Flight Unit Schedule

Sept. 5

Topic:
Newton's laws of motion
Homework due today:
Read handout pages 1-4. Complete homework page labeled 9/5
In Class Work:
Activities with balloons and matchbox cars
Website suggestions:
http://teachertech.rice.edu/Participants/louviere/Newton/law1.html
Great follow up to the handouts for today's class.
https://www.walter-fendt.de/html5/phen/newtoncradle_en.htm
Newton's Cradle explained.

Sept. 12

Topic:
How do airplanes fly? Thrust, drag, weight, lift
Bernoulli's Principle
Homework due today:
Read handout pages 5,6. Complete homework labeled 9/12
In Class Work:
Motion and flight projects
Website suggestions:
https://www.youtube.com/watch?v=QggNdV9TmvA
National Geographics Kids: How do planes fly?
https://www.youtube.com/watch?v=bv3m57u6ViE
Good explanation of Bernoulli's principle.

Sept. 19

Topic:
Creating airplanes for speed, distance and lift
How a helicopter works
Homework due today:
Read handouts pages 7,8. Complete homework labeled 9/19
In Class Work:
Paper airplane workshop
Website suggestions:
https://www.youtube.com/watch?v=AiTk5r-4coc
Inner workings of an airplane.

Sept. 26

Topic:
Ecology study: MEETING AT AZALEA PARK!
Homework due today:
Read handout page 9,10. Complete homework labeled 9/26
In Class Work:
Determining the health of a stream by the number of macroinvertebrates.
Website suggestions:
https://www.youtube.com/watch?v=1HysvsXcmVI
Macroinvertebrates and water quality

Oct. 3

Topic:
Hot air balloons
Sled kites
Homework due today:
Read handouts 11-14. Complete homework labeled 10/3
In Class Work:
Creating a sled kite and reviewing flight terms
Website suggestions:
https://video.nationalgeographic.com/video/i-didnt-know-that/00000144-0a3a-d3cb-a96c-7b3f36950000 Hot air balloons

Oct. 10

Topic:
Propellers and jet engines
Homework due today:
Read handouts 15,16. Complete homework labeled 10/10
In Class Work:
Guest pilot instructor, Dr. David Hudson:

Our guest instructor today is pilot Dr. David Hudson, who has a very diverse background. He is now the Associate Vice President for Research at UVA but has a degree in neuroscience. He did research on circadian rhythms for years. (circadian rhythms are physical, mental and behavioral changes that follow a roughly 24-hour cycle, responding primarily to light and darkness in an organism's environment) He has been a private pilot for almost 20 years, flying "small" single engine aircraft. He has also instructed in the private pilot ground school class at PVCC and for local flight schools. Four years ago, he joined Civil Air Patrol and since then, most of his flying has been in Civil Air Patrol aircraft. Dr. Hudson has been married for 40 years and has 2 daughters. One is an emergency room doctor and the other is a Major in the Air Force who flies in the back of fighter aircraft. He played the bass for years in a Charlottesville based group called "Big Ray and the Kool Kats".

NEWTON'S 1ST LAW

OBJECTS IN MOTION TEND TO STAY IN MOTION UNLESS ACTED UPON BY AN OUTSIDE FORCE.

OBJECTS AT REST TEND TO STAY AT REST UNLESS ACTED UPON BY AN OUTSIDE FORCE.

NEWTON'S 2ND LAW

OF MOTION

WHEN AN OBJECT IS ACTED UPON BY A FORCE, IT WILL EITHER START TO MOVE, SPEED UP OR SLOW DOWN, OR CHANGE DIRECTION.

When an object speeds up, we say that it accelerates. Acceleration of an object depends on its mass and size and the direction of the force acting on it. The more mass, the harder it is to go faster. The bigger the force, the faster the object will go.

The large semi tractor trailer would take a longer time to accelerate than the tiny red car. This is an example of mass, force & acceleration or Newton's 2nd law.

NEWTON'S 3RD LAW

FOR EVERY ACTION THERE IS AN EQUAL AND OPPOSITE REACTION.

PAGE 1

Sir Isaac Newton

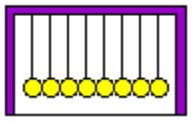
Sir Isaac Newton was one of the greatest scientists and mathematicians that ever lived. He was born in England on December 25, 1643. He was born the same year that Galileo died. He lived for 85 years.

Isaac Newton was raised by his grandmother. He attended Free Grammar School and then went on to Trinity College Cambridge. Newton worked his way through college. While at college he became interested in math, physics, and astronomy. Newton received both a bachelors and masters degree.

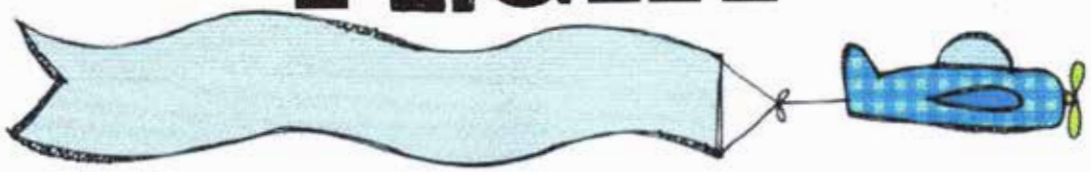
While Newton was in college he was writing his ideas in a journal. Newton had new ideas about motion, which he called his three laws of motion. He also had ideas about gravity, the diffraction of light, and forces. Newton's ideas were so good that Queen Anne knighted him in 1705. His accomplishments laid the foundations for modern science and revolutionized the world. Sir Isaac Newton died in 1727.

In this lesson you will develop an understanding of each of Newton's Three Laws of Motion.

First Law of Motion



FORCES OF FLIGHT



LIFT

THE UPWARD FORCE ON A PLANE MADE POSSIBLE BY BERNOULLI'S PRINCIPLE.

WEIGHT

THE DOWNWARD FORCE ON A PLANE CAUSED BY GRAVITY.

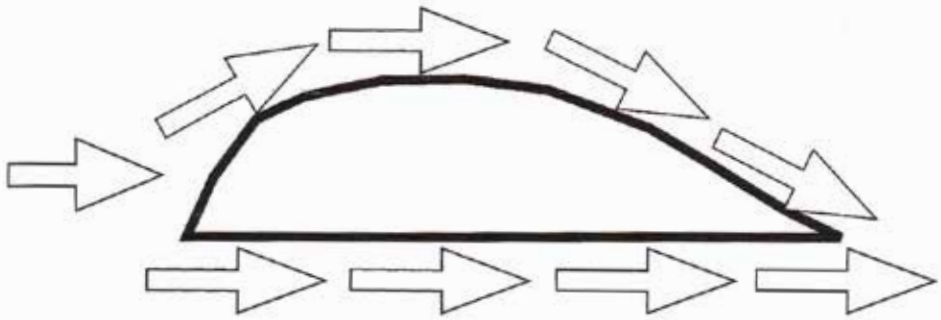
THRUST

THE FORWARD FORCE ON A PLANE USUALLY CAUSED BY THE PLANE'S ENGINES.

DRAG

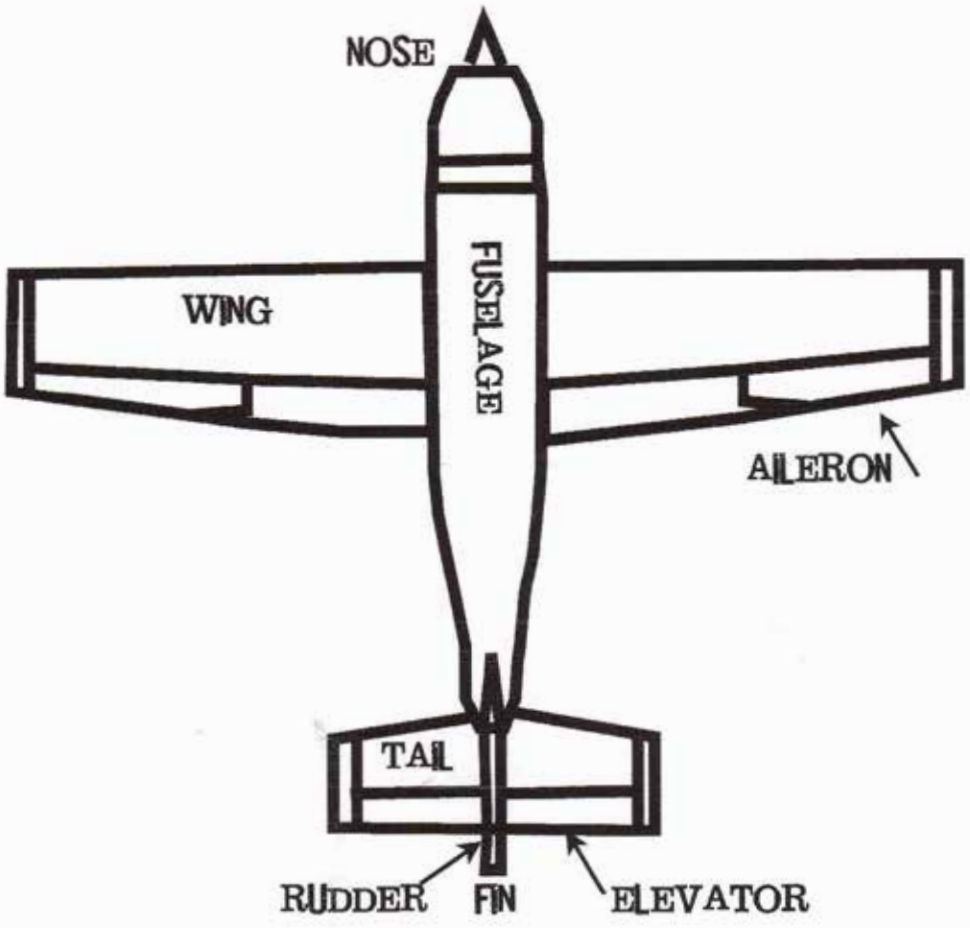
THE BACKWARD FORCES ON A PLANE CAUSED BY AIR RESISTANCE.

BERNOULLI'S PRINCIPLE



WHEN AIR HITS THE WING OF A PLANE, IT TRAVELS MORE QUICKLY OVER THE TOP OF THE WING. THIS CREATES A LOWER PRESSURE THAN IS PRESENT UNDER THE WING. THE HIGHER PRESSURE UNDERNEATH, THEREFORE, CREATES THE LIFT NEEDED TO GET THE PLANE OFF THE GROUND.

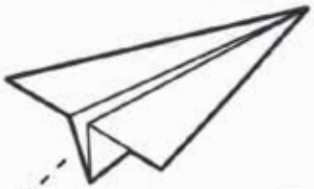
PLANE PARTS USED IN FLIGHT CONTROL



FLIGHT CONTROLS

Animation showing how these terms work:

www.youtube.com/watch?v=pQ24NtnaLI8



ROLL

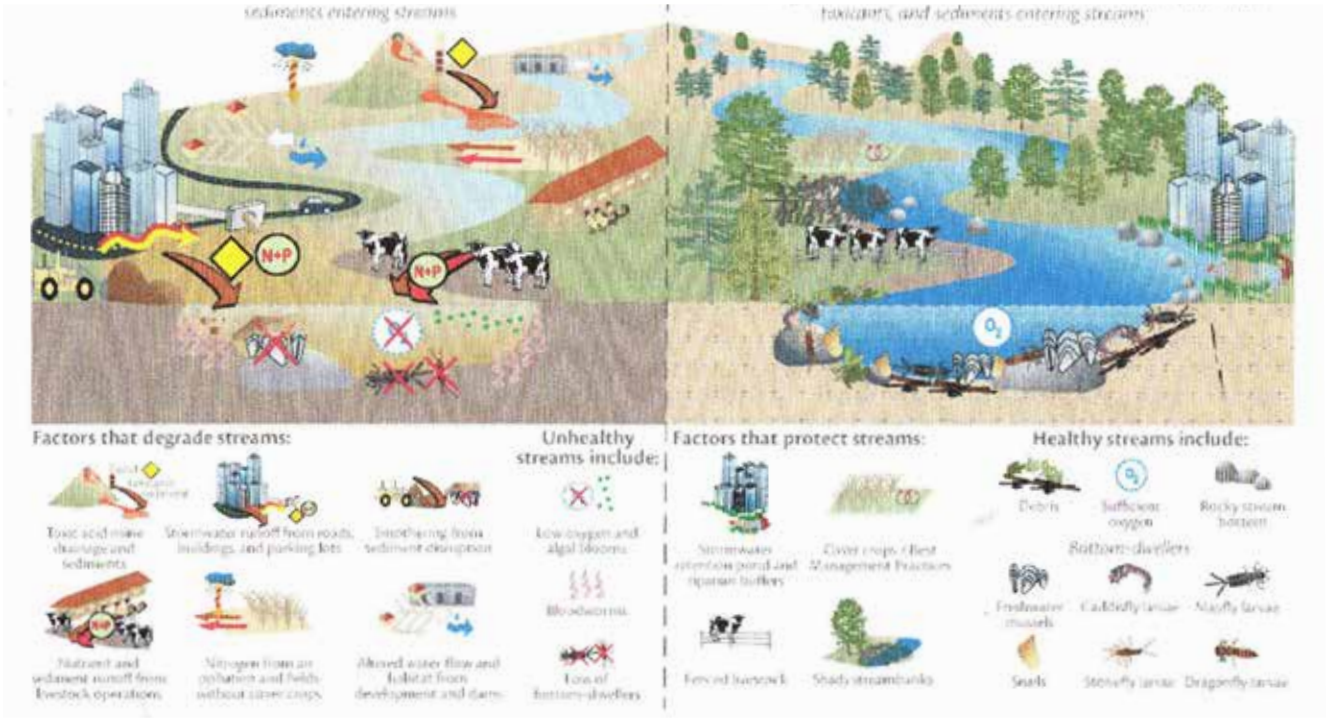
MOVES THE PLANE SIDE TO SIDE BY ADJUSTING THE AILERONS.

YAW

TURNS THE PLANE RIGHT AND LEFT BY ADJUSTING THE RUDDER.

PITCH

TIPS THE NOSE OF THE PLANE UP AND DOWN BY ADJUSTING THE ELEVATOR.


sediments entering streams
toxicants and sediments entering streams
N+P
N+P
Factors that degrade streams:
Unhealthy streams include:
Factors that protect streams:
Healthy streams include:
Debris
Bottom-dwellers
Snails

A **macroinvertebrate** is something that is big enough for you to see without a microscope. Most insects spend most of their life in water, then when they become an adult, they fly away from the water and live for just a few weeks.

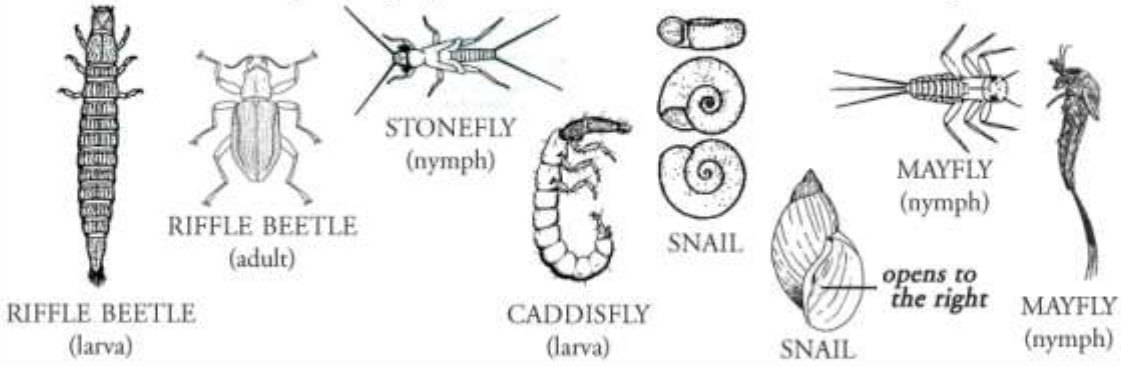
Macro—means you can see it with your eyes

Invertebrate—means it does not have a backbone

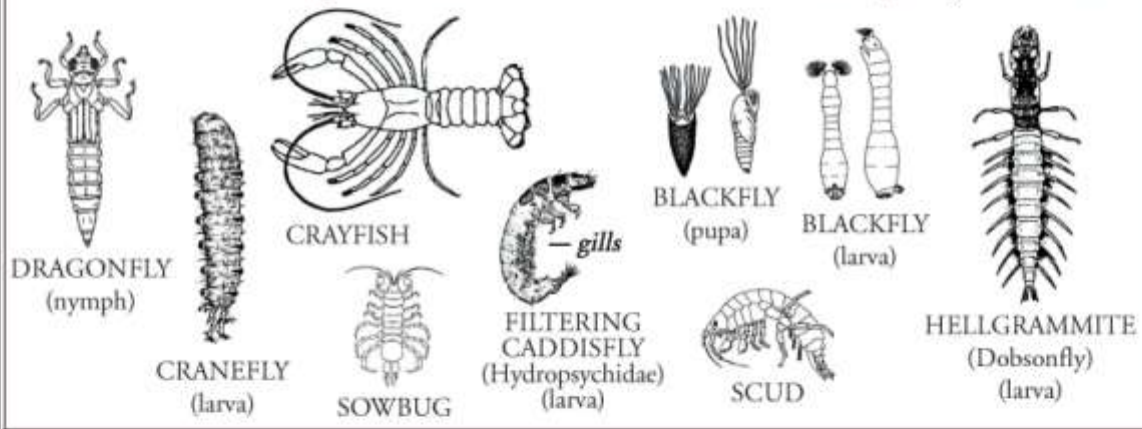
A large net is used to sample the water to check the number and kinds of macroinvertebrates. The scientist rubs the rocks and the macroinvertebrates wash onto the large net.

MACROINVERTEBRATE GROUPS
Beginner's Protocol - PICTURE KEY

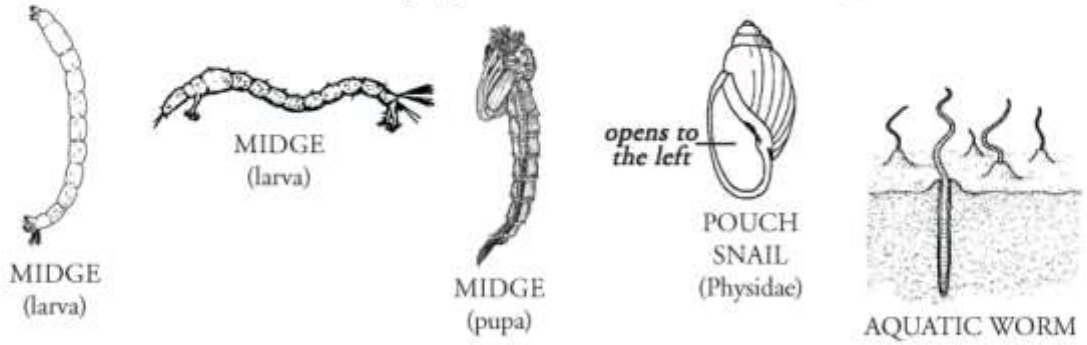
GROUP 1 *These organisms are generally pollution-intolerant. Their dominance generally signifies EXCELLENT-GOOD WATER QUALITY*



GROUP 2 *These organisms exist in a WIDE RANGE of water quality conditions*



GROUP 3 *These organisms are generally tolerant of pollution. Their dominance usually signifies FAIR-POOR WATER QUALITY*



Scientists study the **kind and number of macroinvertebrates** that are found in water samples from a stream to determine the health of the stream. **How?** In the picture key above, notice that **group one** says that the organisms are **pollution intolerant**. That means that they do not like pollution! The water has to be clean for them to live there. Finding these organisms is a sign of a healthy stream. **Group 2 organisms can exist in a wide range** of water conditions. They may be found in good water quality or fair-poor water quality**. Group 3 can live anywhere** and do not mind if the water is really nasty!

Flight: Facts

Humans have always dreamed about flying. They **watched birds, insects, bats, or leaves and imagined and wondered what it must be like.**

However, it took many years for humans to understand the **properties of earth and air necessary for flight** and be able to measure them accurately, develop relevant theories, and predict outcomes. Only then could people build the wings and engines needed to fly.

Short History of Flight

Around 350 BC the **Chinese** began to make kites from bamboo frames covered in paper and silk. Many of today's kites use a similar design. A **kite** is a form of a glider, as it does not technically fly, but instead **sails on air currents**.

In 1492 the Italian scientist, artist and inventor **Leonardo da Vinci observed the flight of birds and analyzed their anatomy**. He designed parachutes, helicopters and flying machines that looked quite like the early attempts at making flying machines in the 1900's. In 1670 another Italian scientist, Giovanni **Borelli**, who studied the mechanics of animal movement, **proved that human muscles wouldn't be strong enough to hold the big wings needed to lift a human off the ground**.

In June 1783 two French brothers, **Joseph and Jacques Montgolfier, who owned a paper mill, inflated a balloon with hot air**. They had observed that **hot air rises** and decided to see if they could create a craft based on this newly discovered science. Their unmanned balloon rose into the sky. This led to additional attempts at flight.

On September 19, 1783 three passengers along with **a sheep, a rooster and a duck** were successfully launched into the air in a hot air balloon. The Montgolfier brothers continued to play with balloon flight, and soon others were experimenting in this type of craft.

Orville Wright

Wilbur Wright

Many additional attempts in flight were made over the next 120 years — mostly glider crafts. However, it was the brothers **Wilbur and Orville Wright who, in 1903**, for the first time ". . . in the history of the world . . . [**created] a machine carrying a man . . . [which] raised itself by its own power into the air in full flight,** . . . sailed forward without reduction of speed and . . . finally landed at a point as high as that from which it started."

In the 1920s and 1930s a craft known as a **dirigible** became a common mode of transportation for intercontinental travel. A dirigible was a **frame covered with fabric and filled with a gas**. The craft could be steered, which made it different from a hot air balloon.

Dirigible

Blimps and zeppelins are kinds of dirigible. The most famous of these is probably the Hindenburg, which crashed in 1937 killing many people. Another famous dirigible is the Goodyear Blimp, which can be seen hovering above many sporting events to advertise Goodyear tires. Air travel is now very common, with thousands of airplane flights worldwide every day. Commercial planes, private aircraft and space travel would not be possible without the pioneers of flight.

Two Kinds of Flight: Gliding and True

Gliding flight is accomplished with **little or no movement or flapping of wings**. Leaves, maple seeds, or dandelion seeds seem to float with the wind, but they aren't true flyers. Man has built gliders which have no engines but are towed into the air by an airplane. It can take hours for a glider to return to earth. A number of animals use this method of movement but do not actually "fly**." Flying squirrels, flying fish and some snakes** have skin that they can stretch out and use to glide through the air.

True flight is accomplished only by birds, insects, and bats. Wings allow these creatures to push on the air to give them lift, thus allowing them to get airborne. Other bodily structures such as muscles and bones provide additional support for flight. Some birds, in addition to flying, will actually seek out warm updrafts of air known as thermals, which travel up from the ground. The birds will glide on these thermals, sailing around in circles or hovering in place.

How does a helicopter fly?

- The lift and thrust of helicopters are provided by **spinning rotors**, usually featuring two or more blades.
- Helicopters have a number of limitations. They can be **noisy, vibrate a lot and aren't as fast as fixed-wing aircraft.**
- The **first working helicopter** is believed to have been the Focke-Wulf Fw 61, first flown in **1936**.
- The fastest speed recorded by a helicopter is around 400 kph (**248 mph).**
- The longest distance traveled in a helicopter without landing is 3562 km (2213 miles).
- Helicopters can be used to fight fires by carrying tanks or **helibuckets** filled with water.
- Helicopters are sometimes called **choppers**.

STUDENT ACTIVITY: Kites

Kites are some of the earliest known flying machines. History books record that the **Chinese** first built kites around 1000 BC.

Kites have been used for many applications, for example, **signalling** over vast distances, providing military observation, fishing, measuring and **discovering the secrets of the atmosphere**, pulling sleds and kiteboarding.

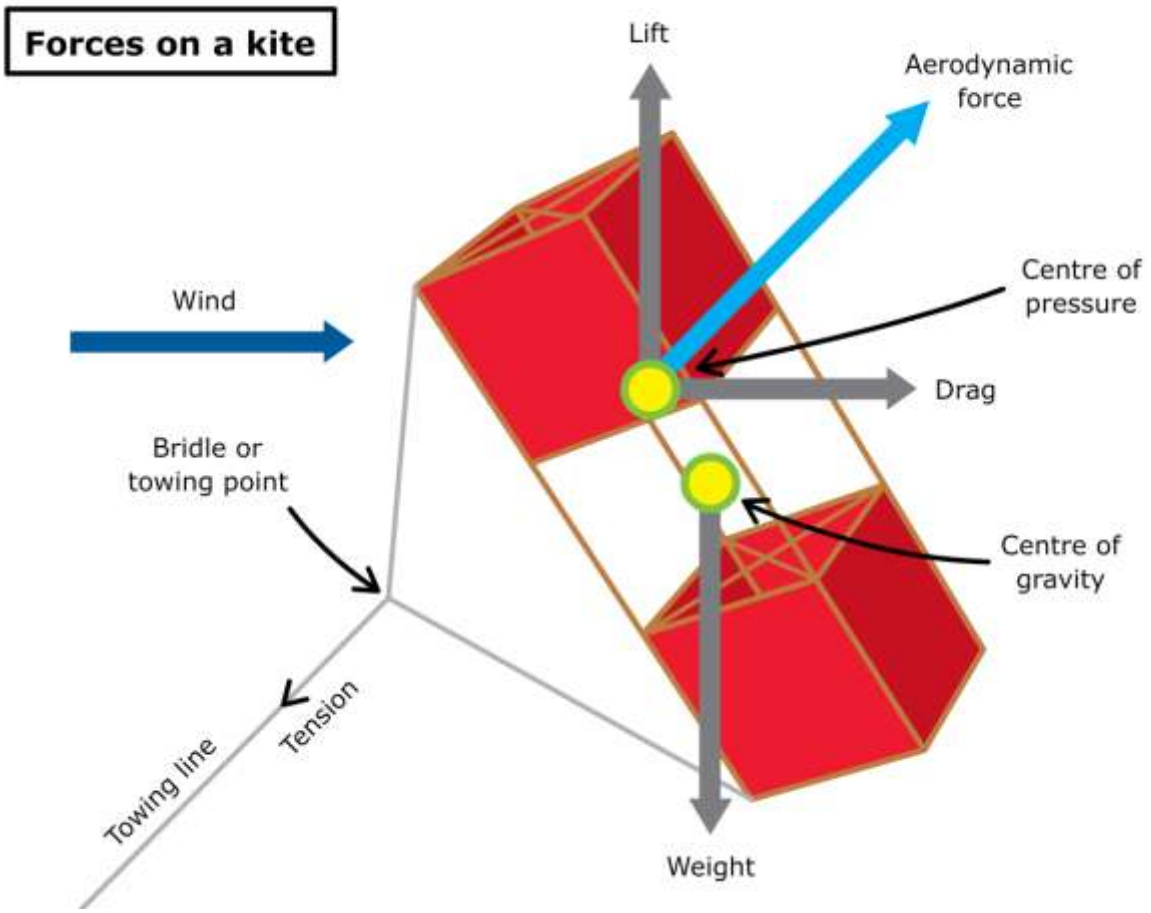
Kite vocabulary

- **Bridle** – the towing line attached to the kite.
- **Flying line or tethering string** – the line attached to the bridle that you hold to fly your kite.
- **Center of pressure** – the aerodynamic force (a combination of the lift force and the drag force) acting on the kite.
- **Frame** – the structural part of the kite to which the sail is attached.
- **Sail** – any material used to cover the kite (the wing material).
- **Tow point** – the connection point for the flying line to attach to the kite.

The science behind kites

A kite is **heavier than air** so there needs to be an upward force of **lift** if it is to fly. Most of the force comes from the wind pushing against the face of the kite sail. For this, the kite must be at the right angle of attack.

The rest of the force comes from the upper surface of the kite acting like an aeroplane wing (**aerofoil**). Low air pressure is produced on the upper surface. (Bernoulli's principle)



Experimenting with the position of the **bridle point** helps to find the place where the forces balance best with the kite flying well.

Sled kites have a very flexible frame or no frame at all. They are easy to make and fly and do not break if they crash. They are excellent learning project kites for students so they make good starter kites.