upwards
- **Weight (gravity)** pulls the glider towards the ground
- **Thrust** pushes the glider forwards
- **Drag (air resistance)** is caused by air pushing back on the glider in the opposite direction to thrust.

When you launch a glider, you create thrust as you push the glider forward and release it.

Eventually, weight overcomes lift, and the plane falls to the ground. When drag overcomes thrust, the glider stops moving forwards.

The movement of the air around the glider is also important. Although we can't feel it, air is always pressing on us from all directions. The amount of force the air exerts on an object is known as **air pressure**. Air will also tend to move from areas of higher pressure to areas of lower pressure.

A scientist called Daniel Bernoulli discovered that the speed air is moving also affects the pressure – faster-moving air has lower pressure than slower moving air. This is known as **Bernoulli's principle** and understanding it is very important in understanding how objects fly.

With our spinning cup glider, the fast moving air around the glider causes a difference in the air pressure above and below the glider. The air below the glider has a higher pressure than the air above it, and because air tends to move from higher to lower pressure, the air below the glider pushes it up, creating lift.

There's also another phenomenon involved here. A spinning object moving through the air will tend to curve towards the direction it is spinning. You can see this in action in many sports – when a tennis ball is hit or a soccer ball is kicked in a way that makes it spin, it will curve or 'bend' in the air. This is called the **Magnus effect**.

Check your understanding

1. What are the four forces that affect a flying or gliding object?
2. Draw a diagram of your glider and use arrows to show the direction of each force.
3. Where does your glider's thrust come from?
4. Why does the glider eventually fall to the ground?
5. Explain your understanding of the following scientific terms: air pressure, Bernoulli's principle, Magnus effect.