

aeronautics

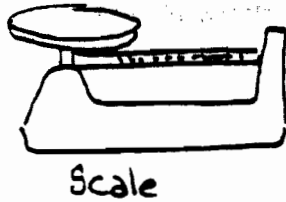


grambo

What is air?

Experiment 1

1) Begin With



Scale



Balloon



Low plate glass



Beaker



Jar



paper

cover

2) What will happen if I put a piece of paper in a jar, cover the jar, & put it in water?

Prediction



Try it.

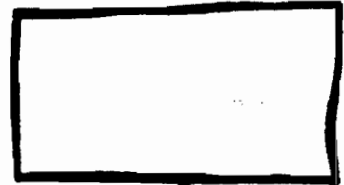


Q- How was the paper affected?

3) Predict what will happen to the paper if I do the same thing, but without the cover.



Prediction:



Try it

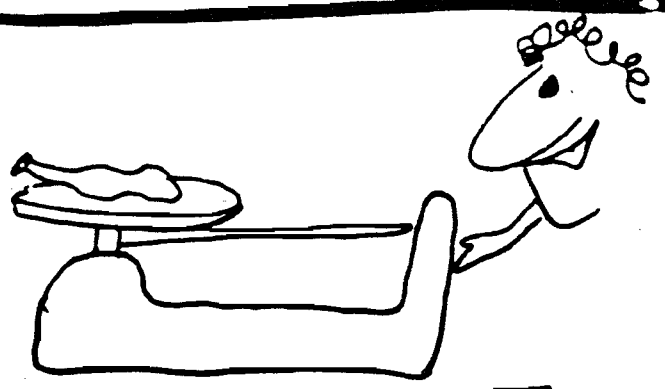
Explain Why this happened:



4

Next weigh a deflated balloon. How much do you think it weighs?

Prediction g



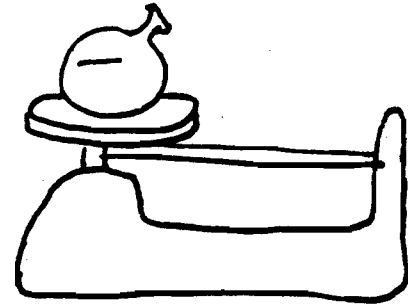
Actual Weight g

5/ Fill the balloon and weigh it again.

Q- Will it weigh more or less?

Q- Why?

Try it



Actual Weight g

Q- How does Air look?

Q- How does Air smell and taste?

Q- Which weighs more a deflated or inflated balloon?

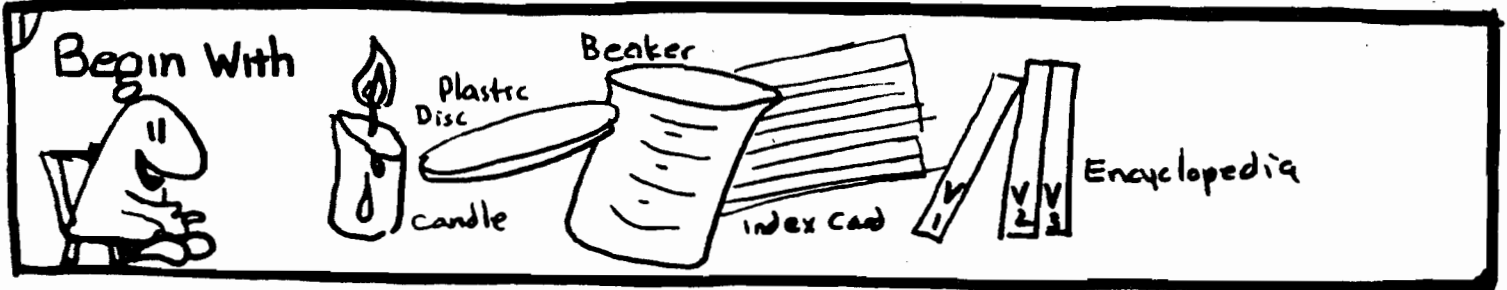
Q- Why?

Q- Why didn't the paper get wet in our experiment?

Q- From our experiment what are 5 things you can tell me about air?

What is air made of?

Experiment 2



2) Place candle on plastic disk and light it.

Q-What might happen if I cover the candle with a beaker?

3) Q-Why will this happen?

4) Q-In a hospital, why are there no smoking signs near the people in Oxygen tents?

5) Q-Why might they give people Oxygen?

6) Wet an index card and let it stand for 10 minutes

7) Describe what happened

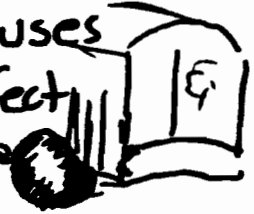
8) Q-Where did the water go?

9) Q-How has the water affected our atmosphere?

10) Q-Why do parents have to dust?

11) Q-How might dust get into our atmosphere?

12) Q-How do buses and cars affect our Air?



13) There are many parts to our air. Some are good, some are bad, but all are there

Homework -

1) Name 3 things air is made of?

2) look in the encyclopedia. See if you can find out the other parts of air. See how much of each thing is in the air.

Where do we find air?

Experiment 3

1) Begin
With

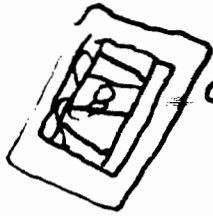


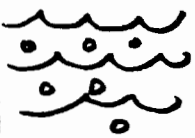
Chart of
atmosphere



2) Q-Why is air important to you?

3) Q-How do we know air is all around us?

4) Q-What about the ocean; how do we know there is air in the water?



5) If you were to climb a tall mountain, why would it become difficult to breathe?

6) Q-Why is there snow on top of tall mountains?



Q- What are 2 things you can tell me about air as you go higher up?

7) If air gets thin as you go up. what can you tell me about air in outer space?

8) As you go up air gets so thin it can't even hold clouds any more. We call this area the Stratosphere.



9) After a while the air is so thin that the sun's rays affect the air. This is the Ionosphere.

10) The area closest to earth is the Troposphere.

11) look at the atmosphere chart. The Stratosphere, Ionosphere and troposphere make up the atmosphere.

12) Q-Which part of the atmosphere is furthest away from the earth?

13) Q-Why would planes fly in the stratosphere?

Homework -

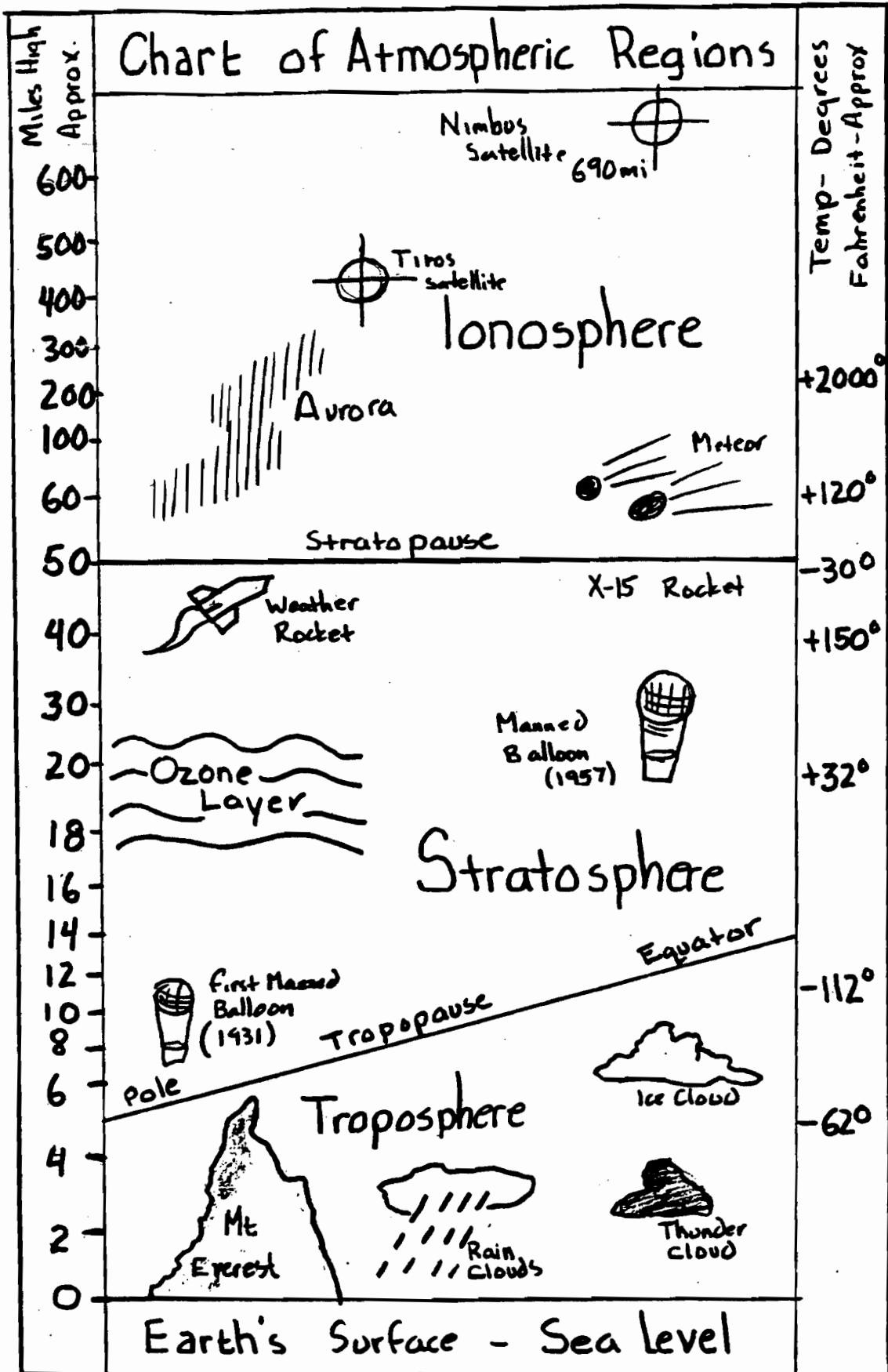
1) - What is the atmosphere? What are its parts?



2) What part would we find weather in?

3) What happens to air as you go up?

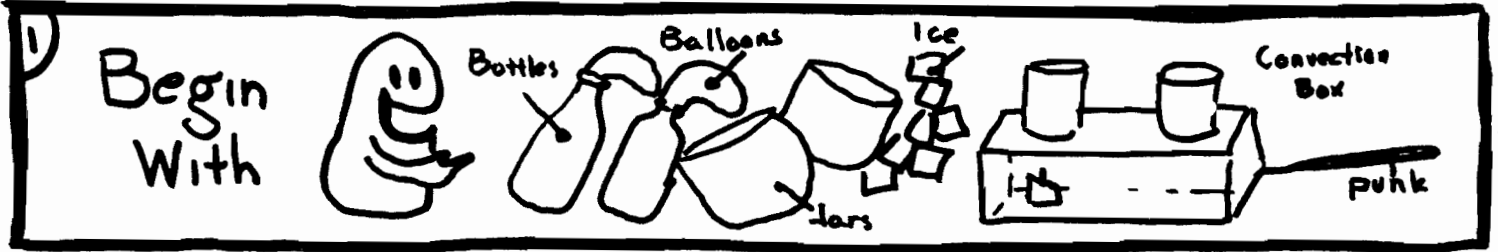
Atmosphere Chart



Adapted from Board of Ed. - City of N.Y. Grades 8

This chart shows the parts of the atmosphere, how high they are, and what is in each part. Put this chart in your notebook.

What causes air to move? Experiment 4



2) What happens to the molecules of something as I cool that thing and freeze it?

3) How are the molecules affected as I heat them to boiling?

5) Why does the same volume of something need more room when it's hot than when it's cold?

4) How many people could you fit in this room?

How will this be affected if the people get energy and begin to move around?

6) As air or any other substance gets hot it picks up extra energy

7) Set up this experiment

Labels: Balloon, Bottle, Jar, Hot Water, Ice

8) Why does balloon #1 inflate or get bigger?

9) What things are needed in order for something to burn?

10) Set up this experiment.

Labels: Convection box, lit punk, close plastic covers

light candle and watch what happens.

11) What happens to the smoke from the punk?

12) Where does the smoke and heat go when the candle burns?

13) Since it goes there, where does the air come from to keep the candle burning?

14) Air moves due to Convection

Hot air rises

cold air comes in to take its place


Homework-

- 1- Why does hot air rise?
- 2- Why would a jar of hot air weigh less than a jar of cold air?

How does moving air affect things?

Experiment 5


1) Begin With



Balance Bar
stick
cup
Balance
Bulb
Candle (if needed)


2) How does heat and cold affect air molecules?

3) Why does a jar of hot air weigh less than a jar of cold air?

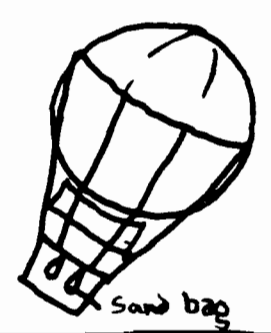


cold hot ? ? ? ?

4) If you were in a burning building why is it better to stay near the floor than to stand up?



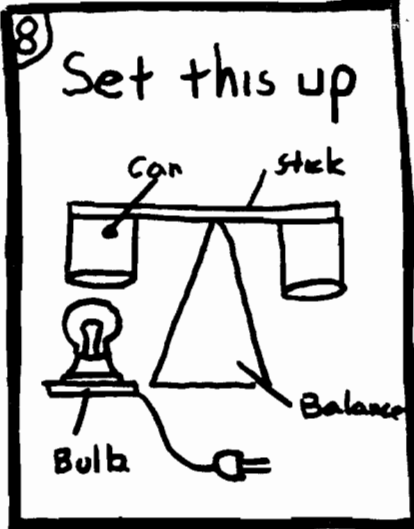
5) You want to fly in a balloon. Would you fill it with hot air or cold air? Why would you use this kind of air?




sand bag

6) look at the light bulb
Turn it on.
How would you know
it were on, if you
were blind?

7) How does the
bulb affect
the air above
it?



9) Turn on the bulb
Watch what happens

10) Why does the balance
tip? 
(if the bulb
does not work
use the candle)

11) How does hot air
affect things?

12) Explain how Convection
works.

Homework - Read chapt 2 - pages 15-19

1- Why did people use balloons and blimps?

2- How did they fly?

3- How do you think they (pick one) are
controlled?

Time for a Quiz 

Does air exert pressure? Experiment 6

Begin With



plastic cup



Index card



Q- What are 5 things you can tell me about air?

Q- How do we know air has weight?

Q- Prove air takes up space.

2

How would your hand feel if I began to pile books on it?



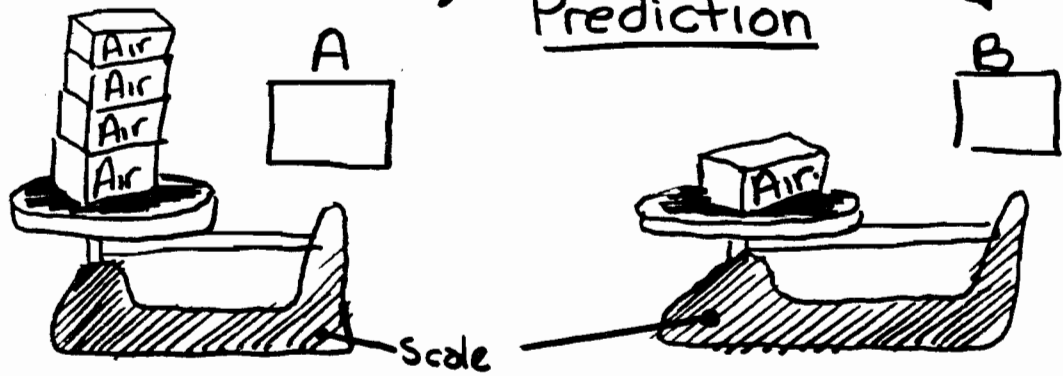
Why does your hand begin to feel this way?

3

How would a scale be affected if I begin to pile books on it?

How might the scale be affected if I replace the books with blocks of air?

4) Which would weigh more?

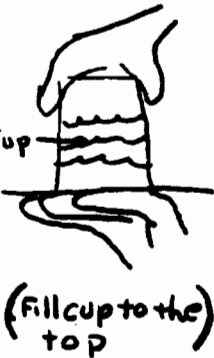


Why?

Q- Why do these things have weight?

5)

Put some water in a cup. Cover it with a index card. Turn over cup, holding card. Remove hand from cup.



6)

Why doesn't water fall out?

What holds the card on the glass?

As I climb a mountain the air gets thinner.

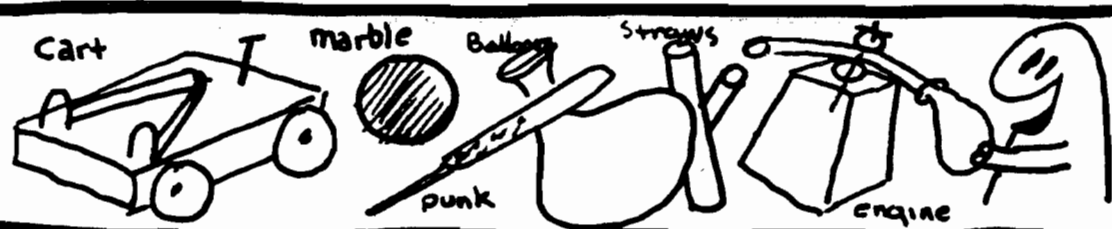
Q- How does this affect the pressure of the air?

Q- How does air pressure affect things like the can I heated or our glass of water & card?

What makes an object move?

Experiment 7

1) Begin With

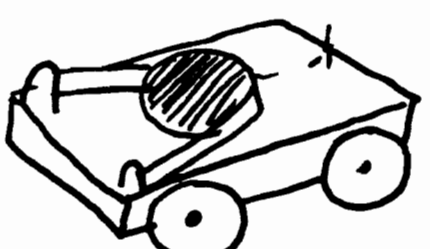


Labels: cart, marble, Ball, Straws, pin, engine

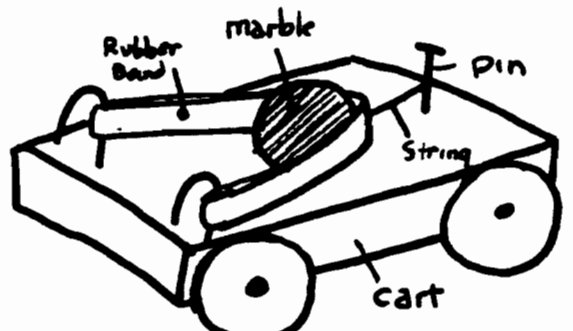
2) Isaac Newton, the man who the apple fell on, discovered that "for every action there is an equal and opposite reaction." Lets see what this means.

4) What happens to the cart?
What happens to the marble?

5) Draw the direction of the marble and the cart.



3) Set up this experiment



Labels: Rubber Band, marble, String, Pin, cart

Using the punk, burn the string so it breaks.
Do not touch the cart.

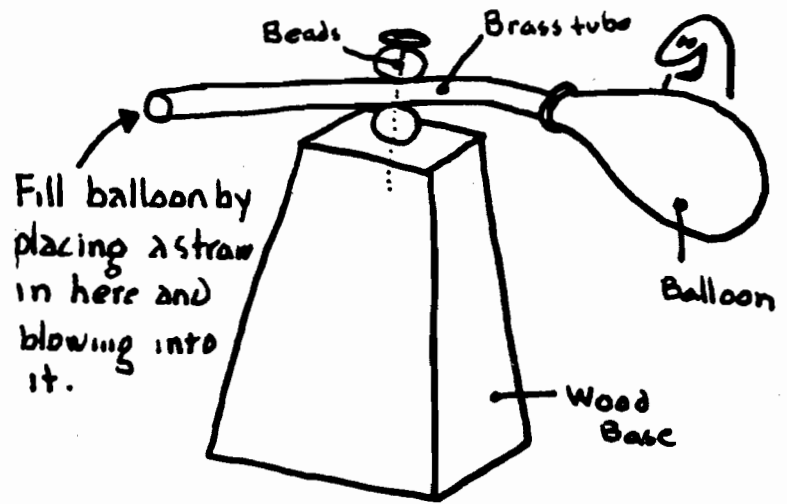
6) Explain why this happened in terms of Isaac Newtons discovery. Newton's 3rd law

7) Blow up a balloon. Let out some air. What direction does it move in.



Draw it

9) Set up this experiment



8) Let go of the balloon. Explain why it moves.

10) Inflate balloon with a straw. DO NOT put your mouth on the brass tube.

11) Remove straw and describe what happens.

12) How would Newton explain why this happened?

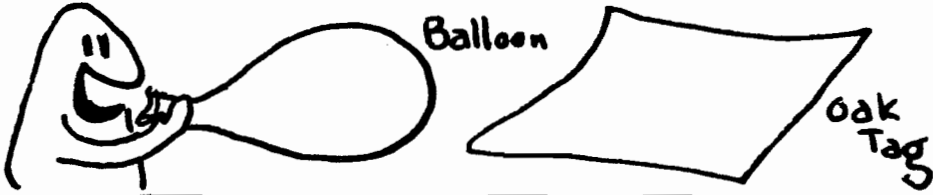
Homework -

1- What did Newton say about how things move?

2- Why did the balloon move when air was released?

How does the action-reaction idea help us?

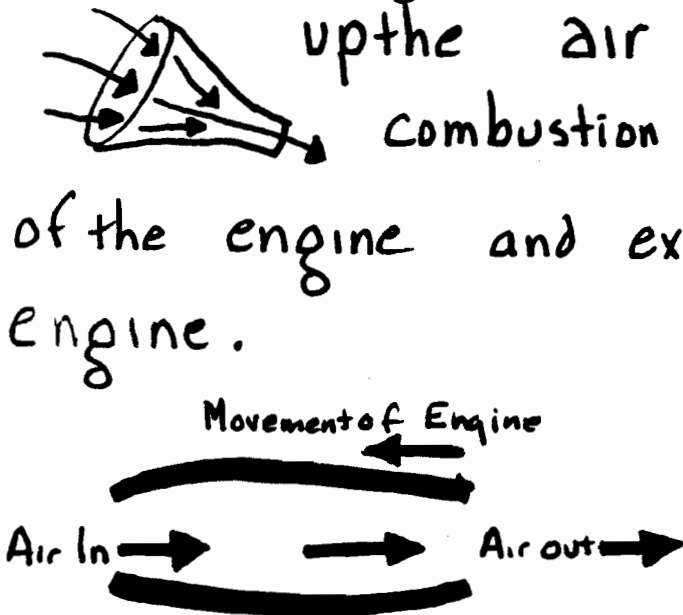
Experiment 8

1) Begin With  Balloon oak Tag

2) Blow up a balloon and let go of it.
Why does it move?

Jet engines were invented, and as a result planes were able to go faster. Jet engines were like funnels.

Air went in and was compressed and sent through a small hole. Fuel is added to heat up the air through a process called combustion. These hot gases came out of the engine and expand. This pushes the engine.

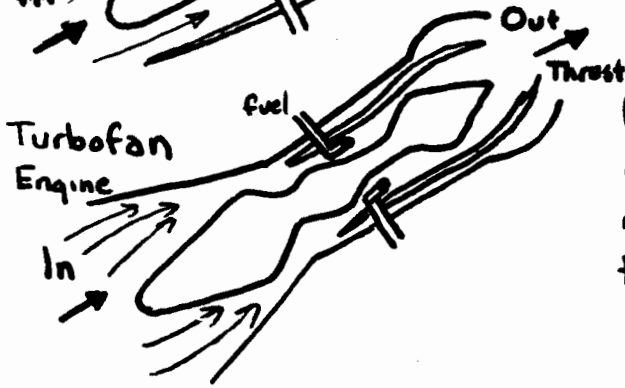


3) Explain a jet engine in terms of the action-reaction idea.

4) There are three main types of jet engine.



Air is forced in and added to fuel where it is burned and ejected. Fans or turbines pull air in.



Compressors pull in a great quantity of air. Since there is a greater amount of air the thrust is greater.

When jets go very fast, faster than the speed of sound; Air hits the engines very fast. Compressors are no longer needed. Air is compressed by the speed it is moving at.



5) Why can't a jet plane fly in the ionosphere?

7) Why is air compressed?

6) Explain the principle that makes a jet work?

8) Why is fuel added?

Homework -

On a large sheet of paper draw a jet engine and explain how it works.

Aeronautics

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How fast can jet planes travel? Experiment 8 A

Sound travels at about 760 miles per hour. Many planes travel faster than sound.



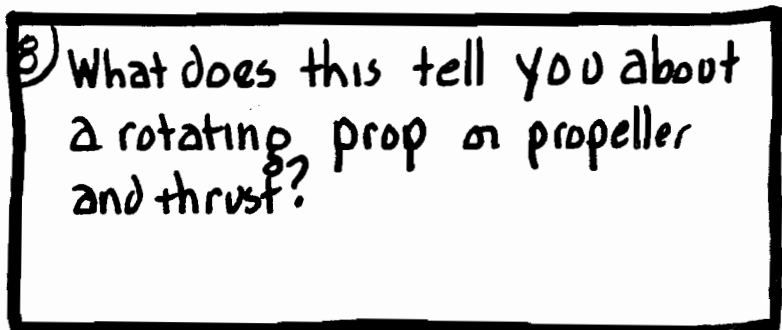
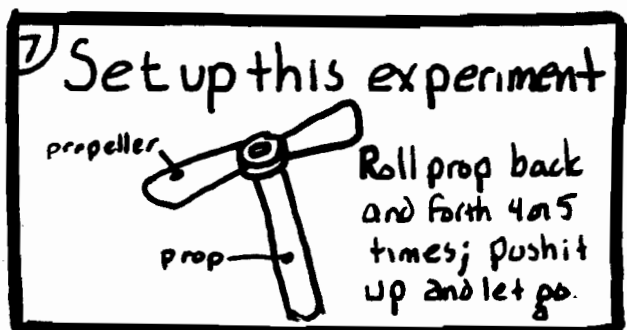
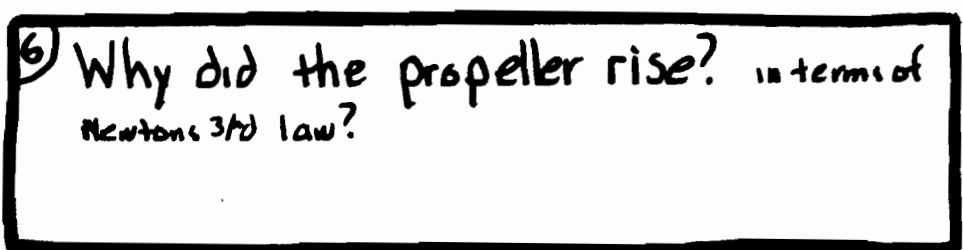
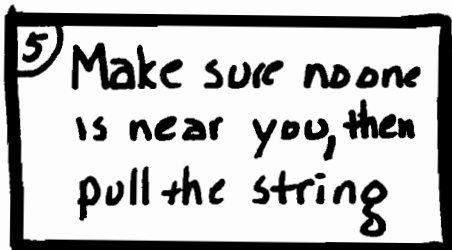
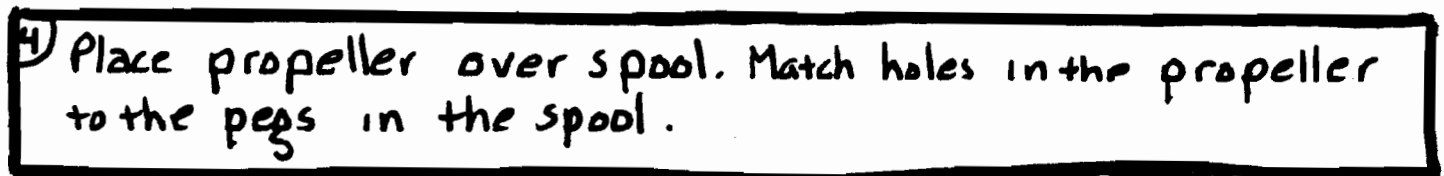
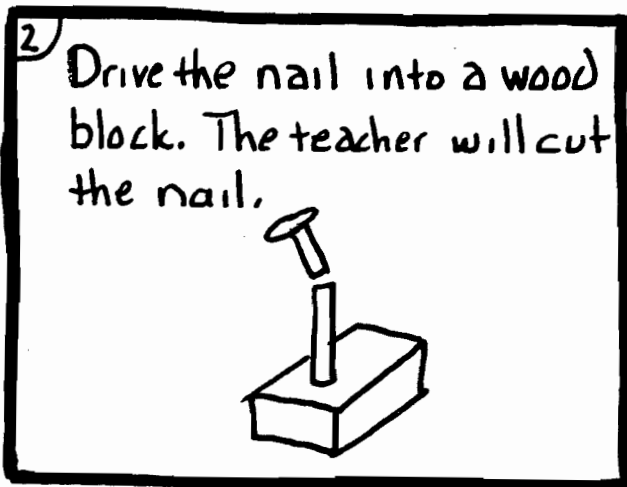
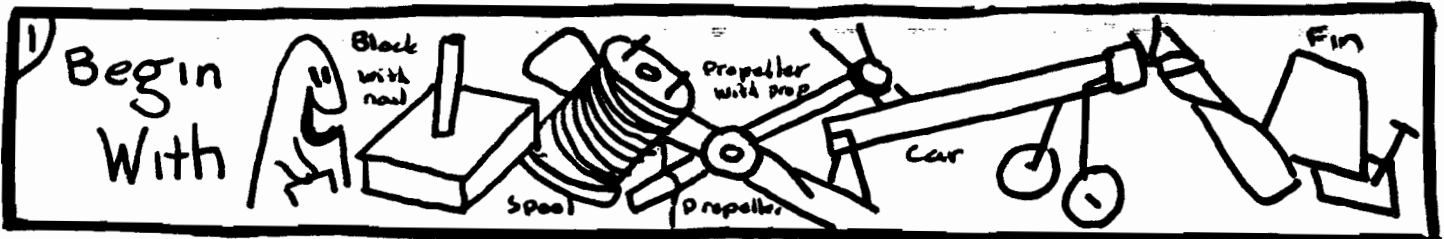
Finish this chart - These are U.S. Airforce jets.

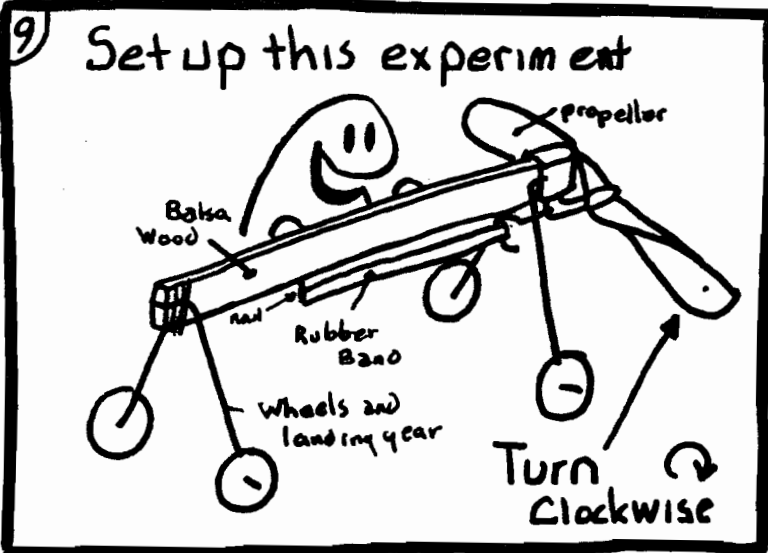
F = fighter plane B = bomber plane

Plane	Speed (miles per hour)	Distance Traveled in		
		30 minutes	5 minutes	1 minute
F-111	1650			
B-58a	1300			
B-47c	600			
F-86F	670			
F-84F	650			
F-100d	822			
F-101a	1200			
F-104a	1400			

How does an airplane move forward?

Experiment 9





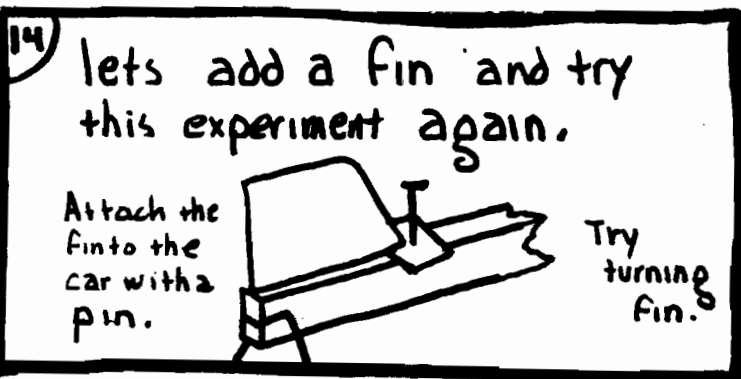
10) Turn the propeller about 50 times, to wind the rubber band engine. Hold propeller

Place car on the floor. let go of the propeller

11) Describe what happens

12) Think of Newtons 3rd law. If the plane-car moves to the right (reaction). What action moved to the left?

13) How does a propeller make things move?






15) How does the fin affect control of the air driven land vehicle?

Homework -

1- How does a propeller work? (Draw a picture. Show air flow- action and reaction)

How can we get a vehicle off the ground?

Experiment 10

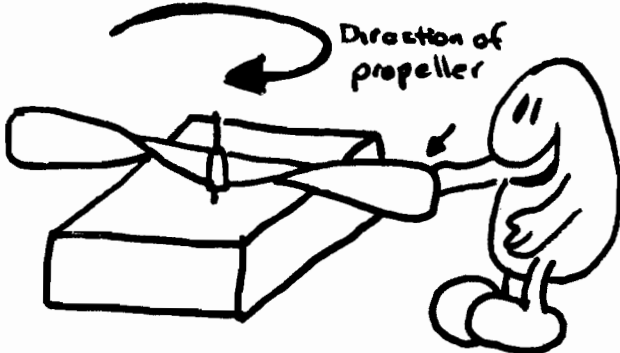
1) Begin With   helicopter  Block.

2) Hold a block in your hand. let go of it. Why does it fall?

3) How would you get something off the ground?

4) State Newton's 3rd Law.

5) look at this picture.
According to Newton, how will the block be affected if the propeller turns clockwise?



6) Why will this happen?

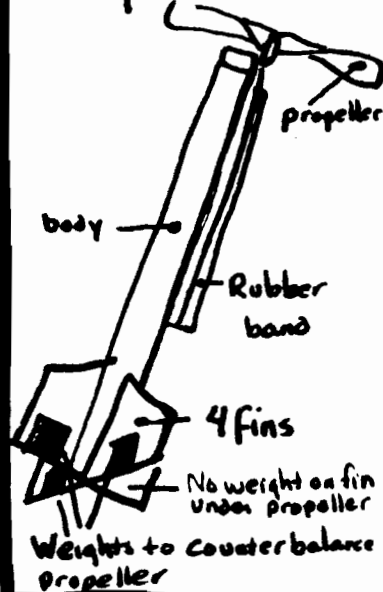
7) How does a propeller make things move?

8) How could we use a propeller to lift something off the ground?

9) How will gravity affect the object being lifted?

What affect would this have on the propeller?

10) Set up this experiment



11) If the propeller turns clockwise; How will the body & fins be affected?

13) Turn the propeller clockwise 50 times and then release your craft.


12) This turning action or torque is stopped by weighting the 3 fins as shown.

14) You now have a Helicopter

Homework -

1- What causes a helicopter to fly?

2- Why is there a torque reaction on a helicopter in flight? (use Newtons law)

Time for a Quiz 

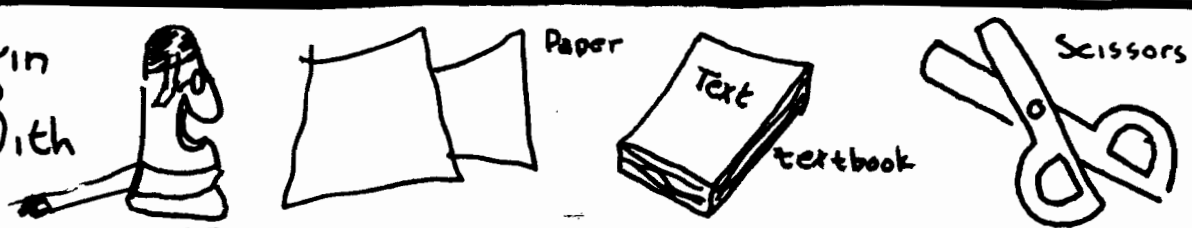
Aeronautics

Name _____
Class _____ Box No _____

What are the parts of an airplane?

Experiment II

1) Begin With

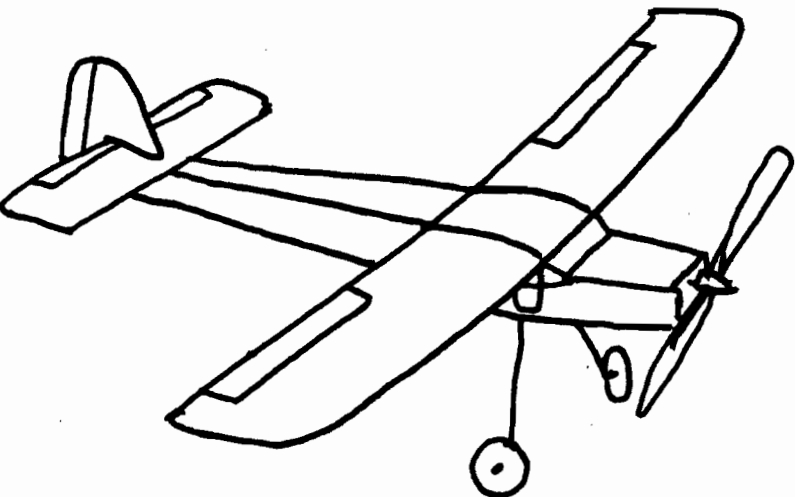


Paper


Textbook

Scissors

2) look at this picture of a plane label as many parts as you can.



3) So far we have learned about the wing.
Why does a plane need wings?
Why is a wing curved on the top and flat on the bottom?



Cross-section of wing

4) We have also learned about the jet engine. Draw a picture of one type of jet engine and tell how it works.

5) Before the jet engine we used propellers. How does a propeller make a plane move forward?

Draw a picture showing the shape of the propeller.

7) Using instructions on page 30 of your text fold a paper airplane.

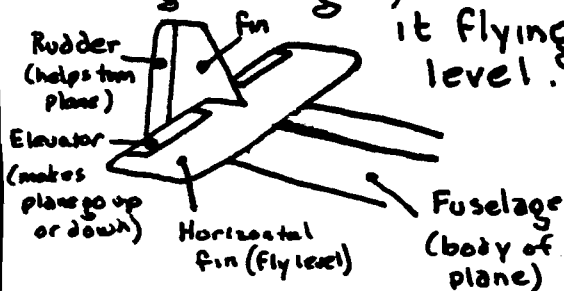
8) Looking at the picture of the wing on the front you will notice it has flaps. These are called ailerons.



9) Ailerons are used for turning. Cut ailerons on your paper plane. Make the plane turn left by moving the ailerons. Then make it turn right. Draw a picture showing how you moved them.

Left turn Right

10) The back of the plane has tail fins which keep the plane moving straight, and keeps it flying level.



12) Why are wheels or landing gear important to a plane?

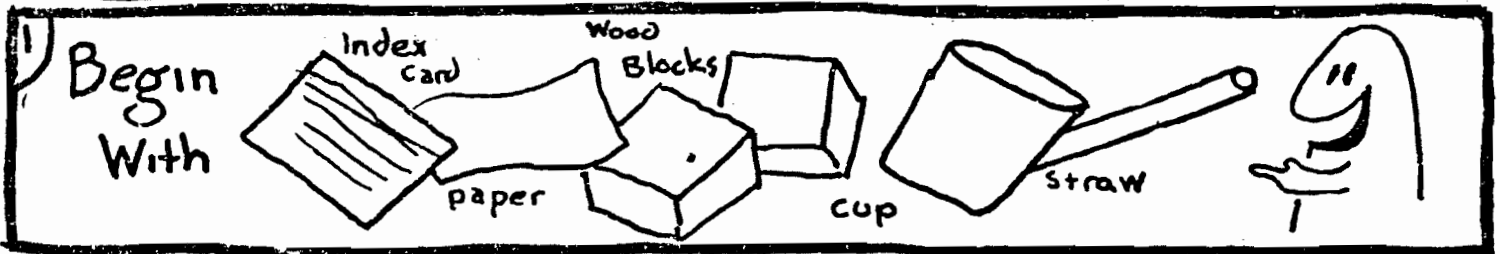
Homework -

Draw a large poster of a plane. label the parts and tell what they do.

11) The plane is controlled from the cockpit or cabin. See instrument panel on page

What is Bernoulli's
Principle?

Experiment 12



Bernoulli's principle states that pressure exerted by a fluid (this includes air) changes with its speed of motion. This means that moving air exerts less pressure than air that is not moving. The faster air moves the less pressure it exerts.

2) Fold an index card in half and place it on a table



Blow under card.



3) Describe what happens to the card.

4) Why does this happen? (explain in terms of Bernoulli's principle)

5) Hold a small piece of paper in front of your mouth.

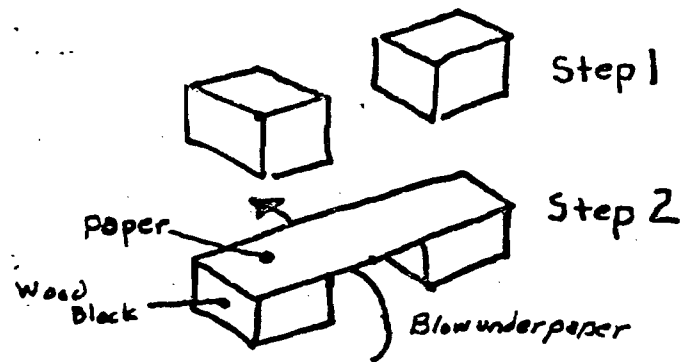


Blow over the paper

7) Why did the paper lift up?



Setup this experiment.



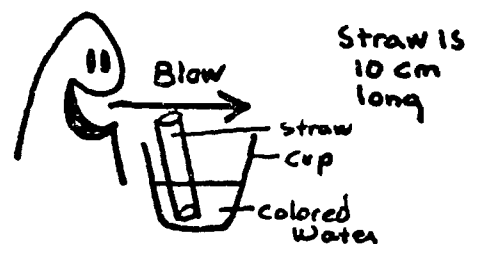
If you blow under the paper will the paper fall off the wood?

Why or Why not?

8) Try it. What happened?
Why did this happen?

Lets try Bernoulli's principle one more time

9) Set up this experiment



11) Explain what happened in terms of Bernoulli's principle

Remember the object will move in the direction of the least pressure, because the pressure on the other side pushes it.

Homework -

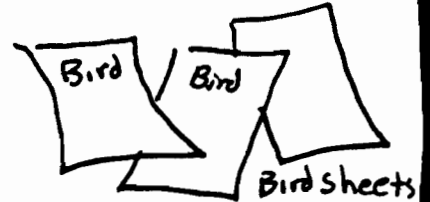
1- How does Bernoulli's principle work?

10) How did the moving air affect the liquid in the straw?

What makes a bird fly?

Experiment 13

1) Begin With

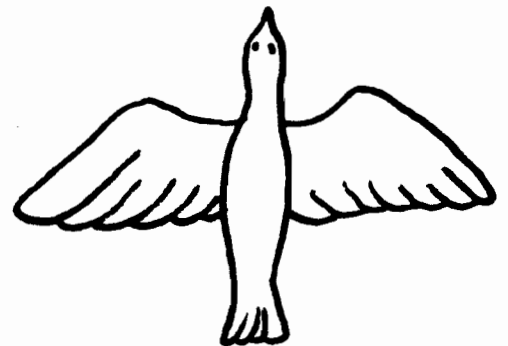


2) look for a bird outside. Watch it for a while. Describe, step by step, what it does in order to get off the ground.

3) Explain Bernoulli's principle.

4) How would a bird be affected if air moved over the bird faster than it moved under the bird?

5) Birds have two wings which are covered by feathers. The shape, size, and weight of the wing is very important for flight



6) If we cut a bird's wing we would see it has a special shape.



Would it take longer to walk over the top or bottom of the wing?

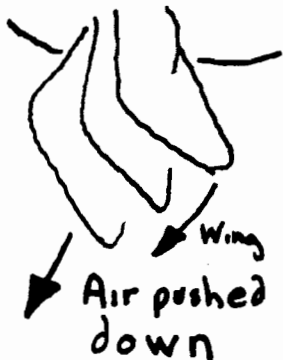
Why?



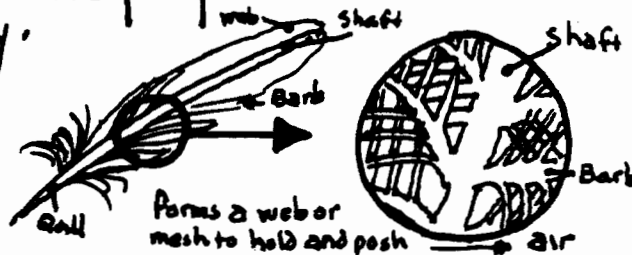
7) Air has to go off the top and bottom of the wing at the same time. Since it takes a longer trip over the top, it has to go faster to reach the back of the wing at the same time as the bottom will. Air over the top speeds up. The fast moving air pulls away from the wing causing suction. Slow moving air under the wing pushes up. This causes the wing to rise. This is lift.



8) Birds flap their wings causing air to go down. What is the reaction on the bird?



9) Feathers help push air, so birds can fly.



10) Birds have hollow bones.
How can this help the bird?

Homework —

- 1- Why can a bird fly? How does the wing shape help?
- 2- Why do birds need feathers?


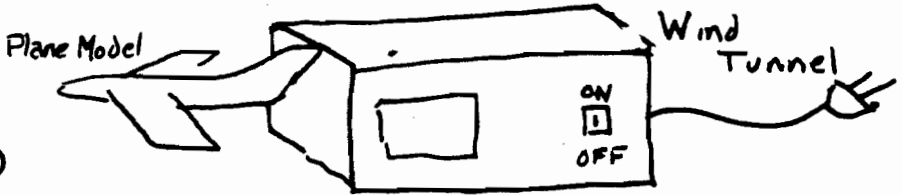
Aeronautics

Name _____

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How does the shape of the wing help a plane fly?

Experiment 14

1) Begin With  

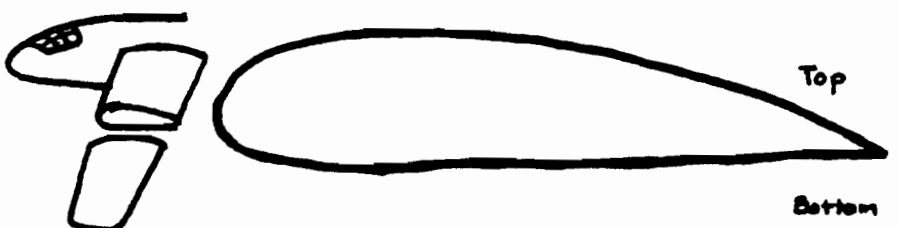
2) How does Bernoulli's principle affect the wings of a bird?

3) Why is a bird's wing shaped like it is?

4) look at the plane model. How is a plane like a bird?

5) How might the wings help the plane fly?

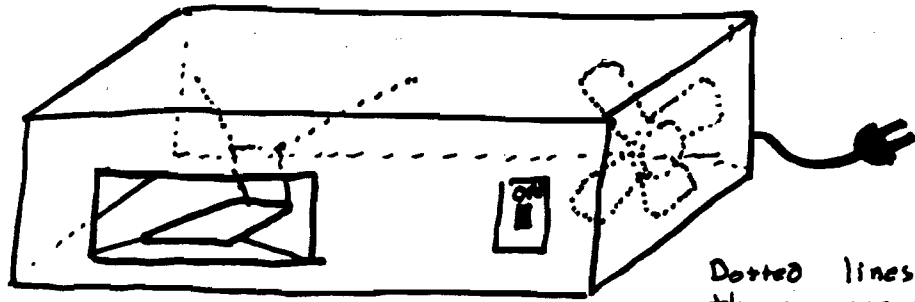
6) Here is a drawing of a plane wing; this is a cross section. We call it an airfoil.
Show how air affects it



Side view or Cross section

Grambo

7) There is a wind tunnel on the front desk. Inside it is a fan, which blows air in one direction. An airfoil, or wing, has been attached inside. You can look at the airfoil through the window.



Dotted lines show you things you can't see because the walls are in your way

8) Turn on the wind.
Describe what happens to the wing

9) Why did this happen?

Home work —

Read Chapt 3 pages 23-26
page 34 answer questions 1, 2, 3, 4, and 5.

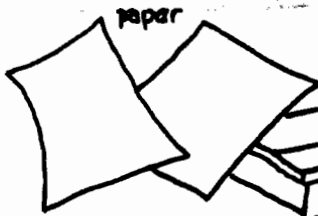
Extra credit —

Draw an airfoil on large oaktag. Show how moving air makes it rise. (gives it lift)

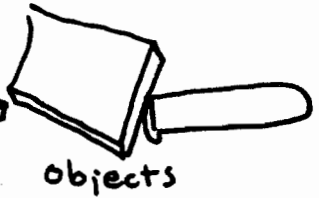
What is drag?

Experiment 15

1) Begin With



Basin



2) Hold up 2 sheets of paper. Drop them
Describe what happens when they hit the ground.
Which hits first?



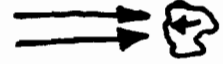
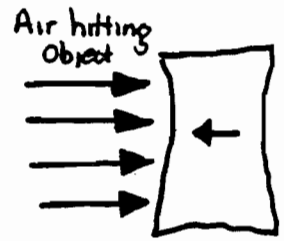
3) Define Surface Area -

4) Crumple one paper. How have you affected the surface area of this paper?

5) Drop the two papers again. How did crumpling the paper affect your experiment?

Why does one paper fall faster?

6) Lets say air is moving to the right. If I put an object, like a plane, in the air, the air must go around it, since it can't go through it. The plane blocks the air flow. If I move the plane to the left air will be hitting it. It slows the plane down. This is resistance. The smaller an object is, the less air hits it, and therefore it will have less resistance.



7) There are two objects in a basin of water. Push them through the water.

8) Why does one object move faster? (They both weigh the same)

9) Why do planes have pointed fronts?

Homework - Read chapt 3. Answer questions 7 and 8 on pages 34 and 35



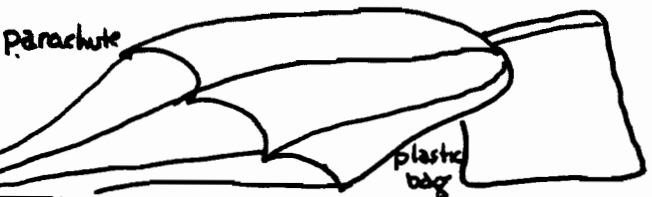
1- What is drag?

2- What causes drag?

Stop Time for a Quiz it's

How does a parachute help stop a moving object?

Experiment 16

1) Begin With  Washers  parachute  plastic bag

2) Cover one hand with a plastic bag. Do not cover the other hand. move both hands. through the air.




3) Which hand is easier to move? (The one with or without the bag)

4) Why is this hand easier to move?

5) How does the plastic bag affect drag?

7) How does webbed feet help a duck?



6) You go swimming. Why might you wear flippers on your feet?

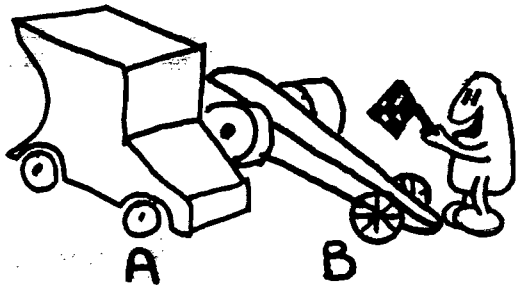


R flippers (side)



Foot hole
Top View

8) Which car will probably go faster?



Why?

9) What does drag have to do with these two cars?

10) Explain how increased air resistance can slow something down.
(Give an example)

11) Find the parachute assembly or build one from a plastic bag. Attach it to a washer. Roll it up and throw it in the air.



12) Drop another washer (the same size) on the floor or table.

13) Why does the one with the parachute fall slower?

Home work -

1- Why does a parachute slow down a moving object?

2- Explain how to make a parachute?

3- Why do you need a big parachute to stop a big object?

14) How does a parachute affect drag

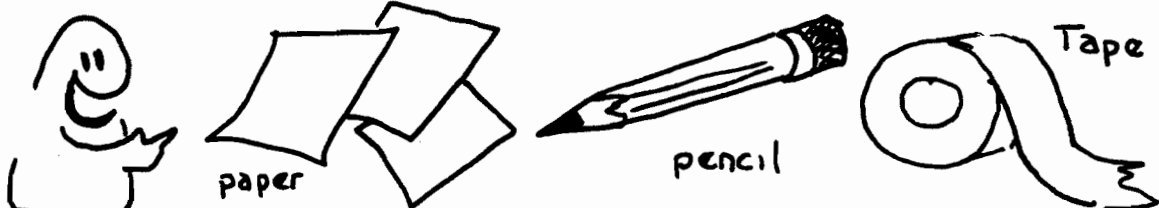
Aeronautics

Name _____
Class _____ Box No _____

How can we decrease drag?


Experiment 17

1) Begin With



paper pencil Tape

2) Hold a paper and a pencil at the same height. Drop them.




3) They should hit the ground at the same time.
Why does one hit the ground before the other?

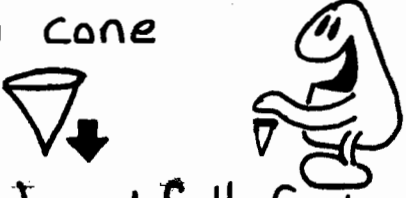
4) What does drag have to do with this experiment?

5) Take 2 papers. Crumple one of them. Hold both at the same height and drop them. How has crumpling the paper affected drag?

6) Take another piece of paper and roll it into a cone. Tape cone




7) Drop cone

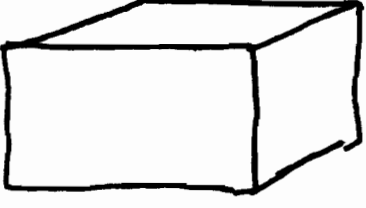


Why does it fall faster than the paper ball?


8) Why does the cone have less drag than a falling sheet of paper?




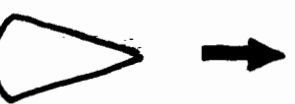
9) How can we make this object move through the air faster? (Draw the new shape)





10) Which object will move faster?

A 

B 

C 

D 

E 

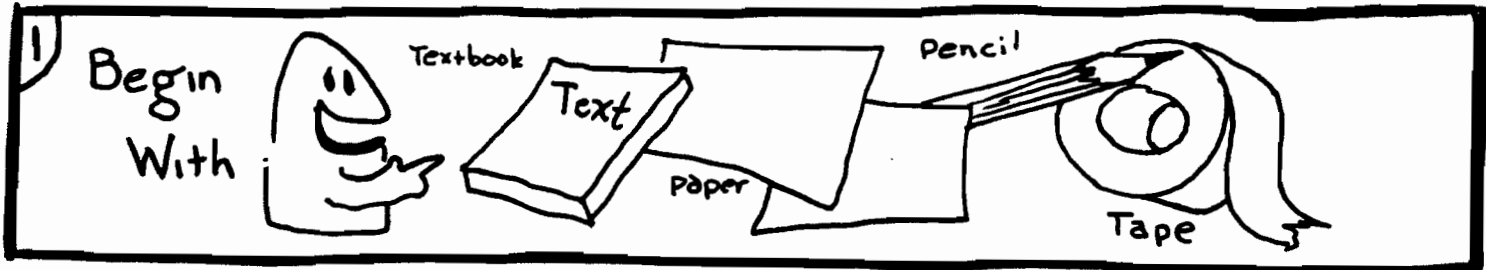
11) Why will this one move faster?

Homework —

- 1- How does the shape of an object affect drag?
- 2- How can we decrease drag on an object?

How can we design a paper plane for less drag

Experiment 18

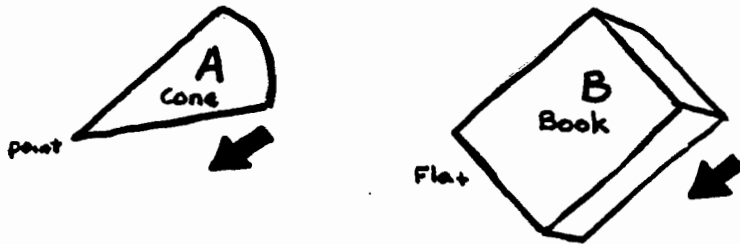


2) What is drag?

3) How does a parachute affect drag?

4) Why does it do this?

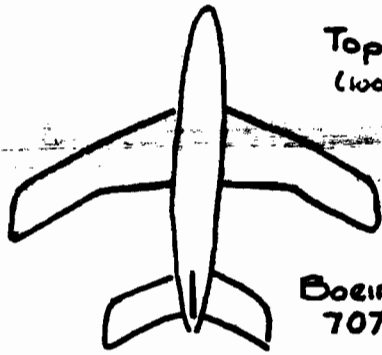
5) If I pushed both objects in the picture with the same force, or push, why would object A move faster and easier than B.



6) What does the shape have to do with the speed?

7) Why do fast moving objects like race cars, planes, rockets, and bullets have pointed fronts?

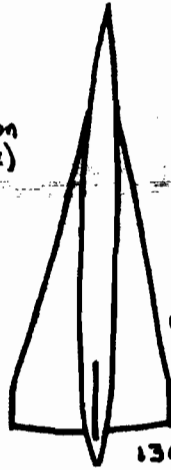
8) look at these planes. How does the shape of the wing affect air speed?



Top View
(looking down
at plane)

Boeing
707

600 mph



Concorde
SST

1360 → 1410 mph

9) Using your knowledge of drag and the instructions on pages 30, 51 of your textbook; design two planes. Design one for less drag and one for more drag.

Draw pictures of the finished planes here.
Why do they have these shapes?

Build Planes

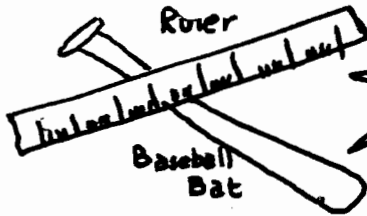
Homework -

1- Build the planes that you designed. You will need them for tomorrow.

What is the center of gravity and how does it affect flight?

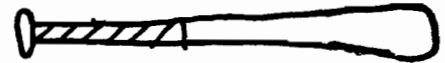
Experiment 19

1) Begin With

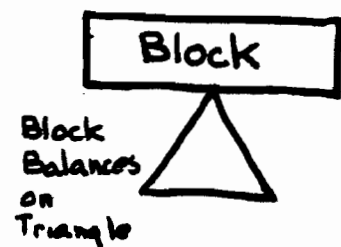


2) Pick up the ruler and balance it on your finger.
At what point on the ruler does it balance?

3) Now balance the baseball bat.
Why doesn't it balance in the center of the bat?



There is a point on every object where all the weight seems to be concentrated. At this point the object will balance. We call this point the center of gravity.



4) How can we find the center of gravity of an object?

5) Where do you think the center of gravity is on this object?

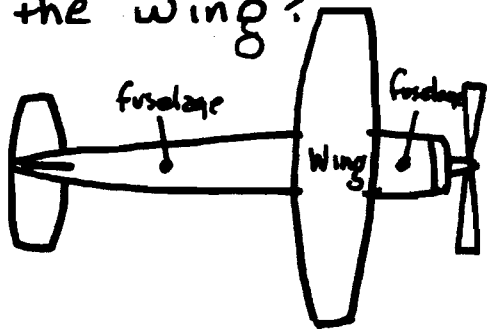


Why here?



6) How can we find the center of gravity of a plane?

7) Why is the fuselage behind the wing longer than in front of the wing?



8) How would the center of gravity affect a plane in flight?

9) Why should a plane be balanced?

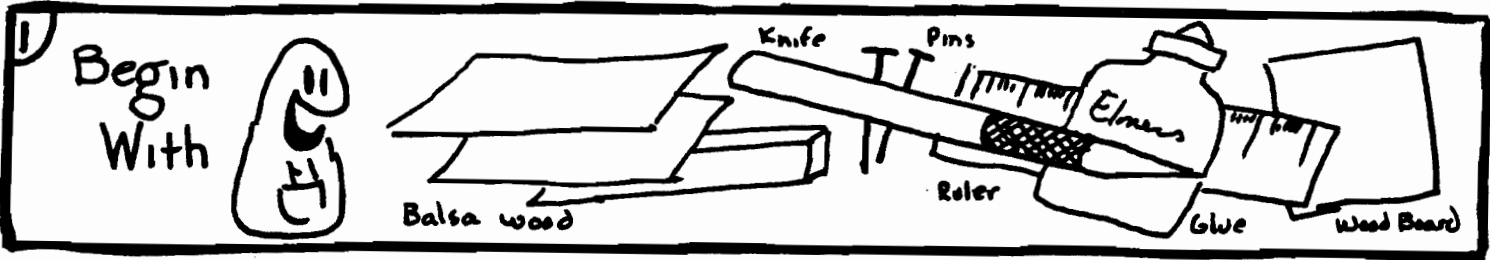
If your paper plane is nose heavy, put a paper clip on the fuselage and move it until the plane balances on your finger. Toss the plane in the air. The plane should be tossed horizontally with a slight downward angle.

Homework-

- 1- What is the center of gravity?
- 2- How can we find it on an object?
- 3- Why should a plane be balanced?

How can we build and fly a
balsa wood glider?

Experiment 20

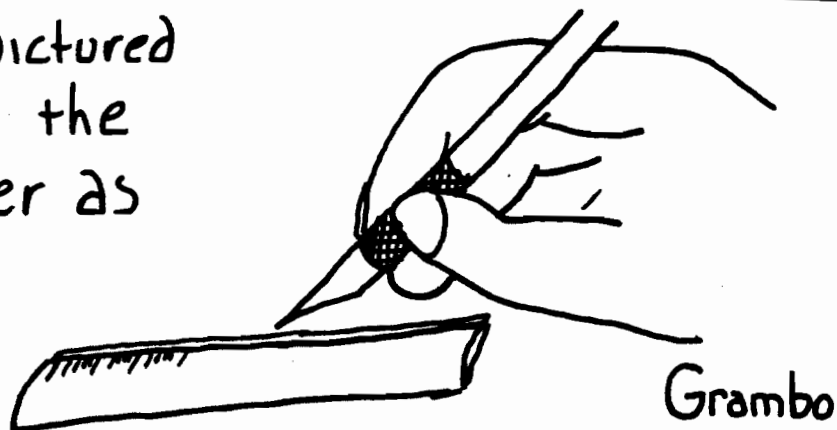


All but the fuselage is to be cut from $\frac{1}{16}$ inch medium soft or $\frac{1}{8}$ inch medium hard sheet. The fuselage is to be cut from $\frac{5}{16}$ inch x $\frac{3}{16}$ balsa sticks. You will also need an exacto[®] knife as indicated above, and a metal edge ruler.

lightly draw pattern onto balsa sheet. Place a board under the balsa wood.

2) Why did you put a board under the wood you are cutting?

Hold knife as pictured and cut with the metal edge ruler as a guide.

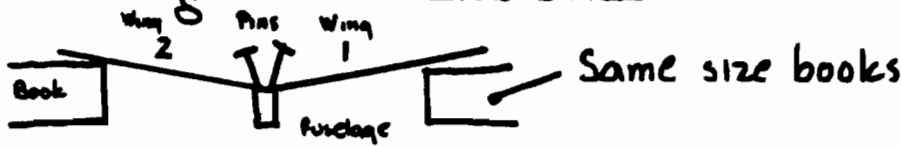


Wing 1

Wing 2

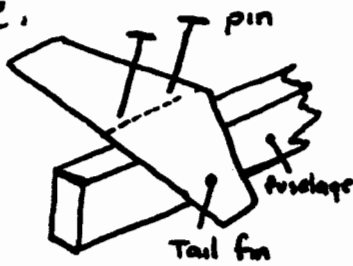
Tail Fins

Place fuselage on table. Balance wings on books. Glue wing to fuselage. Pin wings until glue dries.



Rudder

3) Glue tail fins in place.



4) Slice a groove in the tail of the fuselage 1/2 inches long and 3/8 inch deep.



Place rudder into the groove



Find center of gravity of the plane. Tape paperclips to the plane to balance it. Hold the plane under the wing toss horizontally with a slight downward angle. Clay on the nose can be used instead of paper clips. You can build a plane from the text or can design your own.

Fuselage.