Student Name: _____
Date: _____

Activity Sheet 1
Catapult Variables

Front end of catapult.

1. Use of 1 or 2 rubber bands.
2. Use of thick (#64) or thin (#32) rubber bands.

Back end of catapult.

3. Location of anchor screw on base for “trigger chain”.
4. Link position on chain used for attachment of gate-hook (the length of the trigger mechanism may be varied).

Catapult Arm

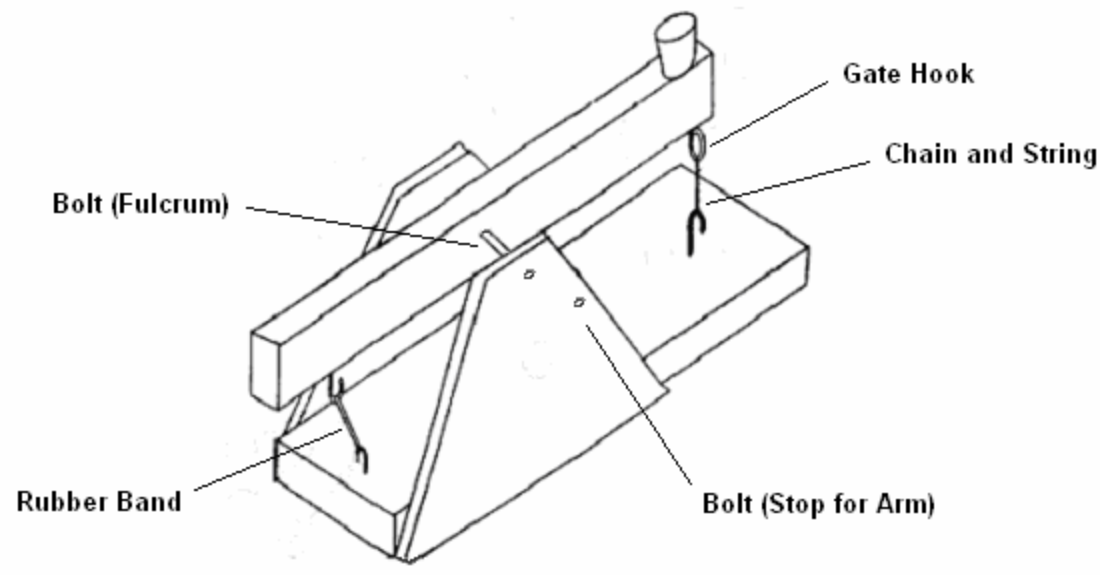
5. Position of pivot pin through catapult arm.
6. Cup modifications (e.g. size, holes in sides, shaping, etc.)

Sides

7. Location of pivot pin through sides.
8. Location of “stop” through sides.

Student Name: _____
Date: _____

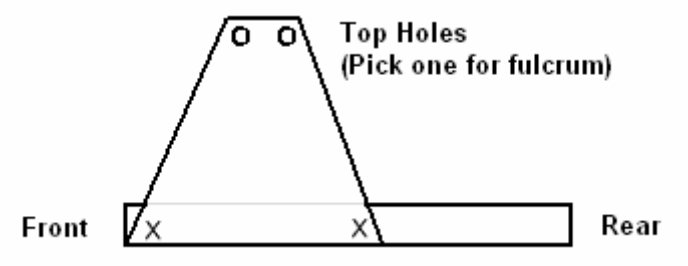
Activity Sheet 2
Catapult Assembly – CT-1



1. Record your catapult number so you keep the same one throughout the competition.

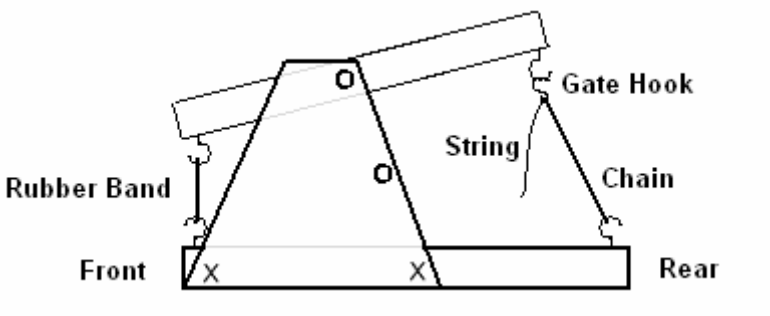
2. Align the sides of your catapult by inserting the machine screw through one of the top holes of one side, followed by a spacer, the lever arm, another spacer, and then the corresponding hole on the second side. Secure this with a nut, making sure to leave it just loose enough for the arm to swing freely.

3. Align the sides with the base and screw in the drywall screws to secure it. These are represented by the x's in the below picture.



4. Now install the second bolt as a stop for the arm. Make sure it is below the bolt holding the lever arm (fulcrum) and closer to the rear. You need not make it terribly tight.

5. Now install the hook eyes at both ends of the base and both ends of the lever arm as shown below.



6. Install the hardware in appropriate location (variable). The length of chain with the gate-hook and attached string (trigger device) should always be mounted on the catapult base, with the separate gate-hook eye ONLY being mounted on the catapult arm as shown above. At no time should the jack-chain with the gate-hook attached be flying through the air in an arc at the end of the catapult arm each time the catapult is triggered.

7. Install cup on the lever arm (used to hold the whiffle ball).

8. Install rubber bands.

9. Test and adjust catapults for the competition.

Student Name: _____
Date: _____

Activity Sheet 3
Variable Data Sheet (Catapult)

Objectives:

1. To assemble a basic catapult.
2. To determine performance by varying adjustable points of the catapults and to observe the change in performance.

Variables:

1. 1 or 2 rubber bands
2. Thick or thin rubber bands
3. Location of hook on base
4. Link position on chain used for catapult arm attachment
5. Position of pivot pin through catapult arm
6. Position of cup holding projectile
7. Location of pivot pin through sides
8. Location of "stop" through sides.

Trial #	VARIABLES							
	Rubber Bands	Location of hook on base	Link Position of chain	Position of pivot pin through arm	Position of cup on arm	Location of pivot pin through sides	Location of "stop" through sides	Distance (ft)

Student Name: _____
Date: _____

Activity Sheet 4
Appendix B

Definition of Terms

Trajectory
The path or curve described by a body (as a planet or projectile) under the action of given forces.

Potential Energy
The kind of energy that a body has by virtue of its position. When a body is raised to a higher level, it is able to do a certain amount of work in falling back again, and hence it was given a certain amount of potential energy in raising it.

Kinetic Energy
The energy that a body has by virtue of its motion.

Energy Storage
If a spring is compressed, and then is forced to stay in that compressed configuration, the spring can be said to have "stored" energy. Once the spring is released, it will return to its original configuration (usually expending the stored energy as rapidly as possible). The same goes for stretching a spring; when released, it will collapse back to its original configuration.

Trigger
The device used to release the catapult once it has been loaded and charged to fire the projectile.

Ballistics
The science of projectiles.

Range
Distance for which a projectile can be thrown.

Student Name: _____
Date: _____

Activity Sheet 5
Catapult Science Challenge Questions

1. Name the various forms of energy involved in the catapult.

2. If one were to use a golf ball instead of the whiffle ball, would the ball go farther, everything else being equal?

3. If you were to do the project on the moon, which of the three balls would you expect to go the shortest distance?

4. Using the whiffle ball on earth, if you doubled the rubber bands, so the force would be twice as much, the whiffle ball would leave the cup at about twice the velocity. Would you expect it to go twice as far?

5. If the ball left the cup going parallel with the ground, would the time in the air be longer with two rubber bands as compared to one?

6. If you didn't have air friction, at what angle with the earth's surface would give the greatest distance?

7. If you tried to fire the catapult exactly the same every time, would you expect the ball to fall in the same place each time or in some specific pattern that would have specific mathematical meaning?

8. If the ball leaves the catapult with a velocity V, what are the vertical and horizontal components?

9. If there is no air resistance, how high will the ball rise?

10. How far would the ball go with no air friction in question 9?

11. Show that the maximum distance will be achieved with a 45-degree angle.