**Investigative Science**

**Catapult Project**

**Overview and Purpose:**

Throughout history, humans have applied innovative ideas and designs to devices for throwing weapons. The sling was developed to improve on the limitations of throwing objects. The bow and arrow was devised to improve accuracy and velocity of propelled objects. The catapult provided major advances in power and accuracy. Catapults began to shift the balance of warfare away from the defenders and to the attackers.

**Objective:**

Each team will create a catapult device that will accurately propel an object over a given horizontal distance.

**Grouping:**

Students will be placed into teams of two to four.

**Criteria:** *(These criteria are susceptible to change)*

- The base of your catapult must be no longer than 24” and no wider than 14”.

- At a minimum, the catapult must be able to propel a tennis ball (provided) a horizontal distance of at least 12’ (in the air) AND land within an area no larger than 1 sq. meter.

- All construction, testing and competition will take place on school grounds within the timeframe of the class session.

**Suggested Resources:**

Internet access, screws, nails, paper clips, binder clips, clamps, staples, nuts and bolts, wire, string, elastic bands, clothes pins, cardboard, cardboard tubes, paper, poster board, tape, glue, hot glue, craft sticks, tin foil, ruler, scissors, rubber cement, foam cups and any other material you think will be useful. Materials purchased specifically for catapult construction are not permitted. Some of the above materials will be supplied (students will be able to see which ones prior to planning). Basic tools to construct with will be provided. If your group requires something not provided please take that into consideration as it will become the responsibility of the group.

**Procedure(s):**

1. **Research What is a catapult? 25 points**
	1. Type a coherent catapult history report or create a brochure about the 3 types of catapults: Ballista, Mangonel, Trebuchet
		1. Discuss the history of the catapult
		2. Provide a brief description of each catapult
		3. Explain the good and bad point of each
		4. Include a picture of each type of catapult
		5. Discuss the differences and similarities between the three types of catapults
		6. Include references at the end of the paper (including references for pictures) (for help see easybib.com or knightcite.com)
		7. Paper/Brochure should be in your own words
		8. Plagiarism (e.g. copying and pasting into your report results in a zero
2. **Plan Choose a catapult to construct 30 points total**
	1. Type of catapult= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (5points)
	2. Create a list of parts needed for construction (10points)
	3. Draw a diagram of what you think it will look like when finished. How much time do you think will be required for the entire construction? (15points)
		1. ***Your diagram needs to be a detailed drawing like a blue print would be. Include dimensions and label the parts.***
		2. ***Multiple views should be drawn***

***THIS MUST BE TURNED IN AND APPORVED BEFORE YOU ARE ALLOWED TO START BUILDING***

1. **Building Constructing and Testing Your Catapult 15 points total**
	1. **First Construction (10points)**

Bring your first catapult construction to be tested/launched. Record the distance of each launch in the space provided below (to be done in class on launch date):

1. Launch # 1=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Launch # 2=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Launch # 3=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average Distance of Launch =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. **Explain the Procedures of Your Catapult Mechanics. (5points)**

Describe (in paragraph form) how your catapult works. Provide as many details so that the reader fully understands the mechanics behind your catapult design.

1. **Analysis & Conclusion 15 points total**
	1. **Record observations below: (10points)**
		1. What worked well with the design? (be specific)
		2. What did not work well with your design? (be specific)
		3. Discuss the relationship between “mass” and “force” seen within your launches.
	2. **State Your Conclusion: (5points)**
		1. What improvements/modifications will be made to improve the design?
		2. How did your design compare/contrast with other designs?
		3. What did you learn overall about catapults? (look back to the research)
2. **Final Launch 15 points total**
	1. **Present your catapult for final testing.**
		1. Repeat launch record.
	2. **Describe in writing all modifications made to your design. (a+b 10points)**
		1. Provide a brief description of all the modifications you made to your previous design tested
	3. **Record any observable improvements with your design. (5points)**
		1. What worked better? Worse?