Materials needed throughout the semester (included in 4 lessons)
- Poster board or rolled paper
- Markers
- Scissors
- Paperclips
- Post-it notes
- Clear tape

Unit 2 – How Aircraft Are Made

● Unit 2.A Lesson 1 – Manned Aircraft Components

Modeling an Airplane’s Components (per student)
- Cardboard
- Paper towel or toilet paper rolls
- Scissors
- Tape or Glue
- Markers

● Unit 2.A Lesson 2 – Unmanned Aircraft Components

Drone Flying Activity (one per class)
- Drone options for the classroom
  - Tello Quadcopter Drone- $99 (Amazon)
  - SYMA X5C 2.4G 6 Axis Gyro HD Camera RC Quadcopter with 2.0MP Camera- $36 (Amazon)
  - DROCON Drone For Beginners X708W Wi-Fi FPV Training Quadcopter With HD Camera - $80 (Amazon)

● Unit 2.B Lesson 1 – Aircraft Structural Materials

Build-A-Plane Activity
- Rolled paper or poster board
- Markers
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- **Unit 2.B Lesson 2 – Aircraft Safety Features**

  **Propose A New Safety Innovation Activity (per team)**
  - Poster board
  - Markers
  - Post-it notes

- **Unit 3 – Understanding Air**

- **Unit 3.A Lesson 1 – Air is a Fluid**

  **Honey Demonstration (per class)**
  - Two jars of honey
  - One or two large bowls

  **Viscosity Activity (per group)**
  - One marker
  - One basin to catch fluids; the basin should be wide enough to hold the incline
  - Vertical Support for incline (such as stack of books or a clamp and stand)
  - One stopwatch
  - Three different inclines, each approximately 15 cm wide x 50 cm long
    - One of the inclines should have a smooth surface, such as glass
    - One incline should mimic the smooth aluminum metal of airplanes (e.g. a sheet of aluminum from hardware store)
    - Other materials to consider include wood, sandpaper, aluminum foil, velcro, or plastic wrap
  - Four different fluids for students to test (e.g. water, glue, syrup, oil)
  - Four 100 mL beakers (or other small containers such as paper or plastic cups)

  **Honey Demonstration (per class)**
  - Strip of paper approximately 5 cm x 25 cm. The paper should not be too flimsy as it needs to hold a convex shape.
  - Two paper, plastic, or foam cups
  - Tape or glue
  - Four long rubber bands

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Materials List

- **Unit 3.A Lesson 2 – Air Density**
  
  **Visualizing Density Demonstration (per class)**
  - Balance scale
  - Metal counterweights
  - Styrofoam cube or slab, at least 4 x 4 x 2 inches
  - Large glass or clear plastic jar, at least 8 inches high (e.g. an empty pickle jar)
  - Rocks of such a size to be able to fill the jar with 4 or 5 of them
  - Small pebbles or river rocks (enough to fill the space between the larger rocks)
  - Sand (enough to fill the space between the pebbles)
  - Water (to fill the rest of the jar)
  - Beaker graduated in liters

  **Layering Water Activity (per group)**
  - Two identical clear baby food jars
  - Hot water (about 50 °C, colored red)
  - Cold water (about 5 °C, colored blue)
  - Water-resistant card (from a deck of cards or laminated index card)
  - Paper towels
  - Cookie sheet or something similar to catch drips and spills

- **Unit 3.B Lesson 1 – Density Altitude**
  
  **Flight Simulation Activity**
  - Computer with flight simulation software or flight simulator
  - Joystick or yoke
  - Optional: Throttle quadrant, rudder pedals, additional monitors

- **Unit 4 – Forces of Flight**
  
  - **Unit 4.A Lesson 1 – Understanding Motion**
    
    **Egg Inertia Demonstration (per class)**
    - One hardboiled egg
    - One raw egg

    **Pop Can Hero Activity**
    - Empty aluminum pop cans with pull tabs intact (one per team)
    - Carpenter nails
    - Small nails
    - String or fishing line (about 20 inches per team)
    - Water tub (one or two per class)
    - Towels

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● **Unit 4.A Lesson 2 – Four Forces**

  Dart Paper Airplane Test (per team)
  - Sheet of 8 ½” x 11” paper
  - Paperclips
  - Measuring tape
  - Scissors

● **Unit 4.A Lesson 3 – Vectors of Flight**

  Flight Vector Analysis Activity (per student)
  - Protractor

● **Unit 4.B Lesson 1 – Theories of Lift**

  Floating Ball Demonstration (per class)
  - Hair Dryer
  - Ping pong ball
  - Optional: one bendable straw and ping pong ball for each student

  Magic Balloon Experiment (per team)
  - Two balloons
  - Two (2) 12” pieces of string
  - Tape
  - Straw

  Airfoil Designs Test (per team)
  - Several Pieces of 8 ½” x 11” paper
  - Tape
  - Plastic straw
  - String
  - Scissors
  - Single-hole punch
  - Electric box fan or other small variable speed fan (per class)

● **Unit 4.B Lesson 3 – Calculating Lift**

  Lift Equation Scenarios (per student)
  - Calculator

  Airfoil Simulation Activity (each group)
  - iPads with “Wind Tunnel” application downloaded ($4.99)

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● Unit 4.B Lesson 4 – Aerodynamic Stalls

Adventures in Stalls Activity
- Markers and/or colored pencils
- Rolled paper or poster board (optional)

Flight Simulation Activity
- Computer with flight simulation software or flight simulator
- Joystick or yoke
- Optional: Throttle quadrant, rudder pedals, additional monitors

● Unit 4.C Lesson 1 – Aircraft Weight and Balance

Balancing Act Activity (per group)
- 12-inch ruler
- Three identical binder clips

Paper Airplane Balancing Activity (per group)
- 8 ½” x 11” piece of paper
- Four paper clips

Flight Simulation Activity
- Computer with flight simulation software or flight simulator
- Joystick or yoke
- Optional: Throttle quadrant, rudder pedals, additional monitors

● Unit 4.D Lesson 1 – In Thrust We Trust

As The Prop Turns Activity
- Rubber band-powered balsa wood airplane with wheels
- Guillow's Balsa Wood Flying Machine Kit (https://amzn.to/2QrnHRo)

Gyroscopic Action Demonstration (Optional)
- Chair that swivels
- Bicycle wheel that students can grasp by the axle

Engineering a Jet Engine Activity
- iPads with “Rolls-Royce Trent XWB” application downloaded (free)
Unit 4.E Lesson 1 – What a Drag!

Warm-Up Demonstration (per student)
- Two 8 ½ x 11-inch pieces of paper

Drag Race (Per Group)
- Rubber band-powered propeller assembly (recommend using the propellers and rubber bands from the balsa wood airplane activity in lesson 4.D.1)
- Size #117B rubber band (if not included in the assembly above)
- Two drinking straws (recommend not using flexible drinking straws)
- Cardstock or manila file folders cut to size
  - One (1) - 5” x 7”
  - One (1) - 1 ½ “ x 7”
  - One (1) - 3” diameter circle
- One brass fastener (brad fastener) size 1”
- One hook or pin to secure far end of rubber band propeller assembly (can use a paperclip)
- Transparent or masking tape
- Ruler/straight edge
- Protractor
- Tape measure or meter stick
- 5 meters of fishing line
- Permanent marker
- Scissors
- Hole punch (one per class)

Unit 5 – Aircraft Stability and Control

Unit 5.A Lesson 1 – Stability in Aircraft Design

Stability In Action Activity (Per Pair)
- Marble
- Bowl with a rounded bottom and curved sides (the bowl should not have a lip on bottom of the outside surface)
- A key with a hole in the top
- A 10-inch length of string

Unit 5.A Lesson 2 – Rotorcraft Lift and Stability

Flight Controls Explanation
- Small Model Helicopter (Optional)
● **Unit 5.B Lesson 1 – Primary Flight Controls**

  **Flight Simulation Activity**
  - Computer with flight simulation software or flight simulator
  - Joystick or yoke
  - Optional: Throttle quadrant, rudder pedals, additional monitors

● **Unit 5.B Lesson 2 – Secondary Flight Controls**

  **Explore the Effects of Secondary Flight Controls (Optional)**
  - iPads with “Wind Tunnel” application downloaded ($4.99)

● **Unit 5.B Lesson 3 – Flight Controls for Unmanned Aircraft**

  **Drone Flying Challenge! Activity (one per class)**
  - Quadcopter drone and controller (with standard controls if possible) - drone options provided in Unit 2, Section A, Lesson 2
  - 2 hula hoops (optional)

● **Unit 5.C Lesson 1 – Turns and Turning Flight**

  **Rate of Turn and Radius of Turn Equations (per student)**
  - Calculator

● **Unit 5.C Lesson 2 – Load Limits in Aircraft Design**

  **Simulating G-Forces Activity**
  - Small hanging scale (a scale for measuring fish or luggage is appropriate and affordable). Be sure to choose a scale that records the highest weight achieved between resets.
    - AccuDial No Batteries Accurate Easy Reading Analog Compact Handheld Luggage Scale (Amazon $9.99)
    - Travel Smart by Conair Compact Luggage Scale (Amazon $9.97)
  - Object to serve as an approximately 1 lb. weight (such as a small bag of rice or sand)
  - String or S-hook (for hanging the weight from the scale)

  **Teacher Demonstration: High G-Forces And A Pilot’s Blood Supply**
  - Water balloon, half-filled with water
  - String or yarn
  - Smartphone or camera with slow motion video capability
  - Towel or paper towels (optional)
Unit 6 – Career Skills

- **Unit 6.A Lesson 1 – Job Application Practice**
  
  **Sample Job Application Activity**
  - One highlighter (per student)

- **Unit 6.A Lesson 3 – Building/Revising Your Career Portfolio**
  
  **Portfolio Materials (each student)**
  - Three-ring binder
  - Tabs (as needed per student based on table of contents)
  - Plastic or vinyl sheet protectors