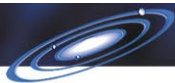


Dynamic Design: Launch and Propulsion

Module Planning Guide

The Learning Cycle

Activity	Teacher Materials	Student Materials	Standards Addressed	Process Skills
BRIEFING				
<ul style="list-style-type: none"> • Pop Rocket Variables 	<ul style="list-style-type: none"> • Teacher Guide 	<ul style="list-style-type: none"> • Student Activity • Student Handout 	<p>Grades 5-8</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • Science in Personal and Social Perspectives • History and Nature of Science <p>Grades 9-12</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • History and Nature of Science 	<ul style="list-style-type: none"> • Observation • Variables • Operational Definitions • Questioning • Collecting data • Interpreting data
<ul style="list-style-type: none"> • Controlling Variables 		<ul style="list-style-type: none"> • Student Text 		
<ul style="list-style-type: none"> • I Can't Believe I Ate the Whole Thing 		<ul style="list-style-type: none"> • Student Text (Optional) 		
EXPLORATION				
<ul style="list-style-type: none"> • Pop Goes Newton 	<ul style="list-style-type: none"> • Teacher Guide 	<ul style="list-style-type: none"> • Student Activity 	<p>Grades 5-8</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • Science in Personal and Social Perspectives • History and Nature of Science <p>Grades 9-12</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • History and Nature of Science 	<ul style="list-style-type: none"> • Observation • Inference
<ul style="list-style-type: none"> • Newton's Laws of Motion and Rockets 		<ul style="list-style-type: none"> • Student Text 		
<ul style="list-style-type: none"> • The History of Rocketry 	<ul style="list-style-type: none"> • Teacher Guide 	<ul style="list-style-type: none"> • Student Activity 	<p>Grades 5-8</p> <ul style="list-style-type: none"> • Science As Inquiry • Science and Technology • Science in Personal and Social Perspectives • History and Nature of Science • Historical Understanding <p>Grades 9-12</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • History and Nature of Science 	



DEVELOPMENT				
<ul style="list-style-type: none"> • Launching Genesis 	<ul style="list-style-type: none"> • Teacher Guide 	<ul style="list-style-type: none"> • Student Activity 	<p>Grades 5-8</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • History and Nature of Science • Numbers and Operations • Measurement • Problem Solving <p>Grades 9-12</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • History and Nature of Science • Numbers and Operations • Measurement • Problem Solving 	<ul style="list-style-type: none"> • Observation • Prediction • Collecting Data • Interpreting data • Questioning • Hypothesis • Variables • Conclusion
<ul style="list-style-type: none"> • Genesis Launch Vehicle: The Delta Rocket 		<ul style="list-style-type: none"> • Student Text 		
<ul style="list-style-type: none"> • Propulsion 	<ul style="list-style-type: none"> • Teacher Text 			

INTERACTION/SYNTHESIS				
<ul style="list-style-type: none"> • Investigating Water Rockets 	<ul style="list-style-type: none"> • Teacher Guide 	<ul style="list-style-type: none"> • Appendix A Safety Rules • Appendix B Safety Checklist • Student Activity Measuring Altitude • Student Activity What a Drag • Appendix C Nosecone Patterns • Student Activity Flying Straight • Student Activity Investigating Fin Shape or Size • Student Activity Investigating Fin Number and Placement • Student Activity Fly Like an Eagle • Student Activity Altitude vs. Volume of Water • Student Activity Altitude vs. Launch Pressure • Student Activity Weather or Not 	<p>Grades 5-8</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • Science in Personal and Social Perspective • Measurement • Problem Solving <p>Grades 9-12</p> <ul style="list-style-type: none"> • Science as Inquiry • Physical Science • Science and Technology • Science in Personal and Social Perspective • Measurement • Problem Solving <p>Grades K-12</p> <ul style="list-style-type: none"> • Technology Productivity Tools • Technology Research Tools • Technology Problem Solving and Decision Making Tools 	<ul style="list-style-type: none"> • Observations • Variables • Collecting data • Measuring • Writing procedures • Operational definitions • Questioning • Interpreting data • Conclusion

ASSESSMENT				
<ul style="list-style-type: none"> • Fly Me High 	<ul style="list-style-type: none"> • Teacher Guide 	<ul style="list-style-type: none"> • Student Activity • Appendix A Safety Rules • Appendix B Safety Checklist 	<p>Grades 5-8</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • Science in Personal and Social Perspectives • Measurement • Problem Solving <p>Grades 9-12</p> <ul style="list-style-type: none"> • Science As Inquiry • Physical Science • Science and Technology • Science in Personal and Social Perspectives 	<ul style="list-style-type: none"> • See Investigating Water Rockets



			<ul style="list-style-type: none"> • Measurement • Problem Solving Grades K-12 <ul style="list-style-type: none"> • Technology Productivity Tools • Technology Research Tools • Technology Problem Solving and Decision Making Tools 	
<ul style="list-style-type: none"> • You Get What You Pay For 	<ul style="list-style-type: none"> • Teacher Guide 	<ul style="list-style-type: none"> • Student Activity 	Grades 5-8 <ul style="list-style-type: none"> • Science and Technology • Economics Grades 9-12 <ul style="list-style-type: none"> • Science and Technology 	

(View a full text of the [National Science Education Standards](#).)

(View a full text of the [Principles and Standards for School Mathematics](#).)

(View a full text of McREL's [Compendium of Standards and Benchmarks for K-12 Education](#).)

Materials lists for each teacher guide in this module.

Below is a quick reference list to each teacher guide and accompanying materials for your convenience.

[Pop Rocket Variables](#)

For each group of three to four students:

- Student Activity, "[Pop Rocket Variables](#)"
- Student Handout, "[Rocket Concept Definition Map](#)"
- Student Text, "[Variables And Operational Definitions](#)"
- (Optional) Student Text, "[I Can't Believe I Ate the Whole Thing](#)"
- Plastic 35 mm film canister with an internal-sealing lid
- Effervescent antacid tablet
- Paper towels
- Water
- Eye protection
- (Optional) *October Sky* video or DVD

[Pop Goes Newton](#)

For each group of three to four students:

- Student Activity, "[Pop Goes Newton](#)"
- Student Text, "[Newton's Laws of Motion](#)"
- (Optional) *Newton In Space* Liftoff to Learning Video

[History of Rocketry](#)

- Student Activity, "[Anatomy of a Liquid Propellant Rocket](#)"
- *History of Rocketry*: Chapters 1-6 available online from Spaceline at <http://www.spaceline.org/rockethistory.html>
- Construction paper, meter sticks, markers (Optional)



[Launching Genesis](#)

For each student:

Choosing a Launch Vehicle:

- Student Activity, "[Launching Genesis: Choosing a Launch Vehicle](#)"
- Student Text, "[Genesis Launch Vehicle: The Delta Rocket](#)"
- (Optional) *Newton In Space* Liftoff to Learning Video

How Do You Spell Success?

- Student Activity, "[Launching Genesis: How Do You Spell Success?](#)"
- Calculator (Optional)

Propulsion

- Student Activity, "[Launching Genesis: Propulsion](#)"
- Teacher Text, "[Propulsion](#)" (Optional)

For each group of students:

Part 1: Launch

- Long, thin balloon (see diagram on student sheet)
- Fishing line (3 meters)
- Paperclip
- Straw
- Small paper cup
- Ping-Pong ball
- Clothes pin

Part 2: Propulsion

- String (strong enough to support a full milk carton)
- Pint-sized milk carton
- Nail
- Tape
- Water

Demonstration (Optional)

- Balloons
- String
- Clothespins
- Lid from a copier paper box
- Scissors

Part 3: The Exit Nozzle

- Hair dryer (with a cool setting)
- Construction paper
- Cotton ball
- Meter stick
- Electrical tape

[Investigating Water Rockets](#)

What do I need to know before launch?

- Appendix A, "[Safety Rules](#)"
- Appendix B, "[Safety Checklist](#)"
- Student Activity, "[Measuring Altitude](#)"
- [Altitude tracker pattern](#) (this can be copied or glued onto tag board)
- Thread, lightweight string, or fishing line



- Cellophane tape
- Small washer or 1-2 ounce fishing sinker
- Scissors
- Rope or string to measure out range (10 meters)
- Angle-to-height conversion chart
- Tennis ball per pair of students

Nosecone Experts

- Student Activity, "[What a Drag](#)"
- Paper towel tube
- Appendix C, "[Nosecone Patterns](#)"
- Meter stick
- Several 2-liter plastic soft drink bottles
- Modeling clay
- Card stock
- Leaf blower or vacuum set to blow
- Books to make a path
- Long hall or open area

Fin Experts (two groups)

- Student Activity, "[Flying Straight](#)" for students in both groups
- Student Activity, "[Investigating Fin Shape or Size](#)" for one group
- Student Activity, "[Investigating Fin Number and Placement](#)" for the second group
- Paper towel tubes
- Tag board (for fins)
- Metric ruler
- Cellophane tape and/or glue
- Scissors
- Safety glasses
- Launching mechanism (vacuum with blower or leaf blower)
- Meter stick for measuring distances
- Arrows with feathers and without feathers

Propulsion Experts

- Student Activity, "[Fly Like an Eagle](#)"
- Student Activity, "[Altitude vs. Water Volume](#)"
- Student Activity, "[Altitude vs. Water Pressure](#)"
- Several 2-liter plastic soft drink bottles
- Water
- Graduated cylinders (one liter)
- Launcher http://www.nerdsinc.com/rock_prod.html
- Tire pump or air compressor
- Safety glasses
- Altitude trackers
- Conversion charts
- Rope to measure out range (10 meters)
- Compass to determine north, south, east, west.

Weather or Not

- Copy of the Student Activity, "[Weather or Not](#)"
- Access to a computer with the Internet
- Weather instruments for measuring wind speed, direction, visibility, and temperature

[Fly Me High](#)

- One or more 2-liter plastic soft drink bottles
- Safety goggles
- Glue or tape
- Card board or thick paper
- Modeling clay
- Scissors
- Pens and decorating supplies
- Balance
- Launch pad with secure pin and washers
- Water
- Safety goggles
- Air pump or tank
- Altitude tracker
- Decorative decals
- *Rockets: A Teacher's Guide with Activities in Science, Mathematics, and Technology* (Information about stability, pages 116-117; 109-110 NASA file.)
- Appendix A, "[Safety Rules](#)"
- Appendix B, "[Safety Checklist](#)"
- Student Activity, "[Fly Me High](#)"

[You Get What You Pay For](#)

- Spreadsheet or balance sheet
- Calculator
- Student Activity, "[You Get What You Pay For](#)"