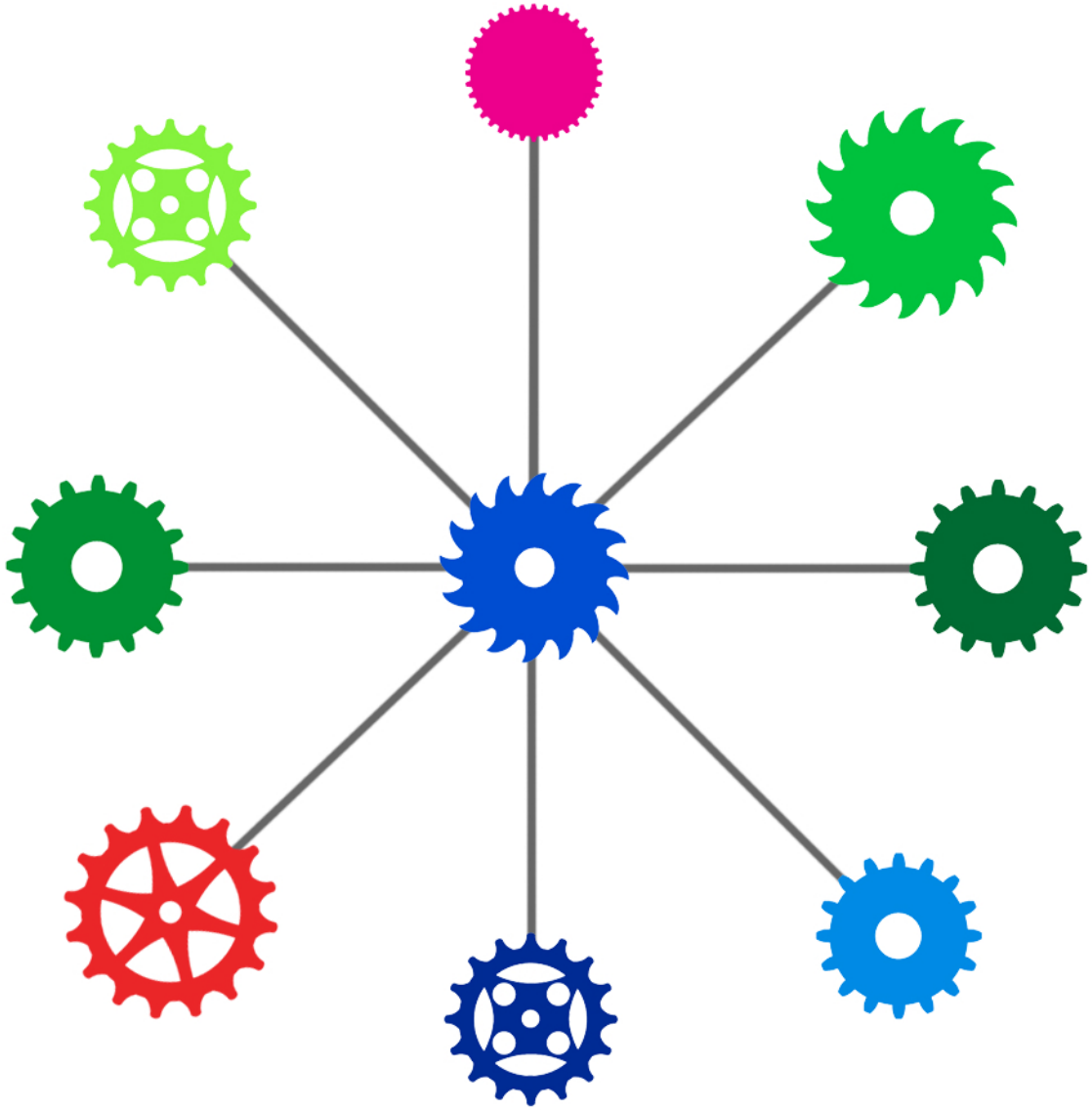

James E. Richmond Science Center

ENGINEERING DESIGN

A

SCIENCE @ HOME ACTIVITY

CENTRIPETAL FORCE

CHARLES COUNTY PUBLIC SCHOOLS
5305 Piney Church Road
Waldorf, MD 20602
301.934.7464
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OVERVIEW FOR PARENTS

The Engineering Design Process...

This lesson introduces the process which engineers use when creating, developing, improving, or implementing an idea. The goal is to help students understand this process when coming up with a solution to a problem. In this experiment:

- A problem has been presented with some questions to think about
- Some ideas have been presented in helping them come up with a solution
- Students should take notes as they work through the process
- Length of time for the project will be different for each individual

We would love to see their creativity so please tag us at James E. Richmond Science Center on Facebook and Twitter.

Thanks for visiting! See you soon!

THE ENGINEERING DESIGN PROCESS

DEFINE
the problem

IDENTIFY
constraints on your solution (e.g. time, money, materials) and criteria for success

BRAINSTORM
multiple solutions for the problem

SELECT
the most promising solution

PROTOTYPE
your solution

TEST
and evaluate your prototype

ITERATE
to improve your prototype

COMMUNICATE
your solution

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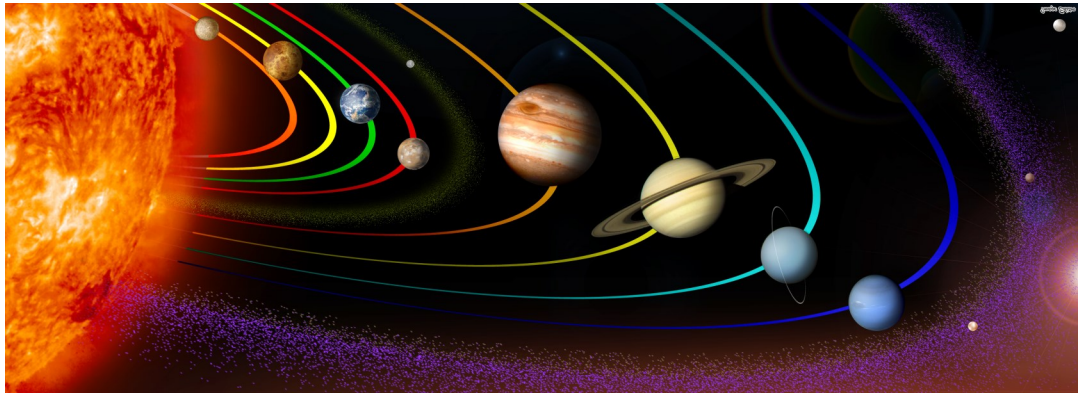
Newton's Laws of Motion

We have talked about friction and gravity and how both are forces that affect motion. Law #1 states an object remains at rest or in motion unless an unbalanced force acts on it. This law, combined with gravity, is what gives us **centripetal force** (the force that keeps an object moving with a uniform speed along a circular path).

This is the same force that keeps the planets in orbit and keeps you on your favorite amusement rides.



Newton's Laws of Motion

Law #3 states that every action has an opposite and equal reaction. This is responsible for **centrifugal force** *(the tendency of an object following a curved path to fly away from the center of the curvature).* This is not an actual force but an illusion as it is a result of **inertia** (the tendency of an object to resist any change in its state of rest or motion).

Conclusion:

Centrifugal force ***is not*** an actual force…objects fly away

Centripetal force ***is an*** actual force…keeps objects from flying away

PROBLEM:

I want to see centripetal force in action.

QUESTIONS

How can I see it?

Is it something I could build?

What materials could I use?

What resources can I use to help me?

AREA TO WRITE RESEARCH & IDEAS

To keep Mom happy, I would suggest trying the bucket of water OUTSIDE 

Videos to Help With Your Experiment

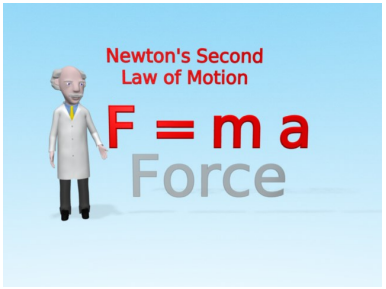
https://youtu.be/qgreqhzkayY

https://youtu.be/Zjqrx7wrpJc

Newton's Laws of Motion

Law #2 looks at the relationship of force, mass, and acceleration. This relationship does not come in to play as much with the marble in the glass or bucket experiment, but is useful to know should you choose to tackle the challenge presented on the next page.

This is a real world example showing the relationship of the 3 **variables** (*a factor that is able to vary or change*). The heavier the car and the faster it is going affects the amount of force or impact on the car it hits. Think about **inertia** (*the tendency of an object to resist any change in its state of rest or motion*). The car from behind wants to keep moving and the car in front wants to remain at rest. You can see why so many people are hurt in car accidents.



So now that you have tried those two experiments and seen centripetal force in action, is it possible you could build something at home?

This will be a challenge like making a marble track or roller coaster. (The Internet and You Tube will be your friends for this.)

Use materials around the house to layout a model

or draw a picture

The engineering notebook is on the next page, along with some thought-provoking questions, should you choose to accept this challenge!

Engineering Notebook

Design: _____

_____

Materials Needed: _____

_____

_____

How To Construct: _____

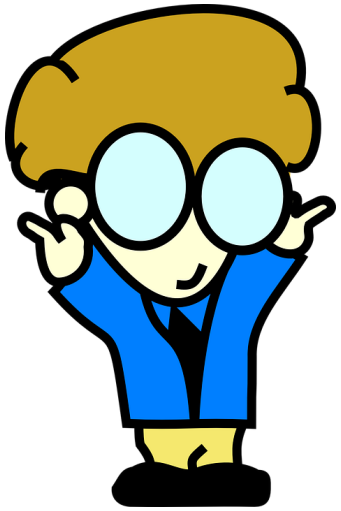
_____

_____

_____

_____

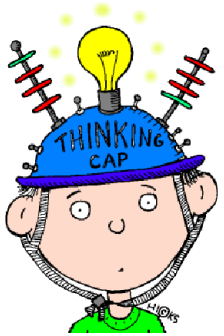
It is important to note the engineering process is a *cycle* and can be started *anywhere* in the process/cycle.



Now that you have your prototype it is time to test your final result—TIME TO BUILD!

Engineers are always thinking and taking notes so let's put on our thinking cap:

- How did you see centripetal force in action based on what you built?
- What other objects can you think of that show centripetal force?
- Are there other materials you could use to achieve your result?
- Does this lesson help you appreciate roller coasters more?



NOTES SECTION

Like a challenge? — practice your writing and communication skills by writing a set of instructions for others.

We at the Science Center would love to see your finished project, notes you have taken in your engineering notebook, and/or get general feedback.

Tag us on Twitter or Facebook at James E. Richmond Science Center