Building Newton's Cart

Use the GEARS-IDS Components to Verify Newton's 2cd Law

$$F = ma$$

Who Will Engineer a Way to Obtain the Greatest Acceleration of a Given Mass From the Least Weight (Force)?

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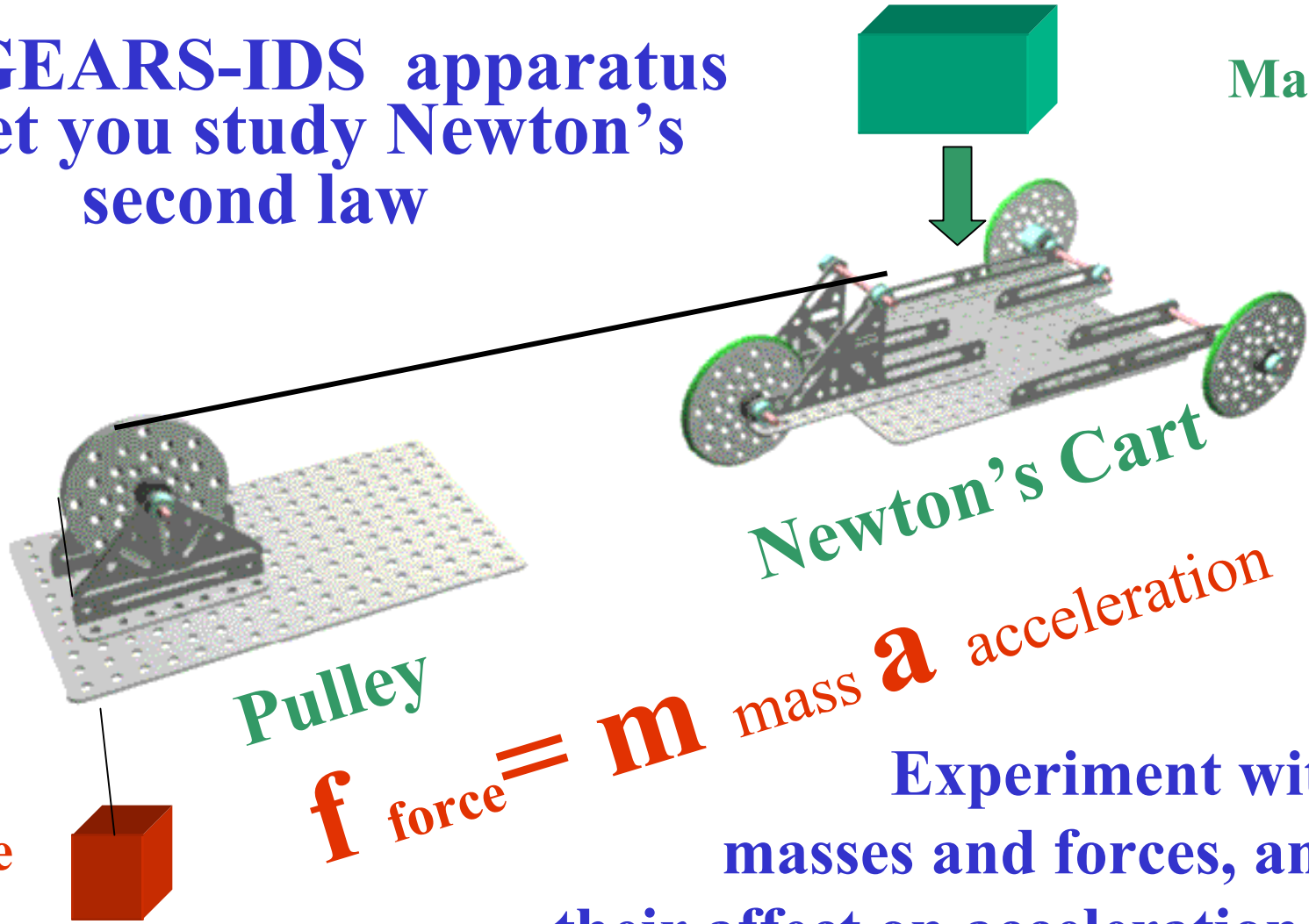
Newton's 2cd Law

This GEARS-IDS apparatus will let you study Newton's second law



$$f_{force} = m_{mass}\ a_{acceleration}$$

Experiment with masses and forces, and their affect on acceleration

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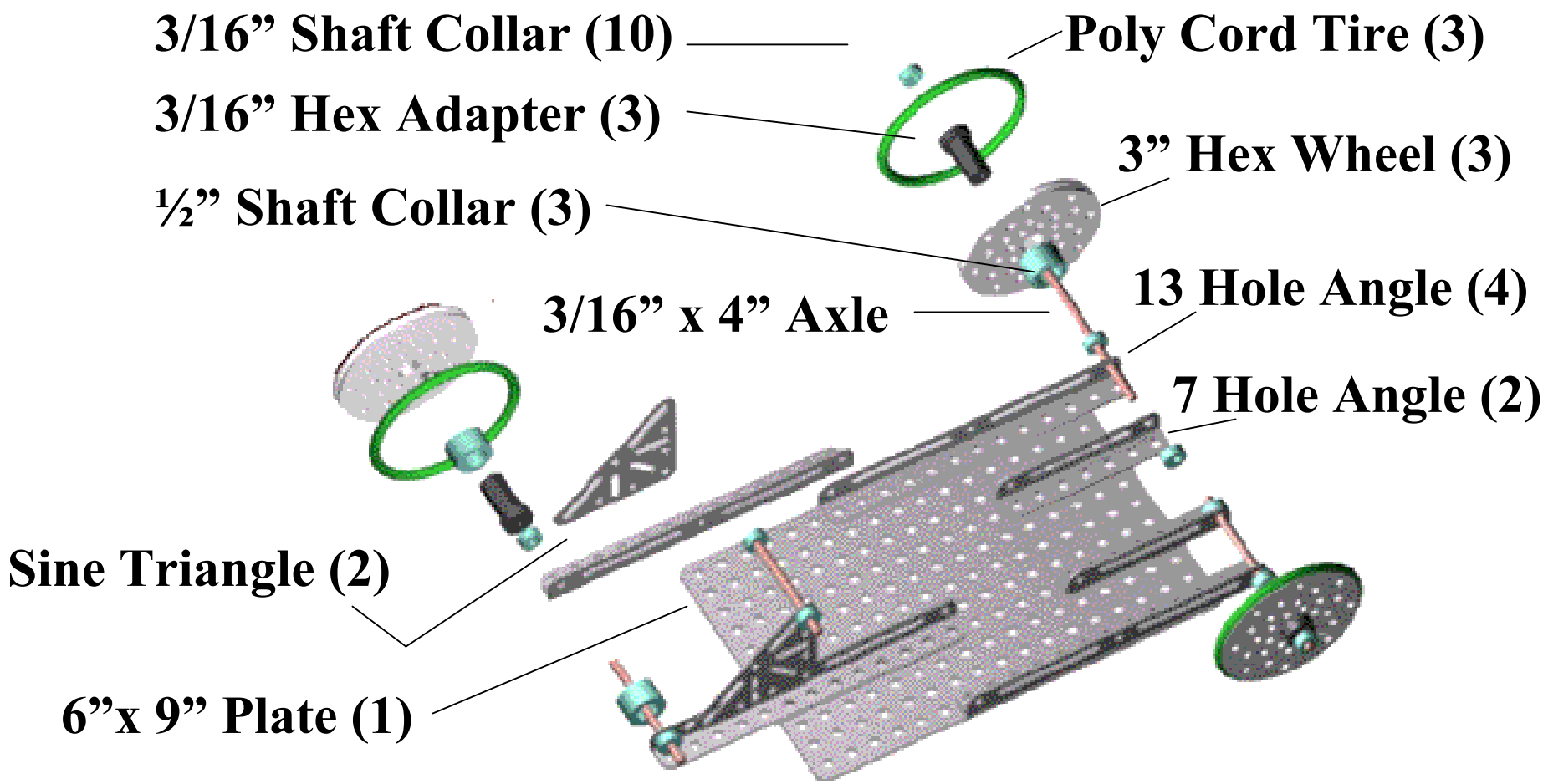
Exploded View of Newton's Cart



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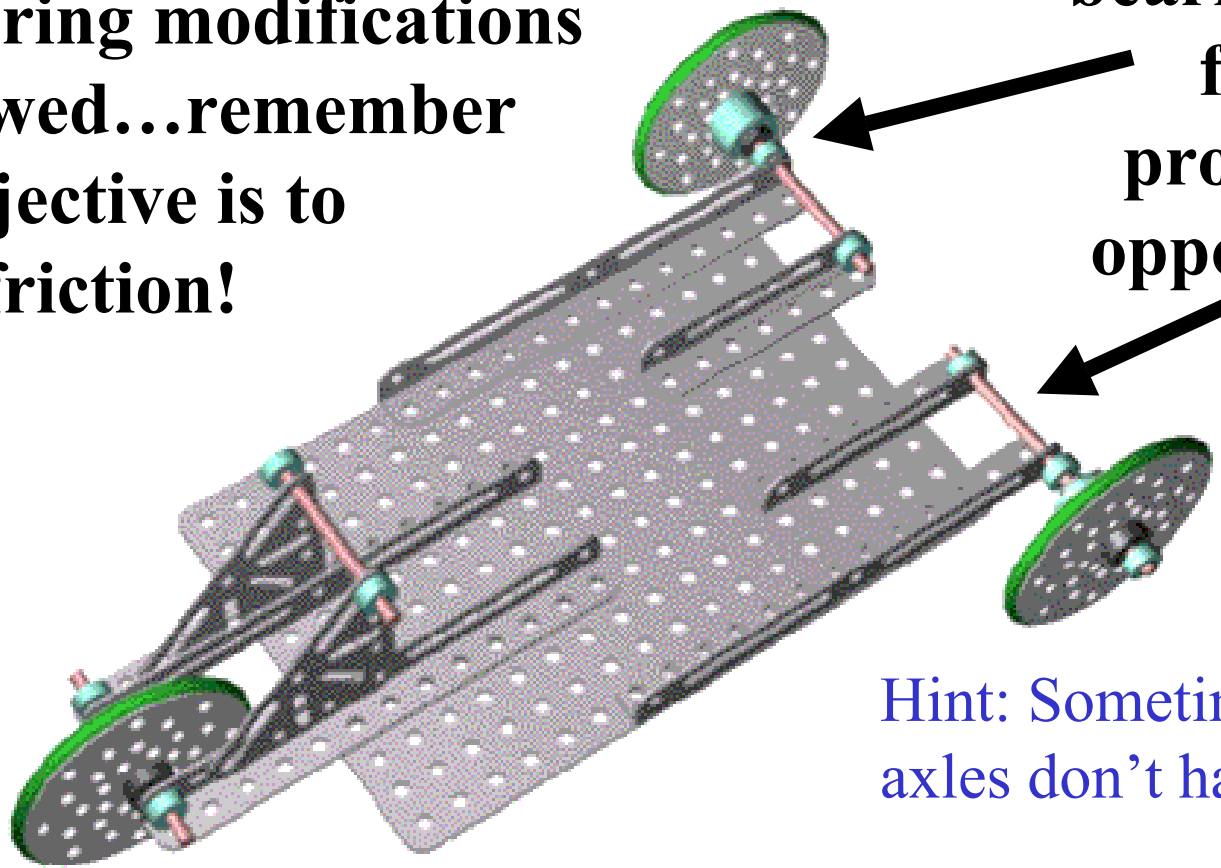
2 Students @ 20 Minutes Assembly Time

Newton's Cart

Engineering modifications are allowed…remember your objective is to reduce friction!

Axles and bearings can be friction problems or opportunities!



Hint: Sometimes the axles don't have to turn!

Be Careful to Strap the Mass on Securely or Inertia Will Cause an Accident!

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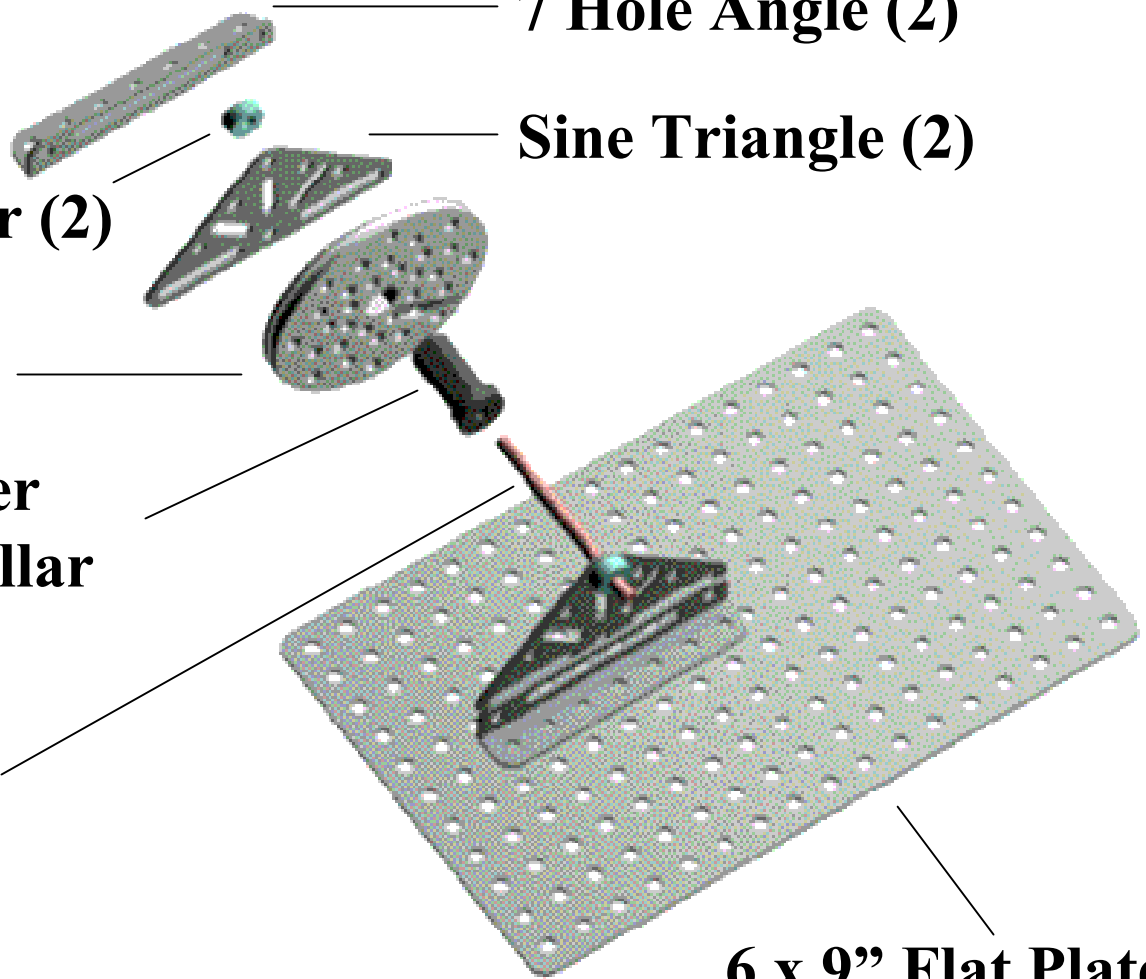
Exploded View of the Pulley



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Newton's Pulley

Note: Clamp the Pulley Securely to a Table

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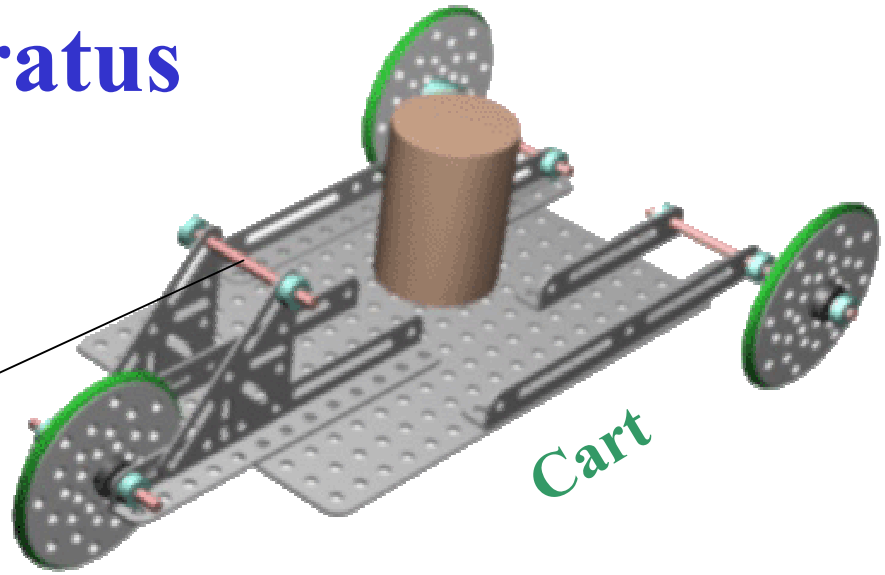
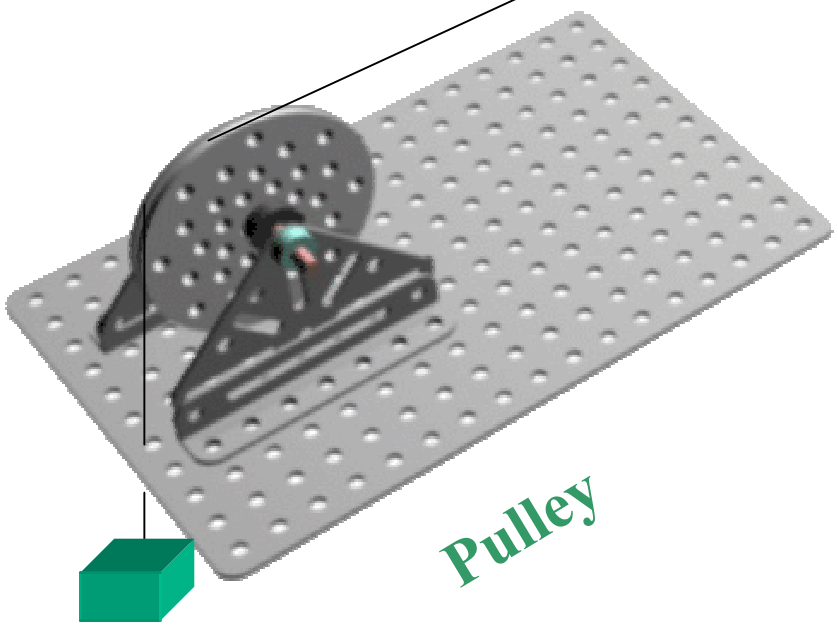
Using Newton's Apparatus

1.) Set the System Up on a High Flat Table

2.) Connect a Masons String from the Cart Through the Pulley





3.) Attach a Weight (Force) to the end of the Pulley Side of the Line

4.) Place a Known Mass on the Cart

5.) Allow the Weight to Drop and Time the Speed of the Cart Over a Known Distance

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Note: Cart and Pulley distance = 2x Table Height. Stop the clock when the weight hits the floor

Calculate the Acceleration of the Cart

Note: This formula will work because the Cart started with a velocity of zero and accelerated at an (approximately) constant rate. In this particular case, the final velocity is the average velocity x 2.

$$C_a = \left(\frac{D}{T}\right) \cdot 2 \Big/ T$$

Where:

C_a= Acceleration of the Cart in meters/sec/sec

D = Distance Covered in meters

T = Time in seconds

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Individual Experimental Data Record for Newtons Cart Activity

Trial	Weight or Force in Kg or lbs.	Total of Mass and Cart in Kg or lbs.	Acceleration in ms^2 or fps^2
1.)			
2.)			
3.)			
4.)			
5.)			

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Note: A class can elect to use either unit system, but be consistent. NEVER MIX UNITS!