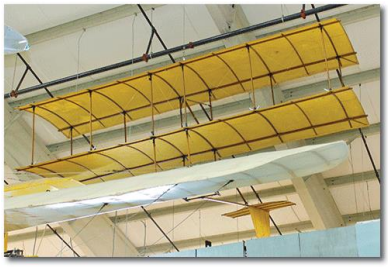
NEW ENGLAND AIR MUSEUM

SOAR for Science




Airplanes: Speed & Motion

Grade 8 Student Notebook
2018-2019

Name: _____

KWL Chart

BEFORE YOUR MUSEUM VISIT: Write three things you **KNOW** about aircraft, forces and motion in the first box. Write three things you **WANT TO KNOW** about airplanes, speed and motion in the second box.

AFTER YOUR MUSEUM VISIT: Write three things you **LEARNED** about aircraft, forces and motion in the third box.

What I Know about the science of flight
What I Want to Know about the science of flight
What I Learned about the science of flight

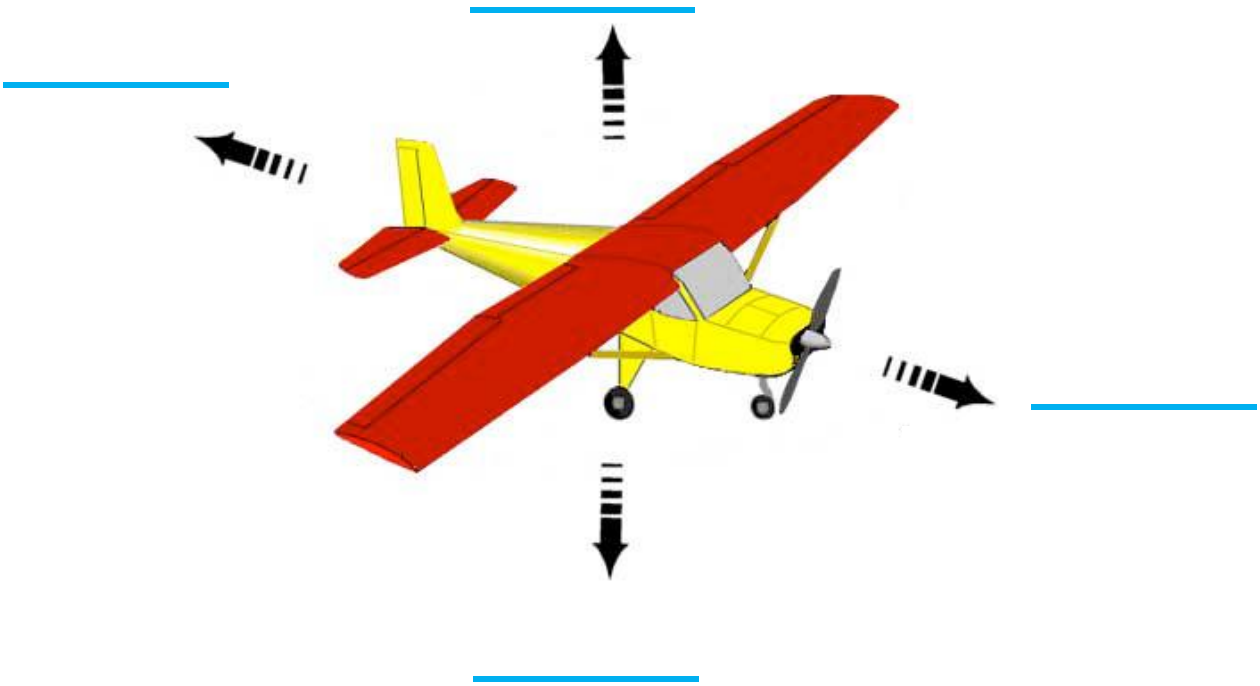
My Class's Questions

BEFORE YOUR MUSEUM VISIT: Working together as a class, choose three questions to bring to the museum and write them in the boxes below.
AFTER YOUR MUSEUM VISIT: Working together as a class, write the answers to your three questions based on what you learned at the museum.

Question 1
Answer
Question 2
Answer
Question 3
Answer

The Four Forces of Flight & Newton's Laws of Motion

<u>DURING YOUR MUSEUM VISIT</u>:
Label the four forces of flight on the picture and fill in the blanks below.



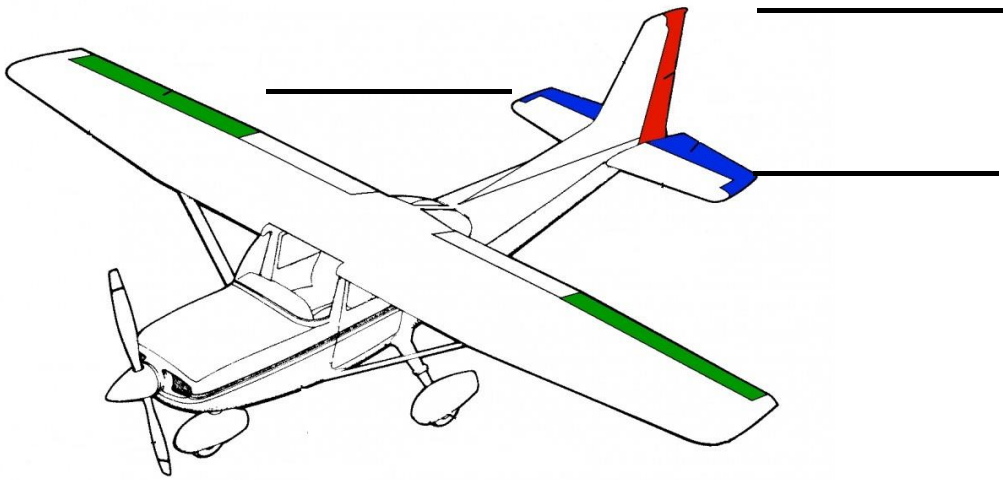
1. **Newton's First Law of Motion:** An object at rest _____ and an object in motion _____ unless acted upon by an _____.

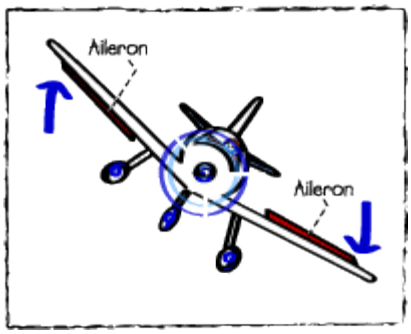
2. **Newton's Second Law of Motion** states that an object's force can be calculated by multiplying its _____ by its _____.

3. **Newton's Third Law of Motion:** For every action there is an _____ _____.

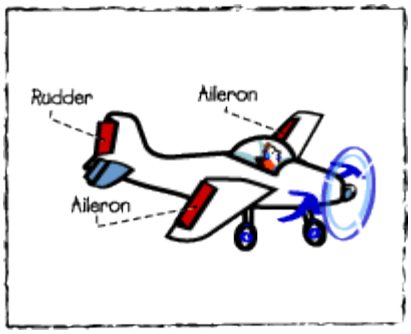
Three Primary Control Surfaces of an Airplane

<u>DURING YOUR MUSEUM VISIT</u>:
Label the three primary control surfaces of an airplane below.

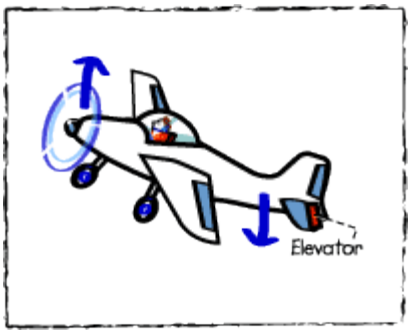




Tilt Side to Side



Nose Left and Right



Nose Up and Down

Focused Experiment

CHALLENGE: Working in teams, you will conduct an experiment to see if you can **increase the speed of a balsa wood airplane** as it flies around a pylon **by changes the forces acting upon the** aircraft.

Step 1: Assign team roles:

Winder: Winds the rubber band clockwise (to the right) 30 times.
Counter: Counts the number of winds to ensure accuracy.
Holder: Holds aircraft upside down for the winder and sets plane on the ground right-side up.
Timer: Times one airborne lap of the aircraft in flight using a stopwatch.
Watcher: Watches the aircraft at all times to ensure group safety and puts all aircraft engines (rubber band) on activity cart after use.
Calculator: Calculates speed using the formula.

Step 2: Perform your **CONTROL FLIGHT** by turning the winder **30 times** in a clockwise direction. Carefully place your plane on the ground. Start timing when the plane becomes airborne and stop timing as soon as the plane makes one revolution.

Step 3: Calculate the speed of your **CONTROL FLIGHT** using this formula:

12.56 meters	÷	_____	=	_____**meters per second**
Distance (circumference)		**Time** (seconds in air)		**Speed**

Please round to the nearest hundredth so your calculations have two decimal places (i.e. 5.346 becomes 5.35 and 4.321 becomes 4.32).

Step 4: As a team, discuss how the design of the airplane wing can increase or decrease the forces that act upon it and therefore increase or decrease the speed of the airplane in flight.

Examine the three Test Wings provided for this experiment: Wing A, Wing B, and Wing C. Choose the wing that you think will **increase the speed of your airplane**.

SEE REVERSE FOR ADDITIONAL INSTRUCTIONS

Step 5: Answer the following questions to develop your hypothesis.

My group chose (circle one): Wing A Wing B Wing C

We believe this wing will (circle one hypothesis for each force):

Increase Weight Decrease Weight Weight Will Remain Constant

Increase Drag Decrease Drag Drag Will Remain Constant

Increase Lift Decrease Lift Lift Will Remain Constant

*Thrust is constant in this experiment and therefore cannot be changed.

Step 6: Change your aircraft's wing. Make **TWO TEST FLIGHTS** measuring the speed of each flight, using a new rubber band engine for each flight. Record your data in the table below and answer the questions below.

TEST FLIGHT 1: 12.56 meters ÷ _____ = _____ **m/sec**
Distance (circumference) Time (seconds in air) Speed
How did this flight compare to your control flight?_____
_____

TEST FLIGHT 2: 12.56 meters ÷ _____ = _____ **m/sec**
Distance (circumference) Time (seconds in air) Speed
How did this flight compare to your control flight?_____
_____

CONCLUSION: Was your team successful in increasing your plane's flight speed? If so, why? If not, why not?

_____
_____
_____
_____
_____
_____
_____

PLEASE TURN TO NEXT PAGE

Step 7: As a team, discuss your findings and graph them using the bar graph below. You will be asked to present the following information to the class:

- Your control flight speed
- Your Wing choice
- Your two test flight speeds
- Your final conclusions and what change you would make if you could do the experiment over again.

FOCUSED EXPERIMENT DATA:

Meters per Second

10								
9								
8								
7								
6								
5								
4								
3								
2								
1								
0								
			Control		**Test 1**		**Test 2**	