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| **Course:** Middle School |
| **Unit:** Flight Level 1 | **exercise:** Paper Airplanes Hallway Flight | **Time Frame:** 1 Hour |
|  | Preparation: *Summary of “to do’s” that the teacher should understand and prepare before bringing this lesson to the classroom.* |
| Teachers will need to ensure that the proper supplies are available for students to build their solutions. From the kit you will need these items:**Materials:*** Copy paper
* Clear tape
* Paper clips

**Tools:*** Ruler
* Pencil
* Drawing tools set
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|  | Safety: *Summary of safety strategies in the lesson.* |
| Please use this space to describe safety procedures or highlights for this lesson.  |
|  | Desired Results:  |
| Established Goals: |  | Transfer: |
| *Problem Solving Techniques and Applications Standards:*Teachers should use the STEM Academy Standards Correlation System available in the STEM Connections area of a unit to extract specific standards and insert these standards here.  | *Students will be able to independently use their learning to…** Design and construct a paper airplane using their knowledge of laws of motion and dynamics of flight.
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| Meaning: |
| Understandings*Students will understand that...** All things that fly need air
* An object in motion stays in motion unless another force acts upon it
* Objects will move faster and farther when a force acts upon it
* When a force acts upon an object, there is an equal and opposite resistant force
* Controlling a plane takes several instruments
 | Essential Questions*Students will keep considering...** How have kites been important to the invention of flight?
* How have humans attempted to fly like birds?
* How can structure affect the flight of an object?
* How exactly does a plane fly?
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| Acquisition OF KNOWLEDGE AND SKILL: |
| *Students will know...** The four forces of flight
* People who have contributed to the invention of flight
* The laws of motion proposed by Sir Isaac Newton
* Definition of roll, pitch, and yaw and how the pilot performs each action
* Air has weight
* The parts of an airplane and their contribution to flight
* The myths, legends, and early attempts of flight

  | *Students will be skilled at...** Investigating scientific experimentation
* Identifying inputs, outputs, and various factors
* Calculating mathematical area, mass, and distance
* Developing and designing a long-distance paper airplane
* Describing an independent variable

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|  | Evidence:  |
| Evaluative Criteria: |  | Assessment Evidence: |
| * Effort/Commitment
* Self-motivated
* Followed criterion
* Appearance
* Creativity
* Time management
* Team work
* Following directions
* Completion
 | *Performance Task(s):* **Paper Airplane**Students will work in pairs to develop and design a paper airplane glider that flies the farthest in a specified hallway path. The activity can be custom fit to students’ learning abilities. For instance, if the students exceed in math, add some trig problems calculating the angle of each flight. To analyze flight performance, you should use a digital camera. Students should create a written problem, criteria, sketches, final drawing, math calculations, handwritten data, and an Excel document with the final results. Compiling this information should be a quick turn-around after the race is over. |
| * Thoughtful, clear, thorough
* Correct answers
 | *Other Evidence:* * Formal report/self-assessment
* End-of-unit quiz
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|  | Learning Plan: *Summary of Key Learning Events and Instruction* |
| **1. Introduce Activity**1. Have students read along and listen as you go over the problem.
2. Students will write the details of the problem on the design brief.
3. Have students read along and listen as you go over the constraints and criteria.
4. Students write down any additional constraints (if applicable) and write down the hardest criteria to work around.

**2. Brainstorm**1. Students will investigate possible designs by reading or watching videos on the Internet.
2. The paper airplane designer should write down and sketch (using pencil only) 5‐10 ideas of what the airplane might look like.
3. Students will talk with their group and choose a final design.
4. Have them construct a full scale drawing and write down dimensions

**3. Construct**1. Students will construct their plane.

**4. Test**1. Students will write down the results of every test flight. In between flights, they will make and write down appropriate modifications.

**5. Communicate Results**1. When the set number of flights is completed and the hand data is written down, it should be transferred to an Excel document and charted in a line graph of some kind.
2. Students will read and write down answers to the reflections questions. They will use this information to type up a formal report that includes a chart.
3. The chart should include the factors of input, the factors of output, and notes on the modifications made in between rounds. It should also include the average distance of the student and the class, as well as the longest distance for the student and the class. You can have students collect this information by discussing their results with teams or have individual teams add their data to a chart on the board to save time. Students or teams should have a written problem, criteria, sketches, final drawing, math calculations, hand written data, and an Excel document with the final results. Compiling this information should be a quick turn‐around after the race is over.

**Progress Monitoring:**Teacher should observe students and provide on-going feedback during the activity. While introducing the unit, the teacher will pause and ask for questions to make sure everyone understands.Students will complete self-assessment and brainstorm how they could improve their skills in the future. At the end of the unit, there will be a quiz to measure their overall understanding. |
|  | Differentiation: *Summary of Key Differentiation Techniques* |
| Please use this space to insert your differentiation techniques. Depending on the needs of students, various techniques might be needed in a classroom, therefore use the information below and experts in the area needed to design your plan for differentiation.The ASCD Study Guide for Integrating Differentiated Instruction and Understating by Design: Connecting Content and Kids.by Carol Ann Tomlinson, Jay McTigheIntegrating Differentiated Instruction and Understating by Design: Connecting Content and Kids.by Carol Ann Tomlinson, Jay McTigheISBN-13: 978-1416602842 ISBN-10: 1416602844Differentiating Reading Instruction*by Laura Robb.*ISBN13: 9780545022989A Teacher's Guide to Differentiating InstructionThe Center for Comprehensive School Reform and Improvement |

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|  | career Connections: *Summary of Career Opportunities Associated with this Lesson* |
| Please use this space to insert careers that might be connected to this lesson. This section will need continuous updating as new careers and emerging technologies change the opportunities available in the workforce.Good sources for career connections:Occupational Outlook Handbook<http://www.bls.gov/ooh>The National Career Clusters® Framework<http://www.careertech.org/career-clusters> |
|  | Keywords: *Please Insert Keywords from this Lesson with their Definitions* |
| Please use this space to insert keywords and their definitionsUse resources like [dictionary.com](http://dictionary.reference.com/) to find definitions to your keywords |