

STEM OUTREACH PRESENTS:
**STEM EACH DAY KEEPS
THE BOREDOM AWAY**

THE FLYING EDITION

DO YOU KNOW THE 4-FORCES OF FLIGHT?



FLYING SAUCERS

SUPPLIES: PAPER PLATE AND SCISSORS

<http://onetimethrough.com/how-to-make-an-out-of-this-world-flying-saucer-toy/>

- Pre-K to 2nd grade
 - Introduce the 4 forces of flight (lift, gravity, drag, thrust) and their directions.
 - If you decorate with markers, color before cutting. You may have to help cut or do the cutting.
- 3rd to 6th grade
 - Introduce the concept of “force” and the 4 forces of flight: lift, gravity, drag, thrust. Try to convey the forces’ directions and what causes them. Ex. Drag pushes us opposite of the way we are moving. What are some things that cause drag? Air resistance!
 - If you decorate with markers, color before cutting. You may have to help cut.
 - Set up a landing pad for a “friendly” competition.
 - To increase complexity, come up with a better design to test. Don’t forget about the 4 forces of flight when designing.
- 7th to 12th grade
 - Introduce the concept of “force” and the 4 forces of flight: lift, gravity, drag, thrust. Try to convey the forces’ directions and what causes them. Ex. Drag pushes us opposite of the way we are moving. What are some things that cause drag? Air resistance! Finally, try to create a Free Body Diagram with the 4 forces.
 - Set up a landing pad for a “friendly” competition.
 - To increase complexity, come up with a better design to test. Don’t forget about the 4 forces of flight when designing.



MARSHMALLOW LAUNCHERS

SUPPLIES: POOL NOODLE*, PACKING TAPE, BALLOON, MARSHMALLOWS

<http://frogsandsnailsandpuppydogtail.com/diy-pool-noodle-pom-pom-shooter/>

- Pre-K to 2nd grade
 - Introduce the concept of force, then introduce thrust. Define projectile.
 - Build the launchers; most young children will not be able to build these themselves.
 - While your children are launching, reiterate the forces behind the experiment.
- 3rd to 6th grade
 - Introduce the concept of force, then thrust and drag. Talk about what is creating those two forces in this experiment.
 - Discuss the definition of projectile.
 - Help your children build the launchers. Some may be able to build on their own.
 - While your children are launching, reiterate the forces behind the experiment. You can also set up a target for them.
- 7th to 12th grade
 - Introduce the concept of force, then thrust and drag. Talk about what is creating those two forces in this experiment. Try having them create a Free Body Diagram of the forces acting on your projectile.
 - Have your children build the launchers.
 - While your children are launching, reiterate the forces behind the experiment. You can also set up a target for them.
 - Have them come up with ways to make the launcher better or move the target to different angles. This can lead to a discussion of trajectory.



* Pool noodles can be replaced with plastic cups, but they need to be sturdy. Pompoms work best as projectiles, but dried beans, beads, aluminum foil balls, and M&Ms can also be used. Do not let children shoot at each other; the projectiles move very fast.

BALLOON ROCKETS

SUPPLIES: BALLOON, STRING, TAPE, CLIP

- Pre-K to 2nd grade
 - Introduce the concept of “force.” You can also introduce thrust and friction.
 - Try also introducing Newton’s Third Law of Motion.
 - https://thatafterschoollife.com/balloon_rockets.html
- 3rd to 6th grade
 - Introduce the concept of force, then thrust and drag. Talk about what is creating those two forces in this experiment. Try also introducing Newton’s Third Law of Motion.
 - To connect this experiment to the Missile Defense Agency, you can discuss the concept of a guidance system.
 - https://thatafterschoollife.com/balloon_rockets.html
 - Try “launching” at different angles (raise or lower the string). If available, test different types of balloons or different amounts of breaths to fill the balloon. Create a data chart to track your differences.
- 7th to 12th grade
 - Introduce the concept of force, then thrust and drag. Talk about what is creating those two forces in this experiment. Try also introducing Newton’s Third Law of Motion.
 - To connect this experiment to the Missile Defense Agency, you can discuss the concept of a guidance system.
 - <https://www.stem.org.uk/resources/elibrary/resource/336420/balloon-rocket>
 - There are few more supplies necessary



*For another version of this activity try this: <https://10minutesofqualitytime.com/balloon-straw-rocket-kids/>.

CATAPULTS

SUPPLIES: POPSICLE STICKS, SPOON, RUBBER BANDS, ALUMINUM FOIL

<https://stlmotherhood.com/popsicle-spoons-catapult-challenge/>

- Pre-K to 2nd grade
 - Introduce the concepts of force and projectile.
 - Help your child build the catapult; they will probably not be able to build this on their own.
- 3rd to 6th grade
 - Introduce the concepts of force and projectile.
 - Introduce the concept of the transfer of energy. This is a great resource and can be completed by your children:
https://theworks.org/wp-content/uploads/2017/06/Catapults-G3-6-Resource_Guide.pdf.
 - Help your children build the catapults. Some may be able to build on their own.
- 7th to 12th grade
 - Introduce the concepts of force, projectile, and the transfer of energy.
 - Have children research different types of catapults with simple materials. Talk with them about which design is best and why. The above links can be used as a starting point.
 - Let your children build the catapults, but be available if they need help.



* Projectiles can be almost anything! Try different objects and see how they fly. Try talking about the different trajectories and what qualities of the projectile create that trajectory.

WATER/FIRE ROCKETS

SUPPLIES: ALUMINUM FOIL, CARDBOARD TUBE, PLASTIC EGG, WATER HOSE WITH A SPRAY NOZZLE / TEA BAG

- Pre-K to 2nd grade
 - <https://www.kcedventures.com/blog/kids-crafts-science-for-kids-water-rockets>
 - Introduce the concept of force and Newton's Laws of Motion.
 - You will need to help your child build and launch the rocket. Be prepared to get wet.
- 3rd to 6th grade
 - <https://www.kcedventures.com/blog/kids-crafts-science-for-kids-water-rockets>
 - Introduce the concept of force and Newton's Laws of Motion.
 - If you have Alka-Seltzer around the house try this rocket: <https://team-cartwright.com/easter-egg-rocket/>
- 7th to 12th grade
 - You can use the two links above to discuss force and Newton's Laws of motion with your children.
 - If you are able to fully supervise your children try this tea bag rocket: <https://www.stevespanglerscience.com/lab/experiments/tea-bag-liftoff/>. There is fire involved, so please DO NOT leave children unattended.



GET CONNECTED.

Science: <https://explore.org/livecams>; <https://www.billnye.com/home-demos>

Technology: <https://www.codecademy.com>; <https://code.org/athome>

Engineering: <https://www.engineergirl.org/>; <https://fun-a-day.com/14-fun-engineering-activities-for-kids/>

Mathematics: <https://www.hand2mindathome.com/>; <https://corbettmaths.com/>

Children's Health and Wellbeing:

- <https://confidentparentsconfidentkids.org/2020/03/13/my-kids-school-is-closed-so-now-what/>
- <https://www.gonoodle.com/>
- https://www.amazon.com/Best-Sellers-Kindle-Store-Childrens-eBooks/zgbs/digital-text/155009011/ref=zg_bs?_encoding=UTF8&tf=1

* Some links throughout this document are not accessible on government computers or in Internet Explorer. If you are experiencing difficulty opening a webpage try changing using Chrome or Firefox.

FOR QUESTIONS OR HELP PLEASE
CONTACT

STEM@MDA.MIL

WE WOULD ALSO LOVE TO RECEIVE
PHOTOS OF YOU AND YOUR CHILDREN
“STEM-ING OUT”!