Flighter than Air

Investigating Air and Flight

Including:

THE LAUNCHPAD
EXAMINING THE PROPERTIES OF AIR
HISTORY IN THE MAKING
LIFTING AGAINST THE PULL OF GRAVITY
CITY COUNCIL MEETING
DRAG AND THRUST
HIGH FLYERS
THE TERMINOLOGY TWIST
THE AIR SHOW

An Integrated Unit for Grade 6

Written by:

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Length of Unit: approximately: 16.3 hours

October 2001

Written using the **Ontario Curriculum Unit Planner** 2.51 PLNR_01 March, 2001* Open Printed on Oct 25, 2001 at 2:02:42 PM

The developers are appreciative of the suggestions and comments from teacher colleagues involved through the internal, external and Theological review.

A sincere thank you to Barry Elliott from Windsor-Essex Catholic District School Board who facilitated the involvement of the Windsor-Essex, London, Brant/Haldimand-Norfolk, St. Clair and Durham Catholic District School Boards in the development of elementary Science units.

The following organizations have supported the elementary unit project through team building and leadership:

The Council of Directors of Ontario
The Ontario Curriculum Centre
The Ministry of Education, Curriculum and Assessment Branch
Catholic Curriculum Cooperative (CCC)

A special thank you to The Institute for Catholic Education who provided leadership, direction and support through the Advisory and Curriculum Committees.

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Flighter than Air
Investigating Air and Flight **An Integrated Unit for Grade 6**

Task Context

The students will explore flight, through the many hands-on investigations in this unit. They are to investigate and discuss how flight is dependent on the ability to harness the properties of air. By understanding the relationship between these two concepts, the students will be able to incorporate this knowledge into the creation of their own high flyers.
Further, they will gain a better understanding of how we as humans, through God's grace, have modeled our aviation technology after the many examples present in nature.

Catholic Graduate Expectations:

CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others.

CGE 3c - thinks reflectively and creatively to evaluate situations and solve problems.

CGE 5a - works effectively as an interdependent team member.

CGE 5e - respects the rights, responsibilities and contributions of self and others.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

CGE 7e - witnesses Catholic social teaching by promoting equality, democracy, and solidarity for a just, peaceful and compassionate society.

CGE 7g - respects and understands the history, cultural heritage and pluralism of today's contemporary society.

Task Summary

Through classroom demonstrations, investigations, and discussions on air and flight, the students experience many key learning concepts.

Subtask one sets the stage for the unit by having the students create a KWL chart. They be introduced to the various formats that need to be followed to ensure good organization. Also, the steps of the scientific process will be reviewed during this opening lesson.

In subtask two, the students learn that air has many observable qualities such as weight, pressure, expansion (when heated), and the ability to take up space. They generate write-ups on their findings.

In subtask three, the students begin their work on a research project on the history of flight. They learn, with a distinctive Canadian influence, that the history of flight is a vast and intriguing topic.

In subtask four, the students investigate, through the creation of an aerofoil, that the surface over which air flows affects how well an object will lift away from the gravity pulling it down. They realize that the models of flight provided by nature enable us to advance our aviation technology.

In subtask five, the students are involved in a "city council" meeting designed to deal with the possible effects of having an airforce base being built in a city during a period of war. They discuss the question, "Are war planes considered a misuse of flight?"

In subtask six, the students form predictions and applying results during a classroom demonstration on drag and thrust. They will investigate the four main forces of flight (lift, gravity, thrust, and drag) and the

importance of maintaining a proper balance between them. The three basic movements of flight will also be examined (yaw, pitch, and roll).

In subtask seven, the students assemble various high flyers.

In subtask eight, the key words from the unit come alive as the students prepare a creative class presentation that utilizes the main terminology in the unit.

The culminating task brings together all the concepts explored during the unit. The students demonstrate this knowledge through the creation of their own special flying machines. An "air show" follows the completion of all of their models of flight.

Culminating Task Assessment

The students are challenged to apply what they have learned in the unit to create the best possible flying devices. They can use and combine any devices or methods presented in the unit to generate their flying machines. The flying devices can be created from something familiar or they can be new inventions. A time will need to be set aside for the students to demonstrate their projects, either outside on a calm day or in the school gymnasium. Classes can be invited in to view the air show.

The students are to also create a flight-report guide on their creations, complete with illustrations, descriptions, test flight data, graphs, charts, and a development timeline. (This can be completed in a multimedia format using programs such as ***Hyperstudio***.)

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Links to Prior Knowledge

The following prior knowledge, should not be assumed, but would be most beneficial if taught prior to the onset of this unit:

- Experience with the setup and reporting of a scientific investigation.
- Familiarity with the scientific process (PHEOCA) and an understanding of the need to control the variables in a scientific investigation.
- Experience evaluating data presented on tables, charts, and graphs.
- Co-operative learning skills.
- Research skills involving library resources, multimedia, and/or the use of the Internet.
- Experience writing reports using proper terminology.

From the grade 5 Matter and Materials strand of Science:

- Familiarity with the three different states of matter – solid, liquid, and gas.
- Knowledge that the third state of matter (gas) has no definite volume, but takes the volume and shape of its container.
- Experience with scientific inquiry, design, and communication.

Considerations

Notes to Teacher

GENERAL INFORMATION

- This unit has been designed to meet all of the grade 6 expectations in the Science strand of Matter and Materials. Further, many of the subtasks effectively integrate expectations from English, Arts, Social Studies, and Data Management curriculum strands.

- Plan to collect all of the necessary materials prior to beginning this unit. You may also like to try some of the investigations first, to become more familiar and comfortable with the procedures involved.

- Each subtask notes section contains the answers to the key questions, to clearly explain the concepts being covered.

- Each subtask lesson will offer students strategies they can incorporate into the culminating task activity.

- A clear awareness of the steps involved with the scientific process and a clear understanding of the importance of experimental efficiency need to be stressed from the onset of this unit. Continually examine how the experimental variables are to be utilized to ensure unbiased results.

- Safety procedures are discussed in the unit notes and may appear on the student pages as well. Despite the minimal amount of danger present with the materials in this unit, it is still worthwhile to review any key safety procedures, such as those needed when handling hot water.

- The subtask notes contain information which may be extracted and used as student notes.

- The centre activities in this unit have been designed to accomodate six groups. Ideally, the groups should be composed of individuals that will be working together on the culminating task. By being grouped together throughout the unit, the students will be able to share and plan more efficiently for their air show. Naturally, different classroom situations will warrant a different setup.

- Decide on a flight log format that best suits the class.

- After each subtask, reflect with the students on how they can better prepare for the upcoming air show (see Looking Ahead to the Air Show).

ADAPTATIONS/ACCOMODATIONS

Learning accommodations are provided for a variety of exceptionality identifications. They include reference to both material and human resources. As well, the resources of the various associations represented on your board's Special Education Advisory Committee - SEAC should be accessed. In many cases, they will be able to provide materials, kits, and speakers, or they will be able to assist you in locating other resources.

- Any changes made with regards to the learning experiences, assessment, and evaluation strategies should be made with consideration of the particular learning style of the student or students in question.

- Since the students will be exposed to terminology related to air and flight, they are to maintain a personal word list, complete with definitions.

- Each subtask adaptation section is divided into three categories: 1. Enrichment Opportunities, 2. ESL/ESD, and 3. Additional Support.

KEEPING A CATHOLIC PERSPECTIVE

As with any technological breakthrough, we must also ask ourselves if we are using our advancement in flight in the way that God intended. Have we properly looked at the pollution controls and safety issues of the communities and nations being served by our aircrafts? We have been able to transport relief help to millions around the the world in our global humanitarian efforts. Still, however, many people in many lands see only

bombs or chemicals being dropped from planes in purposeful acts of aggression. The air they see may be black and ominous as opposed to clear and refreshing. These key issues need to be a form of ongoing discussion throughout the unit.

Despite some of these potential misuses, humans still continue to reach new milestones in the area of flight. Whether it's a plane soaring overhead or a helicopter rising from its launchpad, the beauty of flight never fails to capture our interest and curiosity.

Flighter than Air

Investigating Air and Flight An Integrated Unit for Grade 6

1 THE LAUNCHPAD

The students will be brainstorming on terms related to both air and flight. This activity is intended as a springboard into the investigations and lessons that follow. All students will be contributing towards the development of a KWL class chart, outlining what they already know, what they wonder, and what they want to know more about with this topic.

A sample investigation is examined by the class to identify the steps in a scientific investigation. Also examined, is how the variables are to be controlled during the experimental set-up. A scientific write-up format is firmly established through this opening activity.

The culminating task and rubric will be given to the students as part of the lesson. Further, they will take part in a discussion over whether or not we are valuing our air properly, and/or if we are putting our advancements in flight to good use.

At the conclusion of this initial lesson, the teacher will better understand the degree of prior knowledge which the students bring to this unit.

Catholic Graduate Expectations

CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others.

CGE 3c - thinks reflectively and creatively to evaluate situations and solve problems.

2 EXAMINING THE PROPERTIES OF AIR

Through a hands-on approach, the students will closely examine the following key properties of air:

1. Air takes up space.
2. Air has weight.
3. Air has pressure.
4. Air expands when heated.
5. Air can be compressed to lift objects.
6. Gravity acts on all forces equally.

The students will be in six groups, rotating through six centres.
Key questions and key words are introduced and are kept in the students' flight log books.

Catholic Graduate Expectations

CGE 5a - works effectively as an interdependent team member.

CGE 5e - respects the rights, responsibilities and contributions of self and others.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

3 HISTORY IN THE MAKING

CREATING A PAST AND FUTURE TIMELINE OF FLIGHT:

The students work in pairs to research the major milestones in the history of world flight and in the history of Canada, using the Internet, school library, and/or local library. After researching the information the students create and add three future milestones to their timelines. (Real or fictional names can be used to add flare to their entries.)

As an added component, each pair group reports on a special person or event from their timeline.

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CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

CGE 7g - respects and understands the history, cultural heritage and pluralism of today's contemporary society.

4 LIFTING AGAINST THE PULL OF GRAVITY

In this activity the students will explore the concept that the amount of lift is controlled by three main factors: surface area, shape, and the angle of approach.

Through investigations with surface area, Bernoulli's principle, and an airfoil, the students will discover ways of creating lift to overcome the force of gravity. As a response activity, they will write a news article highlighting what they've learned (i.e., "Gravity Conquered by Lift!").

Further, the students will discuss the occurrence of flight in nature. We as humans have merely taken the examples that God has provided, and utilized them to create and enhance our own flight technology.

Catholic Graduate Expectation

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

5 CITY COUNCIL MEETING

The students will take on the roles of all the key members in the following situation:

You live in a country that is involved in ongoing peace talks with your neighbours to the north and south. These talks continually breakdown and are usually followed by isolated incidents of aggression. Your government is planning to open three new air bases at key locations in the country. One of the considered locations is right in the heart of your relatively peaceful city. The government has sent out a group of officials to visit all of the cities that are being considered. This group is to attend a city council meeting where the topic of the air base will be first and foremost on the list. Their feedback and recommendations will be major deciding factors in the final location decision.

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CGE 7e - witnesses Catholic social teaching by promoting equality, democracy, and solidarity for a just, peaceful and compassionate society.

6 DRAG AND THRUST

The students will learn the meanings of drag and thrust, through a demonstration involving air-powered rocket balloons that race horizontally and vertically in the classroom. They will also be testing out their predictions as to how far the rockets will travel under various conditions. A double bar graph will then be generated by each student to give a visual description of the results that take place.

Catholic Graduate Expectations

CGE 3c - thinks reflectively and creatively to evaluate situations and solve problems.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

7 HIGH FLYERS

In small groups, the students will rotate through the following flight centres, where they will be able to demonstrate the key learnings experienced up to this point in the unit.

1) Creation of a hot air balloon
2) Creation of a parachute
3) Creation of a helicopter
4) Creation of a basic glider
5) Creation of a surface floater

The interaction between the four forces of flight (gravity, lift, thrust, and drag) will be a primary focus in this subtask.

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8 THE TERMINOLOGY TWIST

In small groups, the students prepare and present one of the scenarios below:

a. Commercial: Selling a product related to the unit
b. News report on an interesting development in aviation
c. Interview with a famous aviator
d. Musical jingle
e. Rhyming poem

The focus will be on the terminology highlighted throughout the unit.

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CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others.

9 THE AIR SHOW

The students are challenged to apply what they have learned in the unit to create the best possible flying devices. They can use and combine any devices or methods presented in the unit to generate their flying machines. The flying devices can be created from something familiar or they can be new inventions. A time will need to be set aside for the students to demonstrate their projects, either outside on a calm day or in the school gymnasium. Classes can be invited in to view the air show.

The students are to also create a flight-report guide on their creations, complete with illustrations, descriptions, test flight data, graphs, charts, and a development timeline. (This can be completed in a multimedia format using programs such as ***Hyperstudio***.)

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Flighter than Air

Investigating Air and Flight **An Integrated Unit for Grade 6**

50 mins

Description

The students will be brainstorming on terms related to both air and flight. This activity is intended as a springboard into the investigations and lessons that follow. All students will be contributing towards the development of a KWL class chart, outlining what they already know, what they wonder, and what they want to know more about with this topic.

A sample investigation is examined by the class to identify the steps in a scientific investigation. Also examined, is how the variables are to be controlled during the experimental set-up. A scientific write-up format is firmly established through this opening activity.

The culminating task and rubric will be given to the students as part of the lesson. Further, they will take part in a discussion over whether or not we are valuing our air properly, and/or if we are putting our advancements in flight to good use.

At the conclusion of this initial lesson, the teacher will better understand the degree of prior knowledge which the students bring to this unit.

Catholic Graduate Expectations

CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others.

CGE 3c - thinks reflectively and creatively to evaluate situations and solve problems.

Expectations

6e44 A – understand specialized words or terms, as necessary (e.g., medieval in a historical novel);

6s37 A – formulate questions about and identify needs and problems related to the properties of air and characteristics of flight, and explore possible answers and solutions (e.g., investigate whether the shape of a plane affects its flight path);

6a25 A • produce two- and three-dimensional works of art that communicate a range of ideas (thoughts, feelings, experiences) for specific purposes and to specific audiences, using a variety of familiar art tools, materials, and techniques;

6s39 A – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

Groupings

Students Working As A Whole Class
Students Working In Small Groups
Students Working Individually

Teaching / Learning Strategies

Brainstorming
Collaborative/co-operative Learning
Classifying
Discussion

Assessment

1.Take anecdotal notes on the students during the brainstorming and sharing phases of this lesson. Focus on the degree of prior learning and the different levels of student involvement that are present during this initial activity. Consider this information when grouping students for upcoming investigations and for the culminating task.
2. Collect their journals to verify neatness and proper format.
3. Collect and assess their title pages for neatness, creativity, and topic relevance.

Assessment Strategies

Observation
Response Journal

Assessment Recording Devices
Anecdotal Record

Teaching / Learning

KEY WORDS: FLIGHT, AIR

THE LESSON:

A). CREATING A KWL CLASS CHART

1. Divide the class into six groups. Each group is given a set of dictionaries, a large piece of chart paper, and some coloured markers.
2. As a class have the students look up the verb meaning of fly. Agree on a definition and copy it down so that it is visible to all students.
3. Next, have the students locate the definition of air. Agree on a definition and copy it down so that it is visible to all students.
4. Use the attached brainstorming sheets to model proper format for the next step.
5. Based on the theme of flight, have the groups brainstorm on their chart paper as many words and/or pictures as they can in three to five minutes time.
6. Using a fresh piece of chart paper, have them repeat the same process for the theme of air.
7. Next, have each group post and share their charts with the class.
8. From the student created charts, generate a K (what they know), W (what they wonder), L (what they learned) class chart with the students***.*** Be sure to point out the selections that involve both air and flight. Keep this chart visible and available throughout the unit.

B). THE SCIENTIFIC PROCESS

9. Explain that this unit will be filled with many hands-on investigations. Review and discuss the steps of PHEOCA and why it is important to control the proper variables in a scientific investigation.

C). ESSENTIALS OF THE UNIT

10. Present the culminating task and rubric to the students. Be sure that a copy of both are given to each student. Discuss the criteria you have established for this task.
11. Introduce the flight log concept to the students. Explain that this is a daily science journal that will be used throughout the unit to add vocabulary, ideas, diagrams, and important information that will help them better plan for their air show activity. It can be in the form of a duotang, notebook, or a creation approved by you.

RESPONSE ACTIVITIES:

1. Have the student copy down the steps of PHEOCA into their flight logs.
2. Have them answer the following in their flight logs:
A. "What would God be most proud of with regards to how humans have utilized his gifts of air and flight?"
B. "What would disappoint God the most about our use of his gifts of air and flight?"
After they have had time to jot down their ideas, discuss these two questions in greater depth, citing clear examples (i.e., food transport vs. war), and pertinent Biblical passages (Included in Notes To Teacher).
3. The students can begin designing their ***covers*** or title pages for the unit by using the items produced on the charts as inspiration.

LOOKING AHEAD TO THE AIR SHOW

- The students can begin to think about their own designs for the air show. Also, they can begin to develop the steps of PHEOCA for this culminating task.
- The students can also look more closely at the rubric criteria attached to this culminating task.

Flighter than Air

Investigating Air and Flight **An Integrated Unit for Grade 6**

Adaptations

Enrichment Opportunities:

- The students could arrange for a guest speaker to come to the class to speak on the topic of air and flight. They would have to create the invitation and select the criteria for a good speaker.
- The students could begin to locate Web sites that enhance the unit.

ESL/ESD:

• Allow time for students to adjust to the new environment and unfamiliar learning experiences.
• Give clear instructions accompanied by visual clues.
• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.
• Provide project checklist with timelines and essential resources.
• Send home short description of project and keep parents informed/involved.
• Make sure that students can see and hear clearly (e.g., avoid placing them at the back of the room).
• Encourage students to develop their own dictionary/glossaries.

Additional Support:

- Allow students to make use of diagrams to explain their thinking. (See attached resource list.)

Resources

Flight web	1_Flight web.cwk
Air web	1_Air web.cwk
KWL chart	1_KWL.cwk
PHEOCA steps	1_PHEOCA.cwk
Getting Ready For the Air Show	1_Getting ready.cwk
The New Webster Encyclopedic Dictionary of the English Language	
Launch Pad Group materials	
Assessment Accommodations	
Assignment and Project Accommodations	
Organization Accommodations	
Presentation Accommodations	

Notes to Teacher

KEY QUESTIONS:

(To be completed in the flight log)
A. "What would God be most proud of with regards to how humans have utilized his gifts of air and flight?"
B. "What would disappoint God the most about our use of his gifts of air and flight?"

NOTES:

The following are dictionary definitions of fly and air.
FLY: To move through the air by the aid of wings, or by the force of wind, or by other impulse.
AIR: An invisible gaseous substance surrounding Earth.
The step of PHEOCA are: Purpose, Hypothesis, Experiment, Observation, Conclusion, and Application

The following Biblical references dealing with air and flight can be cited and discussed:
Air: Genesis 1:26-30, 2:19, 6:7, 7:23
Flight: Job 39:26, Psalm 104:7, Isaiah 10:31, Matthew 24:20
You may want to refer to the flight timeline sheet in subtask two to cite the pros and cons of flight technology (i.e., passenger travel vs. war).

Be sure to have the following materials and handouts:

1. Flight log - will be started and will be filled in throughout the unit.
2. Student sheets:
a) PHEOCA steps
b) culminating task and accompanying rubri**c**
3. Optional overhead BLMS - webs, culminating task, culminating task rubric, KWL chart, PHEOCA steps

Decide, with your students, whether to have the culminating task completed individually or in pairs, and what the written report should include. Incorporate their suggestions into the outline provided.

Inform the students that even though this is a culminating task, the bulk of the work must be completed before the end of the unit. Some time will be given to add final details and to conduct testing, but only after the original model has been constructed.

Decide and inform the students on how much class time will be devoted to the culminating task.

Teacher Reflections

Description

Through a hands-on approach, the students will closely examine the following key properties of air:

1. Air takes up space.
2. Air has weight.
3. Air has pressure.
4. Air expands when heated.
5. Air can be compressed to lift objects.
6. Gravity acts on all forces equally.

The students will be in six groups, rotating through six centres.
Key questions and key words are introduced and are kept in the students' flight log books.

Catholic Graduate Expectations

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Expectations

6s28 A – demonstrate understanding that gases expand to fill a space;

6s29 A – demonstrate that air expands when heated (e.g., heat a garbage bag partially filled with air using a blow dryer);

6s38 A – plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

6s39 A – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

6s41 A – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, graphs, drawings, and oral presentations (e.g., hold an invention convention on things that fly).

6s43 A – describe how the properties of air, such as its compressibility and insulating quality, are used in common products (e.g., automobile tires, double-glazed glass, sleeping bags, fire extinguishers);

6e1 A • communicate ideas and information for a variety of purposes (to inform, to persuade, to explain) and to specific audiences (e.g., write the instructions for building an electrical circuit for an audience unfamiliar with the technical terminology);

Groupings

Students Working In Small Groups
Students Working Individually

Teaching / Learning Strategies

Demonstration
Discussion
Experimenting
Learning Centres
Learning Log/ Journal

Assessment

1. Record anecdotal notes when possible on the students as they set up and carry out each investigation.
2. Collect experiment write-ups and assess according to the attached rubric.
3. Collect flight log books to monitor proper format and detail. The key questions from each centre can be assessed based on a level format, as outlined in the ministry curriculum document.

Assessment Strategies

Observation
Response Journal
Learning Log

Assessment Recording Devices
Rubric
Anecdotal Record
Rating Scale

Teaching / Learning

KEY WORDS: Pressure, Variable, Fair Test

REVIEW:
- The students' answers to the questions from subtask one.
- The sample experiment from last day -the importance of controlling the ***variables.***

The steps of PHEOCA are to be completed for each activity centre.

THE LESSON: The following subtask is set-up as centres for the students to rotate through in small groups. (See subtask notes for information and question answers.)

1. Display and explain the write-up sheet.
2. Students complete two centre activities each day.
3. Key questions are to be completed in their flight log books.

CENTRE #1: (AIR TAKES UP SPACE)

EXPERIMENT A:
1. Students crumple a piece of paper or small washcloth into the bottom of a plastic cup. Tape may have to be used to keep the paper at the bottom of the cup.
2. The cup is then turned straight over and submerged straight under the water.
3. The cup is then removed straight out of the water.
4. The cloth or paper will remain dry within the cup.

EXPERIMENT B:
1. Students turn a cup straight over and submerge it straight under the water.
2. While under the water the cup is turned over to allow some air to escape and water to rush in. Then it is placed back in a straight upside down position.
3. Students slip one end of a flexible straw under and inside the cup, while the other protrudes above the surface of the water.
4. A student then blows through the straw while another holds the cup steady.
5. A large air pocket will form due to the newly introduced air.

Note: This could also be accomplished without the straw, by transferring air bubbles from one cup to another.

CENTRE #2: THE BALLOON SCALE (AIR HAS WEIGHT)
1. Tie the string at the centre of the metre stick and set it aside.
2. Inflate two balloons to approximately the same size and tie each at opposite ends of a metre stick.
3. Suspend the metre stick such that it is horizontally balanced by the two balloons.
4. When the set-up is level, tape can be used to hold things in place.
5. The students then puncture one of the balloons with a pin and observe and record the results.

CENTRE #3: (AIR HAS PRESSURE)
EXPERIMENT A:
1. Students fill the glass three-quarters full with water, making sure that the rim is wet.

2. Carefully place the cardboard square to create a tight seal (no air bubbles between the cardboard and the glass).
3. The glass, with the student still holding onto the cardboard, is then turned over above the aquarium or sink basin.
4. The cardboard is then released.
This may take a few tries.
5. The students record the results.

EXPERIMENT B:
1. Lay a ruler on a table so that about one third of it lies over the edge.
2. Spread and smooth a piece of paper over the ruler. Now try to make the paper fly into the air by hitting the ruler downward with a fast and hard motion.
3. Remind students about safety considerations.

CENTRE #4: AIR EXPANDS WHEN HEATED:
1. Stretch out a balloon and place its open end over the mouth of a plastic pop bottle.
2. The bottle is then submerged in the hot water container and is observed. (Kettle and ice are needed.)
3. Next, the bottle is placed into the ice cold water and is observed.
4. Remind students about safety considerations.

CENTRE #5: PREDICTION AND TESTING CENTRE:
1. Based on a simple diagram and a simple set of instructions, have the students fill in the prediction section of their chart (see BLM).
2. The students then set up, test, and complete the observation section of the chart.

CENTRE #6: PLANNING PERIOD:
1. Students can use this time to think ahead to their culminating task or they can use this time to complete their write-ups.

RESPONSE ACTIVITIES:
1. Students complete write-ups for the first five centres.
2. Key questions are completed in their flight log books.

LOOKING AHEAD TO THE AIR SHOW:
Students might use the information gathered on the properties of air to plan their creations for the air show. They may decide to use hot air or they may decide to find ways to reduce the pressure exerted on their flying machine.
The write-up format and PHEOCA steps can be improved upon after this lesson.

Adaptations

Enrichment Opportunities:
- Students can develop their own tests to examine the properties of air.
- Students can brainstorm on ways we use the properties of air (i.e., hydraulic jacks, high-pressure car washes).

ESL/ESD:
• Teach students how to paraphrase, organize and present material.
• Simplify text or have available textbooks with material at a variety of reading levels/complexity.
• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.
• Make notes to signpost key ideas and new words.
• Allow extra time to complete tasks/tests.

• Explain/simplify instructions and questions, if necessary, to ensure that students understand what they are being asked to do.
• Provide a variety options for assignments (not all written).

Additional Support:
(see resource list from subtask one)
• Allow extra time to complete tasks/tests.
- Ensure that instructions are clear.
- Minimize or rephrase the key questions.

Resources

The Write-Up	
Centre Write-ups	2_Centre Write-ups.cwk
Centre #5: Predict and Test	2_predictions.cwk
Centre #1: Materials	
Centre #2: Materials	
Centre #3: Materials	
Centre #4: Materials	
Centre #5: Material	

Notes to Teacher

The key questions are found on the student write-up pages - Conclusion/Application section. The students are to answer these questions in their flight log books.

SOME BACKGROUND INFORMATION

- Air is a gas, which is a form of matter. Air takes up space. Air exerts pressure. Air has weight.
- Air pressure is present on the earth's surface. The air is held to the earth by the force of gravity. The farther you are from the earth's surface, the less air pressure there is because there is less gravity. In outer space, there is no gravity and so there is no air pressure. Gravity is what holds the air pressure together.

KEY QUESTIONS AND ANSWERS:

Centre #1a:
1." Why didn't the paper inside the glass get wet?"
(Air takes up space, which means that the water will not enter the air pocket holding the material.)
Centre #1b:
1. "Explain what happened to the water in the second glass." (Water in the second glass is driven out by air rising from the first glass. The first glass fills with water, which replaces the lost air.)
2. "Explain a situation where an air pocket could save your life." (Trapped in an underwater cave or boat.)

Centre #2:
1. **"Which end rose up and why?"**
(When the balloons are both filled with air, they weigh the same, and therefore balance. When the air is let out of one of the balloons, they no longer have the same weight. The balloon filled with air is heavier than the balloon with no air inside it, and therefore drops. The key is that the full balloon has air at a slightly higher pressure (hence greater density) than the surrounding air. Note: The air in a regular classroom weighs about 160 pounds or 72 kilograms.)
2. **"Why does your stomach feel queasy when you go over a hill or down a roller coaster?"**
(When you're in an elevator moving downward, you briefly feel lighter. If you were standing on a scale in the elevator, you would notice the reading drop. You are approaching weightlessness when you crest a hill in a car or roller coaster. Your stomach is used to feeling weight. When this feeling disappears, you may feel queasy.)

Centre #3a:
1. "What happened to the water when your hand was removed?" (Outside air pressure is greater than the inside water pressure.)
Centre #3b:
2. "Why was it so difficult to lift the paper with the ruler?" (The air pressure pushing down on the large area of the newspaper is great enough to hold the ruler in place.)
3. "Give examples of daily occurrences which use vehicles which you've learned in this investigation?" (Submarines and airplanes.)

Centre #4:
1. "Why did the balloon react this way?" (When the air in the balloon is warmed by the hot water, it expands the balloon. When the air is cooled by the ice water, it contracts the balloon.)
2. "With what you have just learned, describe how a hot-air balloon pilot would get his/her balloon to clear a fast approaching hill." (Adding more heat will cause the balloon to rise above the hill.)

Centre #5: Notes for Review
1. Funnel and ping pong ball: (By blowing into the funnel, the velocity of the air is greater above the ping pong ball than below. When the air reaches the larger cross section, it spreads out and thus slows down. The pressure is less where the air is going faster, above the ball, and greater where the air is going slower, below the ball. A force is created going from high to low pressure, and this keeps the ball up despite gravity.)
Example: Bingo machines

2. Musical bottles: (There is a different amount of air in each bottle so each bottle makes a different sound.)
Example: Musical instruments

3. The Ball Drop: (Galileo first discovered this concept that gravity acts on all objects with the same force, regardless of the mass or size of the object. If conducted properly, the balls will strike the ground at the same time.)
Example: People of different weights skydiving

4. Lifting the books with air: (The books are supported by the compressed air in the bag.)
Example: (Filling tires with air)

Centre #6: Time is allotted for the group to write up the experiments and describe how the properties of air are used in common products.

NOTES:
- Allow time to review with the students the importance of keeping all variables constant except for those being manipulated. Have them cite examples from their work at the centres.
- The student write-ups follow the format of a scientific investigation (Purpose, Hypothesis, Experiment, Observation, Conclusion, and Application) and are to be completed by each student after each investigation.
- Be sure to check for proper neatness and organization of the flight log entries.
- Be sure that each centre has its material supply replenished daily. Small storage bins can be used to easily maintain and transport the equipment required for each centre.
- Circulate continuously to monitor the progress of each investigation.
- Remind students that after completing a centre they are responsible for preparing the materials for the next group.
- Make sufficient copies of the student write-up sheets and of the rewritten, "students-friendly," task specific rubric. Alternatively, the overhead or blackboard can be used in the place of photocopying.

SAFETY PRECAUTION: Provide protective gloves and closely monitor the use of the kettle.

Teacher Reflections

Flighter than Air

Investigating Air and Flight **An Integrated Unit for Grade 6** **100 mins**

Description

CREATING A PAST AND FUTURE TIMELINE OF FLIGHT:

The students work in pairs to research the major milestones in the history of world flight and in the history of Canada, using the Internet, school library, and/or local library. After researching the information the students create and add three future milestones to their timelines. (Real or fictional names can be used to add flare to their entries.)

As an added component, each pair group reports on a special person or event from their timeline.

Catholic Graduate Expectations

CGE 5a - works effectively as an interdependent team member.

CGE 5e - respects the rights, responsibilities and contributions of self and others.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

CGE 7g - respects and understands the history, cultural heritage and pluralism of today's contemporary society.

Expectations

6e21 A	– accurately use appropriate organizers (e.g., table of contents, index);
6e36 A	– plan a research project and carry out the research;
6e8 A	• proofread and correct their final drafts, focusing on grammar, punctuation, spelling, and conventions of style;
6s47 A	– describe milestones in the history of air and space travel;
6s26 A	• identify design features (of products or structures) that make use of the properties of air, and give examples of technological innovations that have helped inventors to create or improve flying devices.

Groupings

Students Working In Pairs
Students Working As A Whole Class

Teaching / Learning Strategies

Advance Organizer
Brainstorming
Research

Assessment

1. Continue to observe and keep anecdotal notes on the process phase of this assignment.
2. Use the rubric to assess the overall project.
3. Have the students assess their own contributions to the project.

Assessment Strategies

Performance Task
Self Assessment

Assessment Recording Devices

Rubric
Anecdotal Record

Teaching / Learning

KEY WORD: milestone

REVIEW:
- The answers to the key questions from the previous subtask (see unit notes from the last subtask). Encourage the students to add new information to their own answers.

Through discussion with the students, add more detail to the wonder and learned columns of their KWL class chart.

THE LESSON:
1. Generate with the students, a list of as many flight milestones as they can think of. Discuss possible future milestones as well.
2. Using the project outline, student pairs research the major milestones in the history of world flight, with a special focus on Canadian content. They are encouraged to use the Internet, school library, and/or local library.
3. After researching the information the students are to then create three milestones for the future. Real or fictional names can be included to add flare to their entries.
4. From the information, the students construct a large flight timeline of the past and future.
5. As indicated in the project outline, each student pair is to report on a special person or event from their timeline.
6. The students add their own family milestones to the timelines as well.
7. Show the project rubric to students.

RESPONSE ACTIVITIES:
1. Students complete a flight timeline.
2. Students complete a special report on a person or event from their timelines.
3. The completed timelines and reports will be displayed for other classes to see during the air show.

LOOKING AHEAD TO THE AIR SHOW:
From all the historical information gathered, the students are to select which of the designs they would like to adapt. They are to point out the similarities between their own creations and ones from past history.

Adaptations

Enrichment Opportunities:
- Students can generate a game in which key dates and events are matched up.
- Students can create their own History of Flight Web site.

ESL/ESD:
• Have students retell in their own words to be sure that directions/instruction have been understood.
• Teach students how to paraphrase, organize, and present material.
• Simplify text or have available textbooks with material at a variety of reading levels/complexity.
• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.
• Provide project checklist with timelines and essential resources.
• Send home short description of project and keep parents informed/involved.

Additional Support:
(See resource list from subtask one for project accomodations.)

Flighter than Air

Investigating Air and Flight **An Integrated Unit for Grade 6** **100 mins**

Resources

Timeline/Report

History of Flight: Student Page	3_timeline.cwk
History of Flight: Information sheet	3_History of Flight.pdf
Self-Assessment: History of Flight	3_Self-Assess History.cwk

Flight timeline materials

Notes to Teacher

NOTES:

- This project is given early on in the unit so that additional work can be completed during computer lab or Language Arts.
- Remind the students to select their partners wisely.
- Look closely at the amount of time available for research. This will help in applying a due date to the project.
- Consider using a computer presentation program if one is available (such as Hyperstudio).
- Consult with the local librarian to help locate materials, books, etc.
- Look at Unit Wide Resources for additional help locating research materials.
- Be sure to display the finished products proudly about the classroom or school during the air show.

Teacher Reflections

Description

In this activity the students will explore the concept that the amount of lift is controlled by three main factors: surface area, shape, and the angle of approach.

Through investigations with surface area, Bernoulli's principle, and an airfoil, the students will discover ways of creating lift to overcome the force of gravity. As a response activity, they will write a news article highlighting what they've learned (i.e., "Gravity Conquered by Lift!").

Further, the students will discuss the occurrence of flight in nature. We as humans have merely taken the examples that God has provided, and utilized them to create and enhance our own flight technology.

Catholic Graduate Expectation

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

Expectations

6s27 A – recognize that gravity does not depend on the presence of air;

6s39 A – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

6s40 A – compile data gathered through investigation in order to record and present results, using tally charts, tables, labelled graphs, and scatter plots produced by hand or with a computer (e.g., record the flight distances of different styles of paper airplanes, and present their findings in a graph);

6s46 A – compare living things to identify the different features that allow them to be transported by wind (e.g., differences among spores, pollen, seeds);

6s30 A – demonstrate and explain how the shape of a surface over which air flows affects the role of lift (Bernoulli's principle) in overcoming gravity (e.g., changing the shape of airplane wings affects the air flow around them);

6s42 A – identify devices that involve the application of Bernoulli's principle (e.g., paint sprayer, carburetor);

6e8 A • proofread and correct their final drafts, focusing on grammar, punctuation, spelling, and conventions of style;

6e1 A • communicate ideas and information for a variety of purposes (to inform, to persuade, to explain) and to specific audiences (e.g., write the instructions for building an electrical circuit for an audience unfamiliar with the technical terminology);

Groupings

Students Working Individually
Students Working As A Whole Class

Teaching / Learning Strategies

Demonstration
Brainstorming
Discussion
Model Making
Response Journal

Assessment

1. Continue to record anecdotal notes on the students as they work on their airfoil. Does it perform the function it was designed for?
2. Assess their news stories using the attached rubric.
3. Collect flight logs to monitor proper format and detail. The key questions from each centre can be assessed based on a level format, as outlined in the ministry curriculum document.

Assessment Strategies

Response Journal

Assessment Recording Devices

Rating Scale
Rubric

Teaching / Learning

KEY WORDS: **Bernoulli's Principle, Lift, Gravity, Air Pressure, Aerodynamic**

THE LESSON: (See subtask notes for background information and question answers.)
1. Set up columns on the board or overhead to brainstorm with the class flyers, gliders, and floaters that are present in nature and/or that are created by man.
2. Discuss the characteristics of the three categories.
3. Reinforce the fact that God is responsible for the occurrence of these characteristics in nature. We as humans have merely taken these examples and utilized them to create and enhance our own flight technology.
4. Discuss the meaning of aerodynamic.

DEMONSTRATION WITH CLASS #1: SURFACE AREA

1. Highlight the gliders and floaters from the charts created in class.
2. Next, have the students form a piece of paper into a ball and release it to the floor. After retrieving it, they are to smooth it out and release it again from the same height. Discuss the results.
3. Discuss the effect of your discoveries on the surface area on a glider or floater.

DEMONSTRATION WITH THE CLASS #2: CREATING LIFT (BERNOULLI'S PRINCIPLE)

1. Have the students hold a strip of paper about 3 cm x 12 cm across their hands as is pictured on the student page. Have them blow straight over the top of the strip.
2. Have the students hold two pieces of paper in front of their faces. Next, they blow air between the sheets to try and separate them.
3. Discuss Bernoulli's principle and its impact on lift.

STUDENT ACTIVITY: CREATING AN AIRFOIL

Procedures:
1. The students fold a strip of paper in half and tape the top edge about 3 cm from the bottom edge. This makes the top surface curved and gives the paper the shape of an airplane wing.
2. Next, they slide a ruler into the fold of the paper.
3. The students then blow on the front of the wing.
4. Finally, they swing the wing design through the air at different angles.
5. Discuss the importance of such a design on airplanes.

RESPONSE ACTIVITIES:
1. Go over the wings and lift blackline master with the students. Have them copy the simple diagrams and labels into their flight logs.
2. The students create a news headline.

Student instructions:
Create an exciting news article using detail, diagrams, and proper terminology, which clearly shows how flying vehicles effectively overcome the law of gravity. Describe some of the essential qualities that wings must have in order to effectively function on a flying object. What are some things that could go wrong? Use the information gathered from your experiments today to enhance your article.

Include a title page with your report.

3. Key questions are completed in their flight logs.

LOOKING AHEAD TO THE AIR SHOW:

- Students use the information gathered on lift, to better plan their creations for the air show. They may begin to look at reducing the amount of weight or may even begin to think about increasing the amount of thrust in their designs. The students may also start thinking about ways to make their flying machines more aerodynamic.
- The write-up format and PHEOCA steps can be reviewed after this lesson.

Adaptations

Enrichment Opportunities:

- Students could explore Web sites and textbooks to create a wind tunnel to test the lifts and aerodynamics of various objects.

ESL/ESD:

• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.
• Make sure that students can see and hear clearly (e.g., avoid placing them at the back of the room).
• Allow extra time to complete tasks/tests.
• Explain/simplify instructions and questions, if necessary, to ensure that students understand what they are being asked to do.
• Provide a variety of options for assignments (not all written.)

Additional Support:
(see resource list from subtask one)

• Allow extra time to complete tasks/tests.
- Insure that instructions are clear.
- Minimize or rephrase the key questions.

Resources

News Article

Creating an Aerofoil: Write-up 4_Creating an Aerofoil.cwk

WINGS AND LIFT 4_Bernoulli.cwk

Subtask #4: Materials

Notes to Teacher

The key questions are found on the student write-up pages - Conclusion/Application section. The students are to answer these questions in their flight log books.

Lift: When air flows over the top of the wing of a plane, it needs to flow in a curved shape. To do this, the pressure of the air right above the wing needs to be at a slightly lower pressure than the air above it, so the air will get pushed to flow around the wing.

The air over the top of a plane is then at a lower pressure than the air underneath it and the plane is pushed upwards - which we call lift. This basic concept of lift can be applied to a frisbee as well. The frisbee is shaped so that the air travels faster over the top than under the bottom. Hence, when the frisbee moves through the air, it rises.

Examples of Floaters (objects that use air to support them as they drift to the Earth): balloons, bubbles, seeds, frisbees, and parachutes.

Examples of Gliders (animals and human-made objects that use design to prolong their time in the air): hang gliders, kites, and certain mammals.

Examples of Flyers (animals and machines able of moving from location to location through the use of thrust): birds, insects, airplanes, helicopters, and rockets.

Bernoulli's Principle or Effect: The faster air moves, the more its pressure drops. Therefore, an airplane's wings have a low pressure area directly over their upper surfaces. This causes the higher air pressure underneath each wing to push the plane into the air. This rising of the airplane due to Bernoulli's Principle is known as induced lift.

KEY QUESTIONS AND ANSWERS:

DEMONSTRATION #1: SURFACE AREA

1. "Do you believe that the weight of the paper has anything to do with it falling or floating?"
2. "What are some factors that affect how the long the paper stays in the air?"
(A paper ball has a smaller surface area than a smoothed out sheet and consequently goes directly to the floor. The smoothed out paper has more surface area and is able to ride on the air beneath it more effectively than the paper ball. Bird wings have a large surface area and a special shape that help keep birds in the air. Large gliders use the same basic principles as these bird wings. So in order to stay aloft for any period of time, an object needs to find ways to overcome the force of gravity pulling it downward).

DEMONSTRATION AND INVESTIGATION #2: BERNOULLI'S PRINCIPLE

1. "How did the papers react in each of the investigations?"
(Lift was created by the stream of air being blown across the top of the paper because it decreased the air pressure pushing downward. Therefore the pressure under the paper is stronger than the pressure above it; thus it rises).

INVESTIGATION: CREATING AN AEROFOIL

1. "What did the aerofoil do when wind was introduced to its front face?" (The top surface of the wing is curved, therefore the air has to go faster over the top of the wing than under the bottom. This causes a pressure difference. There is more pressure on the bottom of the wing than on the top, and the wing is pushed upward.)

2. "Which angle did you find it easiest to swing at: slightly pointed up, even across, or pointed

downward?"
(The ideal angle is slightly upward, to generate even more pressure from below and create more lift. Too much of an angle can cause the wing to flip and fly backwards. The results could be disastrous for a plane or a bird).

NOTES:
- The student headline activity can be easily incorporated into the Language program as a writing assignment.
- Allow this assignment to be due a day or two following the review, which will take place in the next subtask. Many students will need the review to better express what they've learned from this lesson. They can begin, however, to generate diagrams, a title page, and some of the other formatting elements as soon as the assignment is given.

SAFETY PRECAUTIONS: Remind the students to find an open space to carefully swing their aerofoil.

Teacher Reflections

Description

The students will take on the roles of all the key members in the following situation:

You live in a country that is involved in ongoing peace talks with your neighbours to the north and south. These talks continually breakdown and are usually followed by isolated incidents of aggression. Your government is planning to open three new air bases at key locations in the country. One of the considered locations is right in the heart of your relatively peaceful city. The government has sent out a group of officials to visit all of the cities that are being considered. This group is to attend a city council meeting where the topic of the air base will be first and foremost on the list. Their feedback and recommendations will be major deciding factors in the final location decision.

Catholic Graduate Expectations

CGE 5a - works effectively as an interdependent team member.

CGE 5e - respects the rights, responsibilities and contributions of self and others.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

CGE 7e - witnesses Catholic social teaching by promoting equality, democracy, and solidarity for a just, peaceful and compassionate society.

Expectations

6s37 A – formulate questions about and identify needs and problems related to the properties of air and characteristics of flight, and explore possible answers and solutions (e.g., investigate whether the shape of a plane affects its flight path);

6s39 A – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

6e62 A – follow up on others' ideas, and recognize the validity of different points of view in group discussions or problem-solving activities;

6e60 A – use tone of voice and gestures to enhance the message and help convince or persuade listeners in conversations, discussions, or presentations;

6z47 A – demonstrate an understanding of the possible reasons for the presence of Canadian peacekeepers in other countries;

Groupings

Students Working In Small Groups
Students Working As A Whole Class

Teaching / Learning Strategies

Advance Organizer
Guest Speaker
Oral Explanation
Problem-solving Strategies
Role Playing
Simulation

Assessment

1. Take anecdotal notes during the planning phase of this activity. Be aware of the various qualities each individual adds to the group.
2. Use the rubric to assess the oral and written components of the students' work.

Assessment Strategies

Classroom Presentation
Observation

Assessment Recording Devices

Anecdotal Record
Rubric

Teaching / Learning

KEY WORDS: Air force, Air Quality Control, Allies

REVIEW:
- The answers to the key questions from the previous subtask (see unit notes from the last subtask). Encourage the students to add new information to their own answers.

Through discussion with the students, add more detail to the wonder and learned columns of their KWL class chart.

THE LESSON

1). Open the lesson with a discussion on the benefits of living in Canada. Expand the discussion toward the topic of war and how their lives would be different if the threat of war was constantly looming overhead.
2). As a link to social studies, discuss why Canada is often selected to send peacekeepers to other countries.

KEY QUESTIONS:
1. "How would you feel if Canada was close to going to war and had bad relations with neighbouring countries?"
2. "What would be some of your daily thoughts in such a situation?"
3. "If we could invite Jesus into our class for an interview, what do you think Jesus would do and say about our troubling situation?"

THE SET-UP:
Lesson One: Reaching a consensus
1. Distribute and explain the student blackline master and rubric. Highlight the situation.
2. Assign roles to each student and allow time for them to read their profiles and to create fictional identities (individual assignment).
3. After a predetermined amount of time, separate the students into their role groups within the classroom. They are to reach a consensus on whether they are for or against the development of the air base in their city.
4. Leave 15 minutes at the end of the period for the students to work individually on their presentation sheets.

Lesson Two: Planning the presentation
1. During this lesson, each special interest group meets to prepare their overall presentation.
2. These group reports are given to the mayor and city council prior to the actual meeting, so that these officials have time to look over and formulate questions to ask the individual groups.
3. The mayor and town council should begin anticipating questions and formulating answers.
Ample time must be given to these individuals to read over and discuss the group reports.

Lesson Three: The City Council Meeting:
1. The mayor is in charge of carrying out the actual agenda and format for the meeting.
2. After the roles have been given, the reports have been prepared and distributed, and the classroom has been set up, the meeting can then proceed.
3. After listening to all of those involved, the town council then prepares a report on behalf of the city that will be either in favour or against the location decision.
4. Following the city's viewpoint being submitted, the government group then gives their report as to whether or not the city would be a good choice.

The Roles:
1. **Local developers:** Looking forward to infusion of work into the community.
2. **Realtors:** Looking forward to settling property for those forced to move and for the new members who would join the community.
3. **Local business owners:** Strongly in favour of the potential income that may come their way.
4. **Local Catholic Church representatives:** Opposed to any escalation of air warfare, especially in their own backyard.
5. **Environmental groups:** Concerned with the lack of pollution controls that already exist at the public airport.
6. **Local homeowners near the base:** Long-time residents who have been fighting for the closure of the current airport due to noise, pollution, and near disasters in the past 20 years.
7. **Mayor:** chairs the meeting and aids in the final decision of the city.
8. **City councillors:**
- ask questions from the submitted reports;
- listen to community leaders present their viewpoints on the issues;
- puts forth the city's final decision on the matter.
9. **Government fact-finding committee:** Surveys the area, listens closely to the cities special interest groups, and generates a report to all involved with their approval or disapproval of this site.

RESPONSE ACTIVITIES:
1. The students use problem-solving and analysis skills and work within a small group to present a position or stand on an issue of social importance.

LOOKING AHEAD TO THE AIR SHOW:
The students may like to point out the real-world pros and cons of their air show model designs.

Adaptations

Enrichment Opportunities:
- Students could attend/arrange a field trip to a council chamber.
- They could create a school survey to be given at school or over the computer.
- They could form an overseas penpal relationship with a student who may actually be dealing with similar issues.

ESL/ESD:
• Have students retell in their own words to be sure that directions/instruction have been understood.
• Teach students how to paraphrase, organize, and present material.
• Simplify text or have available textbooks with material at a variety of reading levels/complexity.
• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.
• Provide project checklist with timelines and essential resources.
• Send home short description of project and keep parents informed/involved.

Additional Support:
(See resource list from subtask one for project accomodations.)
• Allow extra time to complete tasks/tests.

Resources

Flighter than Air

Investigating Air and Flight **An Integrated Unit for Grade 6**

150 mins

Report and Presentation

Student Pages: City Council Meeting 5_Council st. pg..cwk

Notes to Teacher

THE SITUATION:

You live in a country that is involved in ongoing peace talks with your neighbours to the north and south. These talks continually breakdown and are usually followed by isolated incidents of aggression. Your government is planning to open three new air bases at key locations in the country. One of the considered locations is right in the heart of your relatively peaceful city. They have sent out a group of officials to visit all of the cities that are being considered. This group is to attend a city council meeting where the topic of the air base will be first and foremost on the list. Their feedback and recommendations will be major deciding factors in the final location decision.

THE ROLES (as given to the students):

1. Local developers: You belong to one of the many companies that will actually be either building the airforce base and/or developing the surrounding area. You look forward to the employment opportunities that will be generated by this massive project.
2. Realtors: You're looking forward to settling property for those people that must relocate and for the new members who would join the community.
3. Local business owners: You are strongly in favour of the new business opportunities that may be generated by this development.
4. Local Catholic Church representatives: You are opposed to offering your community as a tool for air warfare.
5. Environmental groups: You are already concerned with the lack of pollution controls that exist at the public airport and you are concerned that things will only get worse with this new development.
6. Local homeowners near the base: You are one of the many long-time residents who have been fighting for the closure of the current airport due to noise, air pollution, and near disasters in the past 20 years.
7. Mayor: You have a vote in the final decision made by the city representatives.
You are to run the meeting to insure proper format and to insure that all groups are heard.
You are to develop a meeting agenda with the city councillors. Include: who will go first and ensure equal opportunities for all involved.
8. City councillors:
You are to:
- set the meeting agenda with the mayor;
- develop and ask questions from the submitted reports and presentations;
- listen to the community leaders as they present their viewpoints on the issues;
- put forth the city's final decision on the matter.

9. Government fact-finding committee: You attend the city council meeting, listen closely to the special interest groups, and receive the city's overall recommendation. Based on all of the gathered information you are to generate a report and presentation to all involved, stating your approval or disapproval of considering this site as an airforce base.

Notes:
- A local council member could attend the class mock meeting.
- If possible, arrange a field trip to attend a city, town, or school council meeting.
- The mayor and city council members should plan the meeting format or agenda. This will include deciding who speaks first and ensuring that equal time be given to each group.
- Collect and review all group reports and the meeting agenda, prior to the actual meeting.
- Since this lesson clearly incorporates other subject areas (see expectations list), the planning and processing components of this activity can take place during other subject times.
- You may want to refer to the flight timeline sheet in subtask two to cite some of the tragedies of air

warfare.

Teacher Reflections

Description

The students will learn the meanings of drag and thrust, through a demonstration involving air-powered rocket balloons that race horizontally and vertically in the classroom. They will also be testing out their predictions as to how far the rockets will travel under various conditions. A double bar graph will then be generated by each student to give a visual description of the results that take place.

Catholic Graduate Expectations

CGE 3c - thinks reflectively and creatively to evaluate situations and solve problems.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

Expectations

6s33 A – describe the sources of propulsion for flying devices (e.g., moving air, propellers, combustible fuel);
6s32 A – explain the importance of minimizing the mass of an object when designing devices to overcome the force of the earth's gravity;
6s31 A – demonstrate and describe methods used to alter drag in flying devices (e.g., flaps on a jet aircraft's wings);
6s34 A – describe how unbalanced forces are used to steer airplanes and spacecraft (e.g., rocket firings to control docking in space).
6s36 A – design and create a device that uses pneumatic power to move another object;
6s45 A – identify characteristics and adaptations that enable birds and insects to fly;
6m106 A • systematically collect, organise, and analyse data;
6m53 A – make simple conversions between metric units (e.g., metres to kilometres, grams to kilograms);
6m120 A – construct line graphs, bar graphs, and scatter plots both by hand and by using computer applications;
6m110 A • evaluate data and make conclusions from the analysis of data;
6s40 A – compile data gathered through investigation in order to record and present results, using tally charts, tables, labelled graphs, and scatter plots produced by hand or with a computer (e.g., record the flight distances of different styles of paper airplanes, and present their findings in a graph);

Groupings

Students Working Individually
Students Working As A Whole Class

Teaching / Learning Strategies

Demonstration
Experimenting
Graphing
Fair Test

Assessment

1. Continue to record anecdotal notes on the students as they answer the key questions and complete their graphs.
2. Collect the student write-ups and their completed double bar graphs. Assess their work using the attached rubric.
3. Collect flight logs to monitor proper format and detail. The key questions from each centre can be assessed based on a level format, as outlined in the ministry curriculum document.

Assessment Strategies

Questions And Answers (oral)
Response Journal

Assessment Recording Devices

Anecdotal Record
Rubric

Teaching / Learning

KEY WORDS: **Drag, Thrust**

REVIEW:

- How to convert centimetres (cm) to meters (m) and vice versa.
- The KWL class chart to go over the key learnings from subtask four - Lifting Against the Force of Gravity.

THE LESSON:

1). Go over the four forces of flight: lift, gravity, thrust, and drag and their meanings with the students (see attached blackline master).
- Having already demonstrated how to overcome the pull of gravity by generating lift in lesson three, this investigation shows more clearly the differences between thrust and drag.
2). Distribute the student worksheet.

THE SET-UP

Rocket Launching (Initial measurement of distance travelled - thrust):
1). Feed a long thread through a straw and attach both ends in as straight a line as possible, across the width of the classroom.
2). Do the same as step #1, only attach vertically from the floor to the ceiling.
3). Next, tape a long balloon to each straw, inflate the balloons, and hold them in place with a clothes pin.
4). Tape wings evenly on both sides of each balloon.
5). Explain the procedure and have the students record their predictions on the distance each rocket thruster will travel.
6.) Release the balloon on each set-up and measure the distance travelled. Discuss the thrust generated by releasing the air.
7.) Discuss the students' hypotheses and the actual distance the rocket thruster travelled.

Rocket Launching (Generating drag):
1). Next, remove the wings and tape them back on with the large flat surface facing the front of the balloon.
2). Again, have the students record their predictions on the distance each rocket thruster will travel.
3). Retest the balloon and measure the distance travelled. Discuss the drag created by lifting the wings to hold back the air (flaps on an airplane). Also, discuss aerodynamic shapes and how the older box shaped cars and trucks created drag, and consequently lower gas mileage.
4). The students then record the results on their charts.

Launching Rockets (The importance of minimizing the weight involved):
1). Place the wings back in their original horizontal position on each balloon.
2). Next, place a varying amount of washers in front of the balloon rockets.
3). Again, have the students record their predictions on the distance each rocket thruster will travel.
4). Retest the balloons and measure the length they travelled while pushing the washers ahead.
Discuss the factors that affected the flight performance of the rocket thrusters. Ask the students to point out examples of variable control in today's investigation.
5). The students then record the results on their chart.
6.) Ask the students; "We have used balloons for thrust today. What sources of propulsion do other flying vehicles use?" Have them record their suggestions, then take them up as a class.

RESPONSE ACTIVITIES:
1. Students predict and record the performance of the balloon rocket launchers, by using the chart on the student blackline master.
2. A double bar graph is then generated by the students from the collected data.
3. Key questions are completed in their flight log books.
4. Students can label a diagram with the various characteristics of flight. (e.g., forces, movements)

LOOKING AHEAD TO THE AIR SHOW:
- Students use the information gathered on the four forces of flight to better plan their creations for the air

show. They may begin to decide on the appropriate shape and design. They may also look more carefully at the methods of thrust they will use.
- The write-up format and PHEOCA steps can be improved upon after this lesson.

Adaptations

Enrichment Opportunities:
- Students can research the many ways that different living things achieve flight (i.e., hummingbirds, ducks, eagles, and insects).
- Students can then create a compare and contrast chart.

ESL/ESD:
• Make sure that students can see and hear clearly, (e.g., avoid placing them at the back of the room).
• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.
• Allow extra time to complete tasks/tests.
• Explain/simplify instructions and questions, if necessary, to ensure that students understand what they are being asked to do.
• Provide a variety options for assignments (not all written.)

Additional Support:
(See resource list from subtask one.)
- Ensure that instructions are clear.
- Minimize or rephrase the key questions.
- Allow extra time to complete tasks/tests.

Resources

Graphing and Charting Drag and Thrust	
The Characteristics of Flight	6_Four forces.cwk
Student Write-up: Drag and Thrust	6_drag and thrust.cwk
Labelling	6_labelling flight.cwk
Drag and Thrust: Class Materials	

Notes to Teacher

SOME BACKGROUND INFORMATION:

Thrust, Drag, Lift and Gravity - the Four Principles of Flight
- When an airplane flies, it must overcome two primary forces - weight and drag.
- Weight is the force of gravity acting to pull the plane to the ground, and it is overcome through lift. Lift results in the plane rising into the air.
- Drag is created by the force of air particles striking and flowing around the airplane, and it is overcome through thrust.
- Thrust is the push of the plane in a forward direction. The thrust of an airplane is created by the use of either jet engines or propellers.

An airplane has three basic movements:
Yaw - movement on the vertical axis. The nose of the plane turns left or right.
Roll - movement on the longitudinal axis. One wing dips lower than the other.
Pitch - movement on a lateral axis. The nose of the plane moves up and down.

- The movement around each axis is controlled by a specific control surface. The pilot can use the elevators to control the pitch of a plane, the rudder to control the yaw, and the ailerons to control the roll.

KEY QUESTIONS AND ANSWERS:
1. "Were your predictions correct?"
2. "What would be needed to push the balloon upward so that it reaches the same distance that was measured when it was on a straight line?" (more thrust - air)
3. "Where else do you see examples of drag in our world?" (drag racing, shuttle takeoffs and landings, transport truck designs)
4. "How would the size of the balloon effect the distance travelled?" (larger balloon means more air or thrust)
5. "Complete a double bar graph from the data generated in class today." Be sure to neatly and properly label your graph.

NOTES:
- Thoroughly discuss the factors that affected the flight performance of the rocket thruster. Ask the students to point out examples of variable control in today's investigation.
- It would save a great amount of time to have the balloon thrusters assembled and attached in the classroom before the lesson begins.
- Review with the students the methods for creating a double bar graph.

SAFETY PRECAUTIONS: In order to avoid injury, be sure that the students stand back when the balloons are released.

Teacher Reflections

Flighter than Air

Investigating Air and Flight **An Integrated Unit for Grade 6** **250 mins**

Description

In small groups, the students will rotate through the following flight centres, where they will be able to demonstrate the key learnings experienced up to this point in the unit.

1) Creation of a hot air balloon
2) Creation of a parachute
3) Creation of a helicopter
4) Creation of a basic glider
5) Creation of a surface floater

The interaction between the four forces of flight (gravity, lift, thrust, and drag) will be a primary focus in this subtask.

Catholic Graduate Expectations

CGE 5a - works effectively as an interdependent team member.

CGE 5e - respects the rights, responsibilities and contributions of self and others.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

Expectations

6m106 A	• systematically collect, organise, and analyse data;
6s24 A	• demonstrate an understanding of the properties of air (e.g., air and other gases have mass) and explain how these can be applied to the principles of flight;
6s25 A	• investigate the principles of flight and determine the effect of the properties of air on materials when designing and constructing flying devices;
6s35 A	– design, construct, and test a structure that can fly (e.g., a kite, a paper airplane, a hot air balloon);
6s50 A	– describe practices that ensure their safety and that of others (e.g., directing flying objects away from oneself and others).
6s44 A	– describe and justify the differences in design between various types of flying devices (e.g., airplane versus helicopter, spacecraft versus hot-air balloon);
6s48 A	– compare the special features of different transportation methods that enable those methods to meet different needs (e.g., features of bicycles, cars, airplanes, spacecraft);
6s49 A	– assess whether the materials in student-designed projects were used economically and effectively (e.g., decide whether paper was wasted during the construction of paper airplanes);

Groupings

Students Working Individually
Students Working In Small Groups

Teaching / Learning Strategies

Learning Centres
Model Making
Response Journal
Fair Test
Graphing

Assessment

1. Assess the write-up sheets for centres 1-5, using the attached rubric.
2. Continue to record anecdotal notes on the students as they answer the key questions and complete their graphs.
3. Collect flight logs to monitor proper format and detail. The key questions from each centre can be assessed based on a level format, as outlined in the ministry curriculum document.

Assessment Strategies

Observation
Performance Task
Response Journal

Assessment Recording Devices
Rubric
Anecdotal Record

Teaching / Learning

KEY WORDS: **Pitch, Roll, Yaw, Propel**

REVIEW:

- The answers to the key questions from the previous subtask (see unit notes from the last subtask). Encourage the students to add new information to their own answers.

- Through discussion with the students, add more detail to the wonder and learned columns of their KWL class chart.

- The steps of PHEOCA are to be completed for each activity centre.

THE LESSON:

1. The students rotate through centres which incorporate all of the elements they have learned so far. By creating a hot air balloon, a parachute, a helicopter, a dart plane, and a surface floater, the students gain enough knowledge to finalize their culminating task design.
2. Distribute the appropriate centre write-up sheets to the appropriate group.
3. The steps of PHEOCA are to be completed for each activity centre.

CENTRE # 1: THE HOT AIR BALLOON (Looking at lift versus gravity and air expanding when heated)

1. The students fasten the end of the yogurt container to the open end of the plastic bag.
2. The bag is then inflated with the hot air from a blow dryer. As the bag begins to rise, the hot air source is removed.
3. Students use the recording chart to measure the time aloft when various amounts of heat are used.

CENTRE #2: THE PARACHUTE (Looking at surface area and the effect of weight on the time aloft)

1. The students tape or tie strings to the four corners of a square piece of cloth or of a plastic bag.
2. The other ends of the strings are tied to various amounts of washers.
3. The parachute is released from a predetermined height and the time aloft is measured, with varying amounts of washers being added.

CENTRE #3: A HELICOPTER (direct lift against gravity)

(See the blackline master.)

1. The students set up their sheets as in the diagram and cut along all the solid lines.
2. Next, they fold one flap forward and the other flap back.
3. A paper clip is then applied at the bottom.
5. The model is then dropped with the blades facing slightly upward.
6. More paper clips can be attached to see if the descent time is affected.

CENTRE #4: THE DART PLANE

(See the blackline master.)

Students are to:

1. Fold a piece of 8.5" x 11" paper in half lengthwise.
2. Fold the top corners to the centre line.
3. Fold the newly formed corners to the centre line.
4. Bring both sides together and fold down each side wing about three-quarters to the bottom.

5. Tape the top part together.
6. Cut slits in the back as wing flaps.
7. Begin the test flights.

Note: From this basic design the students can adjust flaps, fold wing tips, and add a rudder to achieve the maximum distance.

CENTRE #5: THE SURFACE FLOATER

1. Tape the spool to the base.
2. If a hole does not exist in the base, then create one that is lined up with the hole in the spool.
3. Stretch the mouth of an inflated balloon over the spool and pinch it so that no air is released.
4. Release your vehicle just above a smooth surface and observe.
5. Add small increments of weight to your floater and test its performance.

CENTRE #6: CATCH-UP PERIOD

- Students can use this time to complete notes, work on their timeline projects, or plan for the culminating task.

RESPONSE ACTIVITY:

1. The students continue to complete the steps of PHEOCA for centres 1-5.
2. The students complete charts and graphs for centres 1-5.
3. The students create many various models of flight.

LOOKING AHEAD TO THE AIR SHOW:

The students are now in a position to add detail to their culminating task projects. They have explored the four forces of flight and the properties of air within this subtask. They have also learned ways of equalizing the four forces to generate optimal time aloft. These principles can now be utilized by the students in the creation of their own unique flying machines.

Adaptations

Enrichment Opportunities:

- Students can prepare a diagram with instructions on how to build a different glider.
- Students can exchange their diagrams and instructions with other students to see if the models can be built.

ESL/ESD:

• Allow extra time to complete tasks/tests.
• Explain/simplify instructions and questions, if necessary, to ensure that students understand what they are being asked to do.
• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.

Additional Support:

(See resource list from subtask one.)
• Allow extra time to complete tasks/tests.

Resources

High Flyers: Design and Test

Centre sheets: High Flyers 7_High Flyers.cwk

Flighter than Air

Investigating Air and Flight **An Integrated Unit for Grade 6** **250 mins**

The Dart Plane	7_Creating a Dart Plane.cwk
The Helicopter	7_Helicopter.cwk
Centre #1: List of materials	
Centre #2: List of materials	
Centre #3: List of materials	
Centre #4: List of materials	
Centre #5: List of materials	

Notes to Teacher

KEY QUESTIONS AND ANSWERS:

Centre #1: Making a hot air balloon
1. "What is the longest amount of time your balloon stayed in the air?" (answers will vary)
2. "How can you increase the amount of time your balloon stays in the air?" (more hot air, larger balloon to hold more air)
3. "How do hot-air balloonists keep their balloon going?" (helium, more heat, larger balloons)
4. "How did you control the variables in your experiment?" (everything the same except the amount of heat added)
5. "Create a bar graph to show the results of your testing."

Centre #2: Making a parachute
1. "What is the longest amount of time your parachute stayed in the air?" (answers will vary)
2. "How can you increase the amount of time your parachute stays in the air?" (larger surface area of the parachute, higher altitude, less weight pulling down)
3. "How did you control the variables in your experiment?" (everything the same except the amount of weight being applied)
4. "Create a bar graph to show the results of your testing."

Centre #3: Making a helicopter
1. "What is the longest amount of time your helicopter stayed in the air?" (answers will vary)
2. "How can you increase the amount of time your helicopter stays in the air?" (larger surface area of the helicopter wings, higher altitude, less weight pulling down)
3. "How do helicopter pilots keep their helicopter flying?" (increased thrust, large wings, high altitudes, less weight)
4. "How did you control the variables in your experiment?" (everything the same except the amount of weight being applied)
5. "Create a bar graph to show the results of your testing."

Centre #4: Making a dart plane
1. "What is the longest amount of time your dart plane stayed in the air?" (answers will vary)
2. "How can you increase the amount of time your dart plane stays in the air?" (increased forward thrust, reduce drag by reducing weight, aerodynamic design)
3. "What is the furthest distance your dart plane travelled?" (answers will vary)
4. "How did you control the variables in your experiment?" (everything the same except the adjustment being made)
5. "Explain the difference between how a helicopter and an airplane lift off the ground." (An airplane increases forward thrust to lift its wings, while a helicopter uses its propeller to lift it straight up, hover, and move laterally.)
6. "Why wouldn't an airplane work well in space?" (There is no air in space.)
7. "Create two bar graphs to show the results of your testing: one for time aloft and one for distance travelled."

Centre #5: Making a surface floater
1. "What is the greatest distance your surface floater travelled?" (answers will vary)
2. "How can you increase the distance travelled?" (smoother surface, decrease in weight, larger balloon for more air, slower release of air)
3. "How did you control the variables in your experiment?" (everything the same except the amount of weight being applied)
4. "Where else might you see examples of surface floaters?" (hovercraft)

5. "Create a bar graph to show the results of your testing."

Centre #6: Catch-up centre
- Students can use this time to complete notes, work on their timeline projects, or plan for the culminating task.

SAFETY PRECAUTIONS: Remind students about safety rules for launching their high flyers. ensure that students direct their models away from themselves and their classmates.

Teacher Reflections

Description

In small groups, the students prepare and present one of the scenarios below:

a. Commercial: Selling a product related to the unit
b. News report on an interesting development in aviation
c. Interview with a famous aviator
d. Musical jingle
e. Rhyming poem

The focus will be on the terminology highlighted throughout the unit.

Catholic Graduate Expectation

CGE 5a - works effectively as an interdependent team member.

CGE 5e - respects the rights, responsibilities and contributions of self and others.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others.

Expectations

6e44 A – understand specialized words or terms, as necessary (e.g., medieval in a historical novel);

6s39 A – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

Groupings

Students Working In Small Groups

Teaching / Learning Strategies

Choral Reading
Role Playing

Assessment

- Assess the group performance using the attached rubric.
- Closely monitor the use of proper terminology.

Assessment Strategies

Classroom Presentation
Performance Task

Assessment Recording Devices

Rubric

Teaching / Learning

KEY WORDS: All words learned so far and any words associated with air and flight.

REVIEW:

- The answers to the key questions from the previous subtask (see unit notes from the last subtask).

Encourage the students to add new information to their own answers.

- Through discussion with the students, add more detail to the wonder and learned columns of their KWL class chart.

THE LESSON:

1. Review with the students the terminology used in the unit (see glossary).
2. Distribute and explain the work sheet and the rubric with the students.
3. Using as much of the unit terminology as possible, the students select and develop one of the following scenarios:

a. Commercial: Selling a product related to the unit.
b. News report on an interesting development in aviation.
c. Interview with a famous aviator.
d. Musical jingle about air and flight.
e. Rhyming poem about air and flight.

An example would be:

Commercial: "How would you like to thrust yourself into the spotlight? Nobody wants to be a drag, so lift your spirits with these new air walkers, guaranteed to comfortably shuttle you to the top of the popularity hill!"

RESPONSE ACTIVITY:

1. Develop a scenario using as much of the unit terminology as possible.

LOOKING AHEAD TO THE AIR SHOW:

Through their direct focus on the key words in the unit, the students are encouraged to incorporate pertinent air and flight terminology into their culminating task write-ups.

Adaptations

Enrichment Opportunities:

- The students may decide to include a multimedia format for their presentation.
- The students may like to create a vocabulary game book, including crosswords, word searches, etc.
- The students may create a booklet of challenging, unfamiliar aviation terms.

ESL/ESD:

• Present figurative language in context and rephrase to ensure understanding.
• Use music, choral speaking, rhymes, poems; use interesting ways of building vocabulary.
- Students may create a visual display of the unit terminology instead of the language based classroom presentation.

Additional Support:

(See resource list from subtask one.)
- Modify the terminology list for the students.
- See ESL/ESD adaptations.

Resources

THE TERMINOLOGY TWIST

Subtask 8

80 mins

Terminology Twist

Glossary of terms 8_Terminology.pdf

Student page: terminology twist 8_terminology twist.cwk

Notes to Teacher

NOTES:

- Decide, with your students, whether to have the presentation completed in pairs or in groups. Incorporate their suggestions into the outline provided.
- Be sure to go over the assessment rubric with the students at the beginning of the subtask.

Teacher Reflections

Description

The students are challenged to apply what they have learned in the unit to create the best possible flying devices. They can use and combine any devices or methods presented in the unit to generate their flying machines. The flying devices can be created from something familiar or they can be new inventions. A time will need to be set aside for the students to demonstrate their projects, either outside on a calm day or in the school gymnasium. Classes can be invited in to view the air show.

The students are to also create a flight-report guide on their creations, complete with illustrations, descriptions, test flight data, graphs, charts, and a development timeline. (This can be completed in a multimedia format using programs such as ***Hyperstudio***.)

Catholic Graduate Expectations

CGE 2c - presents information and ideas clearly and honestly and with sensitivity to others.

CGE 5a - works effectively as an interdependent team member.

CGE 5e - respects the rights, responsibilities and contributions of self and others.

CGE 5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

Expectations

6e1 A	• communicate ideas and information for a variety of purposes (to inform, to persuade, to explain) and to specific audiences (e.g., write the instructions for building an electrical circuit for an audience unfamiliar with the technical terminology);
6e7 A	• revise and edit their work in collaboration with others, seeking and evaluating feedback, and focusing on content, organization, and appropriateness of vocabulary for audience;
6e8 A	• proofread and correct their final drafts, focusing on grammar, punctuation, spelling, and conventions of style;
6e21 A	– accurately use appropriate organizers (e.g., table of contents, index);
6m110 A	• evaluate data and make conclusions from the analysis of data;
6m115 A	– experiment with a variety of displays of the same data using computer applications, and select the type of graph that best represents the data;
6s24 A	• demonstrate an understanding of the properties of air (e.g., air and other gases have mass) and explain how these can be applied to the principles of flight;
6s25 A	• investigate the principles of flight and determine the effect of the properties of air on materials when designing and constructing flying devices;
6s35 A	– design, construct, and test a structure that can fly (e.g., a kite, a paper airplane, a hot air balloon);
6s40 A	– compile data gathered through investigation in order to record and present results, using tally

Groupings

Students Working In Small Groups

Teaching / Learning Strategies

Advance Organizer
Experimenting
Fair Test
Model Making

Assessment

- Take anecdotal records on the efficiency and co-operation exhibited by the students.
- Use the self-assessment form, the checklist, and the attached rubric to assess the students' process work, model production, and class presentations.

Assessment Strategies

Exhibition/demonstration
Performance Task
Self Assessment
Observation

Assessment Recording Devices

Anecdotal Record
Rubric
Checklist

charts, tables, labelled graphs, and scatter plots produced by hand or with a computer (e.g., record the flight distances of different styles of paper airplanes, and present their findings in a graph);

6s49 A – assess whether the materials in student-designed projects were used economically and effectively (e.g., decide whether paper was wasted during the construction of paper airplanes);

6m107 A • use computer applications to examine data in a variety of ways;

Teaching / Learning

KEY WORDS: Students are to incorporate the key words from the unit into the flight guide that accompanies their culminating task models.

REVIEW:

- The culminating task student activity sheets and rubric, which were given at the onset of the unit.
- The criteria that will be assessed for their flying devices.
- The elements of the flight guide, as is outlined on the student worksheet.

THE LESSON:

Note: The students should have most of their projects completed at this point.

Flight Check:

1. Allow a period for the students to bring in their designs for a final makeover.
2. Allow a second period for the students to conduct the flight tests in your presence and to finalize their flight-report guides.

The Presentation:

The students present their models to their classmates. During the presentations, they are to describe their designs, reveal their test results, and demonstrate how their models work.

The Air Show:

Set up a time for other classes to attend your class air show.

RESPONSE ACTIVITIES:

1. Completed flying device
2. Accompanying flight-report guide
3. Class presentation of their flying devices
4. Air show

Adaptations

Enrichment Opportunities:

- The students can develop unique tests to put their flying vehicles through (i.e., closest to the target.)
- The students can create an air show program for the attending classes.

ESL/ESD:

• Allow extra time to complete tasks/tests.
• Explain/simplify instructions and questions, if necessary, to ensure that students understand what they are

being asked to do.
• Provide a variety options for assignments (not all written).
• Have students work with partners from the same linguistic background who can act as interpreters, classroom partners, and peer tutors.

Additional Support:
(See resource list from subtask one for project accomodations.)

Resources

Culminating Task Rubric	
"AIR VEHICLE" write-up	9_air show write-up.cwk
Self-Assessment: Air Show	9_Self-Assess air show.cwk
Checklist: Air Show	9_Checklist - air show.cwk

Notes to Teacher

KEY QUESTIONS:
1. "What could you do to improve the capabilities of your model?"
2. "Why did you decide to build the air vehicle that you did?"

NOTES:
In this culminating task, look for the following key criteria:
1. There must be a balance between the four forces of flight.
2. The mass will need to be reduced enough to provide for sufficient thrust.
3. On average how long did their flying device stay aloft?
4. Were the tests conducted appropriately and carried out efficiently?
5. How are some of the ideas presented related to the real world outside the classroom?

Be sure to plan ahead for time in the gym or outside to conduct the air show.
Be sure to inform the other classes in advance of the time and location of the air show.

SAFETY PRECAUTIONS: Remind students about safety rules for launching their air vehicles. Ensure that students direct their models away from themselves and their classmates.

Teacher Reflections

Appendices

Flighter than Air

Investigating Air and Flight

Resource List:

Black Line Masters:

Rubrics:

Unit Expectation List and Expectation Summary:

Flighter than Air
Investigating Air and Flight An Integrated Unit for Grade 6

Rubric

- ☐ **Culminating Task Rubric** **ST 9**
  2
- ☐ **Graphing and Charting Drag and Thrust** **ST 6**
  3
- ☐ **High Flyers: Design and Test** **ST 7**
  2
- ☐ **News Article** **ST 4**
  2
- ☐ **Report and Presentation** **ST 5**
  1
  The following rubric can be applied to both the oral and written components of this lesson.
- ☐ **Terminology Twist** **ST 8**
  3
- ☐ **The Write-Up** **ST 2**
  2
  To be used to assess the student "write-ups" for each centre or collectively.
- ☐ **Timeline/Report** **ST 3**
  2

Blackline Master / File

- ☐ **"AIR VEHICLE" write-up** **ST 9**
  9_air show write-up.cwk
- ☐ **Air web** **ST 1**
  1_Air web.cwk
- ☐ **Centre #5: Predict and Test** **ST 2**
  2_predictions.cwk
- ☐ **Centre sheets: High Flyers** **ST 7**
  7_High Flyers.cwk
- ☐ **Centre Write-ups** **ST 2**
  2_Centre Write-ups.cwk
- ☐ **Checklist: Air Show** **ST 9**
  9_Checklist - air show.cwk
- ☐ **Creating an Aerofoil: Write-up** **ST 4**
  4_Creating an Aerofoil.cwk
- ☐ **Flight Checklist: Overall** **Unit**
  10_Checklist - overall.cwk
- ☐ **Flight web** **ST 1**
  1_Flight web.cwk
- ☐ **Getting Ready For the Air Show** **ST 1**
  1_Getting ready.cwk
- ☐ **Glossary of terms** **ST 8**
  8_Terminology.pdf
- ☐ **History of Flight: Information sheet** **ST 3**
  3_History of Flight.pdf
- ☐ **History of Flight: Student Page** **ST 3**
  3_timeline.cwk
- ☐ **KWL chart** **ST 1**
  1_KWL.cwk
- ☐ **Labelling** **ST 6**
  6_labelling flight.cwk
- ☐ **PHEOCA steps** **ST 1**
  1_PHEOCA.cwk
- ☐ **Self-Assessment: Air Show** **ST 9**
  9_Self-Assess air show.cwk
- ☐ **Self-Assessment: History of Flight** **ST 3**
  3_Self-Assess History.cwk
- ☐ **Student page: terminology twist** **ST 8**
  8_terminology twist.cwk
- ☐ **Student Pages: City Council Meeting** **ST 5**
  5_Council st. pg..cwk
- ☐ **Student Write-up: Drag and Thrust** **ST 6**
  6_drag and thrust.cwk
- ☐ **The Characteristics of Flight** **ST 6**
  6_Four forces.cwk
- ☐ **The Dart Plane** **ST 7**
  7_Creating a Dart Plane.cwk
- ☐ **The Helicopter** **ST 7**
  7_Helicopter.cwk

Flighter than Air
Investigating Air and Flight An Integrated Unit for Grade 6

☐ **WINGS AND LIFT** **ST 4**
4_Bernoulli.cwk

Licensed Software

☐ **1998 Candian and World Enclyclopedia** **Unit**

☐ **Hyperstudio** **Unit**

Print

☐ **175 Science Experiments** **Unit**
Walpole, Brenda
ISBN: 0-394-8991-1(pbk.)

☐ **DISCOVER FLIGHT** **Unit**
Exclusive Educational Products #0007

☐ **FLIGHT** **Unit**
Dixon, Malcolm
ISBN 1-85210-931-9

☐ **Matter and Materials: Grade 6** **Unit**
OECTA Teacher Resources

☐ **Science and Technology: Air and Flight** **Unit**
Addison Wesley
ISBN 0-201-65437-7

☐ **Science Everywhere** **Unit**
Harcourt Brace, Canada
ISBN 0-7747-0566-3

☐ **The New Webster Encyclopedic Dictionary of the English Language** **ST 1**

☐ **The Ontario Curriculum: Science and Technology** **Unit**
Ministry of Education and Training

☐ **The sky's the limit: aerodynamics** **Unit**
AIMS Education Foundation
ISBN 1-881431-44-4

Media

☐ **Bill Nye the Science Guy: Air and Flight** **Unit**

Website

☐ **Air Pressure Demonstration** **Unit**

☐ **Air Quality Lesson Plans** **Unit**
http://www.tnrcc.state.tx.us/air/lesson_plans.html

☐ **Air.....What Gives?** **Unit**
http://ericir.syr.edu/Virtual/Lessons/Science/Physical/PHY001.html

☐ **Alex's paper airplanes** **Unit**
http://www.paperairplanes.co.uk/heliplan.html

☐ **Bill Nye The Science Guy** **Unit**
http://nyelaabs.kcts.org/openNyeLabs.html

☐ **Canadian Space Agency** **Unit**
http://www.space.gc.ca/home/index.asp

☐ **Flights of Inspiration** **Unit**
http://www.fi.edu/flights/

☐ **How things fly** **Unit**
http://educate.si.edu/resources/lessons/siyc/flight/start.html

☐ **How things fly: Space museum** **Unit**
http://www.nasm.edu/galleries/gal109/NEWHTF/HTF030.HTM

☐ **LDAPS** **Unit**
http://ldaps.ivv.nasa.gov/index.html

☐ **Science: Fun with airplanes** **Unit**
http://www2.ag.ohio-state.edu/~flight/homepage.html

☐ **Space Shuttle Home Page** **Unit**
http://shuttle.nasa.gov

☐ **Whitewings Racer Sky Club II** **Unit**
http://whitewings.com

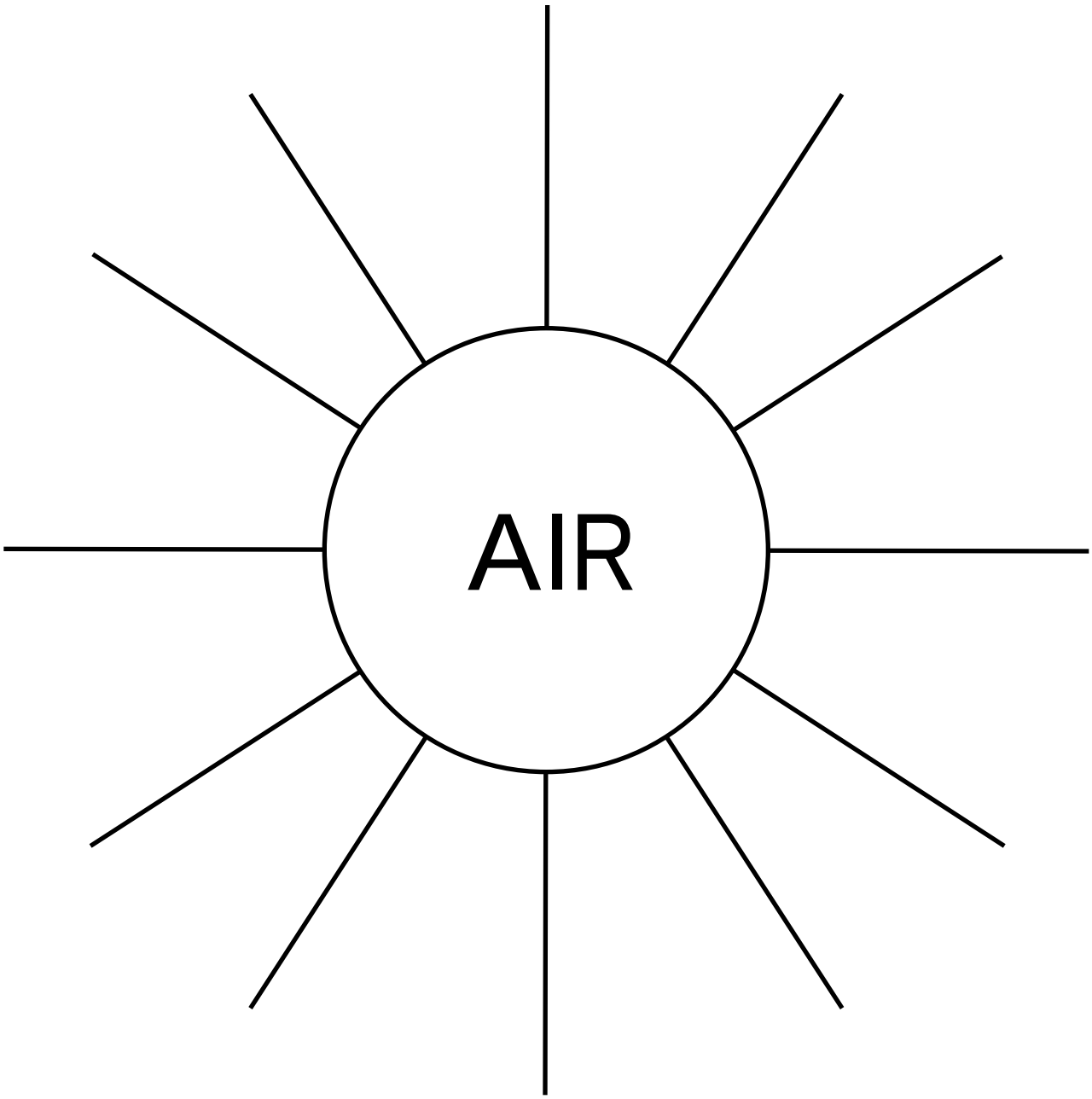
Flighter than Air
Investigating Air and Flight An Integrated Unit for Grade 6

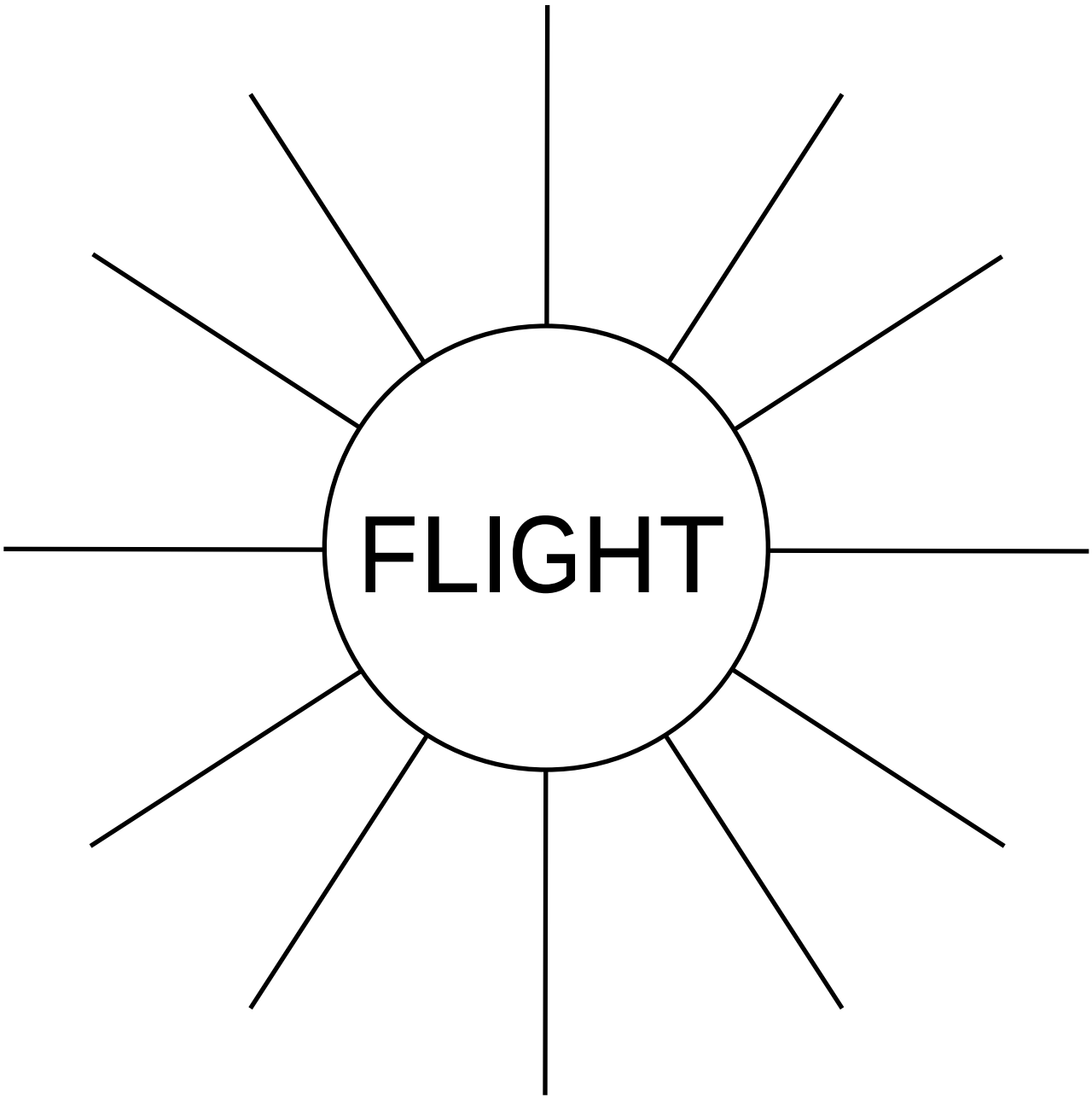
Material

- ☐ **Centre #1: List of materials** **ST 7**
  per group
  yogurt container or polystyrene cup, plastic bag, blow dryer
- ☐ **Centre #1: Materials** **ST 2**
  per group
  clear plastic cups, a container to hold water (i.e. aquarium or sink) - large enough for the students to work with two cups, crumpled sheet of paper or washcloth, paper towels, flexible or curved straws, tape
- ☐ **Centre #2: List of materials** **ST 7**
  per group
  string or strong thread, square of cloth or of a plastic bag, washers
- ☐ **Centre #2: Materials** **ST 2**
  per group
  Two balloons (exactly the same shape and size), metre stick, string or thread, tape, pin
- ☐ **Centre #3: List of materials** **ST 7**
  per group
  paper template, scissors, paper clips
- ☐ **Centre #3: Materials** **ST 2**
  per group
  drinking glass, square piece of cardboard or stiff paper (aproximately 15cm x 15cm), aquarium or sink basin to perform a water experiment over, newspaper, ruler
- ☐ **Centre #4: List of materials** **ST 7**
  per group
  8.5" x 11" paper, tape, trundle wheel or tape measures
- ☐ **Centre #4: Materials** **ST 2**
  per group
  plastic pop bottle, long stretchy balloon, kettle, containers to hold ice cold water and boiling hot water, heat and water resistant gloves, ice
- ☐ **Centre #5: List of materials** **ST 7**
  per group
  spools, large balloon, tape, base: playing card, old cd, flat plastic lid
- ☐ **Centre #5: Material** **ST 2**
  per group
  funnel, ping pong ball, balls of different sizes, medium sized stack of books, plastic bag, glass bottles (same), water
- ☐ **Drag and Thrust: Class Materials** **ST 6**
  per class
  Plastic pop bottles, thread, straws, washers, strong paper to form the wings, long stretchy balloons
- ☐ **Flight timeline materials** **ST 3**
  per pair
  Large strips of chart or butcher block paper, markers, pencils
- ☐ **Launch Pad Group materials** **ST 1**
  per group
  chart paper, markers, tape, dictionaries, air/flight resource material
- ☐ **Subtask #4: Materials** **ST 4**
  per person
  Sheets of paper, scissors, glue, a ruler, a strip of paper approximately 28 cm by 8 cm, a strip of paper approximately 3cm x 12 cm, and some tape.

Companions Bookmark

- ☐ **Assessment Accommodations** **ST 1**
- ☐ **Assignment and Project Accommodations** **ST 1**
- ☐ **Organization Accommodations** **ST 1**
- ☐ **Presentation Accommodations** **ST 1**


AIR


FLIGHT

GETTING READY FOR THE AIR SHOW

CAN YOU MAKE A TOP NOTCH FLYING DEVICE THAT WILL INCORPORATE ALL THAT YOU WILL LEARN IN THIS UNIT?

During this unit, you will be learning how to create the best possible model of an air vehicle. Once you have decided on a design, you will then begin the planning and revising stages of your air vehicle. Each lesson will present some information that will help you maximize the potential of your model. Some time will be given to work on your creation, but most of the work will have to be completed away from school. At the end of the unit, you will be given two periods to put on the final touches and to test your air vehicle. Be sure to look over the assessment rubric that goes along with this outline.

A). The following must be included in your project:

1. A flight report guide

It will consist of :

- the complete steps of PHEOCA;

- tests that you have decided to put your vehicle through;

- graphs, charts, descriptions, and diagrams that are relevant to your design;

- a title page.

2. A model or the air vehicle you have created.

B). You will be presenting your project in the following ways:

1. In-class presentation, where you will be explaining your design, test results, and any special features of your model.

2. An air show for other selected classes in the school to view.

Due Date:_____

Name(s):

_____

_____

STEPS IN THE SCIENTIFIC PROCESS:

P - PURPOSE (OR QUESTION)
H - HYPOTHESIS (EDUCATED GUESS)
E - EXPERIMENT (PROCEDURES USED)
O - OBSERVATION (WHAT YOU NOTICED)
C - CONCLUSION (IS YOUR HYPOTHESIS CORRECT OR INCORRECT?)
A - APPLICATION (WHERE DO YOU OR COULD YOU SEE EXAMPLES OF WHAT YOU HAVE LEARNED?)

SET UP AND COMPLETE THE SCIENTIFIC STEPS FOR EITHER OF THE FOLLOWING INVESTIGATIONS:

CHOICE #1: THE EGG AND BOTTLE TRICK

MATERIALS: Cooked egg without a shell, a bottle with a neck slightly smaller than the egg, a piece of paper, a match or candle.

1. Check that the egg just fits into the neck of the bottle without falling through.
2. Scrunch up the piece of paper and put it into the bottle.
3. Light the paper by using a long candle or dropping a burning match into the bottle.
4. Quickly place the egg into the bottle neck.

PURPOSE: Can we use air pressure to cause an egg to be sucked into a bottle?
HYPOTHESIS: Yes, we can use air pressure to suck an egg into the bottle. By lighting the paper we are forcing more pressure from above.
EXPERIMENT:
1. We will crumple up a piece of paper and place it at the bottom of a glass jar.
2. We will then light the paper in the jar.
3. We will then quickly seal the jar with a cooked egg (shell removed).
OBSERVATIONS: The egg will be sucked into the jar as the paper burns.
CONCLUSION: Our hypothesis was correct. As the paper burned, it used up the oxygen in the air, causing less pressure from inside. The egg on top created a seal so that no new air could get in. This reduced air pressure inside and increased pressure outside, caused the egg to be sucked into the jar.
APPLICATION: Pressure chambers, submarines, weather systems.

CHOICE #2: CAN WE BLOW OUT A CANDLE HIDDEN BEHIND A BOTTLE?

MATERIALS: Tall candle, saucer, modelling clay, glass bottle, matches
PURPOSE: Can we blow out a candles flame from behind a bottle?
HYPOTHESIS: No. It is impossible to blow out the candle because an object is in the way. The air never reaches the wick.
EXPERIMENT:
1. Firmly attach the candle to the saucer using modelling clay.
2. Place the bottle in front of the candle.
3. Blow from behind the bottle and observe the flame.
OBSERVATION: The flame flickered and eventually went out.
CONCLUSION: My hypothesis was incorrect. The air stream went around the bottle and joined together on the other side.
APPLICATION: An airplane wing, shelter behind a tree from a wind storm.

The Variables:

1. Have the students list all of the variables in the investigation you chose.
2. Have the students determine which variables will remain constant and which will be changed in the following scenarios.

Choice #1: Will air pressure allow a lemon to be sucked into a bottle?
(Everything except the egg remains the same.)
Choice #2: Will the candle flame go out if it is moved further away from the bottle?
(Everything except the distance of the plate is changed.)

K (What we know)	W (What we wonder)	L (What we learned)

THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION?: CENTRE #1: DOES AIR TAKE UP SPACE?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) :

MATERIALS: **cups, large container to hold water (aquarium, sink), crumpled paper or washcloth, tape, flexible straws**

EXPERIMENT A:

1. Crumple a piece of paper or small washcloth into the bottom of a plastic cup (tape may have to be used to keep the paper at the bottom of the cup).
2. Turn the cup straight over and submerge it straight under the water.
3. Remove the cup straight out of the water.

EXPERIMENT B:

1. Turn a cup straight over and submerge it straight under the water
2. While under the water tilt the cup slightly to allow some air to escape and water to rush in. Then place the cup back in a straight upside-down position.
3. Slip one end of the flexible straw under and inside the cup, while the other protrudes above the surface of the water.
4. Blow through the straw while your partner holds the cup steady.

WHAT HAPPENED ? (OBSERVATIONS)

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

Centre #1a:

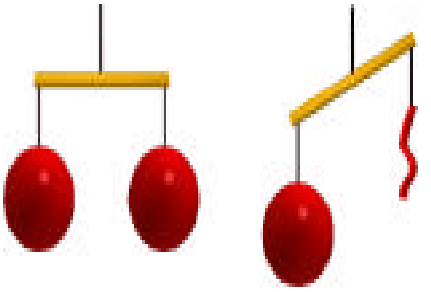
1. Why didn't the paper inside the glass get wet?

Centre #1b:

1. Explain what happened to the water in the second glass?

2. Explain a situation where an air pocket could save your life.

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK



THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #2: DOES AIR HAVE WEIGHT?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (MATERIALS AND PROCEDURES OR EXPERIMENT STEPS) :

MATERIALS: **metre stick, tape, balloons of equal shape and size, pin, string**

1. Tie a string to the centre of a metre stick and set it aside.
2. Inflate two balloons to approximately the same size, and tie a balloon to each end of the metre stick.
3. Suspend the metre stick such that it is horizontally balanced by the two balloons.
4. When the set-up is level, use tape to hold things in place.
5. Puncture one of the balloons with a pin and observe the results.

Safety precaution: Be careful not to pop the balloon near ears.

WHAT HAPPENED ? (OBSERVATIONS)

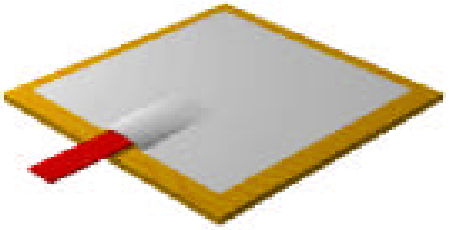
CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

1. Which end rose up and why?

2. Why do you think your stomach feels queasy when you go over a hill or down a roller coaster?

3. Where else might you see examples of what you've learned in this investigation?

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK.



THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #3: DOES AIR HAVE PRESSURE?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (MATERIALS, AND PROCEDURES OR EXPERIMENT STEPS) :

MATERIALS: **glass, cardboard square that is just larger than the mouth of the glass, container to hold water (aquarium, sink), ruler, newspaper**

Experiment A:

1. Fill the glass three-quarters full with water, making sure that the rim is wet.
2. Snuggly, place the cardboard square over the mouth of the glass to create a tight seal (no air bubbles between the cardboard and the glass).
3. Still holding on to the cardboard, turn over the glass above the aquarium or sink
basin.
4. Release the cardboard.
(This may take a few tries.)

Experiment B:

1. Lay a ruler on a table so that about one third of it lies over the edge.
2. Spread and smooth a piece of newspaper over the ruler. Now try to make the paper fly into the air by hitting the ruler downward with a fast and hard motion.

Safety Precation: Make sure that the ruler is placed enough under the paper that it doesn't kick back.

WHAT HAPPENED ? (OBSERVATIONS)

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

Centre #3a:

1. What happened to the water when your hand was removed?

Centre #3b:

2. Why was it so difficult to lift the paper with the ruler?

3. Give examples of daily occurrences that use vehicles which you have learned in this investigation?

COMPLETE A DRAWING OF YOUR INVESTIGATION BELOW

THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #4: DOES AIR EXPAND?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (MATERIALS AND PROCEDURES OR EXPERIMENT STEPS):

MATERIALS: plastic pop bottle, kettle, long stretchy balloon, ice, two containers to hold hot and cold water, heat and water resistant mitts

SAFETY PRECAUTIONS: Be sure to wear the protective mitts when handling the hot water and make sure that the teacher is supervising when pouring the hot water into the container.

1. Stretch out a balloon and place its open end over the mouth of a plastic pop bottle.
2. Place the bottle in the hot-water container with the balloon on top (use the kettle to heat the water). The water should come at least half way up the outside of the bottle.
3. Next, repeat the same steps with the cold water (add ice to chill the water).

WHAT HAPPENED ? (OBSERVATIONS)

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

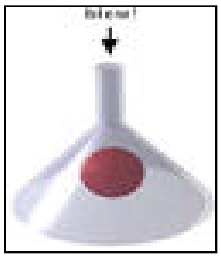
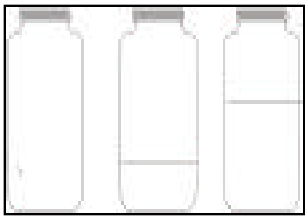
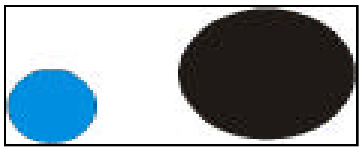
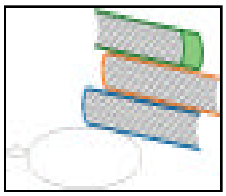
1. Why did the balloon react this way?
2. With what you have just learned, describe how a hot-air balloon pilot would get his/her balloon to clear a rather large hill.

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK

Centre #5: Student Sheet

Name:_____

Materials: funnel, ping pong ball, bottles (same), water, spoon, different-sized balls, books, bag

What to do:	Your Prediction	Your Observation
Will a ping pong ball bounce under a funnel of air? (blow in the top) 		
Can different amounts of air cause different sounds to be heard? (tap with a spoon) 		
Will certain similar objects fall to the ground faster than others? (drop two different-sized balls from the same height at the same time) 		
Can a pile of books be raised using only your breath? (pile some books on top of a plastic bag and blow into the opening) 		

HISTORY OF FLIGHT

400 B.C.E. - First kites invented by the Chinese.

1485 - Wing-flapping aircraft (ornithopter) designed by Leonardo Da Vinci.

1783 - Duck, sheep, and a rooster launched in a hot-air balloon.

1849 - First three-winged glider, designed by Sir George Cayley, elevates a person off the ground.

1891 - First practical glider built for long flights by Otto Lilienthal.

1903 - The Wright Brothers developed the first airplane that had a pilot, power, control, and could fly.

1907 - First free-flying helicopter built by Paul Cornu.

1908 - First fatal air crash is a passenger in a plane built by Orville Wright.

1913 - First nonstop flight across the Mediterranean Sea (700 kilometres) by Roland Garros.

1914 - First bombs dropped from a plane on the city of Paris during WWI.

1918 - The greatest ace of the war, Manfred von Richthofen shoots down his 80th aircraft and is then himself shot down.

1919 - Two Canadians (John Alcock and Arthur Brown) fly nonstop across the Atlantic Ocean.

1926 - The first liquid-fuelled rocket is launched by Robert Goddard.

1927 - Charles Lindbergh is the first person to fly across the Atlantic Ocean nonstop.

1932 - Amelia Earhart becomes the first woman to fly solo across the Atlantic Ocean.

1939 - WWII starts as German planes help Hitler overwhelm Europe.

1941 - In Pearl Harbor, Japanese planes, taking off from aircraft carriers, cripple the American navy in a surprise attack.

1945 - The United States drops an atomic bomb on Hiroshima and Nagasaki, ending WWII.

1947 - The X-1 piloted by Chuck Yeager, breaks the sound barrier, at a speed of Mach 1.015.

1961 - Yuri Gargarin becomes the first person in space.

1969 - Neil Armstrong becomes the first person to walk on the moon.

1986 - Space shuttle Voyager flown around the world by Dick Rutan and Jeana Yeager.

1991 - The world's first Stealth aircraft is used in the Gulf War.

Self Assessment Sheet:

Lesson: History In The Making

Name: _____
Date:_____

Levels/Criteria	Level 1	Level 2	Level 3	Level 4
1. Did I include my own ideas and opinions?				
2. Did I make good use of the available resources?				
3. Did I proofread my work to ensure that it was neat?				
4. Did I proofread my work to check spelling and grammar?				
5. Did I use my class time wisely?				
6. Did I use my home time wisely?				
7. Did I contribute an equal amount of work to this project?				
8. Did I learn a great deal from this project?				
9. Did I summarize the information in an organized way?				
10. Have I completely met all of the required elements of this project?				
11. The level I feel I deserve is....				

Level 1 - rarely
Level 2 - occasionally
Level 3 - often
Level 4 - consistently

Name:_____

FLIGHT TIMELINE OUTLINE

What to do?

1. You will be responsible for creating a flight timeline and a special report on a significant person or event in the history of flight.
2. Once you have compiled all of your information, you will be given some chart paper to organize your timeline. Be sure to space out all of the events of your timeline in a equal and eye-pleasing fashion. The events must be neatly written or typed, and pasted onto the timeline.
3. The special report is to be neatly written or typed and should include an artistic component to make it look nice.

Note: With teacher approval, this project may be completed using a computer presentation program such as *Hyperstudio*.

What's involved:

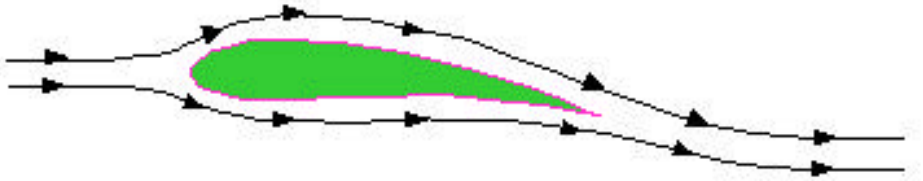
Timeline:

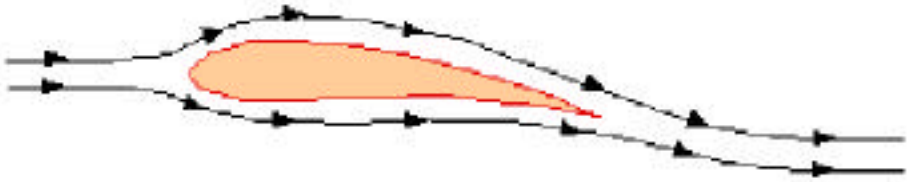
1. You are to research the historical milestones of flight via the Internet, school library, local library, and/or through any other available resource.
2. Include the following for each milestone on your timeline:
a) milestone
b) date
c) brief description
3. Include and checkmark the many significant Canadian flight milestones in history.
4. Create three future milestones using only the limits of your imagination as a guide.

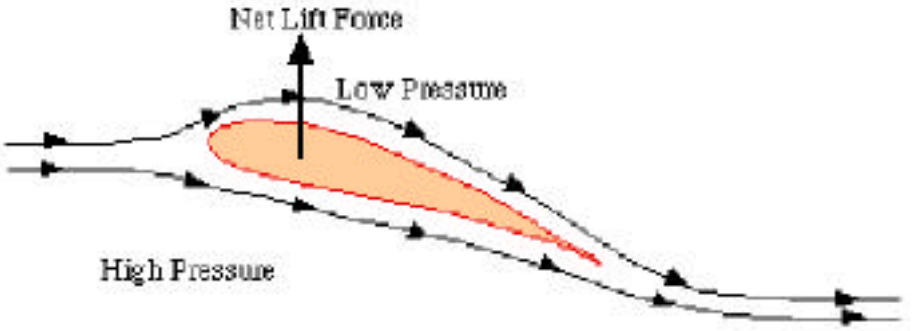
Report:

1. You are to generate a special report on a person or event from your timeline, in either a poster or booklet format. This report should include:
a) The name of the event or person
b) The location involved
c) The date involved
d) Why the event or the person was important to the timeline of flight
e) Any other items you wish to add
f) Title page, table of contents, and bibliography

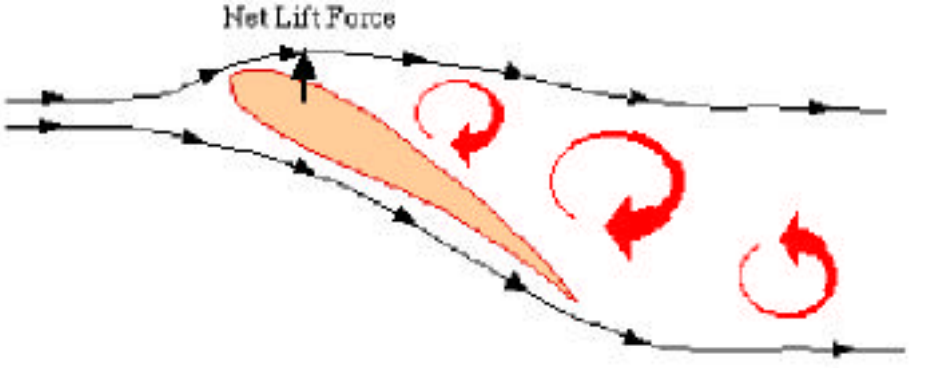
Due date:_____







A difference in pressure causes the lifting force



THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CAN THE SHAPE OF A WING HELP IT TO OBTAIN LIFT?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) :

MATERIALS: a ruler, strip of paper about 28 cm by 8 cm, and tape.

Creating an Aerofoil:

1. Fold the strip of paper in half and tape the top edge about 3 cm from the bottom edge. (This will make the top surface curved and give the paper the shape of an airplane wing.)
2. Slide the ruler into the fold of the paper.
3. Blow on the front of the wing.
4. Swing your wing through the air at different angles.

Safety Procedures: Be sure to aim your aerofoil in directions away from yourself and others.

WHAT HAPPENED ? (OBSERVATIONS)

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

KEY QUESTIONS FROM TODAY'S LESSON:

1. Do you believe that the weight of the paper has anything to do with it falling or floating? Explain your answer.
2. What are some factors that effect how the long the paper stays in the air?
3. How did the papers react in each of the investigations?
4. What did the aerofoil do when wind was introduced to its front face?
5. Which angle did you find it easiest to swing at: slightly pointed up, even across, or pointed downward?

Create a news article - suggested headline: Gravity Conquered by Lift!

Create an interesting, detailed news article with diagrams and proper terminology that clearly shows how flying vehicles effectively counteract the force of gravity. Utilize the information gathered from your investigations today to enhance your article. Describe some of the essential characteristics that wings must have in order to effectively function on a flying object. What are some things that could go wrong?

Include a title page with your report.

City Council Meeting:

Name: _____ **Date:**_____

Role:_____ **Group Position: For** _____ **or Against** _____
(Check one)

The Situation:
You live in a country that is involved in ongoing peace talks with your neighbours to the north and south. These talks continually breakdown and are usually followed by isolated incidents of aggression. Your government is planning on opening three new air bases at key locations in the country. One of the considered locations is right in the heart of your relatively peaceful city. The government has sent out a group of officials to visit all of the cities that are being considered. This group is to attend a city council meeting where the topic of the air base will be first and foremost on the list. The officials' feedback and recommendations will be major deciding factors in the final location decision.

WHAT TO DO?
1. You will be given a role to play and will be meeting with your group to plan out a report and presentation to city council.
2. Everybody in the group is required to:
a). Create a unique identity and background (example: Kyle Workforu: Top selling real estate agent.)
b). Complete an individual written report that will be added to your group report (see handout).
c). Contribute to your group presentation to council.

THE ROLES:
1. **Local developers:** You belong to one of the many companies that will actually be either building the airforce base and/or developing the surrounding area. You look forward to the employment opportunities that will be generated by this massive project.
2. **Realtors:** You're looking forward to settling property for those people that must relocate and for the new members who would join the community.
3. **Local business owners:** You are strongly in favour of the new business opportunities that may be generated by this development.
4. **Local Catholic Church representatives:** You are opposed to offering your community as a tool for air warfare.
5. **Environmental groups:** You are already concerned with the lack of pollution controls that exist at the public airport and you are concerned that things will only get worse with this new development.
6. **Local homeowners near the base:** You are one of the many long-time residents who have been fighting for the closure of the current airport due to noise, air pollution, and near disasters in the past 20 years.
7. **Mayor:** You have a vote in the final decision made by the city representatives.
You are to run the meeting to insure proper format and to insure that all groups are heard.
You are to develop a meeting agenda with the city councillors. Include: who will go first and ensure equal opportunities for all involved.
8. **City councillors:**
You are to:
- set the meeting agenda with the mayor;
- develop and ask questions from the submitted reports and presentations;
- listen to the community leaders as they present their viewpoints on the issues;
- put forth the city's final decision on the matter.

9. **Government fact-finding committee:** You attend the city council meeting, listen closely to the special interest groups, and receive the city's overall recommendation. Based on all of the gathered information you are to generate a report and presentation to all involved, stating your approval or disapproval of considering this site as an airforce base.

City Council Meeting: Special Interest Group Form

Name: _____ **Date:_____**

Your Fictional Name:_____

Role:_____ **Group Position: For _____ or Against _____**
(Check one)

Tell us some things about your character (use another sheet if needed):

Key points you want to make during the presentation (use another sheet if needed):

City Council Meeting: Mayor and City Council

City Council Meeting: Mayor and City Council Members Form

Name: _____ **Date:_____**

Your Fictional Name:_____ **Role:_____**

City's Position: For _____ or Against _____
(Check one)

Tell us some things about your character (use another sheet if needed):

Key questions you want to ask during the meeting (use another sheet if needed):

City Council Meeting: Government Fact-Finding Committee Form

Name: _____ **Date:_____**

Your Fictional Name:_____ **Role:_____**

Government's Position: For _____ or Against _____
(Check one)

Tell us some things about your character (use another sheet if needed):

Key points from the meeting which persuaded the decision your group made:

TESTING DRAG AND THRUST

Name:_____
Date:_____

PURPOSE OR QUESTION?:

1. DOES THE ANGLE AT WHICH A ROCKET IS LAUNCHED AFFECT THE DISTANCE TRAVELLED?
2. DOES THE ANGLE AT WHICH A WING IS ANGLED AFFECT THE DISTANCE TRAVELLED?
3. DOES THE AMOUNT OF WEIGHT AFFECT THE DISTANCE TRAVELLED?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

1.
2.
3.

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) : This experiment will be set up by the teacher. You may be called upon to help.

WHAT HAPPENED ? (OBSERVATIONS/RESULTS):

TEST/DISTANCE TRAVELED	VERTICAL BALLOON ROCKET PREDICTION	HORIZONTAL BALLOON ROCKET PREDICTION	VERTICAL BALLOON ROCKET ACTUAL	HORIZONTAL BALLOON ROCKET ACTUAL
Distance travelled with flat surface of the wings facing the ground - normal position (m and cm)				
Distance travelled with flat surface of the wings facing the air (cm and m)				
Distance travelled with 1 washer				
Distance travelled with 3 washers				
Distance travelled with 5 washers				

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

1. Were your predicitions correct? Explain why.

2. What would be needed to push the balloon upward so that it reaches the same distance that was measured when it was on a straight line?

3. Where else do you see examples of drag and thrust in our world?

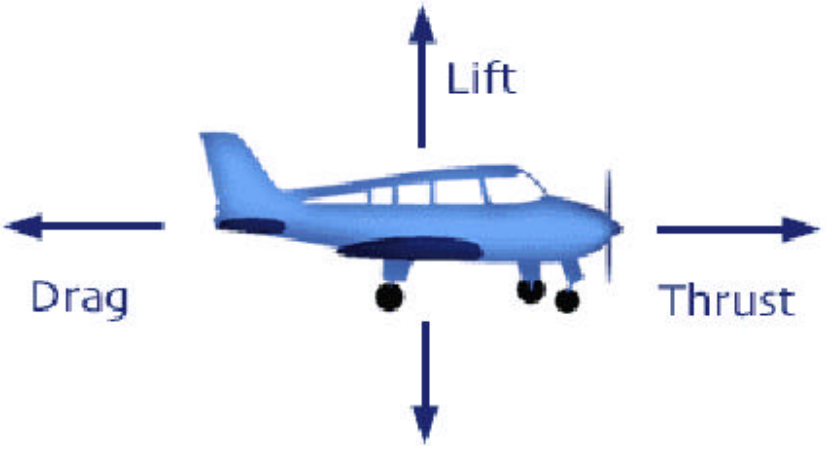
4. How would the size of the balloon effect the distance traveled?

5. Complete a double bar graph from the data generated in class today."

Be sure to neatly and properly label your graph.

BELOW, COMPLETE A SERIES OF DRAWINGS FROM TODAY'S INVESTIGATION;

The Four Forces of Flight



Thrust, drag, gravity, and lift are the four forces that usually work together to make things fly. You already know something about each of them, although you might not have called them by their names.

Think of an airplane sitting on the ground. The plane and the earth are pulling on each other because of the force called gravity. However, we would like to be able to raise the plane up into the air - and we call that **lift**. Also, unless you push really hard on it, the plane is sitting still on the ground because of the friction between the wheels and the ground. When the plane starts rolling there will be friction between the air and the plane - and we call that **drag.** When the plane starts flying there will still be drag, and lots of it!

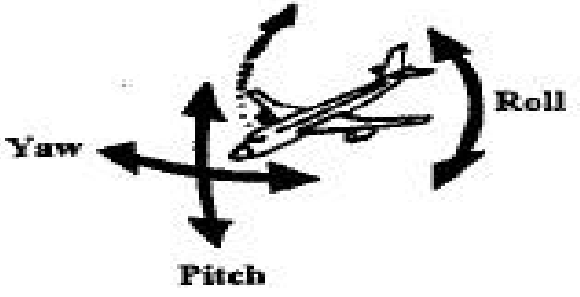
So, to make the airplane fly somewhere, we have to do at least two things. Engineers call these things requirements or functions: 1) **lift** the plane in the air, and 2) **thrust** the plane through the air.

Wing Flaps

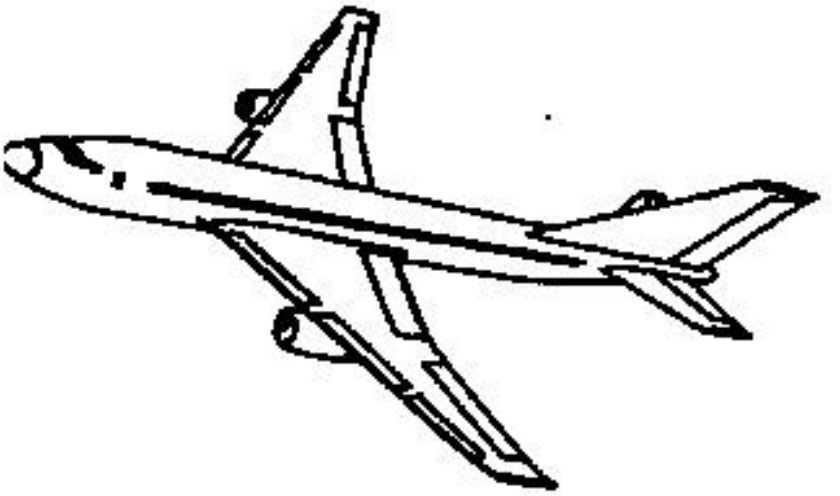
The importance of flaps: Flaps change the curvature of a wing, increasing lift. Airplanes use flaps to maintain lift at lower speeds, particularly during takeoff and landing. This allows an airplane to make a slower landing approach and a shorter landing. Flaps also increase drag, which helps slow the airplane and allows a steeper landing approach.

The Three Basic Movements of an Airplane

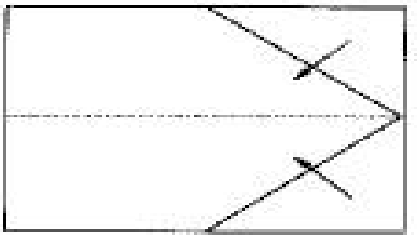
Yaw - movement on the vertical axis. The nose of the plane turns left or right.
Roll - movement on the longitudinal axis. One wing dips lower than the other.
Pitch - movement on a lateral axis. The nose of the plane moves up and down.
The movement around each axis is controlled by a specific control surface.
The pilot can use the elevators to control the pitch of a plane, the rudder to control the yaw, and the ailerons to control the roll.

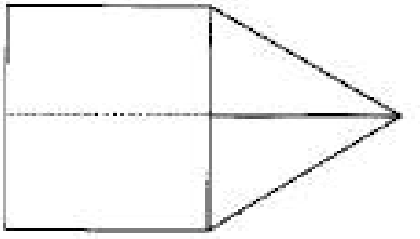


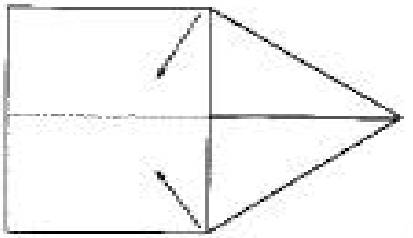
LABEL THE FOUR FORCES OF FLIGHT AND THE THREE BASIC MOVEMENTS OF AN AIRPLANE

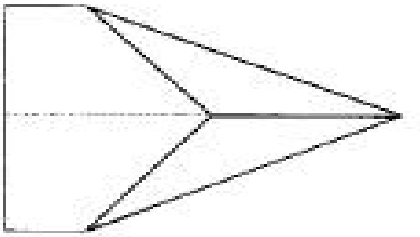


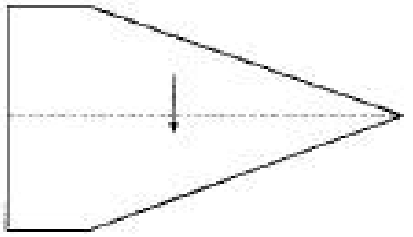
CREATING A DART PLANE

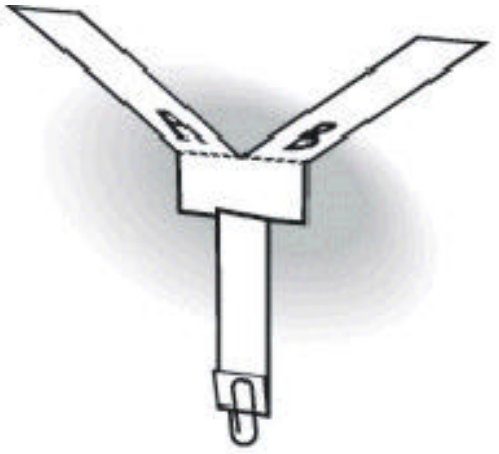


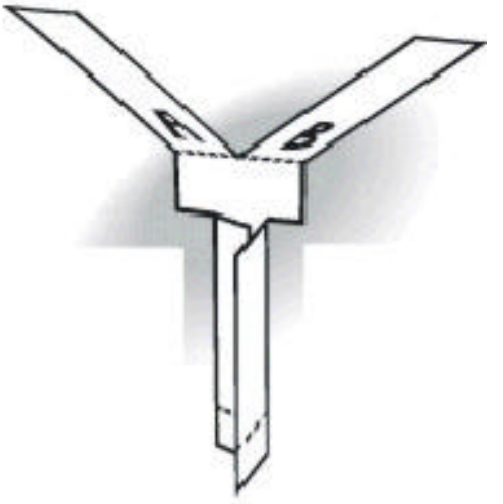


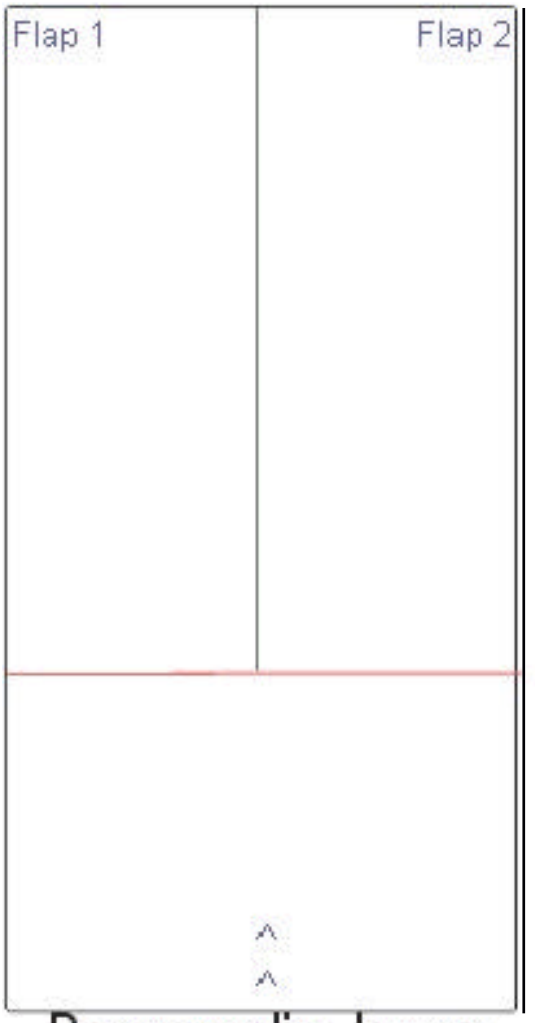




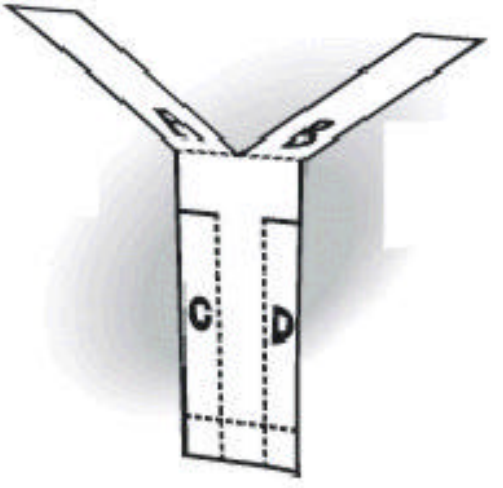








Paper clip here



THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #1: CAN YOU CONTROL THE TIME A HOT-AIR BALLOON STAYS ALOFT?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) :

Materials: yogurt container or expanded polystyrene cup, lightweight kitchen garbage bag, blow dryer, four equal pieces of string or strong thread (40 cm), scissors

1. Using the string, fasten the end of a yogurt container to the open end of the plastic bag.

2. Next, inflate the bag with the hot air from a blow dryer. As the bag begins to rise, remove the hot air source.

3. Use the recording chart to measure the time aloft using various amounts of heat.

Safety Precaution: Keep the blow dryer at least 10 cm from the bag. Check often for temperature.

WHAT HAPPENED ? (OBSERVATIONS):

Conduct four flight tests with your balloon:

Amount of time the blow dryer is on/Time aloft	Time aloft
Test #1: time:_____	time:_____
Test #2: time:_____	time:_____
Test #3: time:_____	time:_____
Test #4: time:_____	time:_____

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

1. What is the longest amount of time your balloon stayed in the air?
2. How can you increase the amount of time your balloon stays in the air?
3. How do hot-air ballonists keep their balloons going?
4. How did you control the variables in your experiment?
5. Create a bar graph to show the results of your testing.

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK OF THIS SHEET.

THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #2: CAN YOU CONTROL THE TIME A PARACHUTE STAYS ALOFT?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) :

Materials: four lengths of string or strong thread (40 cm each), square of a plastic bag (25 cm), metal washers, scissors

1. Tape or tie strings to the four corners of a plastic bag.
2. Bring the other ends of the strings together and tie them to various amounts of washers.
3. Release the parachute from a predetermined height and measure the time aloft using various amounts of washers.

WHAT HAPPENED ? (OBSERVATIONS):

Conduct four flight tests with your parachute:

Height parachute is released from/Time aloft	Time aloft
Test #1: amount of washers:_____	time:_____
Test #2: amount of washers:_____	time:_____
Test #3: amount of washers:_____	time:_____
Test #4: amount of washers:_____	time:_____

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

1. What is the longest amount of time your parachute stayed in the air?
2. How can you increase the amount of time your parachute stays in the air?
3. How did you control the variables in your experiment?
4. Create a bar graph to show the results of your testing.

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK OF THIS SHEET.

THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #3: CAN YOU CONTROL THE TIME A HELICOPTER STAYS ALOFT?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) :

Materials: paper, scissors, paper clips
(see example sheet)

1. Set up your sheet as in the diagram and cut along all the solid lines.
2. Fold one flap forward and the other flap back
3. Apply paper clips at the bottom.
5. Drop the model with the blades facing slightly upward
6. Attach more paper clips to see if the descent time is effected.

WHAT HAPPENED ? (OBSERVATIONS):

Conduct four flight tests with your helicopter:

Height helicopter is released from	Time aloft
Test #1: amount of paperclips:_____	time:_____
Test #1: amount of paperclips:_____	time:_____
Test #1: amount of paperclips:_____	time:_____
Test #1: amount of paperclips:_____	time:_____

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

1. What is the longest amount of time your helicopter stayed in the air?
2. How can you increase the amount of time your helicopter stays in the air?
3. How do helicopter pilots keep their helicopters in the air? flying?
4. How did you control the variables in your experiment?
5. Create a bar graph to show the results of your testing.

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK OF THIS SHEET.

THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #4: CAN YOU CONTROL THE DISTANCED TRAVELLED AND THE TIME ALOFT OF A DART PLANE?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) :

Materials: **8.5" x 11" paper, tape (see example sheet)**

1. Fold a piece of 8.5" x 11" paper in half lengthwise
2. Fold the top corners to the centre line.
3. Fold the newly formed corners to the centre line.
4. Bring both sides together and fold down each side wing about three-quarters to the bottom
5. Tape the top part together and cut slits in the back as wing flaps
6. Begin the test flights.
7. From this basic design you can adjust flaps, fold wing tips, or add a rudder to achieve the maximum distance.

Safety Precaution: Aim your dart plane away from yourself and others.

WHAT HAPPENED ? (OBSERVATIONS):

Conduct four flight tests with your dart plane:

Adjustment made/Time aloft	Time aloft	Distance travelled (metres)
Test #1: adjustment:_____	time:_____	
Test #2: adjustment:_____	time:_____	
Test #3: adjustment:_____	time:_____	
Test #4: adjustment:_____	time:_____	

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

1. What is the longest amount of time your dart plane stayed in the air?

2. How can you increase the amount of time your dart plane stays in the air?

3. What is the greatest distance your dart plane travelled?

4. How did you control the variables in your experiment?

5. Why wouldn't an airplane work well in space?

6. Create two bar graphs to show the results of your testing: one for time aloft and one for distance travelled.

COMPLETE A DRAWING OF YOUR INVESTIGATION BELOW.

THE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION: CENTRE #5: CAN YOU CONTROL THE DISTANCE A SURFACE FLOATER TRAVELS?

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET-UP (PROCEDURES OR EXPERIMENT STEPS) :

Material: spools, large balloon, tape, base: playing card, old compact disc, flat plastic lid, paperclips (The card, CD, or lid is used as the base.)

1. **Tape the spool to the base.**
2. **If a hole does not exist in the base, then create one that is lined up with the hole in the spool.**
3. **Stretch the mouth of an inflated balloon over the spool and pinch it so that no air is released.**
4. **Release your vehicle just above a smooth surface and observe.**
5. **Add small increments of weight (paperclips) to your floater and test its performance.**

WHAT HAPPENED ? (OBSERVATIONS):

Conduct four flight tests with your surface floater:

Amount of paperclips/Time aloft	Distance travelled (cm)
Test #1: amount of paperclips:_____	
Test #2: amount of paperclips:_____	
Test #3: amount of paperclips:_____	
Test #4: amount of paperclips:_____	

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

1. What is the greatest distance your surface floater travelled?
2. How can you increase the distance travelled?
3. How did you control the variables in your experiment?
4. Where else might you see examples of surface floaters?
5. Create a bar graph to show the results of your testing.

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK OF THIS SHEET.

GLOSSARY OF TERMS

Aerodynamics - a branch of dynamics that deals with motion of air and gaseous fluids and with the forces acting on bodies in motion.
Aileron - control surfaces on wings which operate in opposing pairs to raise and lower, thus causing the plane to roll. Ailerons increase or decrease the surface area of the airfoil.
Air - a mixture of invisible, odourless, tasteless gases that surrounds the earth.
Airflow - the movement of air over and under a surface, such as a wing.
Airfoil - shape of the wing. More curved above than below.
Air pressure - the force of air spread over a surface; it can be caused by the weight, or the atmosphere above, or by moving through the atmosphere.
Altitude - an aircraft's height above sea level.
Aviation - all flying done by general aviation, the military, and the airlines.
Aviator - the operator or pilot of an airplane.
Balloon (Hot-Air) - a bag made of rubber, plastic, or other material filled with hot air or other gases.
Bernoulli's Principle - the faster air moves over an object, the less air pressure on the object.
Biplane - an aircraft with two pairs of wings, one pair above the other. Popular until the 1930s**.**
Blimp - a soft, lighter-than-air flying craft.
Ceiling - the maximum height at which an aircraft can fly safely.
Cockpit - the compartment at the front of an aircraft where the pilot and copilot sit. All of the flight controls are located in the cockpit.
Commercial aircraft - airplanes, helicopters, or jets used for business purposes.
Deflate - to release air or gas from; to reduce in size.
Drag - the slowing force of air resistance. The opposite of thrust. It is caused by any aircraft surface that deflects or interferes with smooth airflow around the plane. Decreasing drag increases speed.
Elevator - control surfaces on the tail of the plane which operate in pairs to cause the plane to pitch. Raising the elevators causes the nose to come up and the tail to go down. Lowering the elevators causes the nose to go down and the tail to come up.
Engine - a machine for converting energy into a force or motion.
Experimental aircraft - aircraft tested for performance and reliability before manufacture.
Flap - a moveable part on the wings of an aircraft. Used for increasing lift or drag or change of direction.
Flight - to fly like a bird or airplane through the air.
Force - something that propels a body or changes movement or direction. (four forces that affect an aircraft: lift, drag, weight, thrust).
Fuselage - the main or central body of an aircraft. The wings and tail assembly are connected to the fuselage.
Gas - a fluid that doesn't have shape or volume, but expands indefinitely.
General aircraft - aircraft that is not military or commercial.
Glider - an aircraft without an engine.
Gliding - flying through the air without propulsion.

Gravity - a force that pulls everything to the ground.
Inflate - to swell or expand with air or gas.
Landing Gear - the parts of an aircraft that support its weight and allow it to move around on the ground or in the water.
Lift - the force created with air flows over an airfoil (pushes an object up, against the natural force of gravity).
Matter - a material substance that occupies space and has mass.
Momentum - a measure of the motion that continues after force is applied to an object; it is equal to the product of mass and velocity.
Monoplane - an aircraft with a single pair of wings.
Motion - changing positions, movement.
Parachute - like a very large umbrella used to float down through the air.
Pneumatic- worked by or filled with compressed air.
Pressure - the force over an area.
Propeller - a part of a mechanical device with blades mounted on a hub.
Rocket - a vehicle that can carry humans and equipment into space.
Roll - roll air from side to side. Controlled by the aileron surfaces.
Rotor - the rotating blades of a helicopter.
Rudder - control surface located on the tail of the plane. The rudder is moved from side to side and causes the plane to move to the left or right. Rudder moves to the right to turn the aircraft nose right.
Streamline - streamlining cuts down drag. The teardrop shape of an airfoil helps to lower drag
Thrust - pulls or pushes the plane forward. The opposite of drag.
Trailing edge - the back edge of a wing is the trailing edge.
Velocity - rate of motion, the speed, and direction of an object.
Wings - used by birds and airplanes to help them fly.
Yaw - moves the nose right or left. Controlled by the rudder surface.

THE TERMINOLOGY TWIST

In small groups, you will prepare and present to the class one of the selections below:

a. Commercial: Selling a product related to the unit
b. News Report on an interesting development in aviation
c. Interview with a famous aviator
d. Musical Jingle
e. Rhyming poem

The focus will be on the terminology highlighted throughout the unit:

An example would be:

Commercial: "How would you like to thrust yourself into the spotlight. Nobody wants to be a drag, so lift your spirits with these new air walkers, guaranteed to comfortably shuttle you to the top of the popularity hill!!! .....(Continue)

Notes: Use as much of the unit terminology as possible.

LOOKING AHEAD TO THE AIR SHOW:

Remember to include the terminology in your “flight guide” report.

YOUR AIR VEHICLE WRITE-UP

NAME:_____
DATE:_____

PURPOSE OR QUESTION:

WHAT DO I THINK WILL HAPPEN? (HYPOTHESIS):

THE SET- UP (MATERIALS, PROCEDURES, OR EXPERIMENT STEPS) :

WHAT HAPPENED ? (OBSERVATIONS):

CONCLUSIONS AND APPLICATIONS (Complete in your flight log book):

COMPLETE A DRAWING OF YOUR INVESTIGATION ON THE BACK OF THIS SHEET.

Checklist:

Lesson: AIR VEHICLE DESIGN

Name: _____
Date:_____

Levels/Criteria	Level 1	Level 2	Level 3	Level 4
1. Was the task understood?				
2. Was good use made of the available tools, equipment, and materials?				
3. Where all of the procedures followed safely?				
4. Were changes made to the design as needed?				
5. Were enough tests conducted?				
6. Was time used wisely?				
7. Was the workload evenly distributed within the group?				
8. Did new learning take place?				
9. Was the information summarized in an organized fashion?				
10. Is the information complete and detailed?				

Level 1 - rarely
Level 2 - occasionally
Level 3 - often
Level 4 - consistently

Self Assessment Sheet:

Lesson: "AIR VEHICLE DESIGN"

Name: _____
Date:_____

Levels/Criteria	Level 1	Level 2	Level 3	Level 4
1. Did I understand the task?				
2. Did I make good use of the available tools, equipment, and materials?				
3. Did I follow all the procedures safely?				
4. Did I make changes to my design when I needed to?				
5. Did I conduct enough good tests?				
6. Did I use my time wisely?				
7. Did I contribute an equal amount of work to this project?				
8. Did I learn a great deal from this project?				
9. Did I summarize the information in an organized way?				
10. Is the information complete and detailed?				
11. The level I feel I deserve is....				
12. Why I feel I deserve this level:				

Level 1 - rarely
Level 2 - occasionally
Level 3 - often
Level 4 - consistently

Checklist:

FLIGHT UNIT: OVERALL

Name: _____
Date:_____

Levels/Criteria	Level 1	Level 2	Level 3	Level 4
1. Asks appropriate questions?				
2. Takes part in discussions?				
3. Listens when group partners or teacher speaks?				
4. Makes constructive and positive comments to the group members?				
5. Stays on task?				
6. Contributes ideas and suggestions?				
7. Shows interest in project work?				
8. Takes risks?				
9. Raises questions and discusses possible explanations?				
10. Kept detailed notes?				

Level 1 - rarely
Level 2 - occasionally
Level 3 - often
Level 4 - consistently

Name: _____

TECHNOLOGICAL PROGRESS THROUGH THE AGES

TOOLS TO MAKE EXPLORATION POSSIBLE	**VIKINGS**	**EUROPEAN**	**TODAY**
TRANSPORTATION	OARS MAN POWER	SAILS RUDDERS	MOTORS
INSTRUMENTS OF NAVIGATION	STARS	ASTROLAB SEXTANT CROSS-STAFF	COMPASS SATELLITES RADAR
WEAPONS	CLUB ARROW SPEAR	KNIVES CANONS MUSKETS	SOPHISTICATED GUNS BOMBS NUCLEAR
MAPS	THEY WERE THE FIRST TO CHART THE WAY	QUADRANTS LATITUDE LONGITUDE	SATELLITE IMAGES
TRAINING AND EDUCATION	NONE	MATH ASTRONOMY	UNIVERSITY HIGHLY TECHNICAL
SPONSORS	SELF	KING / QUEEN COUNTRY	GOVERNMENT

Student Name:_____
Date:_____

Report and Presentation

for use with Subtask 5 : CITY COUNCIL MEETING
from the Grade 6 Unit: **Flighter than Air**

Expectations for this Subtask to Assess with this Rubric:

6e60 – use tone of voice and gestures to enhance the message and help convince or persuade listeners in conversations, discussions, or presentations;

6e62 – follow up on others' ideas, and recognize the validity of different points of view in group discussions or problem-solving activities;

6s37 – formulate questions about and identify needs and problems related to the properties of air and characteristics of flight, and explore possible answers and solutions (e.g., investigate whether the shape of a plane affects its flight path);

6s39 – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

6z47 – demonstrate an understanding of the possible reasons for the presence of Canadian peacekeepers in other countries;

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Understanding of basic concepts	– shows understanding of few of the basic concepts – demonstrates significant misconception – gives explanations showing limited understanding of the concepts	– shows understanding of some of the basic concepts – demonstrates minor misconceptions – gives partial explanations	– shows understanding of most of the basic concepts – demonstrates no significant misconceptions – usually gives complete or nearly complete explanations	– shows understanding of all of the basic concepts – demonstrates no misconceptions – always gives complete explanations
Relating of science and technology to each other and to the world outside the school	– shows little understanding of connections between science and technology in familiar contexts	– shows some understanding of connections between science and technology in familiar contexts	– shows understanding of connections between science and technology in familiar contexts	– shows understanding of connections between science and technology in both familiar and unfamiliar contexts
Reasoning	– with assistance – using a few simple ideas – inconsistently and with limited understanding	– with limited assistance – using a variety of simple and related ideas – consistently and with limited understanding	– independently – using ideas of some complexity – consistently and with general understanding	– independently – using complex ideas – consistently and with thorough understanding
Communication	– with assistance – unclearly – for a limited range of simple purposes – with a limited range of simple forms	– independently – with some clarity and some precision – for a variety of simple purposes – with several different forms	– independently – clearly and precisely – for specific purposes – with a variety of forms	– independently – clearly, precisely, and confidently – for a wide variety of purposes and in a wide variety of contexts – with a wide range of complex forms
Organization of ideas	– with assistance – incompletely – for a limited range of simple purposes	– independently – in a mechanical and sequential way – for a variety of simple purposes	– independently – appropriately and logically – for specific purposes	– independently – appropriately and in complex and logical ways – for a wide variety of purposes and in a wide variety of contexts

Student Name:_____
Date:_____

The Write-Up

for use with Subtask 2 : EXAMINING THE PROPERTIES OF AIR
from the Grade 6 Unit: **Flighter than Air**

Expectations for this Subtask to Assess with this Rubric:

6s28 – demonstrate understanding that gases expand to fill a space;

6s29 – demonstrate that air expands when heated (e.g., heat a garbage bag partially filled with air using a blow dryer);

6s39 – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

6s41 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, graphs, drawings, and oral presentations (e.g., hold an invention convention on things that fly).

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Understanding of basic concepts	– shows understanding of few of the basic concepts – gives explanations showing limited understanding of the concepts	– shows understanding of some of the basic concepts – gives explanations showing partial understanding of the concepts	– shows understanding of most of the basic concepts – gives complete or nearly complete explanations showing some understanding of the concepts	– shows understanding of all of the basic concepts – always gives complete explanations of the concepts
Inquiry and design skills	– applies a few of the required skills and strategies – demonstrates limited ability to use tools, equipment, and materials correctly	– applies some of the required skills and strategies – demonstrates some ability to use tools, equipment, and materials correctly	– applies most of the required skills and strategies – demonstrates general ability to use uses tools, equipment, and materials correctly	– applies all (or almost all) of the required skills and strategies – uses tools, equipment, and materials correctly
Communication of required knowledge	– communicates with limited clarity and precision – demonstrates limited ability to use appropriate science and technology terminology and units of measurement	– communicates with some clarity and precision – demonstrates some ability to use appropriate science and technology terminology and units of measurement	– generally communicates with clarity and precision – demonstrates general ability to use appropriate science and technology terminology and units of measurement	– comprehensively communicates with clarity and precision – demonstrates extensive ability to use appropriate science and technology terminology and units of measurement
Relating of science and technology to each other and to the world outside the school	– shows limited understanding of connections between science and technology in familiar contexts	– shows some understanding of connections between science and technology in familiar contexts	– shows general understanding of connections between science and technology in familiar contexts	– shows comprehensive understanding of connections between science and technology in both familiar and unfamiliar contexts

Student Name:_____
Date:_____

Timeline/Report

for use with Subtask 3 : HISTORY IN THE MAKING
from the Grade 6 Unit: **Flighter than Air**

Expectations for this Subtask to Assess with this Rubric:

6e8 • proofread and correct their final drafts, focusing on grammar, punctuation, spelling, and conventions of style;

6e21 – accurately use appropriate organizers (e.g., table of contents, index);

6e36 – plan a research project and carry out the research;

6s26 • identify design features (of products or structures) that make use of the properties of air, and give examples of technological innovations that have helped inventors to create or improve flying devices.

6s47 – describe milestones in the history of air and space travel;

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Understanding of basic concepts	– demonstrates with regards to the milestones of flight – gives explanations showing limited understanding of the concepts	– demonstrates minor misconceptions with regards to the milestones of flight – gives partial explanations	– demonstrates no significant misconceptions with regards to the milestones of flight – usually gives complete or nearly complete explanations	– demonstrates no misconceptions with regards to the milestones of flight – always gives complete explanations
Reasoning	– using a few simple ideas – inconsistently and with limited understanding	– using a variety of simple and related ideas – consistently and with limited understanding	– using ideas of some complexity – consistently and with general understanding	– using complex ideas – consistently and with thorough understanding
Communication of required knowledge	– communicates with limited clarity and precision – makes limited use of appropriate science and technology terminology and units of time	– communicates with some clarity and precision – makes limited use of appropriate science and technology terminology and units of time	– generally communicates with clarity and precision – generally uses appropriate science and technology terminology and units of time	– communicates with clarity and precision – extensively uses appropriate science and technology terminology and units of time
Relating of science and technology to each other and to the world outside the school	– shows limited understanding of connections between science and technology and the world outside the school; past, present, and future	– shows some understanding of connections between science and technology and the world outside the school; past, present, and future	– shows general understanding of connections between science and technology and the world outside the school; past, present, and future	– shows comprehensive understanding of connections between science and technology and the world outside the school, past and present, as well as their implications for the future

Student Name:_____
Date:_____

News Article

for use with Subtask 4 : LIFTING AGAINST THE PULL OF GRAVITY
from the Grade 6 Unit: **Flighter than Air**

Expectations for this Subtask to Assess with this Rubric:

6e1 • communicate ideas and information for a variety of purposes (to inform, to persuade, to explain) and to specific audiences (e.g., write the instructions for building an electrical circuit for an audience unfamiliar with the technical terminology);

6s27 – recognize that gravity does not depend on the presence of air;

6s30 – demonstrate and explain how the shape of a surface over which air flows affects the role of lift (Bernoulli's principle) in overcoming gravity (e.g., changing the shape of airplane wings affects the air flow around them);

6s39 – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Understanding of basic concepts	– shows limited understanding of the basic concepts – demonstrates significant misconception – gives explanations showing limited understanding of the concepts	– shows some understanding of the basic concepts – demonstrates minor misconceptions – gives explanations showing partial understanding of the concepts	– shows general understanding of basic concepts – demonstrates no significant misconceptions – gives explanations showing general understanding of the concepts	– shows comprehensive understanding of the basic concepts – demonstrates no misconceptions – gives explanations showing comprehensive understanding of the concepts
Communication of required knowledge	– communicates with limited clarity and precision – makes limited use of appropriate science and technology terminology	– communicates with some clarity and precision – makes some use of appropriate science and technology terminology	– generally communicates with clarity and precision – makes considerable use of appropriate science and technology terminology	– extensively communicates with clarity and precision – makes extensive use of appropriate science and technology terminology
Organization of ideas	– for a limited range of simple purposes	– for a variety of simple purposes	– for specific purposes	– for a wide variety of purposes and in a wide variety of contexts
Application of language conventions	– using a few of the conventions studied	– using at least half of the conventions studied	– using most of the conventions studied	

Student Name:_____
Date:_____

High Flyers: Design and Test

for use with Subtask 7 : HIGH FLYERS
from the Grade 6 Unit: **Flighter than Air**

Expectations for this Subtask to Assess with this Rubric:

6s25 • investigate the principles of flight and determine the effect of the properties of air on materials when designing and constructing flying devices;

6s35 – design, construct, and test a structure that can fly (e.g., a kite, a paper airplane, a hot air balloon);

6s44 – describe and justify the differences in design between various types of flying devices (e.g., airplane versus helicopter, spacecraft versus hot-air balloon);

6s49 – assess whether the materials in student-designed projects were used economically and effectively (e.g., decide whether paper was wasted during the construction of paper airplanes);

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Identifying the problem	- requires significant assistance to develop a workable plan	- requires some assistance to develop a workable plan	- develops a workable plan	- develops a thorough and flexible plan
Carrying out the plan	- requires substantial assistance to follow the plan - with substantial assistance uses tools, equipment, and materials correctly	- requires some assistance to follow the plan - with some assistance uses tools, equipment, and materials correctly	- follows the plan - uses tools, equipment, and materials correctly with only occasional assistance	- adapts the plan while developing the product - independently uses tools, equipment, and materials correctly
Testing, recording, and evaluating	- conducts insufficient testing - records insufficient data - poor analysis of data	- conducts simple testing - records some data - limited analysis of data	- conducts appropriate and sufficient testing - records sufficient data - good analysis of data	- conducts thorough testing - records data systematically - thoroughly analyses the data, making appropriate modifications
Communicating	- provides incomplete and confusing explanations	- provides partial explanations	- provides explanations that are generally correct, but may lack detail or completeness	- provides correct and thoroughly detailed explanations

Student Name:_____
Date:_____

Culminating Task Rubric

for use with Subtask 9 : THE AIR SHOW
from the Grade 6 Unit: **Flighter than Air**

Expectations for this Subtask to Assess with this Rubric:

6s24 • demonstrate an understanding of the properties of air (e.g., air and other gases have mass) and explain how these can be applied to the principles of flight;

6s25 • investigate the principles of flight and determine the effect of the properties of air on materials when designing and constructing flying devices;

6s35 – design, construct, and test a structure that can fly (e.g., a kite, a paper airplane, a hot air balloon);

6s40 – compile data gathered through investigation in order to record and present results, using tally charts, tables, labelled graphs, and scatter plots produced by hand or with a computer (e.g., record the flight distances of different styles of paper airplanes, and present their findings in a graph);

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Understanding of basic concepts	– demonstrates a limited understanding of the properties of air and the principals of flight	– demonstrates a some understanding of the properties of air and the principals of flight	– demonstrates a general understanding of the properties of air and the principals of flight	– demonstrates a comprehensive understanding of the properties of air and the principals of flight
Design and materials	– selects and uses a few appropriate materials – identifies and describes the design challenge with limited clarity – outlines limited steps to complete the plan	– some of the time selects and uses appropriate materials and design criteria – identifies and describes the design challenge with partail explanations and clarity – outlines some steps to complete the plan	– most of the time selects and uses appropriate materials – identifies and describes the design challenge with consideraable explanation and clarity – outlines in a detailed manner steps to complete the plan	– all or almost all of the time selects and uses appropriate materials – identifies and describes the design challenge using complete and precise explanations and clarity – outlines in a complex and thorough manner steps to complete the plan
The impact of the flying device	– tests the design and makes minimal modifications for improvment	– tests the design and makes some modifications for improvment	– tests the design and makes several modifications for improvment	– tests the design and makes extensive modifications for improvment
Relating of science and technology to each other and to the world outside the school	– explanations show limited understanding of the connections between science and technology and the world outside the school	– explanations show some understanding of the connections between science and technology and the world outside the school	– explanations show general understanding of the connections between science and technology and the world outside the school	– explanations show comprehensive understanding of the connections between science and technology and the world outside the school, as well as their implications

Student Name:_____
Date:_____

Graphing and Charting Drag and Thrust

for use with Subtask 6 : DRAG AND THRUST
from the Grade 6 Unit: **Flighter than Air**

Expectationsfor this Subtask to Assess with this Rubric:

6m53 – make simple conversions between metric units (e.g., metres to kilometres, grams to kilograms);

6m110 • evaluate data and make conclusions from the analysis of data;

6m120 – construct line graphs, bar graphs, and scatter plots both by hand and by using computer applications;

6s40 – compile data gathered through investigation in order to record and present results, using tally charts, tables, labelled graphs, and scatter plots produced by hand or with a computer (e.g., record the flight distances of different styles of paper airplanes, and present their findings in a graph);

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Communication of required knowledge	– communicates with little clarity and precision – rarely uses appropriate science and technology terminology and units of measurement	– communicates with some clarity and precision – sometimes uses appropriate science and technology terminology and units of measurement	– generally communicates with clarity and precision – usually uses appropriate science and technology terminology and units of measurement	– consistently communicates with clarity and precision – consistently uses appropriate science and technology terminology and units of measurement
Application of mathematical procedures	– with assistance – that are considered to be basic in solving problems – graphing and charting with major errors and/or omissions	– with limited assistance – that are considered to be appropriate in solving problems – graphing and charting with several minor errors and/or omissions	– independently – that are considered to be the most appropriate in solving problems – graphing and charting with a few minor errors and/or omissions	– independently – that are considered to be the most appropriate in solving problems, and justifies the choice – graphing and charting with practically no minor errors and/or omissions
Understanding of concepts	– with assistance – using only a few of the required concepts	– independently – using more than half of the required concepts	– independently – using most of the required concepts	– independently – using all of the required concepts

Student Name:_____
Date:_____

Terminology Twist

for use with Subtask 8 : THE TERMINOLOGY TWIST
from the Grade 6 Unit: **Flighter than Air**

Expectationsfor this Subtask to Assess with this Rubric:

6e44 – understand specialized words or terms, as necessary (e.g., medieval in a historical novel);

6s39 – use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Organization of ideas **- content** **- format**	– with assistance – incompletely – for a limited range of simple purposes	– independently – in a mechanical and sequential way – for a variety of simple purposes	– independently – appropriately and logically – for specific purposes	– independently – appropriately and in complex and logical ways – for a wide variety of purposes and in a wide variety of contexts
Originality	– with assistance – unclearly – for a limited range of simple purposes – with a limited range of simple forms	– independently – with some clarity and some precision – for a variety of simple purposes – with several different forms	– independently – clearly and precisely – for specific purposes – with a variety of forms	– independently – clearly, precisely, and confidently – for a wide variety of purposes and in a wide variety of contexts – with a wide range of complex forms
Use of terminology in the presentation	– communicates with little clarity and precision – rarely uses appropriate science and technology terminology	– communicates with some clarity and precision – sometimes uses appropriate science and technology terminology	– generally communicates with clarity and precision – usually uses appropriate science and technology terminology	– consistently communicates with clarity and precision – consistently uses appropriate science and technology terminology

Expectation List

Flighter than Air

Investigating Air and Flight An Integrated Unit for Grade 6

		Selected	Assessed
English Language---Writing			
☐ 6e1	• communicate ideas and information for a variety of purposes (to inform, to persuade, to explain) and to specific audiences (e.g., write the instructions for building an electrical circuit for an audience unfamiliar with the technical terminology);		3
☐ 6e7	• revise and edit their work in collaboration with others, seeking and evaluating feedback, and focusing on content, organization, and appropriateness of vocabulary for audience;		1
☐ 6e8	• proofread and correct their final drafts, focusing on grammar, punctuation, spelling, and conventions of style;		3
☐ 6e21	– accurately use appropriate organizers (e.g., table of contents, index);		2
English Language---Reading			
☐ 6e36	– plan a research project and carry out the research;		1
☐ 6e44	– understand specialized words or terms, as necessary (e.g., medieval in a historical novel);		2
English Language---Oral and Visual Communication			
☐ 6e60	– use tone of voice and gestures to enhance the message and help convince or persuade listeners in conversations, discussions, or presentations;		1
☐ 6e62	– follow up on others' ideas, and recognize the validity of different points of view in group discussions or problem-solving activities;		1
Mathematics---Measurement			
☐ 6m53	– make simple conversions between metric units (e.g., metres to kilometres, grams to kilograms);		1
Mathematics---Data Management and Probability			
☐ 6m106	• systematically collect, organise, and analyse data;		2
☐ 6m107	• use computer applications to examine data in a variety of ways;		1
☐ 6m110	• evaluate data and make conclusions from the analysis of data;		2
☐ 6m115	– experiment with a variety of displays of the same data using computer applications, and select the type of graph that best represents the data;		1
☐ 6m120	– construct line graphs, bar graphs, and scatter plots both by hand and by using computer applications;		1
Science and Technology---Matter and Materials			
☐ 6s24	• demonstrate an understanding of the properties of air (e.g., air and other gases have mass) and explain how these can be applied to the principles of flight;		2
☐ 6s25	• investigate the principles of flight and determine the effect of the properties of air on materials when designing and constructing flying devices;		2
☐ 6s26	• identify design features (of products or structures) that make use of the properties of air, and give examples of technological innovations that have helped inventors to create or improve flying devices.		1
☐ 6s27	– recognize that gravity does not depend on the presence of air;		1
☐ 6s28	– demonstrate understanding that gases expand to fill a space;		1
☐ 6s29	– demonstrate that air expands when heated (e.g., heat a garbage bag partially filled with air using a blow dryer);		1
☐ 6s30	– demonstrate and explain how the shape of a surface over which air flows affects the role of lift (Bernoulli's principle) in overcoming gravity (e.g., changing the shape of airplane wings affects the air flow around them);		1
☐ 6s31	– demonstrate and describe methods used to alter drag in flying devices (e.g., flaps on a jet aircraft's wings);		1
☐ 6s32	– explain the importance of minimizing the mass of an object when designing devices to overcome the force of the earth's gravity;		1
☐ 6s33	– describe the sources of propulsion for flying devices (e.g., moving air, propellers, combustible fuel);		1
☐ 6s34	– describe how unbalanced forces are used to steer airplanes and spacecraft (e.g., rocket firings to control docking in space).		1
☐ 6s35	– design, construct, and test a structure that can fly (e.g., a kite, a paper airplane, a hot air balloon);		2
☐ 6s36	– design and create a device that uses pneumatic power to move another object;		1
☐ 6s37	– formulate questions about and identify needs and problems related to the properties of air and characteristics of flight, and explore possible answers and solutions (e.g., investigate whether the shape of a plane affects its flight path);		2
☐ 6s38	– plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;		1
☐ 6s39	– use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, streamline, and aerodynamics when discussing flight materials);		5
☐ 6s40	– compile data gathered through investigation in order to record and present results, using tally charts, tables, labelled graphs, and scatter plots produced by hand or with a computer (e.g., record the flight distances of different styles of paper airplanes, and present their findings in a graph);		3

		Selected	Assessed
☐ **6s41**	– communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, graphs, drawings, and oral presentations (e.g., hold an invention convention on things that fly).		1
☐ **6s42**	– identify devices that involve the application of Bernoulli's principle (e.g., paint sprayer, carburetor);		1
☐ **6s43**	– describe how the properties of air, such as its compressibility and insulating quality, are used in common products (e.g., automobile tires, double-glazed glass, sleeping bags, fire extinguishers);		1
☐ **6s44**	– describe and justify the differences in design between various types of flying devices (e.g., airplane versus helicopter, spacecraft versus hot-air balloon);		1
☐ **6s45**	– identify characteristics and adaptations that enable birds and insects to fly;		1
☐ **6s46**	– compare living things to identify the different features that allow them to be transported by wind (e.g., differences among spores, pollen, seeds);		1
☐ **6s47**	– describe milestones in the history of air and space travel;		1
☐ **6s48**	– compare the special features of different transportation methods that enable those methods to meet different needs (e.g., features of bicycles, cars, airplanes, spacecraft);		1
☐ **6s49**	– assess whether the materials in student-designed projects were used economically and effectively (e.g., decide whether paper was wasted during the construction of paper airplanes);		2
☐ **6s50**	– describe practices that ensure their safety and that of others (e.g., directing flying objects away from oneself and others).		1

The Arts---Visual Arts

☐ **6a25**	• produce two- and three-dimensional works of art that communicate a range of ideas (thoughts, feelings, experiences) for specific purposes and to specific audiences, using a variety of familiar art tools, materials, and techniques;		1

Social Studies---CWC: Canada and Its Trading Partners

☐ **6z47**	– demonstrate an understanding of the possible reasons for the presence of Canadian peacekeepers in other countries;		1

Expectation Summary

Selected **Assessed**

Flighter than Air

Investigating Air and Flight An Integrated Unit for Grade 6

English Language

6e1	3	6e2		6e3		6e4		6e5		6e6		6e7	1	6e8	3	6e9		6e10			
6e11		6e12		6e13		6e14		6e15		6e16		6e17		6e18		6e19		6e20			
6e21	2	6e22		6e23		6e24		6e25		6e26		6e27		6e28		6e29		6e30			
6e31		6e32		6e33		6e34		6e35		6e36	1	6e37		6e38		6e39		6e40			
6e41		6e42		6e43		6e44	2	6e45		6e46		6e47		6e48		6e49		6e50			
6e51		6e52		6e53		6e54		6e55		6e56		6e57		6e58		6e59		6e60	1		
6e61		6e62	1	6e63		6e64		6e65		6e66											

French as a Second Language

6f1	6f2	6f3	6f4	6f5	6f6	6f7	6f8	6f9	6f10
6f11	6f12	6f13	6f14	6f15	6f16	6f17	6f18		

Mathematics

6m1		6m2		6m3		6m4		6m5		6m6		6m7		6m8		6m9		6m10			
6m11		6m12		6m13		6m14		6m15		6m16		6m17		6m18		6m19		6m20			
6m21		6m22		6m23		6m24		6m25		6m26		6m27		6m28		6m29		6m30			
6m31		6m32		6m33		6m34		6m35		6m36		6m37		6m38		6m39		6m40			
6m41		6m42		6m43		6m44		6m45		6m46		6m47		6m48		6m49		6m50			
6m51		6m52		6m53	1	6m54		6m55		6m56		6m57		6m58		6m59		6m60			
6m61		6m62		6m63		6m64		6m65		6m66		6m67		6m68		6m69		6m70			
6m71		6m72		6m73		6m74		6m75		6m76		6m77		6m78		6m79		6m80			
6m81		6m82		6m83		6m84		6m85		6m86		6m87		6m88		6m89		6m90			
6m91		6m92		6m93		6m94		6m95		6m96		6m97		6m98		6m99		6m100			
6m101		6m102		6m103		6m104		6m105		6m106	2	6m107	1	6m108		6m109		6m110	2		
6m111		6m112		6m113		6m114		6m115	1	6m116		6m117		6m118		6m119		6m120	1		
6m121		6m122		6m123		6m124		6m125													

Science and Technology

6s1		6s2		6s3		6s4		6s5		6s6		6s7		6s8		6s9		6s10			
6s11		6s12		6s13		6s14		6s15		6s16		6s17		6s18		6s19		6s20			
6s21		6s22		6s23		6s24	2	6s25	2	6s26	1	6s27	1	6s28	1	6s29	1	6s30	1		
6s31	1	6s32	1	6s33	1	6s34	1	6s35	2	6s36	1	6s37	2	6s38	1	6s39	5	6s40	3		
6s41	1	6s42	1	6s43	1	6s44	1	6s45	1	6s46	1	6s47	1	6s48	1	6s49	2	6s50	1		
6s51		6s52		6s53		6s54		6s55		6s56		6s57		6s58		6s59		6s60			
6s61		6s62		6s63		6s64		6s65		6s66		6s67		6s68		6s69		6s70			
6s71		6s72		6s73		6s74		6s75		6s76		6s77		6s78		6s79		6s80			
6s81		6s82		6s83		6s84		6s85		6s86		6s87		6s88		6s89		6s90			
6s91		6s92		6s93		6s94		6s95		6s96		6s97		6s98		6s99		6s100			
6s101		6s102		6s103		6s104		6s105		6s106		6s107		6s108		6s109		6s110			
6s111		6s112		6s113		6s114		6s115		6s116		6s117		6s118		6s119		6s120			
6s121		6s122		6s123		6s124															

Social Studies

6z1	6z2	6z3	6z4	6z5	6z6	6z7	6z8	6z9	6z10
6z11	6z12	6z13	6z14	6z15	6z16	6z17	6z18	6z19	6z20
6z21	6z22	6z23	6z24	6z25	6z26	6z27	6z28	6z29	6z30
6z31	6z32	6z33	6z34	6z35	6z36	6z37	6z38	6z39	6z40
6z41	6z42	6z43	6z44	6z45	6z46	6z47	1 6z48		

Health & Physical Education

6p1	6p2	6p3	6p4	6p5	6p6	6p7	6p8	6p9	6p10
6p11	6p12	6p13	6p14	6p15	6p16	6p17	6p18	6p19	6p20
6p21	6p22	6p23	6p24	6p25	6p26	6p27	6p28	6p29	6p30
6p31	6p32	6p33	6p34						

The Arts

6a1	6a2	6a3	6a4	6a5	6a6	6a7	6a8	6a9	6a10
6a11	6a12	6a13	6a14	6a15	6a16	6a17	6a18	6a19	6a20
6a21	6a22	6a23	6a24	6a25	1 6a26	6a27	6a28	6a29	6a30
6a31	6a32	6a33	6a34	6a35	6a36	6a37	6a38	6a39	6a40
6a41	6a42	6a43	6a44	6a45	6a46	6a47	6a48	6a49	6a50
6a51	6a52	6a53	6a54	6a55	6a56	6a57	6a58	6a59	6a60
6a61	6a62	6a63	6a64	6a65	6a66	6a67	6a68	6a69	6a70
6a71									

Flighter than Air

Investigating Air and Flight An Integrated Unit for Grade 6

Analysis Of Unit Components

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-- Unique Expectations --
8 Language Expectations
6 Mathematics Expectations
27 Science And Tech Expectations
1 Arts Expectations
1 Social Studies Expectations

Resource Types

8 Rubrics
25 Blackline Masters
2 Licensed Software
9 Print Resources
1 Media Resources
13 Websites
14 Material Resources
0 Equipment / Manipulatives
0 Sample Graphics
0 Other Resources
0 Parent / Community
4 Companion Bookmarks

Groupings

5 Students Working As A Whole Class
1 Students Working In Pairs
6 Students Working In Small Groups
5 Students Working Individually

Assessment Recording Devices

7 Anecdotal Record
1 Checklist
2 Rating Scale
8 Rubric

Teaching / Learning Strategies

3 Advance Organizer
3 Brainstorming
1 Choral Reading
1 Classifying
1 Collaborative/co-operative Learning
3 Demonstration
3 Discussion
3 Experimenting
3 Fair Test
2 Graphing
1 Guest Speaker
2 Learning Centres
1 Learning Log/ Journal
3 Model Making
1 Oral Explanation
1 Problem-solving Strategies
1 Research
2 Response Journal
2 Role Playing
1 Simulation

Assessment Strategies

2 Classroom Presentation
1 Exhibition/demonstration
1 Learning Log
5 Observation
4 Performance Task
1 Questions And Answers (oral)
5 Response Journal
2 Self Assessment