



9th GRADE - LAUNCHING INTO AVIATION - SEMESTER ONE

Materials needed throughout the semester

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

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

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)

- 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:
 - 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

MATERIALS LIST



- 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

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(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 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
 - 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 9 – Innovation Challenge

- *Unit 9.A Lesson 1 – Da Vinci and His Flying Machines*
Create Your Own Paper Helicopter (materials per student)
 - 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

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