



LAUNCHING INTO AVIATION - SEMESTER ONE

Materials needed throughout the semester

- Poster board or rolled paper (included in 5 lessons)
 - Markers
 - Scissors
 - Paperclips
 - Clear tape
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Unit 1 - Aviation 101

- *Unit 1.A Lesson 2 – Engineering Practices in Action*

Heavy Lift Rocket Activity (materials per group)

- Large binder clip
 - Fishing line/smooth string
 - 4 long balloons - 5" x 24" or 3" x 60"
 - Bathroom size (3 oz.) paper cup
 - 2 straight drinking straws
 - 50 small paper clips
 - Sandwich-size plastic bag
 - Masking tape
 - Wooden spring-type clothespins (optional)
 - Scissors
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Unit 2 - Taking Flight—Early Aviation Innovations

- *Unit 2.A Lesson 2 – Da Vinci and His Flying Machines*

Create Your Own Paper Helicopter (materials per student)

- Paper
- Paperclip
- Scissors

DaVinci's Design Dilemma (materials per team)

MATERIALS LIST



- Scissors
- Clear Tape
- Fishing line or string
- Washers or marbles
- Template for spacecraft
- Area to drop from (or ladder)
- Plastic grocery bags
- Rulers
- Digital Scale or Balance (one per class) [Amir Digital Pro Pocket Scale](#)
- Stopwatch/other timing device (app on cellphone)
- Small resealable sandwich bag
- Cardstock or old file folders for spacecraft template
- Tissue paper or plastic tablecloths

- *Unit 2.B Lesson 1 – Hot Air and Gas Ballooning*

Density Demonstration Activity (materials per class)

- Large clear tank or tub filled with water
- Pairs of sinking and floating objects
 - Two cans of soda—regular and diet
 - Orange with peel and orange peel only
 - Two bowling balls—one more than 12 lbs and one less than 10 lbs

Hot Air Balloon Activity

Materials per team:

- 13 sheets of tissue paper (approximately 20" x 30") (bright, mixed colors)
- Glue stick
- Scissors
- Straight edge (yard or meter stick works best)
- Marker (any dark color)
- Large bowl with smooth, rounded bottom and sides
- Masking tape

Materials per class:

- Camp stove with propane fuel converter and metal heating duct to hold over camp stove
- Lighting device
- Fire extinguisher
- Heat protection for hands
- Optional heat sources:
 - Metal ice bucket or small metal garbage can with 3-4 cans of Sterno or similar gel fuel

MATERIALS LIST



- Should be large enough to hold multiple cans of gel fuel
- Sides should be more than 6 inches high
- Hot air popcorn popper
- Hair dryer set on low speed with high heat

- *Unit 2.C Lesson 2 – Glider Flight and Early Innovators*

Warm-Up Activity

- Large pieces of cardboard (about 20 x 30 inches)
- Fan

Paper Tent Activity (materials per student)

- 8 1/2-inch x 11-inch piece of paper for each student

Glider Building Activity (materials per team)

- Balsa-wood gliders (one kit per student or per pair of students) [Jetfire Balsa Gliders](#)
- Extra balsa wood [Small Box o' Balsa](#)
- Craft knives (one per student pair)
- Stopwatch or other timing device (may use cell phone app)
- Tape measure
- Masking or electrical tape
- Glue
- Other simple materials for modifying glider designs (index cards, paper, tape, sticky notes, paper clips, putty, etc.)

- *Unit 2.D Lesson 2 – Build and Test a Wind Tunnel*

Build and Test a Wind Tunnel Activity

Materials per wind tunnel:

- Large pieces of cardboard cut into the following dimensions:
 - Four (4) 21" x 25" x 8"
 - Four (4) 40" x 8"
- Four small pieces of cardboard for two support stands (5.75" inches in height)
- Box fan (highest powered fan available)
- Box knife
- Metal straight edge
- Measuring tape/ruler
- Drinking straws (recommend using jumbo size straws)
- One (1) 8" x 10" piece Lexan/Plexiglass (can be purchased pre-cut at a major hardware store)
- Duct tape
- Hot glue gun and glue sticks
- Digital scale (measures to 0.1g, at a minimum) [Amir Digital Pro Pocket Scale](#)



- Safety glasses

Airfoil Build (per team)

- Box knife
- Metal straight edge
- Measuring tape/ruler
- Hot glue gun and glue sticks
- Pliers/wire cutter
- Protractor
- Safety glasses

Airfoil Mount

- Three (3) 7 ½" pieces of wire (can be from a wire hanger)
- Foam board cut into the following pieces (recommend [Dollar Tree](#) foam board)

Airfoil Mount

One (1) 6" x 6"

Eight (8) 1" x 3"

Symmetrical Airfoil foam board pieces

One (1) 16" x 5 ¼"

Three (3) 5 ¼" x 1"

Asymmetrical Airfoil foam board pieces

One (1) 16" x 5 ¼"

Three (3) 5 ¼" x 1"

Airfoil of student's own design

One (1) 16" x 5 ¼"

Three (3) 5 ¼" x 1"

Unit 3 - From Theory to Practical Reality—Rapid Developments in Powered Flight

- *Unit 3.C Lesson 2 – One For All, All For One*

Riveting Activity (Going Further activity - optional)

- Pop rivet gun (minimum one gun per class) [Hand Rivet Tool](#)
- 1/8" x 1/8" aluminum rivets (minimum one per student) [Aluminum Rivets](#)
- No. 6 metal washers (minimum two per student) [Steel Flat Washers](#)
- Safety goggles



Unit 4 - To the Stars—Making Jet and Space Travel Possible

- *Unit 4.A.1 – Development of the Jet Engine*

Jet Engine Lab Activity

Materials per class:

Intake Station

- One desk fan
- Sheets of paper

Compression Station

- Two desk fans
- Six-inch pieces of string
- Index cards
- Tape
- Markers
- Paper clips

Combustion Station

- 250-500 milliliter Erlenmeyer flask
- Balloon
- Can of sterno or other heat source
- Matches or lighter
- Tongs
- Heat/oven mitts
- Timer
- Safety glasses

Jet Engine Schematic Activity

Materials per student:

- One paper towel or toilet paper tube (approximately 4-inches long)
- One flexible straw
- One 12x12-inch sheet of aluminum foil
- Four paper circles 1 ½ inches in diameter
- One small paper clip
- One three-ounce paper cup
- Scissors
- Tape
- White glue



- *Unit 4.B Lesson 1 – The Space Race Begins*

Rocket Launch Activity (Going Further activity - optional)

- Digital Scale (one per class)
- Tape Measure (minimum one per class)

Materials per student:

- Scissors
- Clear tape
- Paper
- Straw
- Pencil
- Ruler
- Protractor
- Masking tape
- Clay
- Other materials as provided by teacher

- *Unit 4.B Lesson 3 – The Space Race Winds Down*

Let's Dock! Activity

Materials per team:

- One larger water bottle representing the Apollo module (empty)
- One smaller water bottle representing the Soyuz module (empty)
- Four 6-foot strings
- Ring cut from a Styrofoam cup
- Clear tape

Unit 5 - Creating the Future—What's New and Next in Aviation and Aerospace

- *Unit 5.A Lesson 2 – Aircraft Navigation*

VFR Chart Practice Activity

- VFR sectional aeronautical charts (one per student or small group – see Explore section of lesson plan for ways to acquire charts)



- *Unit 5.A Lesson 3 Composites and Structures*

Build-Your-Own Composite Activity

Materials per class:

- Balance or digital scale (to measure the weight of the flour and measure the weight of the composite structures)
- Graduated cylinders (50-100 mL, several per class or one per group)
- Counterweights or other weights (i.e. books) to test strength
- Measuring cups and spoons (several per class or one per group)
- Several types of flour for use in making paste
- Warm water
- Materials to cover work surfaces
- Vaseline
- Variety of fabrics (biodegradable and other), such as paper towels, newspaper, tulle, cotton, burlap, nylon, etc. Each student will need several strips of one or two types of fabric about 2 inches x 6 inches.
- Mixing bowls and utensils for making paste
- Empty plastic containers to use as molds (empty yogurt cups, sour cream containers, margarine tubs work well).
- Safety goggles per student
- Hair dryer or fan

- *Unit 5.C Lesson 1 - End of the Semester Project*

End of Semester Project – Exhibit Construction

Materials per student:

- Suggestions for physical exhibits include, but are not limited to, poster board/foam board, markers, pencils, scissors, glue, video presentation device, other basic presentation materials



9th GRADE - LAUNCHING INTO AVIATION - SEMESTER TWO

Materials needed throughout the semester

(included in 3 lessons)

- Poster board or rolled paper
- Markers
- Scissors
- Paperclips
- Clear tape
- Graph paper

Unit 7 – Exploring Careers in Aviation and Aerospace

- *Unit 7.B Lesson 1 – Becoming an Aerospace Engineer*

Parachute Challenge Activity

Per Team

- 2 plastic bags
- Fabric or other materials to construct the parachute
- 5 feet of string
- 2 raw eggs
- Tape
- Cardboard or foam board
- Scissors
- Other materials determined by the teacher (paper plate, manila folder, etc.)

Per Class

- Hot glue gun and glue sticks
- Other materials determined by the teacher

Engineering Research Activity (per team)

- Access to PowerPoint (or other presentation software) to create a slide presentation

- *Unit 7.C Lesson 1 – Becoming an Air Traffic Controller*

ATC Simulation Activity (per class)

- Large flat area (parking lot, football field, gymnasium, wide hallway)
- Sidewalk chalk, masking tape, or spray paint
- Measuring tape



Unit 8 – Aviation Innovation and Problem Solving

- *Unit 8.A Lesson 1 – Improving Aviation’s Environmental Impact*
Chevron Activity
 - Thunder drum (small or large ones will work for this activity). One needed, or, if possible, one per small group
 - Paper, cardstock, various building materials (i.e. aluminum foil)
 - Measuring devices – Decibel meter (real or smart phone app) ° There are many free decibel meter apps that are constantly changing. Simple app searches for “decibel meter” will show popular apps that include “Sound Meter,” “Decibel Meter” and “SPL Meter.”

Safety

 - Actively supervise students during the lab or activity. Be ready to offer guidance in situations where safety could be compromised.

- *Unit 8.B Lesson 2 – Integrating Drones*
Friday Night Drones Activity
 - Access to “Google Earth”
 - Graph Paper
 - Colored Pencils

- *Unit 8.C Lesson 1 – Supersonic Aircraft*
Measuring the Speed of Sound Activity (per class) (GOING FURTHER)
 - Two blocks of wood (recommend using two 20-inch pieces of 2x4 boards)
 - Long tape measure
 - Colored Pencils
 - Multiple stopwatches (can use the stopwatch function on smartphones)
 - Clipboards
 - Calculators
 - Thermometer (to take outside temperature)
 - An open space several hundred feet from a building from which to bounce the sound

- *Unit 8.C Lesson 3 – Electric Aircraft*
Build-your-own-battery Activity (per team)
 - 7-10 test leads with alligator clips
 - 4-6 lemons
 - Small electric motor with propeller
 - One AA battery
 - Small LED light
 - 4-6 galvanized nails/screws

MATERIALS LIST



- 4-6 pieces of bare copper wire (about 2 inches long)
 - Ruler
 - 2-3 rubber bands
 - 4-6 drinking straws or small dowels
 - Safety glasses
 - Multimeter (shared among the class)
 - Wire cutters/strippers (shared among the class)
 - Digital scale (shared among the class)
- *Unit 8.B Lesson 2 – Colonizing Space*
 - Welcome to Columbia Hills, Mars! Activity
 - Graph paper (per student)
 - Poster board or rolled paper (per team)
 - Markers (per team)

Unit 9 – Innovation Challenge

- *Unit 9.A Lesson 1 – “Peep Odyssey” Innovation Challenge*
 - Innovation Challenge
 - Three-ring binder (per team)
 - Several pieces of graph paper (per team)
 - 2-3 Peeps (per team)
 - One vacuum cylinder and pump (per class)
 - Safety glasses
 - Suggested materials that a teacher may provide to assist in building prototypes:
 - Pieces of plastic or plexiglass
 - Pieces of metal
 - Caulk
 - Duct tape
 - Rubber plugs
 - Hot glue gun and glue
 - Foam board pieces
 - Aluminum foil
 - Plastic wrap
 - Wax paper
 - Cardboard or cardstock
 - Any tools required to build the prototypes

MATERIALS LIST

Unit 10 – Thinking About a Career in Aviation



- *Unit 10.C Lesson 1 – Building a Career Portfolio*
Portfolio Materials (Going Further activity - optional)
 - Three-ring binder
 - Tabs (as needed per student based on table of contents)
 - Plastic or vinyl sheet protectors

PROPRIETARY