11th Grade Aviation STEM Curriculum Materials – Semester 1

Unit 1 - Aviation Weather Theory

Lesson 1.B.1 Makeup of the Atmosphere

Build a Barometer Activity (per group)

- Empty, clear, 2-liter soda bottle, or equivalently sized clear container
- Food coloring
- Ruler
- Marker (permanent)
- Sticky Tack or “mounting putty”
- Clear plastic tube with a small diameter, approximate length of the bottle
- Tape (clear)
- Scissors or utility knife

Build a Hygrometer Activity (per group)

- Two identical spirit (liquid) thermometers that provide access to the “bulb” at the base of the liquid
- 1-liter bottle or milk carton
- Sturdy string
- J-cloth or equivalent water-absorbent, cotton material
- Electrical tape
- Scissors

- Relative humidity table (see https://www.nasa.gov/centers/langley/pdf/245887main_MeteorologyTeacherRes-Ch11.r3.pdf)

Lesson 1.B.2 Atmospheric Circulation and Winds

Convection in Action (per group)

- Wide, heat safe glass container, such as a baking dish
- 8-12 plastic cups used to create a stand for the glass container
- 1 smaller (shorter) plastic cup to use as a candle stand
- Cool water
- 1 small candle
- Matches or lighter
- Metric ruler
- Food coloring
- Eye dropper
- Stopwatch

Uneven Heating (per group)

- 3 sheets (approx. 18–24”) of white paper
- Flashlight
- Metric ruler
- Protractor
- Pencil

Coriolis Force Activity (per group)

- Circular paper disk
- Ruler or straight edge
- Pencil
- Push pin
- Cardboard backing

Summative Assessment (per class)

- Globe or world map
- Yarn and tape

Lesson 1.B.3 Clouds and Precipitation

Dew Point and Moisture Activity (per group)

- Cup (metal is ideal, but glass or hard plastic works)
- Cup (any material) of ice-cold water
- Warm water (8 ounces at about 85 °F)
- Syringe (any type)
- Thermometer

Create a Cloud in a Bottle Activity (per group)

- Water
- Transparent plastic bottle with lid
- Matches

Lesson 1.B.5 Thunderstorms

"Make Your Own Lightning" Activity (per group)

- Rubber gloves (one per student)
- Plastic fork
- Aluminum foil
- Wood or plastic cutting board
- Piece of Styrofoam, such as a plate or rubber balloon (inflated)
- Wool cloth (or hair on a student's head)

Unit 3 - Airport Operations

Lesson 3.A.2 Airport Markings and Signs

Build Your Own Airport Activity

- One gray foam sheet, 12" × 18"
- One black foam sheet, 12" × 18"
- Two pieces white foam board, 20" × 30"
- One roll white craft tape, 1/4" wide
- One roll yellow craft tape, 1/4" wide
- Orange post-it notes
- Toothpick or other craft stick about 2–3" long
- Clear tape
- Three pieces of green felt
- One pack, white 1" numbers
- Ruler

- Tape measure or yard stick
- Scissors
- Exacto knife or box cutter
- Tacky glue
- 17 magnets
- 17 washers

Lesson 3.A.3 Airport Lighting

Finding Airport Lighting Activity (per group)

- Colored adhesive dots (red, green, white, blue, amber/yellow)
- Airport model built in Lesson 3.A.2

Build a Glide Slope Indicator Activity (per group)

- Sheet of paper
- 8 sticky note pads
- Protractor
- 24 inches of string
- Black marker

Lesson 3.A.4 Traffic Patterns

Planning for the Traffic Pattern (per group)

- Satellite Imagery (for example, Google Earth)
- Digital FAA products (https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dafd/search/)
- AirNav (http://www.airnav.com/airports/)
- SkyVector (https://skyvector.com/)

Identifying Traffic Patterns (per group)

- Pad of sticky notes
- Black marker
- Runway and labels from Student Activity 1

Flight Simulation

- Computer with flight simulation software or flight simulator
- Joystick or yoke
- Optional: Throttle quadrant, rudder pedals, additional monitors
- Masking tape may be used for a non-electronic simulation.

Lesson 3.A.5 Communications

Student Controllers and Student Pilots (per class)

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

Lesson 3.A.6 Air Traffic Control

Marco Polo (per group)

- Narrow-focus flashlight or laser pointer
- Meter stick
- 20 strands of yarn (24”/strand)
- 1 roll of strong tape
- 36” × 36” piece of cardboard, cut into the shape of a mountain

Responding to Traffic Calls (per team)

- Bright colored chalk or tape
- 3 sheets of cardboard or blank paper, 8 ½” × 11”

Lesson 3.A.8 Airport Safety and Pilot Considerations

Warm-Up (per class)

- Table
- Large piece of white paper
- Model airplane
- Classroom props (to be used as “targets” in students identifying traffic)

How Close Can They Follow? (per class)

- Table
- 4 model airplanes, ranging in size

Create Your Own Vortices (per group)

- 1 roll of aluminum foil
- 1 meter stick
- 2 cones (any sturdy material), one 6” tall and the other 12” tall
- 2 model airplanes of different size
- 1 roll of Scotch tape

Unit 4 - Introduction to Aeronautical Charts and Airspace

Lesson 4.A.1 Introduction to Aeronautical Charts

Chart the Globe (per group)

- Beach ball, balloon, pumpkin, or other round object to model a globe
- Markers appropriate for marking the “globe” material
- Tailor’s cloth tape measure, or string and ruler

Chart Symbol Matching (per group)

- 24 index cards, cut in half
- Black marker or other writing utensil

Lesson 4.A.1 Introduction to the National Airspace System

Build Your Own Airspace (per group)

- 1 Foam board: 0.9 in. × 11.8 in. × 17.8 in.
- 1 Foam cutter (https://www.michaels.com/floracraft-cleankut-foam-cutter/10596502.html) or X-Acto knife
- Tracing paper
- Hot glue gun and glue
- 1 sectional chart showing Class B airspace or “Sporty’s Sectional Training Chart: VFR Sectional Chart Segment + Legend”

Unit 5 - Post-Course Exam Review

Lesson 5.A.1 Review or Project

- Sticky Notes

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11th Grade Aviation STEM Curriculum Materials – Semester 2: PILOT

Unit 6 - Navigation: Plotting, Pilotage, and Paperwork

Lesson 6.B.1 Makeup of the Atmosphere

- Sporty's Sectional Training Chart for each student or pair of students
- Local Sectional Aeronautical Charts for each student or pair of students
- VFR Sectional Plotter with Rotating Azimuth Wheel
- Ruler for each student or pair of students
- Protractor for each student or pair of students

Flight Simulation Activity: Student Activity 7

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

Lesson 6.B.2 Which Way to Steer?

- VFR sectional chart (local area, Memphis, or any)
- Aeronautical chart plotter with rotating azimuth wheel
- Box fan and balsa gliders

Solving the Triangle Activity: Student Activity 4 (per student)

- Paper
- Protractor
- Straightedge or ruler

Flight Simulation Activity: Student Activity 6 (per group)

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

Wind Correction Diagramming Activity: Student Activity 7 (per group)

- Card stock
- Ruler
- Protractor
- Tape
- Scissors

Lesson 6.B.3 Flight Computers

- VFR sectional aeronautical chart (any area is suitable, but one covering the local area is preferable)
- Aeronautical chart plotter with rotating azimuth wheel
- E6-B manual flight computer

Flight Simulation Activity: Student Activity 3

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

Lesson 6.C.1 Plotting Your Course

- VFR sectional aeronautical chart (any area is suitable, but one covering the local area is preferable)
- Plotter
- E6-B manual flight computer

Lesson 6.C.2 Helpful Documents

- E6-B Flight Computer (manual or electronic)
- VFR sectional charts for local area (digital or paper)
- Chart Supplement for local area (digital or paper)
- Plotter

Lesson 6.C.3 VOR and GPS Navigation

- VFR sectional aeronautical chart (any area is suitable, but one covering the local area is preferable)
- Chart Supplement
- Protractor
- Pencil, ruler indicating centimenters

Unit 7 - Aircraft Performance

Lesson 7.A.1 Weight and Balance

- Calculator

Student Activity 2

- 5 whiteboards or pieces of chart paper
- Markers

Lesson 7.A.2 Density Altitude

- E6-B Flight Computers

Unit 8 - Aeromedical Factors: Am I Safe to Fly?

Lesson 8.B.1 It's Getting Harder to Breathe

It Depends on Oxygen: Student Activity 1 (per group)

- Freestanding candle
- Two large drinking glasses, Mason jars, or similar
- Matches or lighter
- Dry ice and insulated gloves; or
- Baking Soda (2 tablespoons)
- Vinegar (1 cup)

Lesson 8.B.2 Your Eyes are Deceiving You

- Quarters
- Tape

Student Activity 3: Runway Illusions (per group)

- Camera (cell phone camera okay)
- Tripod
- Set of 3 paper runways
- You may print out the images in the PDF titled 3runwaywidths, or you may create your own.
- Tape
- Wedge

Student Activity 4: Runway Illusions Simulator Scenarios

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

Student Activity 5: How Do You See It? (per student)

- 10 index cards
- Pens or markers

Lesson 8.B.3 Disorientation and Motion Sickness

Disorientation and Motion Sickness Teaching Aid 1

- Chair with rotating seat, similar to an office chair
- Blindfold or sleeping eye mask
- Ginger candies
- Peppermint candies
- Small paper bags, or immediate access to a trash can

Disorientation and Motion Sickness Teaching Aid 2

- 1 gelatin ring mold or tube cake pan
- 2 metal washers (⅜" diameter hole)
- 1 plastic soft drink straw
- 1 wooden craft stick
- 1 hot glue gun and appropriate glue stick
- 1 paper clip
- 1 utility knife
- 1 "Lazy Susan" turntable
- Water to fill gelatin ring mold

Unit 10 - Private Pilot Projects

Lesson 10.B.1 Career Portfolio Development

Portfolio Materials (for each student who has not already created a portfolio)

- Three-ring binder
- Tabs (as needed per student based on table of contents)
- Plastic or vinyl sheet protectors
- Access to computers, printers, and scanners for the creation of portfolio materials