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
  o Two cans of soda—regular and diet
  o Orange with peel and orange peel only
  o 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:
  o Metal ice bucket or small metal garbage can with 3-4 cans of Sterno or similar gel fuel
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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 ¾”
    - Three (3) 5 ¾” 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 ½”
    - Three (3) 5 ½” x 1”

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**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