[Teacher Notes/ Worksheet/ Planning]

**Section I:** Start with the End In Mind

1. *Brainstorm* project ideas:

(Bottle Rockets/ Physics/ Motion/ Projectiles/ ***Scientific Method***)

1. *Be Creative* – What would be your *dream* activity? (Water Bottle Rockets)
2. *What Standards are being addressed?* (NGSS/ CCSS)
3. *Outcomes:* What do you want to see your students doing as a result of this project? **(Bottle Rockets)**

* Students will work together in small groups to design and build their own bottle rocket by using the scientific process.
* Students will collect data from the launches and display it on a graph correctly.
* Students will analyze the reliability and validity of their results.
* Students will determine which group had the best design to keep their rocket in the air the longest.
* Students will communicate their results through lab reports/ presentation.

**Section II.** Driving Question -

Essential Question: FOCUS

**Problem/ Testable Question:**

“ How can we build a water bottle rocket that will stay in the air for the maximal amount of time?”

**Section III.** Assessment (the real stuff…)

1. Lab report

- Students write/ prepare a ***written lab report*** (print, neatly hand written, typed) to demonstrate their understandings of conducting the process of the ***scientific method***.

1. Calculated average

- Students will calculate the average time their rockets were airborne.

1. Water Bottle Rocket

- Students will have produced a complete fabricated **Water Bottle Rocket** that demonstrates their research and understanding of how to build a rocket.

**Section IV.** Project Map

**End Product(s):** Well constructed bottle rocket

[nose cone, fins, written lab report]

1. **Timeline of Tasks and Activities**

*Task One:* Watch Movie – October Sky

*Task Two:* Present challenge to student (*sample letter* to

mission members)

*Task Three:* Demonstrate rocket bottle launch ( or video);

Discuss what is observed (*observation sheet*)

*Task Four:* Teacher designated groups (Head Quarters-

Commissioned Assignments); groups formulate

group names; form hypothesis (*team sheet*)

*Task Five:* Student research of bottle rocket designs;

Each group is tasked to build (in-class?); each

member will track/ record individual, daily

accomplishments (*Apollo Log Sheet*)

*Task Six:* Team displays and describes finished product

*Task Seven:* **MISSION CONTROL:** **Rocket Launch**;

Collect data – dimensions, mass with and w/out water(?), time in air (*data collection sheet*)

*Task Eight:* Graph class averages of collected data

*Task Nine:* Data Analysis (*data analysis sheet*);

Lab Conclusion

1. **Project launch off - Student engaged.**

- Water Bottle Rocket project is introduced by watching the movie

(or clips) of “October Sky”

- Introduce students to the idea of rocketry.

- Review the process of the scientific method (*movie sheet*)

1. **Materials: (suggested)**

(predetermine the number of groups/ number of students per group)

- Movie: October Sky (108 min) - stop watches (6 – 12)

- launch pads (4) - tire pumps (4)

- 2 L bottles (not green) - clear packaging tape

- scissors - string

- trash bags (size may vary) - rulers

- poster board/ cardboard/ card stock

- assorted materials:

- paper clips, washers, erasers, etc.

- Altimeter (online – Amazon.com ~ $30)

1. **Project calendar:** (84 minute Periods/ Block Schedule)

Day 1 – 2: Movie: “October Sky”; discuss movie notes

Day 3: Mission Challenge presentation; demo.

launches; Introduce **ENGINEER’S NOTEBOOK**;

*observation* discussion; designate groups; *team names*; team *hypothesis* statement;

id. *variables*; **RESEARCH** as homework

Day 4: Reserve computer Lab: documented **research**;

research discussion; materials plan; individual member **drafts**

Day 5 - 7: Construct (84 x 3 = 252 minutes); document

activity log and progress

Day 8: Completed rocket, hypothesis, variables,

materials list, draft, procedures/ log; Group

presentations

Day 9: **Rocket Launch**

Launch rockets 1 to 3 times; collect data –

qualitative and quantitative data.

Day 10: Calculate the **average**/ mean of the time each

rocket spent in the air; **graph** group results;

discuss/ compare class data; write a

**conclusion**

Day 11: Peer review of conclusion

**Section V:** Process Management

**What preparations/ accommodations are required to**

**address the needs for differentiated instruction?**

ESL, Special Education, 504

1. **Student goals:**

- Students will build a Water Bottle Rocket that launches

and stays in the air for a minimum of 5 seconds

- Students will build a Water Bottle Rocket that will reach a ‘maximum’ potential height (compared to their peers or previous launches)

- Students will

- Students will conduct research using credible resources

that will aid in a successful rocket launch

1. **Problem-Solving Tools**
2. **Milestones/ Check Points:**

- Check point one: Brainstorm; Identifying variables

- Check point two: Research; materials; Plan

- Check point three: Activity log (construction day two)

- Check point four: *Qnt*and *Qlt* data/ data table

- Check point five: Calculation of average time; graph (ranges of

data; scatter-plot of max. height vs. peak

time)

1. **Evaluation and Reflection**

* Multiple graphing opportunities
* Engineering Notebook
* Reflection Packet
  + Group evaluation
  + Analysis of data
  + Conclusion/ Reflection paragraphs

1. **Time to celebrate!**

**\* How will students display their products?**

- Students vote on the ***best rocket design*** (flight time, aesthetics…)

(see form);

**Additional Extensions:** Students voted the ***best*** (or all) will launch for other classes/ other grades/ during lunches, etc.