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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

April 17, 1917.

Theme - In What Liquids Will Rubber Dissolve?

Experiment - Some rubber bands were put into tubes containing chloroform, ether, and grain alcohol. Then some crude rubber was put into test tubes containing ether, chloroform, and carbon tetrachloride. The fluids

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Manufactured rubber absorbs chloroform and
ether but does not dissolve.

Remarks - As a result we should use a cork or glass stopper instead of a rubber cork in a bottle containing alcohol, ether or chloroform.

South Philadelphia
High School for
Girls

Teacher
Dr. M Louise Nichols

notes - General Science
classes

April 17, 1917

Theme - In What Liquids Will Rubber Dissolve

Experiment - Some rubber bands were put into tubes containing chloroform, ether, and grain alcohol. Then some crude rubber was put into test tubes containing ether, chloroform, and carbontetrachloride. The fluids remained so about an hour.

Sequence - 1 - There was no change in the condition of the rubber except that it was swollen. The rubber floated on top of the chloroform.

2 - The rubber also swelled, but was on the bottom of the tube.

3 - Rubber did not change.

4 - The rubber was dissolved and the liquid was brown.

6 - Rubber partially dissolved.

7. The liquid was dark brown and there were dark brown pieces in it.

Conclusion - Crude rubber dissolves more readily than manufactured rubber does. Chloroform is heavier than ether or alcohol. Manufactured rubber absorbs chloroform and ether but does not dissolve.

Remarks - As a result we should use a cork or glass stopper instead of a rubber cork in a bottle containing alcohol, ether or chloroform.

Theme - In What Substances is Resin soluble?

Experiment - Some resin was put into ethyl alcohol, some in ether and some in chloroform and the last in carbon tetrachloride

Sequence - 7. The resin was dissolved but the alcohol was cloudy.

8. There was a brown residue in the tube.

9. The resin was partially dissolved.

10. " " " " "

Conclusion - Resin is partially soluble.

Ida Kaplan

April 17, 1913

Theme - In what substances is Cottonseed Oil soluble.

Experiment - Some cottonseed oil was put in chloroform, some in ether and some in carbon tetrachloride.

Sequence - 11 There was a clear yellow liquid in the tube.
12. The liquid in the was pale yellow and somewhat cloudy.
13. The liquid was yellow and clear.

Conclusions. Cottonseed oil is soluble.

Remarks. Chloroform, ether and carbon tetrachloride are used to extract grease. For this purpose carbon tetrachloride is best. Chloroform and ether are also used as solvents for various organic compounds in making drugs.

Theme. In What will Lac Dissolve.

Experiment - Lac was placed in tubes containing grain alcohol, wood alcohol and chloroform.

Sequence - 14. Color was yellow and a residue in bottom.

15. " " " " " " " "

16. The lac was partly dissolved and liquid was yellow.

Conclusion - Lac is partially soluble.

Remarks. Alcohol is used a solvent for lac in making shellac drug etc. A solution in alcohol is called a tincture.

Sept 12, 1917

Food Preservation

In this time of economy when persons is trying to preserve food there are times when we cannot get the food. There are many things which cause food to decay while growing. These are rainfall and climate including draughts, sudden changes of weather etc; then there are blights and insects of all kinds including cutworms, potato bugs, apple & cabbage worms and many others.

After the food has been preserved many other things may spoil it. Some of these are fermentation, mold, rats & mice, ants, roaches, plant lice, spiders etc.

The direct causes of decay in preserved food are bacteria, yeasts, & molds. The indirect causes are dampness, warm temperature, dirt and air which when combined with all these we must have food.

If we are very careful we can avoid many of these things and have food when it is not so plentiful.

Among the methods of preservation are canning, drying, smoking, salting, Pickling, cold storage, sugaring, sterilizing chemical preservation (liquid glass-for eggs)

Manufacture of Flour Sept 19 1911

Many different kinds of grains are used in the manufacture of flour, but the most common is wheat.

Wheat belongs to the grass family and while growing looks very much like grass. The seed or the part used for flour grows at the head of the wheat. The kernel consists of three parts, the embryo with the cotyledons, the endosperm and the seed coat. The embryo is the growing part and contains starch as do the cotyledons. The embryo is sweet sometimes as the germ. The endosperm is divided into two parts one of which contains starch, the other gluten. The endosperm is the nourishing part of the seed. The seed coat is divided into two parts one of three layers, the other of two.

There are three different kinds of flour Bran or Graham, Whole Wheat and ordinary White Flour. The bran or graham flour is really whole wheat flour because it contains the germ, the endosperm and the seed coat, which is known commercially as whole wheat flour but that is not because it lacks the germ. The ordinary white flour contains only the endosperm.

The following is the story of the wheat from the field until it is ready for use as flour. After it has become ripe in the field it is cut and tied into bundles. Then it is threshed to separate the wheat from the straw. After the wheat

is cleaned it is ready for grinding. It is ground three times to make it very fine. Flour is ready for use.

In an experiment which we did in the laboratory we crushed some wheat in mortar. We then put the ground grain on a wire screen and sifted the wheat onto a piece of white paper. Broken wheat and the red coat remained on the wire while a white powder powder was on the paper. It is used for flour.

These are the middlings which are removed after each grinding and on the mill was bran. In factories the bran is separated from the middlings by a fan so that the light bran is blown out and the middlings stay in.

To get gluten out of flour place a small amount of flour in a piece of muslin tyed at the top. Then sop the "ball" up and down in water for a few minutes. The starch will pass out through the meshes of the muslin and what remains will be a sticky substance called gluten.

But wheat is not the only grain used — corn barley, oats, rye etc.

High Milling is the term used when flour is ground three or more times. Low milling is the term used when flour is ground only once

Sept. 94

Bread Making

The most important thing in bread making is yeast because it is that which makes the bread rise.

Show details

Yeast

Yeasts are tiny, colorless oval bodies that grow best in warm, moist places. In bread-making the yeasts cause carbon dioxide to rise and this forces the bread up. The yeasts reproduce by a process called budding. First a small knot grows on some one of the yeast, then as the knot grows larger the wall draws in and finally there are two distinct yeasts.

The materials used for bread are flour, sugar, salt, shortening, yeast and water. First the flour, sugar & salt are sifted together, then the shortening is rubbed in. Then add yeast which has been dissolved in lukewarm water. Mix all together thoroughly and set away to rise. Knead it. After it has risen knead the dough and let it rise again. Then make it into loaves and put in the oven to bake. The ~~carbon dioxide~~ being elastic rises and during that time the carbon dioxide and alcohol formed by a chemical action escape

Theme – Test for Gluten in flour

Experiment: Two bags containing corn meal and wheat flour were separated up and down in a glass of water. Then the water was tested with iodine. The bags were then opened and the contents examined

Sequence:- The water in the glass turned blue as soon as the iodine was added. The bag of wheat contained a sticky white substance. The other bag contained a sa" like sawdust

Conclusion:- The sticky white substance was gluten This was absent in the cornmeal. Because of this

Remarks:- Because of this corn bread (not being elastic) does not rise as well as wheat bread.

Insects Oct 3, 1917

General characteristics
1. Body divided into 3 parts { head, thorax, abdomen
2. Head { antennae, eyes (compound), mouth parts { biting, sucking
3. Thorax { 3 pairs legs, 2 " wings (usually)
4. Abdomen { segments, Breathing holes, ovipositor ?
5. Metamorphosis { complete { egg, larva, pupa, adult; incomplete { egg, nymph, adult

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Beetles

The characteristics of beetles are, first, they have a pair of horny wing covers, beneath which they have a pair of wings. They use their mouth parts for biting. They have a complete metamorphosis passing through four stages. Beetles are found on fruit trees, on the ground, etc.

(over)

The potato beetle as all other beetles passes from egg to larva, to pupa, to adult. The eggs are laid on the under side of the leaves of the potato plants. When the eggs hatch the larva eat the potato leaves and finally kill the plant. The beetles can be destroyed by spraying the plants with some poison mixture which the beetles eat.

Plant Lice (aphids)

Plant lice are very small and are found on the under sides of the leaves, on the stems and on other places where they can use their mouth parts for sucking the juices from the plants. The aphids make these juices into honey dew which they secrete from honey tubes one on each side of the back. The ants take the aphids to the plants and then make the aphids secrete the honey dew for them.

Ants

The divisions between the body parts are very distinct. The ants usually have no wings but the kings and queens have wings.

Ants (continued)

The ants live in colonies. The workers get the food, build the houses, take care of the pupa, etc. The ants use their mouth parts for both biting and sucking. Ants have a complete metamorphosis.

Bees

Bees just as the ants have distinct body division. All bees have four wings. Bees are divided into three, queens, and workers. In one hive of bees there can only be one queen. Because their mouth parts for ~~biting or~~ ~~and~~ sucking.

Classification of Insects Animals

Anthropoda jointed legs

1. Crustacea - crabs and lobsters
2. Arachnida - Spiders - 4 pairs legs
3. Myriapoda - centipedes
4. Hexapoda - Insects
   a - Orthoptera - roaches, grasshoppers crickets and katy-dids
   b - Hemiptera - Lice and Aphids
   c - Lepidoptera - Moths and Butterflies
   d - Diptera - Flies
   e - Coleoptera - Beetles
   f - Hymenoptera - bees and ants

Kinds of bugs?

THE LOCUST

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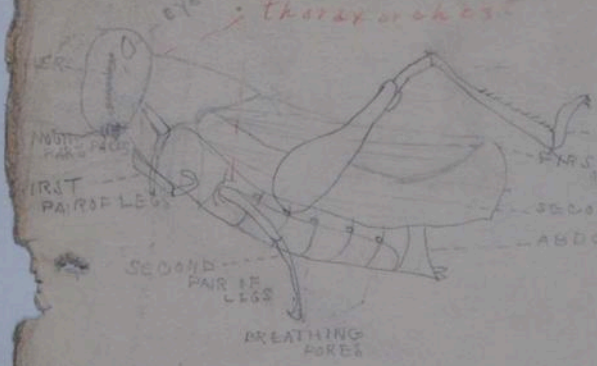
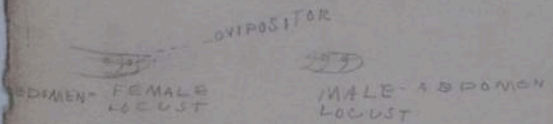




III.

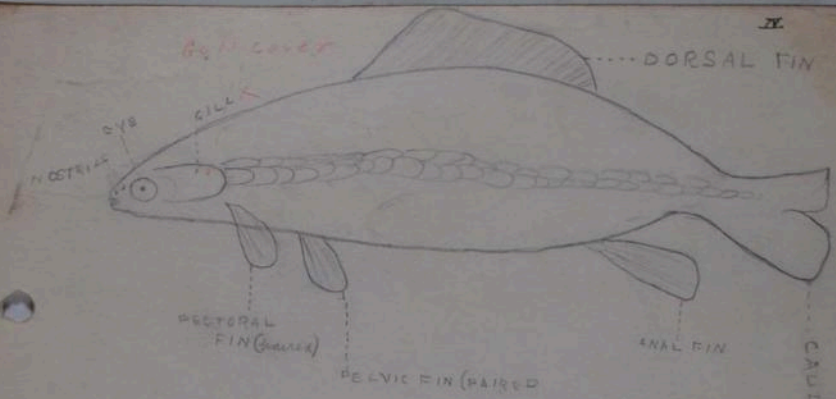
The Hydra

TENTACLES

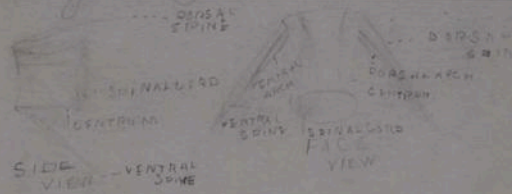
EXPANDED

CONTRACTED

B



The Gold Fish (A Vertebrate)

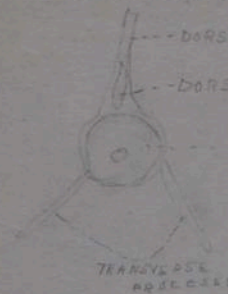


Vertebrae of a Fish

B

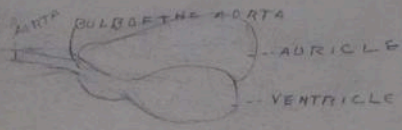
Not very neat

Fish (continued)



Thoracic Vertebrae

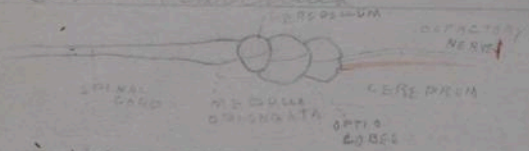
Gill



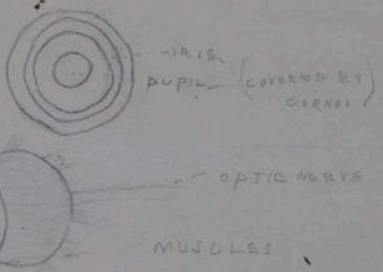
Heart.

Arrangement

Fish continued



The Brain



The Eyes

Oct. 1, 1917

Object to show behavior of different things used to make baking powder.

Experiment:- Into seven test tubes are placed a small amount of baking soda ($NaHCO_3$). Then, to each of three test tubes were added a small amt. of the following substances respectively; in the first water; in the second sour milk; in the third tartaric acid; in the fourth, cream of tartar; in " fifth, phosphate of lime; " sixth alum and in the seventh, alum and phosphate of lime. We held these test tubes over a flame and noted the results. Then we held a lighted taper in the mouth of the test tube.

Sequence:- No results were noted in the first test tube. In all the other test tubes, after a few seconds, the taper was extinguished. In the second test tube the taper was extinguished very rapidly but this did not keep up for long. In all others it took a short while for the taper to begin to be extinguished but after it began it kept up for a long time. Drops of moisture were seen on the sides of the test tube.

Conclusion:- In all the test tubes carbon dioxide and water were given off, but there was only a slight amount of carbon dioxide in the first test tube.

(over)

Object:- To test the nature of the remaining compound

Experiment.-

We poured some water into the test tubes containing the cream of tartar and phosphate of lime

Sequence. The cream of tartar readily dissolved but the phosphate of lime did not.

Conclusion - ~~cream of tartar is changed into tartaric acid before it gives off~~ - cream of tartar is soluble

Remarks ~~Conclusion~~:- In the first test tube remains baking soda; in the second; sodium lactate, a soluble harmless compound; in the third & fourth sodium tartrate a soluble, harmless compound. The remaining three contained insoluble harmful compounds.

The only advantage in using sour milk is that we might put in too much sour milk and the cake would be sour or with too much baking soda it would taste [illegible]

Oct 7, 1907 Ida Kaplan

Coffee

Coffee is a tropical plant which first grew in Arabia, Abyssinia etc, but it now grows in almost all tropical countries. The part of the plant we use is the dark pulpy berry. The leaves are evergreen, the flowers are white and bloom two thirds of the year. The berries are bright red and grow in clusters on long branches and sometimes on the trunk itself. The leaves are gathered three times a year.

After the berries are plucked they are dried. These berries are covered with a red skin, then comes a gummy layer, and finally the two berries covered with parchment. When the berries are dried the red skin turns brown. Then the beans are fermented to rot away the gummy layer. Then the parchment is broken away by machinery. Then the beans are sorted and separated according

size and color then it is put in bags and shipped to the markets. At the stores the beans are roasted and then ground. Roasting makes the tannin less soluble and decreases the amount of tannin. caffeine.

Sometimes the coffee is adulterated with cheaper materials but sold for the pure coffee.

To test for pure coffee mix some coffee with cold water or salt water. If the coffee floats on the top it is pure; if it sinks it is adulterated. If the water becomes red there is chicory in the coffee

The Kinds of Sugar

Oct 10

Kinds of Sugar
- lump
- Confectioner's
- Culverized
- granulated
- maple
- brown
- palm
- beet

Sources
- maple tree
- cane (sugar)
- palms + sorghum
- beets

How sugar is made in plants

Green leaf - factory
- chlorophyll - machinery
- sun light - power
- $CO_2 + H_2O$ = raw materials
- Starch - manufactured product
- Oxygen - waste

In leaves there is a diastase which changes starch to sugar.

Starch

Refining of Sugar Oct 15

Cane sugar. After the sugar cane is cut it is brought to a factory and crushed through rollers. The juice runs down to a tank. The woody part is used for fuell. The juice contains sugar, water and nutrient salts, sometimes proteins. To remove the sugar first the juice is heated. This will evaporate some of the water and coagulate the proteins. The juice is strained to remove the proteins. Then lime is added. It then has part of salts and coagulated proteins. The juice is filtered to remove the ppt and crag. It then cool the juice and we have the sugar crystallized. The liquid which remains is New Orleans molasses. Then the sugar is taken to a refinery and boiled to purify it and put through carbon to make it white. The crystals are dissolved and filtered through bone black. Then it is cooled and crystallized. Then it is hurled through centrifugal machines to separate the crystals from the liquid. Then the crystals are bleached with ultra-marine. The granulated sugar may be made into lumps, gran. sugar, pulverized sugar, confectioners. The light liquid is sugar house molasses

Experiments on Sugars

Oct 22
Oct 10

Ex- We dissolved some grape sugar in water and then added Fehling's solution and heated the mixture.

Sequence - The mixture changed through green yellow, orange, and finally red. There was a red precipitate at the bottom.

Conclusion - Grape sugar changes Fehling's solution through the above colors.

Remarks - Fehling's solution is composed of caustic soda and copper sulphate. Grape sugar is a reducing agent and reduced Fehling's solution.

Does granulated sugar reduce Fehling's?

Expt: - We poured some Fehling's solution into a test tube containing granulated sugar dissolved in water. We then heated the mixture.

Seq. No color change was noted.

Conc. Granulated sugar does not reduce Fehling's solution

Rem. Granulated sugar is chemically different from grape sugar. The difference is shown in the formula. Gran. sugar has more H and O than grape sugar. Gran. sugar is called double sugar and grape sugar is called invert or simple sugar

Does long boiling change sucrose

Exp. We tested sugar water which had been boiled ½ hr) with Fehling's solution

Seq. The sugar water changed slightly brown

Conc. Long boiling changes sucrose slightly

Remarks:- This method is used whenever we want to prevent crystallization. The sucrose is changed to glucose which does not crystallize.

What is the effect of boiling sucrose with acid

Exp. What is the We dissolved granulated sugar, added acid and boiled this with Caustic soda. We then added Fehling's

Seq. The sucrose changed through all the colors

Conc. Boiling with acid changes sucrose to glucose

Remarks- We use this when making candy. To keep it smooth we use ~~vinegar~~ acid to change the sucrose to glucose which won't crystallize. When we boil make jelly we should boil the fruit first then add the sugar and boil a short time, so that all the sucrose won't change to glucose.

Nov 5, 1917 Ida Kaplan

The Extraction of Tannin from Coffee

Exp) a) Some water was boiled and then equal quantities of it were poured into two test tubes containing equal quantities of coffee. One test tube was allowed to stand and the other was boiled for a few minutes. Then they were tested with blue litmus paper

b) Then equal quantities of coffee from both tubes were poured into two test tubes containing equal quantities of ferrous sulphate.

Sequence- a) The coffee that was boiled was darker than the one that was boiled. The litmus turned pink when tested.

b) The ferrous sulphate turned green in both test tubes but much darker in the one in which boiled coffee was poured in. There was a precipitate in the latter one.

Conclusion- There was an acid in the coffee. This was tannic acid as was proved by the green color on the ferrous sulphate.

Remarks- The amount of tannin brought out by boiling in coffee is not much larger than that brought out by scalding.

Nov 5, 1917 Ida Kaplan

The Extraction of Caffeine from Coffee

Exp. Some coffee was boiled, filtered and cooled. Then it was poured into a separatory funnel and Chloroform was added to it. Then the mixture was shaken. Then it was allowed to settle and some chloroform was poured into a plate and allowed to evaporate in the sun.

Sequence- The same white crystalline substance was left on the plate as remained in the effluent and tea.

Conclusion- We conclude that the chloroform had taken out a substance from the coffee. ~~This is caffeine~~

Remarks- The substance is caffeine and ~~then is~~ it is an alkaloid. There is more caffeine in coffee than there is theine in tea.

Nov 24, 1917 Ida Kaplan

Tests for Proteins in Meat

Object (A) The effect of cold water on meat
(B) " " " boiling " " "

Exp. (A) Meat was shaken in cold water, then filtered. The residue and filtrate were tested with HNO_3 and NH_4OH. Then the filtrate was boiled and filtered and the residue and filtrate were tested for protein.

(B) Boiling water was poured over meat, then boiled for a while and filtered. The residue and filtrate were tested for protein. The filtrate was boiled and ~~the residue tested for protein~~.

Obs. (A) The water was discolored. The residue and filtrate ~~turned~~ yellow when HNO_3 was added and orange when NH_4OH was added. The filtrate showed the test slightly. When the filtrate was boiled a coagulate was formed. This showed the protein test very plainly.

(B) The water was very much discolored and the meat became white and shriveled on the top. The residue showed the test very plainly but the filtrate not much. When the filtrate was boiled more coagulate was formed.

Concl. A - Something was dissolved from the meat by the cold water. By testing the residue we saw that meat contains protein. Some of this is lost when cold water is poured on meat.

B. Hot water does not take out any protein from meat. The protein is left in the meat.

Rem. A - If meat is soaked in cold water and the water thrown away we lose some of the protein. (Ca.)

2. When meat is plunged into boiling water the some of the mineral matter is dissolved in the water but the protein coagulates on the top of the meat.

The Effect of Limewater on Grape Juice

Exp. The juice of some grapes was poured into a test tube. Then we tested the juice with blue litmus paper. We then poured limewater into the juice.

Sequence:- The litmus turned ~~blue~~ pink at first but when limewater was added the litmus turned back to blue. There was a precipitate formed.

Conclusion:- Limewater neutralizes acid. There were salts and ~~proteins~~ in the grape juice because there was either a precipitate or a coagulate formed.

Remarks:- In the manufacture of sugar limewater is used to remove the proteins and salts which are in the liquid

Can we turn cho starch to sugar.

Exp a) We tested starch with Fehling's

Seq. a) There was no change

Exp. b) We boil starch + water with an acid. We poured in caustic soda and then added Fehling's

Sequence b) - The required change in colors took place

Conclusion - We can change starch to sugar by boiling with acid

Remarks - This is the way glucose is made.

Oct 22

The Effect of Lime Water on Calcium Phosphate

Exp. Some lime water was poured into a test tube containing calcium phosphate solution.

Sequence - The mixture became cloudy and there was a fine precipitate in the test tube

Conclusion - The precipitate was an insoluble calcium phosphate. Lime water precipitates soluble salts.

Remarks - This is done in the manufacture of sugar.

The Effect of Lime water on Egg-white

Exp - Some lime water was poured into a test tube containing egg white

Sequence - Small white flakes were formed.

Conclusion - Lime water precipitates the protein in egg white. Lime water coagulates proteid

Remarks - this is done in the manufacture of sugar

Tea

Ida Kaplan

Tea is a tropical plant and grows best in China, Japan and Ceylon. When wild it will sometimes reach a height of forty feet but the people who cultivate it will not allow it to grow higher than five feet at the most. The parts we use are the leaves. The leaves are long and narrow and pointed at the end. The flowers resemble the apple blossom and the fruit is a small berry.

The leaves are picked when young and sorted as to size. Then they are dried in the air to wilt them. Then the tea is rolled. There are two known green tea and black tea. To make black tea just at this point the green tea is fermented and thus turns black. This happens because the tannin is made more insoluble. Then both the black and the green tea are steamed over charcoal fires and packed. Some tea is packed in bulk after fermentation but most of it is packed in lead lined boxes.

We use tea as a beverage and as a stimulant. The proper way to make tea is to scald it (that is, pour boiling water over it. The improper way is to boil tea. This is injurious because it brings out a lot of tannin.

There are different grades of tea. The best made from the bud is called the flowery pekoe. Our grade is the orange pekoe and pekoe are made from the first two leaves. Then come first and second souchon and finally congo.

Tea is composed of tannin, which is an astringent and disrupts the mucous in the tissues, theine, an alkaloid which is the stimulating substance, and the volatile oils which [illegible] the flavor

The Extraction of Theine from Tea.

Exp- Some boiled tea was strained and cooled. Then some chloroform was poured into a separatory funnel into it and then the mixture was shaken. The chloroform was then poured into a clear dish and set in the sunshine.

Seq. When the chloroform was poured in it went to the bottom and was no longer clear. After the dish was taken from the sunshine & the chloroform had evaporated and a thin crystalline deposit was left on the dish

Conc. Chloroform extracts a white crystalline substance from the tea

Term. The crystalline substance was theine. Theine is an alkaloid and belongs to the same class of alkaloids as quinine, strychnine, nicotine, morphine, belladonna, caffeine, theine &c. Alkaloids taste bitter, are nitrogen compounds and will dissolve in acid.

Ida Kaplan

Ida Kaplan

How should we make tea

Exp. (a) Into two test tubes containing small quantities of tea leaves, we poured in equal quantities of boiling water. We put one test tube away as it was, and the other we boiled for five minutes.

(b) Then we poured equal quantities of the boiled and scalded tea, respectively into test tubes containing equal quantities of ferrous sulphate ($FeSO_4$). We then diluted the mixture with equal quantities of cold water.

Exp. (a) The boiled tea was much darker than the scalded tea.

(b) When the tea was added to the ferrous sulphate it turned blue but the one containing boiled tea was a much darker blue and contained a great deal of precipitate which the other did not.

Conclusion - Boiling tea brings out a substance which scalding does not.

Remarks - Boiling tea liberates a great quantity of tannin. It is tannin which turns the $FeSO_4$ blue. Tannin is taken from the bark of trees and is used to tan leather and hides. Being used to harden hides it is harmful to our stomachs and should not be used in excess.

Milk

Milk is an animal food that is obtained for the purpose of nourishing the young. Milk is sometimes called the ideal food because it contains all the elements necessary for good food. It has 87% water, 4½% protein, 5% sugar, ½% minerals and 3% fats.

When milk is allowed to stand, or when it is mixed with rennet or acid, it curdles or separates into a thick part and a watery part. This ~~is called~~ protein of the milk. ~~The protein~~ When milk is heated the scum that forms is the protein of the milk. When rennet or acid is used to curdle milk the curd is called casein, but the scum is called lactalbumen. The watery part of milk is called whey. The whey contains the lactose (sugar) of milk, which is the part of the milk that turns sour. The acid in sour milk is lactic acid and the bacteria which cause milk to sour are lactic acid bacteria. Milk is an emulsion, that is the globules of fat are floating around in it. Sometimes when we want to coagulate milk (that is change the protein to a compact mass) we use rennet. Rennet is the lining membrane of a calf.

To keep milk from souring, to get rid of the disease bacteria and bacteria of decay, the following two methods are now always used. Bacteria may get in the milk in various ways. The hands of the milker, the cow, the stables, the pails, the utensils are not always clean and so bacteria will enter the milk. To get rid of these bacteria the milk is pasteurized and sterilized.

Cream and Butter

Cream consists of the fat globules of the milk which have slowly risen to the top of the milk and have been separated from it. In milk the globules of fat are encased in a covering of milk. When milk is soured this covering is made thin. For this reason when we make butter we use sour cream. Then when we churn the cream the covering is broken and the fat comes out and forms lumps of butter. The milk left over is buttermilk. Butter has sweet butyric acid bacteria which form butyric acid. This acid gives butter its flavor.

There are many substitutes for butter. Some of these, like oleomargarine and butterine are wholesome, being made from cottonseed oil etc. and flavored with butter or butyric acid. Renovated butter is made from rancid butter which is melted, strained, purified and churned with butter. Adulterated butter is a substitute for butter not sold under its right name. When butter is heated it foams, oleomargarine etc. spatters and renovated butter foams and spatters.

Cheese

To make cheese, milk is soured until it forms a thick curd. The curd is placed in a cheese cloth bag and the whey is allowed to drain off. This makes cottage cheese. If harder cheese is desired the sour milk is heated and more whey is allowed to drain off. Sometimes the cheese is flavored with different bacteria to give it different colors or flavors.

The Effect of Heat on Milk

Exp. Some milk was boiled for a while. Then the scum was tested with nitric acid and ammonia.

Sequence - A wrinkled, cream colored scum was formed on the top of the milk. After added the acid and ammonia were yellow and orange respectively.

Conclusion - Heat brings the protein of the milk to the top as a scum.

Remarks - This scum will dissolve again when stirred. The scum is the protein of the milk.

Exp - The milk was tested with pink and blue litmus paper.

Sequence - The pink litmus did not change but the blue became slightly pink.

Conclu. Milk is very slightly acid.

The Effect of Rennet on Milk

Exp. Some dissolved rennet was boiled with milk. Then it was allowed to cool.

Seq. A thick curd was formed and this separated from the watery part.

Conc. Rennet coagulates milk so as to make it clog together.

Rem. This is the method used for making rennet junket. Rennet makes and likes allied to dairying.

Exp. We filtered whey and heated it in an evaporating dish to dryness

Obs. A solid substance remained in the dish. An odor of burning sugar was present.

Con. The watery part of sugar contains sugar

Rem. The sugar of milk is lactose. It is used to sweeten milk for babies. The sugar in sour cream dries up & will become sour

The Effect of dilute Hydrochloric Acid on Milk.

Exp. Some dilute hydrochloric acid was heated with milk.

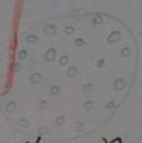
Obs. The milk curdled in flaky curds

Con. Acids curdle milk

Rem. This happens when milk turns sour. When cooking milk into vinegar we may add some lime to neutralize the acid and thus prevent the acid from curdling. The curd is casein

Cream

Whole Milk



Skim Milk

Under the microscope

Pasteurization of Milk

Exp. Some milk was poured into a test tube then the mouth of the tube was closed with cotton. The test tube was placed on cotton on the bottom of a pan, then it was heated at a temperature of 80° for twenty minutes. It was set away in the cold for four days.

Obs. The milk did not turn sour.

Conc. Pasteurizing milk keeps it from getting sour in twenty four hours if it is kept cold.

Rem. If pasteurized milk is kept warm it will turn sour after forty eight hours.

Sterilization of Milk

Exp. Some milk was put in a test tube which was then closed with cotton. The tube was placed in a boiler, & covered and boiled for twenty minutes. It was kept in a warm room for four days.

Obs. ~~Sterilizing milk keeps it from getting sour.~~ The sterilized milk did not turn sour.

Conc. Sterilizing milk keeps it from getting sour

Rem. Sterilized milk will not get sour even for years and years. Although sterilization kills the lactic acid bacteria, still, boiling changes the flavor of milk, and for that reason, we like pasteurized milk better.

He found that it did not support combustion or life. He also weighed the marble before and after the experiment and also CO_2, finding that the weight of the CO_2 agreed to the loss of weight in marble. He called the CO_2 "fixed air". He then reversed the experiment and caused the CO_2 to bubble thru $Ca(OH)_2$ or limewater, producing $CaCO_3$.

About the same time Bergman a Swede, tested the same gas with litmus, and named it "aerial acid". LaVoyer produced CO_2 by burning carbon in pure oxygen, and named it carbonic acid.

Test on Gelatine

Ida Kaplan

Ex. Some gelatine was mixed with cold water.
Seq. The gelatin did not dissolve.
Con. Cold water does not dissolve gelatin, therefore it is not a protein.

Ex. Some gelatin was mixed with hot water.
Seq. The gelatin dissolved.
Con. The hot water dissolves gelatin but does not coagulate it, therefore gelatin is not a protein.

Ex – Some gelatin was mixed with water and tested with nitric acid and ammonia.
Seq – The gelatin did not turn yellow and orange.
Con – Gelatine is not a protein because it does not answer the test.

Ex. Some acid was mixed with gelatin.
Seq. The gelatin did not curdle.
Con. Gelatine is not a protein.

Remarks

Gelatine is a substance which is obtained by boiling long and slowly the bones and sinews of meat. The gelatine has nitrogen but no proteon and is not a tissue builder. For this reason it is sometimes called an ~~albu~~ albuminoid.

Meat

Meat is the fleshy muscle of ~~an~~ animal used for food. This also includes fish and poultry. Meat is distinctively a protein fat. Meat contains from 60 to 75 % of water, one percent minerals and the rest is divided equally between fat and protein.

Meat is composed of bundles bound together by connective tissue. This can be separated by the from the meat itself

Gelatin

Gelatin is a substance which is obtained by boiling long and slowly the bones and cartilage of meat.

Ida Kaplan

Clothing Materials

Clothing materials are made from either cotton, wool, silk, linen or a combination of these. Cotton and linen are from the vegetable order and are composed of cellulose. Cotton comes from the cotton plant and linen from the flax plant. Wool and silk are from the animal order. Wool comes from sheep and goats and silk from the silk worms. The wool and silk are therefore proteins.

Cotton	Linen	Wool	Silk
thin or thick	coarse or fine	thick	smooth thin
rougher than linen	glossy smooth or rough	rough soft	soft glossy
stiffer than linen	heavy or light	downy warm	flimsy light in weight.
3d in warmth	coolest	warmest	not as warm as wool

In order to wear each of these it is necessary to have clothes. Some of these have a high heat capacity and some a low. Wool and silk have a high heat capacity and therefore are warmest. Cotton and linen have a low heat capacity and are coolest. They are good conductors of heat and let the heat pass out. Wool is more durable than silk and cotton more durable than linen. Silk ~~but~~ and wool is cheaper than silk and cotton is cheaper than linen.

Cotton

Cotton is a tropical plant or bush ~~grows~~ grows in tropicals and semi-tropical countries. The leaves are five lobed and the flowers (white purple or yellow) have five petals. The ~~cot~~ cotton is held in a five parted boll.

Effect of Heaton Cloth

Appearance 6

Name	Flame	Ash & Charring	Rapidity	Appearance	Odor
Cotton	yellow keeps burning after taken out of flame	charred small amount of a gray ash	burned very rapidly	straight edge	odor of burning paper or wood
Linen	dully yellow keeps burning after taken out of flame	gray ash charred	burnt rapidly	even edge	"
Silk	yellow does not burn after taken out of flame	charred mass	burnt slowly	wavy edge	odor of burnt feathers
Wool	glows and burns as soon as taken out of flame	charred mass no ash	burns more slowly than silk	curly edge	strong odor of burnt feathers.

Conclusions - This test is used a great deal by manufacturers to see whether they have received the right goods.

Ida Kaplan

Ida Kaplan

Ida Caplan

Theme - Effect of Heat on Fibers.

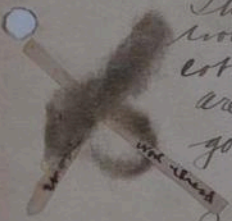
Exp. Some cotton linen silk and wool fibers were heated in separate test tubes. Then a piece of pink litmus was held in each tube. The results were noted.

Sq. There was moisture on the sides of all tubes. They was an oily deposit in all the tubes. The cotton linen ~~contained~~ turned black but not the silk and the wool. In the cotton and linen test tubes the litmus did not turn blue but did in the other two. There was an odor of burning paper from the first two test tubes but an odor of burning feathers from the other two.

Conc. All cloth contains moisture but silk the most. Wool contains the most oil although all have oils (hydro-carbons). All four contain carbon in the form of charcoal. Vegetable fibers contain no alkaline gas which turns litmus but animal fibers do. Because of the odor of burning paper we know that cotton and linen are cellulose. Silk and wool are protein containing ammonia and that gives the odor of burning hair.

Ida Kaplan

When cotton is gotten from the fields the seeds are separated from it, then the cotton is cleaned then carded. That is it is smoothed down and made ready for spinning. Then it is spun into a thread and woved into cloth.



The same things are done with wool. It is harder to spin wool than cotton. That is why cotton woolen goods are so much rougher than cotton goods.

In making linen the stems of the flax plant are rotted away until the fibers only remain. Then the fibers are cleaned carded, ~~thanned~~ spun and woven.

From cotton

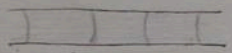
Ida Kaplan

Dyeing Cloth.

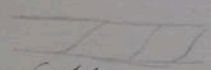
Ex. Some woolen fibers and some cotton fibers were dipped respectively into hoematoxylon dye and blue aniline dye.

Con. It is harder to dye cotton than wool and the color comes out lighter.

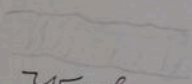
Microscopical Appearance of Fibers



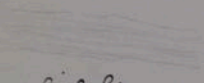
linen



cotton



Wool



Silk

Silk

J. Caspelan

Silk is gotten from the silk worm. The silk worms when they are in the caterpillar stage, are ready to become pupae. They secrete a fluid which becomes thread. They wind this thread around and around themselves until they form a cocoon. Then the people making silk gather the cocoons and plunge them in boiling water. The cocoon consists of the silk thread and a gummy substance. The boiling water makes the thread harden and makes the gummy substance soften. Then the silk is spun from the cocoon and wound on spools.

Effect of Alkali and Acid on Fibers

Ed. (Teacher) Into test tubes containing wool and cotton were poured respectively water and sodium hydroxide, dilute hydrochloric acid, concentrated hydrochloric acid, dilute sulphuric acid, concentrated sulphuric acid.

Eq.	NaOH	dil. HCl separated	conc. HCl at once	dilute H_2SO_4 separated	conc. H_2SO_4
Cotton	no change	Cotton	very quickly	Cotton very quickly	decomposed cotton to C.
Wool	broke wool solution turned yellow	formed a lump	formed a lump	coagulated wool	decomposed cotton to C more slowly than wool.

Con. The effects of caustic soda and acids on cotton and wool are just the opposite.

Rem. It is safe to use soda when washing cotton but not on wool. Acids will harm cotton but if one use acids when washing wool the wool will shrink, therefore this is not advisable.

The effect of Acid on Silk.

Ed. Into two beakers were put respectively a piece of cotton tack alk and a piece of chiffon. Then cold hydrochloric acid was poured in both. The contents of the first were washed.

Eq. Cotton fiber remained in the first but in the second the silk separated although the solution

Con. Cold hydrochloric acid makes silk separate.

Ida Kuplan

Some Useful Organic Compounds

Methane (CH_4) is a colorless gas which burns with a blue flame and gives heat. It is found in natural and coal gas.

Chloroform ($CHCl_3$) is a clear, colorless, volatile liquid with a strong sweet odor. It is fairly heavy and decomposes readily in the light. It is used as an anaesthetic, to assist the preparation of drugs, as a solvent for oil and as a cleansing agent.

Carbon Tetrachloride (CCl_4) is a clear, colorless liquid with a strong unpleasant odor. It is used in the preparation of cleansing fluids.

Iodoform (CHI_3) is a yellow powder with a strong disagreeable odor. It is used as an antiseptic.

Methyl Alcohol - CH_3OH - is a colorless liquid with a strong penetrating odor. It is used as a solvent in drugs, etc. as a drying fuel etc.

Ethyl Alcohol - C_2H_5OH - is a colorless, clear liquid with a pleasant odor. It is used as a solvent in drugs, to keep the temperature of fever patients down, in the manufacture of alcoholic liquids etc.

Glycerin - $C_3H_5(OH)_3$ - is a colorless, syrupy liquid with a sweet taste. It is used in medicine, cosmetics and making nitro-glycerin.

Ether ($(C_2H_5)_2O$) - is a clear, colorless, volatile, liquid with a sweet penetrating odor. It is used as an anaesthetic and as a solvent for organic substances.

CH_3COOH - Acetic Acid - is a clear colorless liquid with a sour smell. It is present in vinegar and is used as a solvent for organic substances.

Acetylene - C_2H_2 - is a colorless Gas which burns with a white flame. It is very explosive. It is used in lamps on vehicles.

Composition of Bones.

Object: Of what are bones composed?

Experiment

a) A bone was put in the fire and allowed to burn.

Sequence

a) The first thing that happened was that a flame came out and burned. The bone turned brown. A steam came from the bone. The bone kept on getting darker and darker until was almost as black as charcoal. It was very brittle. Then it turned white and crumbled to ashes. After burning the bone was much lighter. During the burning there was a very disagreable smell.

Conclusion

a) The black substance was carbon. The liquid that came out was fat or grease. There was an addition to that a white inconbustible material. The steam showed that the bone contained water. The carbon burned and passed away as carbon-dioxide.

Experiment.

b) A bone was placed in Hydrochloric Acid (HCl) and allowed to remain there for two days.

Sequence

b) The bone became very soft.

Conclusion.

b) The bone was so soft because the hydrochloric acid had acted on the bone and taken away the mineral matter leaving only the soft animal matter.

Remarks (a+b) The inorganic matter in the bone is calcium carbonate ($CaCO_3$) and calcium phosphate ($Ca_3P_{O_4}{}_2$). Calcium phosphate is one of the salts necessary for the growth of plants, therefore ground bone is a good fertilizer. The action of the acid on the bone is chemical.

Not guaranteed.

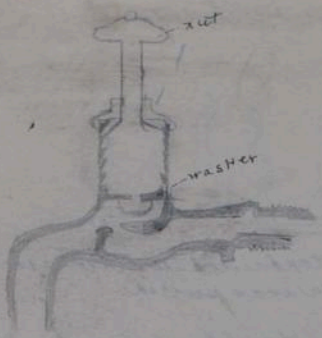
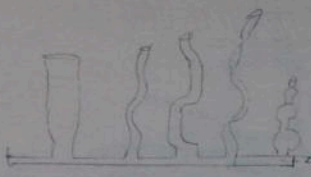


Diagram of Spigot

nutmeat

Theme - The Hydrostatic Paradox. Feb. 25, 1918

Apparatus -



Experiment - The tank contained water. Into the first tube water was poured.

Sequence - Water rose to the same height in all the tubes & fell at the same rate.

Conclusion - No matter what the size or shape of the tubes is the water will rise to the same height in each.

Remarks - In this way the water rises in the pipes in houses supplied by the gravity system. The law that the pressure of water is independent of its volume is called the hydrostatic paradox.

Theme – Does Water exert Pressure Upward Feb. 27, 1918

Experiment – A tube was placed in a beaker of water. Under the tube was a suited crystal.

Sequence – The crystal stuck to the tube until the water in the tube was as high as that in the beaker.

Conclusion – It was air pressure upward that made the crystal stick to the tube.

Remarks – Water flows from low to higher levels in houses on account of its upward pressure.

Theme – Does Water Transmit Pressure Equally

Experiment how. Water was put into a bulb and the piston was clamped down.

Sequence :- Equal quantities of water flowed with equal force from the different nozzles.

Conclusion – There is equal pressure ~~against~~ by the water against the sides against the sides of the bulb as against the bottom.

Remarks – This is the reason we can get an equal supply ~~of~~ of water on the bottom floor as on the second floor.

Poor drawing.

Leave a margin

Theme - The Upward Pressure of Air March 4/08

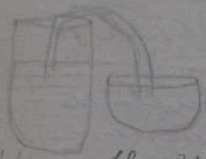
Experimentations - A card was placed on a glass filled with water. Then the glass was inverted.

Sequence - The card stuck fast to the glass

Conclusions - The upward pressure of air prevented the card from falling. The pressure of air is stronger than that of water

Remarks - Pascal's law applies to gases as well as to liquids.

Post drawing



Theme - How We Can Remove Water from one vessel to Another

Exper. Into a bowl of water we placed one end of a rubber pipe. We sucked the air from the tube from the other end. Then we held the tube over the second vessel.

Sequence - The water flowed from the first bowl through the pipe and into the second tube.

Conclusion - When we sucked the air from the tube that left a vacuum and the water in the first bowl rushed up to fill it.

Remarks - A bent tube like the one above is called a siphon.

not neat

Theme - When Is Water at its Greatest Density

Experiment - The temperature of the water was taken at different intervals from 10.20 A. M (the time the apparatus was set up) to 12.45 A. M.

Sequence

	Lower Therm.		Upper Therm.
10.20	16°	without ice	16°
10.45	10°		16°
11.00	8½°		16°
11.15	7°		16°
11.45	5½°		16°
12.45	4°		4°

Conclusion - When the water near the ice was chilled, it became heavy and sank. Then it displaced the warm water which rose till the level of the ice where it also was chilled. Then it sinks, and so the process keeps on. Then when the water in the bottom became four degrees, the water suddenly became light and rushed up, so that the temperature of the upper water became lower. Consequently, water is heaviest at four degrees. Convection took place in the water.

Remarks - This explains why water freezes on the top, first, and also why pipes burst in winter.

Ida Kaplan

Theme- Conditions Necessary for the Formation of Ice.

Experiment- We took the temperature of water in a beaker. Then we added a quantity of sand ammonium nitrate. Into a test tube containing some cooled water we placed a thermometer. Then we placed the tube in the beaker. Every now and then we took the temperature of the water in the tube.

Sequence- The temperature of the water in the beaker was 17½°. After the ice was added the temperature went down to below 0°. The temperature of the water in the test tube was 3°. After stirring put in the beaker the temperature went slowly down. At zero crystals began to form.

Conclusion- It is because we had ammonium nitrate mixed with ice that the temperature went down to below zero. Crystals of ice will not form unless the water is stirred.

Remarks- This principle is used in storing vegetables in a cold cellar by placing them in a box surrounded by water.

Theme- The Effect of NaCl and NH_4NO_3 on Water

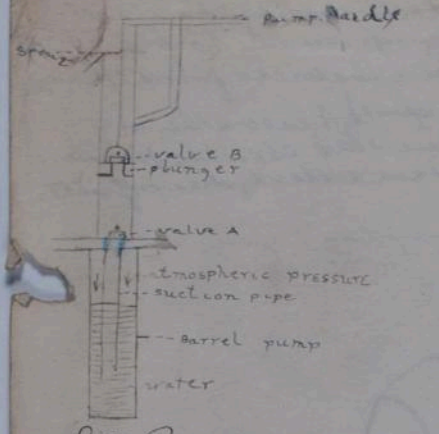
Experimentation- Two grams of NH_4NO_3 and two grams of NaCl were put respectively into two beakers containing 40 cc of water. Then the temperature was taken before and after the addition of the salts.

Sequence is-

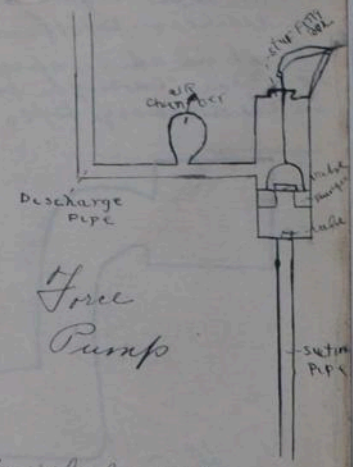
A- Salt		B- NH_4NO_3
19°	before	19°
18°	Standing	16°
17°	After stirring	13°

Conclusion- It takes some heat to dissolve salts in water. Therefore the temperature went down. It also takes more heat to dissolve NH_4NO_3 than to dissolve NaCl.

Remarks- Therefore salt is used with ice in freezing ice-cream, and NH_4NO_3 is used in making artificial ice.



Lift Pump



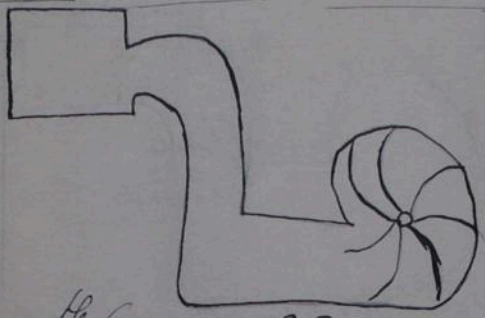
Force Pump

The following is an explanation of why water comes out of the spout when we move the pump handle up and down a few times.

When the plunger goes up for the first time it takes along the air thus creating a vacuum beneath. Since a vacuum cannot exist the air in the suction pipe rushes up to fill it. Then water comes up to the suction pipe as far as valve A. When the plunger comes down it presses together the air. The air pressure is so strong then as to force open valve B and air rushes past. When the plunger goes up for the second time it creates another vacuum but the water in the suction pipe rushes up only because air pressure from the side and not from the top can come up through valve A. When the plunger comes down again it presses together the water and the pressure forces open valve B and the water goes up and out through the spout.

(over)

The left pump is used to draw water from a well for a short distance. The force pump is used to force water to a higher level. When water is forced through a discharge pipe (instead of a spout) it enters the air chamber and compresses the air there & when the pressure is strong enough to maintain a steady stream of water in the discharge pipe.



H Centrifugal Pump

The centrifugal pump is used to draw large quantities of water for a short distance

Ida Kaplan

Mar. 6, 1918

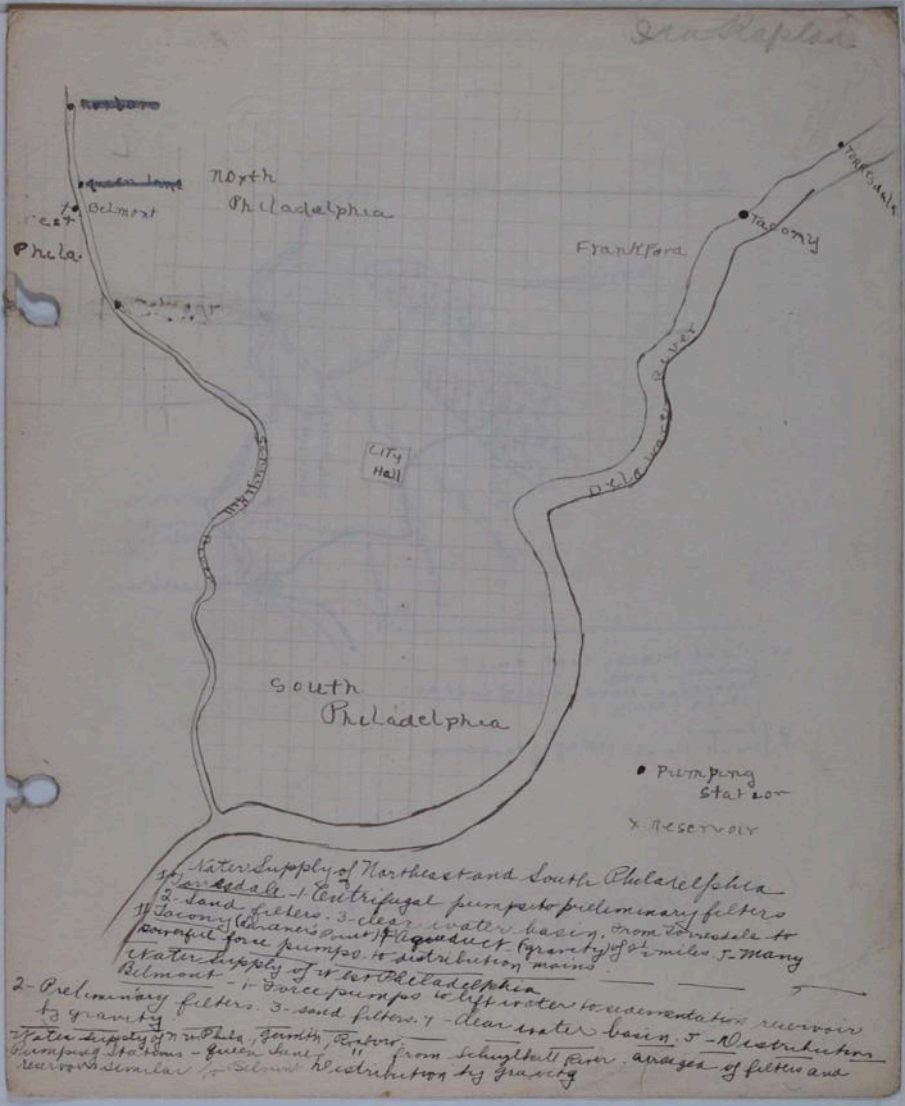
March 1, 1918

Ida Kaplan

Bacteria from the Human ~~Body~~ Intestine killed and stained.

Magnified 950 times.

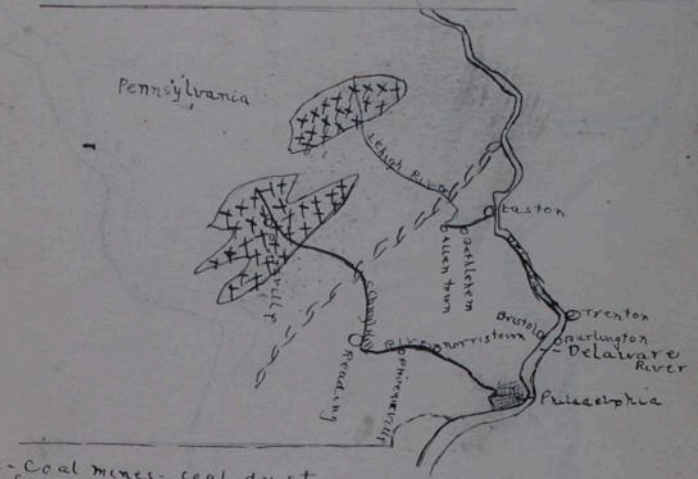
The rod shaped bacteria are called bacillus, spherical are called coccus, the spiral spirillum.



Water Supply of Northeast and South Philadelphia
Torresdale - 1 Centrifugal pumps to preliminary filters
2 - Sand filters. 3 - clear water basin. 4 - Aqueduct (gravity) 3½ miles. 5 - Many
Tacony (Frankford Creek) 1 Aqueduct
powerful force pumps to distribution mains

Water supply of N & W Philadelphia
Belmont - 1 Force pumps to lift water to aeration & reservoir
2 - Preliminary filters. 3 - sand filters. 4 - clear water basin. 5 - Distributions
by gravity

Water supply of N. Phila, Fourth Ward from Schuylkill River. arrages of filters and
Pumping Stations - Queen Lane "
reservoir similar to Belmont Distribution by gravity



xx - Coal mines - coal dust
- Sandstone - sand
- Limestone - Hardness of water
- Shale - clay

o o - Large + small towns = sewage - bacteria

Chief Sources of Impurities in the Schuylkill and Delaware Rivers

Ida Kaplan

Theme-Conditions Necessary for the Growth of Bacteria

Exp:- A mixture of gelatine and peptone which had been previously sterilized was poured into a number of sterilized dishes.

A- A few drops of water were dropped on the gelatin

B & C- were touched with the fingertips

D- A needle dipped in gelatin sweet milk was scraped over the gelatin.

E- The same thing was done with sour milk

F- Exposed in a schoolroom

G- " " hall during passing of classes

H- " to the dust of the street

I- Sprinkled with dust from the street.

All dishes were then closed and one half of "I" was covered with black paper.

Sequence- A- few small, shiny, yellow particles.

B- Light, fuzzy green patch, white edge

C- Thick patches of green and yellow

D- Streak of yellow, creamy, shiny stuff

E- Heavy patches of creamy, shiny matter

F- Large patches of green, gray, yellow.

G Patches of green, fuzzy and yellow.

H- Large " " white, gray, orange, yellow.

I- On light side few patches of gray; on dark side large patches of green, " white

Conclusion – there must have been many living particles in the air on the fingertips etc which settled in the dishes living on the substances there. We can also conclude that there are different kinds of particles, also there are more living objects in sour milk than in sweet; also darkness favors the growth of these particles

Remarks

Mar 13, 1912

Ida Kaplan

Science

Theme - The Relative Strength of Disinfectants

Experimentation - Ten test tubes containes white of egg mixed with water in the proportion of ten parts of water to one part white of egg. Into these were poured respectively the first one nothing, ½ gram salt, 1 gr. salt 1 gr sugar 5 gr. sugar 2 drops of Corrosive sublimate, 1 drop formaldehyde, 2 drops of Corrosive sublimate, 6 drops formaldehyde, 2 drops latter 3 " same ½ gram borax, ½ gram latter, 4 drops carbolic acid, 1 " carbolic acid.

Sequence - After a week the first was cloudy and a disagreable odor, the second and third were clear and odorless the next was slightly cloudy, the next clear and no odor, " slightly cloudy & odor, next the same as the last three were clear with a slight precipitate, the next two were clear with no odor and the last three were cloudy.

Conclusion - There was no disinfectant in the first tube, therefore there was no protection against bacteria. Some of the tubes were cloudy because some disinfectants coagulated white of egg.

Remarks: The most poisonous of these substances are $HgCl_2$ and C_6H_5OH. Their poisonous actions are due to the coagulation of the proteins of the body. Bacterial products have a similar effect a dilute solution of sugar will not preserve food but a strong solution will.

March

Observations on Disinfectants and Antiseptics

A disinfectant is used to remove germs already present and an antiseptic is used to prevent the entrance of germs.

Inorganic Substances

Sulphur oxide (SO_2) is a colorless gas with a strong penetrating odor. It is produced by burning sulphur. It is used to disinfect a room but has a bleaching action.

Chlorinated lime ($CaOCl_2$) is a white powder and has the strong odor of chlorine. It is used to disinfect sewage etc. It is produced by passing chlorine over slaked lime.

Corrosive Sublimate ($HgCl_2$) It is a white powder like salt and has no odor or taste. It is used for disinfectant and antiseptic. It is extremely poisonous and therefore used in dilute solutions 1 part to 1000 parts water. Antidote for this is white of egg or milk. Use large quantities or make the person vomit.

Iodine (I) comes in the form of greenish horn scales. It is commonly used in solution with alcohol or water. It is used as an antiseptic

Hydrogen Peroxide (H_2O_2) is a clear, colorless liquid with a strong odor. It is used as an antiseptic or disinfectant

Potassium permanganate ($KMnO_4$) comes in purplish rod shaped crystals. It is used as a disinfectant. It is to be dissolved in water

Organic Substances

Organic Substances contain a radical CH.

Phenol (C_6H_5OH) is used as a disinfectant or antiseptic. It comes in the form of whitish crystals which dissolve in water.

Formalin (CH_2O) is used as a disinfectant. It has a very strong odor, but looks like water. It is used as a solution.

Don't crowd your writing

Ft

May 29th 1918

Ida Kapla
Science V.

Theme - Relative Humidity.

Experimentation - A tin cup was partially filled with water. Then, gradually ice was put in. The temperature was noted carefully.

Sequence - Before the ice was put in, the temperature was 74°. When a film of water was seen the temperature was 46° + (the temp average of four readings).

Conclusion - The film formed because the warm air around the cup was chilled and therefore could not hold all of the vapor and condensed some on the cup.

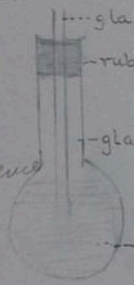
Remarks - By the use of tables (which told the ammount of water vapor in the air at the saturation point at 74° and at 46°) we could determine that 33⅓% was the relative humidity of the air at 74°. The tables said that at 74° the air held 9 gr. of water, at 46° it held 3 gr. water. Therefore $\frac{3}{9} = \frac{1}{3} = 33\frac{1}{3}$. But it was 34°, therefore it is 33+%.

Sept 10, 1918

Ida Kaplan
Science IX a

Theme - Equalization of Air Pressure

Experiment - a) Air was sucked out of the tube
b) Air was blown into the tube



Sequence - a) The water which had already risen slightly in the tube now rose more than halfway.
b) Bubbles formed in the water and the water in the tube nearly ran over the top.

Conclusion - In the very beginning, the water rose in the tube because of capillarity. When we sucked the air out there was less pressure on top of the water, than on the sides, therefore the water rose.
When we blew more air into the tube, the higher pressure forced the air to rise.

Remarks - In liquids and gases, pressures tend to equalize each other. Owing this equalization, work may be performed. Such is the case in a lift pump, force pump.

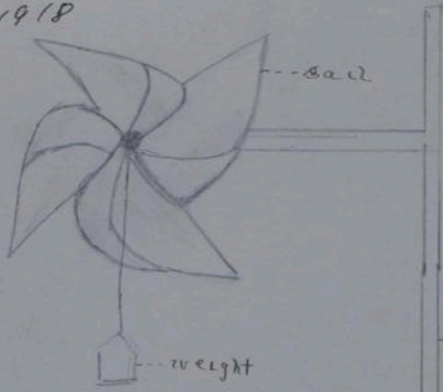
(over)

Remarks- In force pumps, rain tubes, work is done by the expansion of compressed air.

Equalization of pressure also causes winds.

Theme-Windmill
Sept 12, 1918

Ida Kaplan
Science IV a



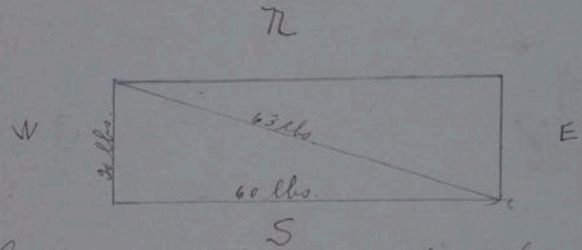
The pinwheel (as shown above) illustrates the principle of the windmill. If we blow upon the sail of the windmill, all the sails go around and the weight attached to the center of the pinwheel moves up and down.

In a windmill the sails are acted on by winds and breezes. Instead of a weight, a pump is attached to the windmill and when the sails rotate, the pump handle moves up and down and raises water. By attaching (and) machinery, the windmill may be utilized to grind grain.

The windmill also illustrates the wheel and axle principle which says, that the greater the distance the force moves, the less force is used.

Theme- Measurement of Force by Lines and the Resultant of Two Forces.

Sept 17, 1918



A boat is going east with a force of sixty lbs. against a current of 30 lbs. The boat will go Southeast with a force of 63 lbs. The two forces are represented by the sides of the rectangle and the diagonal is the resultant between the two forces, representing the real force with which the boat travels.

Ida Kaplan
Seventh A

Theme Resultant of Two Forces
Sept 24, 1918

Ida Kaplan
Science VI a

Experiment -

a) Two scales, similar to the one attached were attached to the hook of a third one. A weight was attached to each of the hanging scales.

Sequence: - Each hanging scale registered 2 oz. and the single scale registered 4 oz.

Conclusion: - When two forces are acting together in a straight line, the resultant is the sum of the two.

Experiment

b) Two scales were hooked together and were pulled in opposite direction.

Sequence: - One scale registered 4 oz; the other 4 oz.

Conclusion - We conclude the resultant was eight oz. because the resultant of two forces acting against each other is the difference between the two.

Experiment

A piece of twine was tied to the middle of another piece of twine in the manner shown. Scales were attached to the three ends of the strings. One weight remained stationary while the other two were pulled at a small angle.

c) When the scales were pulled at a larger angle

Sequence - c) One scale registered 24 ozs. The other 16 oz. The stationary scale registered 32 oz.

d) One scale registered 28 ozs and the other 24 while the top scale registered 24 ozs.

Conclusion - The smaller the angle the greater the resultant. When forces are acting at a large angle, they are ~~was a very~~ nearly acting against each other and the resultant is small. When two forces are acting at a small angle, they are acting almost together in a straight line, and the resultant is large.

Sept 26, 1918

Ida Kapelan
Sequence II a

Theme- Which Holds More Without Sinking, a Boat or a Raft?

Experiment- We made a raft of a piece of paper 1½ by 2½ in. We also made a boat of a piece of paper ½ by 3 in. We put these into a pan of water, and put gram weights on them.

Sequence:- The raft held four grams without sinking, and the boat held nine grams without sinking.

Conclusion:- The boat displaces more water than the raft, because it has deep sides which can extend into the water, without having water enter the boat. Therefore, the boat can hold more weight without sinking because, Archimede's principle says that buoyancy is the resultant upward pressure of a liquid against a body immersed in it equal to the amount of water displaced by it. When weights were added they overcame the buoyancy of the boat and it sank.

Remarks:- Salt water has more buoyancy than fresh water because it is heavier and can exert more pressure upward.

Oct 3/1918

Ida Kaplan
Grade VI a

Science

Theme - The Comparative Weight of a Body in Water and Air.

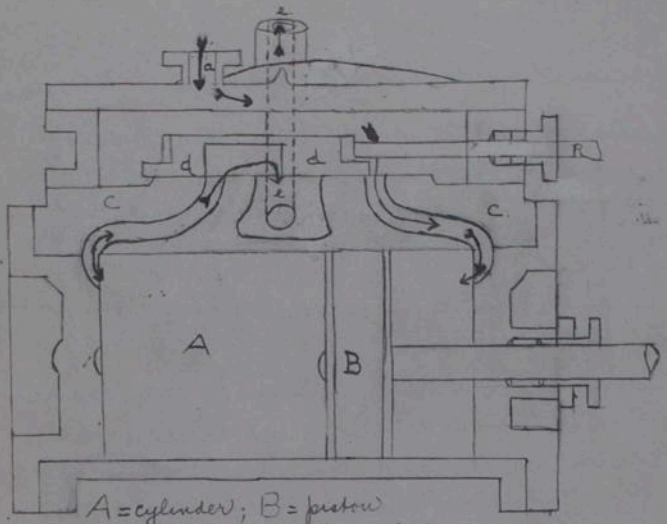
Exper. - A glass rod was weighed. Then two pieces of cotton thread were attached to the ends of the scale pan and the rod knotted to the ends of the string. The rod was immersed in the water and weighed.

Sequence - The rod weighed 6 grams in air and four grams in water.

Conclusion - Therefore the body appears to weigh more in water than in ~~air~~ air. It weighs less in water because in the air there were two forces working against the rod, the force of gravity and the upward pressure of the air. But in water there must be a greater upward pressure to subtract from gravity than in air. Therefore the resultant in water is less than in air.

Remarks - This is in accordance with Archimedes principle which says that buoyancy or the resultant upward pressure of a liquid against a body immersed in it equal to the amount of water displaced by the body. The following instance is an illustration a boat with the ~~demonstration~~ dimensions 5 c. X 3 c. X 1 c. will displace 15 grams of water and a raft with the dimensions 5. 9 c. X 3. 9 c. X 1 c. will displace 2. 301 grams of water.

The Steam Engine



A = cylinder; B = piston
c c = steam chest, d = slide valve
e e = exhaust pipes; a = inlet pipe
R = rod.

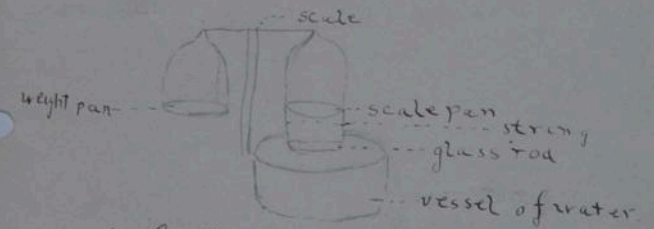
Explanation

Steam passes in through "a". When the valve is in the position shown, the steam passes into the cylinder the direction of the arrows. The pressure of the steam pushes the piston to the left. But the valve is connected by the rod to an eccentric. When this is turned the valve moves to the other end of the ~~tube~~ steam chest. Then steam comes in through the left and pushes the piston to the right. All exhaust steam passes out the exhaust pipe ee. The piston is connected with a rod to a wheel where its (the piston's) horizontal is converted to a turning motion. In this way steam is propelled by a steam engine.

Oct 3, 1918

Ida Kaplan
Science VI a

Theme - The Apparent Weight of a Body in Water and Air.



Experiment - A piece of glass rod was first weighed on the scale. Then it was suspended from the scale pan and immersed in water.

Sequence - In the air the rod weighed 5 grams and in the water 4 grams.

Conclusion - The body apparently weighs more in air than in water. ~~The weight of gravity is greater than buoyancy of~~ In the air the weight of the rod is the weight of gravity. In the water there is gravity pressing downward and buoyancy pressing upward, therefore the resultant of the two, the weight of the rod, is less than the weight of gravity alone.

Remarks - This is in accordance with Archimedes' principle.

A boat whose dimensions are 6c. × 3c. × 1c. is compared to a raft 5.9c × 3.9 × 1c. The same ammount of material is in both. The boat will displace 15 c.c. of water while the raft will displace 230 c. c. of water. The boat therefore will displace 12.499 c.c. more and will therefore carry that much more weight. Consequently, the more water displaced, the greater the buoyancy

October 29, 1910

Ida Kaplan
Science VI a

Theme - Turning heat into work.

Experiment - A tube partly filled with water was tightly corked and held over a flame.

Sequence - After the water had come to a boil the cork of the test tube popped out very suddenly.

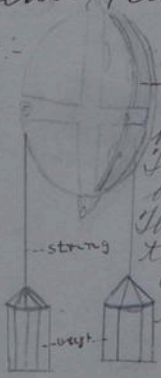
Conclusions - The heat changed the water to vapor. This air rose to the top and was compressed there. Since the pressure on the inside was greater than that on the outside, the cork popped out.

Remark - Work may be accomplished by this attempt to equalize pressure. The lifting of the lid on the tea kettle is an example of work done by the expansion of steam. Occasional bursting of water boilers are also due to the expansion of steam.

Nov 5, 1918

Ida Kaplan
Science 1a

Theme - Potential Energy

Experiment:- 

Two weights of equal value were suspended from a pulley as shown in the diagram. They were also suspended at different levels from the table. Then one was placed on the table and the other was 25 4/7 centimeters from the table. Then the higher one was suddenly pushed upward.

Sequence:- When the weights were put at different distances from the table they remained stationary. But in the second case after the push the top weight fell and the lower weight rose to the former level of the first.

Conclusion:- The continued movement of the weight was due to inertia. The slight push was enough to start the weights going until stopped by force of cohesion. The weight performed some work by moving because it overcame resistance to gravity.

Remarks:- The energy possessed by the weight is called potential energy or energy of position

November 6, 1918

Ida Kaplan
Seventh a

Theme - Kinetic Energy

Experiment:

A wooden ball was suspended and then struck by a mallet at first slowly and lightly. Then the ball was struck quickly and strongly.

Sequence:- After the first blow, the ball moved slowly in a small arc. The second time the ball moved more quickly in a large arc.

Conclusion:- The ball covered a greater arc the second time because the velocity of the mallet was greater. The work done by the ball depends upon the velocity of the mallet.

Remarks- The ball possessed kinetic energy or energy of motion. After being hit by the mallet it also had kinetic energy.

November 12, 1918

Ida Kaplan
Science IX a

Object - To illustrate the conversion of potential energy into kinetic energy.

Experiment - Two balls were suspended by a string from a ring stand. The one was placed in a higher position than the second and allowed to drop and strike the other.

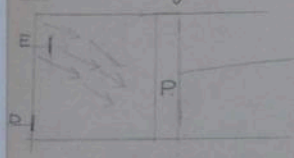
Sequence - The two balls swung together in a large arc, which gradually became smaller.

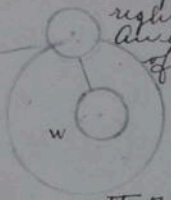
Conclusion - The first ball had energy of position or potential energy, because it was higher than the other. But in swinging the potential energy was changed to kinetic energy. When the two balls met this kinetic energy was transferred to the second ball. In swinging upward the kinetic energy was changed to potential energy and back to kinetic energy which was transferred to the first ball etc., etc.

Remarks - The Niagara Falls is a good example of the conversion of potential to kinetic energy.

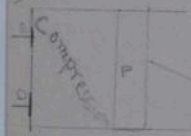
Nov 12, 1918

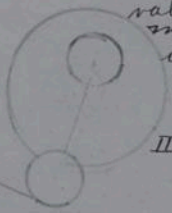
The Gasoline Engine



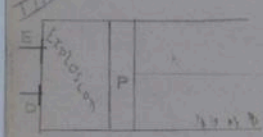


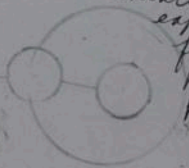
I When the flywheels w are set in motion by cranking the piston P moves to the right and valve E opens & explosive mixture of air and gas enters.



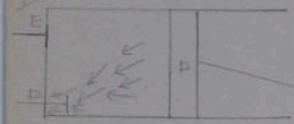


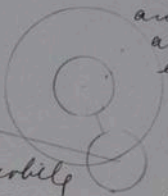
II Then the piston moves to the left valve closes and the mixture is compressed in the cylinder.





III Then an electric spark ignites the mixture and the explosion which follows sends the piston to the right.





IV On the return stroke of the piston, the valve D opens and the exhaust air and gas escapes.

Inertia in Automobile

We crank an automobile to overcome the inertia of the engine. It is also on account of inertia that the engine keeps on moving until stopped.

To ensure uniformity of motion, autos have 4, 6, 8 or more cylinders in which explosions take place one after the other.

Nov 19, 1918

Ida Kaplan
Science 9a

Object - The Jack Screw

Experiment - A heavy dictionary was raised a short distance with our hands. Then the book was placed on the b and a was turned. Then a pencil was inserted in b and the pencil was turned.

P.S. The apparatus is called a jack screw.

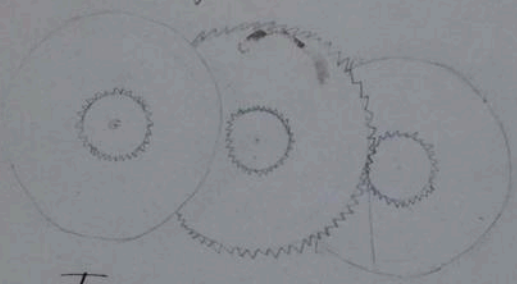
Sequence - When the book was first lifted it was very heavy. The second time it was easier to raise the book and the third time very much lighter.

Conclusion - It was hard to raise the book the first time because the distance to which the force was applied was equal to the distance the book was raised and the law of machines is that force x distance the object is raised is equal to force x distance the force is applied. Then the second time we applied a greater force by turning a" thus making the applied force less. The third time we applied the force to a still greater distance and therefore had to use less force.

Remarks - This principle is illustrated when people occasionally raise their house and also when we raise coal in a mason's automobile

Nov 21. 1918

Gear Wheels



The above diagram illustrates gear wheels. These are found in the gear box of an automobile. By applying slight force to wheel I. a weight heavy weight at III can be lifted slowly, and if a wheel No 3 is turned quickly, a light force will be lifted quickly at I.

In going up a steep hill, power is applied to wheel No I and the automobile goes slowly. In going gently on a smooth road power is applied to wheel No 3.

Nov. 26, 1918

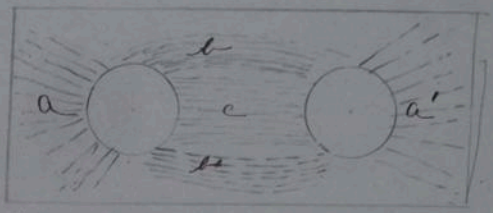
Id a Kaplan
Science VI a

Theme

Experiment (a) A horseshoe magnet was placed under a sheet of paper, that so the legs of the magnet were stuck through holes. Then iron filings were scattered over the paper.

(b) Two electric batteries were inserted in holes in paper as above and filings were scattered over the paper. Current was then sent thro the coils

Sequence (a)



The filings arranged themselves in the above diagram. Around the electric batteries the filings arranged themselves in a similar manner.

Conclusions - The filings did not arrange themselves around the batteries until the current was turned on, because the electricity transformed the batteries to magnets. Between the two poles (as in c) the filings arranged themselves in straight lines because a straight line is the resultant between two forces acting in a straight together. In a and a' the filings arranged

themselves in a radiating lines because there was only one force acting on the filings. The filings which arranged themselves in the a and b around the poles of the magnet did so because the arc is the resultant between two forces acting at an angle. Between the two poles of the magnet, the filings were very thick because there were two forces attracting the filings. The greater distance the filings are from the magnet, the less attraction there is, and consequently, the filings are not arranged so thickly.

Remarks. The lines traced by the filings are called lines of magnetic force and the space covered by them, the magnetic field.

In a converse way we can create a current of electricity by using a magnet. We had a great many coils of wire and, first of all, inserted the North Pole of the magnet through the coil of wire. It then applied to the galvanometer, the needle moved in the opposite direction. The same happened when the South Pole was inserted. The needle moved only as long as the wires were being pushed over the legs of the magnet. When the movement was stopped, the needle remained stationary. The same thing happened when the wires were removed from the magnet. The direction of the current produced in the wires depends on the poles pushed through the wire and on the direction of movement

Dec 10, 1918

Ida Kaplan
Science VI a

Theme:- The Effect of an Electro-magnet on a Coil of Wire.

Experiment:- a) We connected a coil of wire with an iron core, to an electric battery of two dry cells. Another coiled coil of wire was connected with a galvanometer. The primary coil was slowly put in the secondary coil.

b) The core of the first coil was quickly moved up and down in the secondary coil.

Sequence:- a) The needle moved slowly in a small arc backward and forward.

b) The needle moved more rapidly and more extensively in opposite directions.

Conclusion:- The primary coil, because it is connected with a battery is an electro-magnet. Consequently when it is placed in the second coil the latter is charged with a current of electricity and deflects the needle of the galvanometer. The needle moved slowly the first time and more quickly the second time, because the current was much stronger the second time.

Lines of force are cut

The principle of the Electric motor.

Why does the armature revolve?

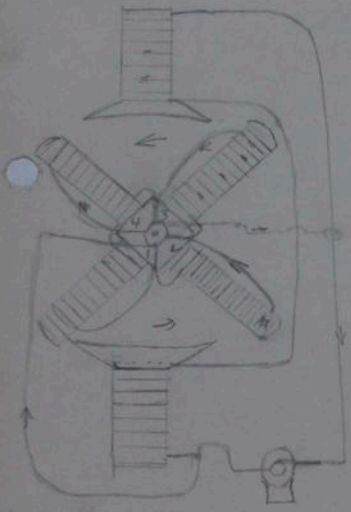
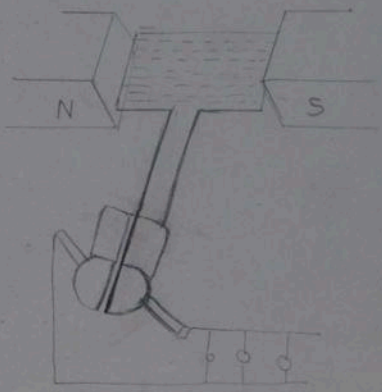


Diagram of an Electric ~~motor~~.



Explanation

Dec 19, 1918

Ida Kaplan
Section VI a

Thermo-Measurement of Resistance.

Experiment:- A battery was connected with a German silver wire which was attached to a meter stick. A current was sent thru it. The same was done with a coarse copper wire and with a thin copper wire. By means of a slide on the silver wire, we tested the resistance in different lengths of wire.

Sequence:- German silver wire — $\frac{1}{5}$ meter — $\frac{2}{10}$ meter — $\frac{3}{7}$ meter
Thick copper wire — 9
Thin copper wire — 5

Conclusion:- The longer the wire the stronger the resistance and therefore the weaker the current. The thicker the wire, the less the resistance and therefore the stronger the current. Copper is a better conductor of electricity than silver, because it offers less resistance.

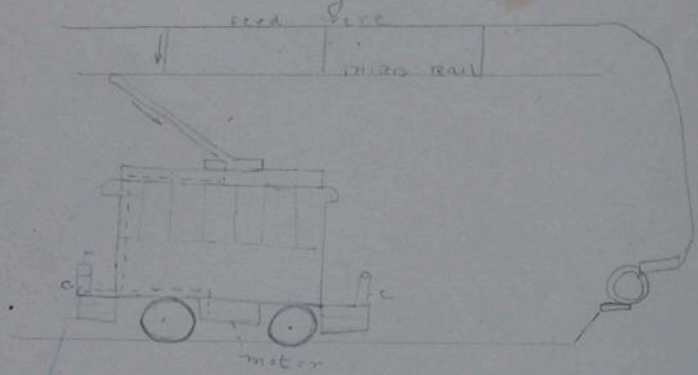
Remarks:- Resistance is added or cut out by the motorman of a trolley car in order to control the strength of the current entering the motor. The strength of the current affects the speed by making the movement between the field magnet and armature stronger or weaker.

Jan 2, 1919.

Ida Kaplan
Science 7a

F 7
(Nature)

The Trolley Car



Isa Kaplan
Science VI a

Theme-Inertia

Experiment-

a) A smooth card was placed over the neck of the bottle with a ball on top of it. The card was then given a sudden and quick push.

b) A book was placed upright on a piece of paper and the paper was given a sudden quick jerk. A second time the paper was slowly moved forward and then given a jerk.

Sequence:- a) The card flew off leaving the ball in the neck of the bottle.

b) The book fell backward and the second time fell forward.

Conclusion- The tendency to resist flying off was called inertia. The book fell backward because the top of the book had more inertia and tended to stay at rest. The second time, the bottom of the book had more inertia and tended to move forward and therefore the book fell forward.

Remarks-

Inertia is that property which all mass possesses, which keeps it at rest or in motion, unless acted on by some other force.

This is illustrated when a person falls backwards when a trolley starts or when the car suddenly stops.

Feb 3/1919

Ida Kaplan

Science VII a

Observations on the Heavens

7.00 A M - Sun rises in southeast } February
5.15 P M - Sun sets in southwest }

6.00 P M - Moon rises in west — shape of crescent

7.30 P M - Stars appear just after twilight.

Size - stars are of about seven different sizes or magnitudes, as they appear to us.

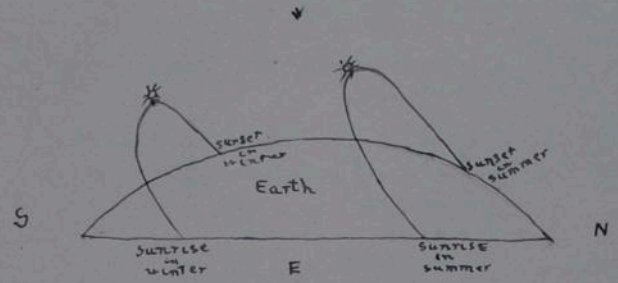
Patterns of stars

Stars change their position during the night, moving across the sky from east to west.

2/3/19

Ida Kapelow

Path of the Sun in February Science VII a



In summer because the earth is tilted the sun shines on the whole northern hemisphere and ~~the~~ it seems to rise in the northeast. But in winter it shines on the southern hemisphere more directly and so seems to rise in the southeast and set in the southwest.

2/3/19

Ida Kaplan
Science XII a

Theme - Observations on the Heavens

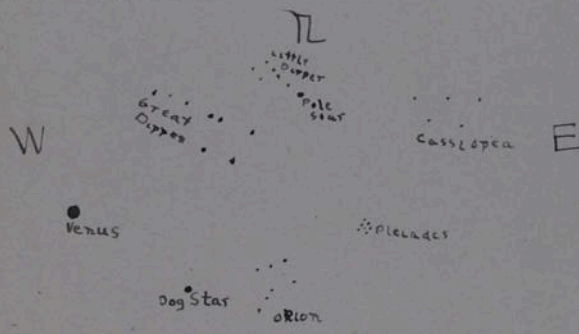
Sun -
7.00 A. M. - rises in southeast
5.30 P. M. - sets in southwest

Moon -
6.00 P. M. - rises in west - in shape of a crescent

Stars -
7.00 P. M. - appear just after dusk
Size - Stars are of seven different sizes or magnitudes.

.....

Patterns



Stars change their positions in the heavens, moving from east to west. except pole star

Theme - The Temperature at the Evaporation of Water and Ether.

Exp. - Some cotton saturated with water was tied around the bulb of a thermometer. Some cotton saturated with ether was also treated in the same way. The temperature was taken before and after putting the cotton around.

Sequence - In the same length of time, the mercury in the thermometer with water around it went down from 34° to 20°. In the other thermometer the temperature went from 23½ to 3° below zero.

Conclusion - The mercury fell in both thermometers because in evaporating the cotton took heat from the surrounding objects. Ether needs more heat to evaporate than water, and then it evaporates more rapidly. Water could be frozen if placed in evaporating ether.

Remarks - In making artificial ice, liquid ammonia would have the same effect on water as ether. Besides ammonia is cheaper, safer and all together a better product to use. The heat required to evaporate substances is called the heat of vaporization.

Theme - The Effect of a vacuum on Flame and Weight.

Exp. - A bell jar with a burning candle beneath it was placed on the platform of an air pump. The piston was pushed up and down a few times.

Sequence - The candle in the jar slowly went out, and the jar could not be lifted from the platform.

Conclusion - The candle went out because there was a vacuum created and consequently there was no oxygen. The jar stuck to the platform because there was greater pressure outside than within the jar. We know this from Pascal's law which says that air pressure is transmitted equally on all sides.

Remarks - The pressure of air is about fifteen pounds to a sq. inch at sea level.

Theme - The Effects of a Vacuum on Transmission of Sound and Light Waves.

Experiment -

A - A candle was placed on one side of the jar. Then a vacuum was created. The candle was looked at before and after the air was drawn out.

B - An electric bell was placed in the jar as shown. Then it was connected with a battery and an electric bell. Then a vacuum was created again. The bell was rung before and after the vacuum was created.

Sequence - a - We could see the same light of the candle just as clearly before as after the vacuum was created.

b - The sound from the bell could not be heard in the vacuum, whereas the sound could be heard, though faintly, through the air.

Conclusion - Light can be transmitted, but sound cannot through a vacuum. Air is necessary for the transmission of sound. When the bell was rung in the jar the sound was faint because the jar would have to be taken in vibration besides the air. That would use up the energy from the sound.

Remarks - Heat can also be transmitted through a vacuum.

How do we know this?

Theme-Varieties of Matches

Experiment

a) Two kinds of matches were struck on the sole of a shoe.

b) Both kinds of matches were struck on the side of a box.

Sequence

a) One match would not light when struck on the sole of one shoe. The other did.

b) Both matches began to burn.

Conclusion.

There is some substance on the box which ~~is~~ not on the sole that caused the first match to light when struck on the box and not when struck on the sole. The white substance on the match No 2 which is missing in match No. 1 also helps to light it even when struck on the sole of a shoe.

Remarks

a) The light substance at the tip of Match No 2 is a compound of sulphur phosphorus and glass which has a low kindling point. It catches fire from the heat of friction. The dark substance contains charcoal, sand and other substances such as oxygen.

(over)

The substance in the box contains red phosphorus mixed with powdered glass. The tip of match No. 1 is covered with powdered glass mixed with substance such as in eggs.

That some Gas given off by a burning match

Experiment

A match was lit and then extinguished. Another lighted match was held near it.

The first match immediately burned with a flame.

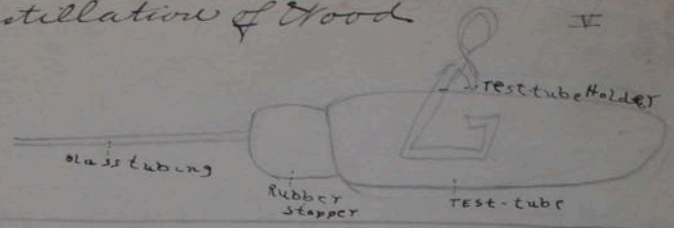
Conclusion

The first match when burning gave off a gas which remained around the other match and this gas burned when the other match was held near and set the match on fire.

IV

Theme- Distillation of Wood V

Apparatus



Experiment

A few pieces of wood were burned in the above test tube. Then a match was applied to the end of the glass tubing.

Sequence

The wood turned black when it was heated. The test tube and glass tubing were soon filled with a dense smoke. Drops of a dark yellowish fluid appeared on the inside of the test tube. A flame appeared at the end of the test tube when the match was applied. A strong odor was noticeable.

Conclusions

The black substance on the wood is carbon. The liquid was formed when the smoke condensed on the cold sides of the test tube. The flame was due to burning gas.

Remarks

Theme- Is the liquid an Acid or a base

Experiment

The fluid in the tube was collected and a few drops of water were added. Then it was tested with blue litmus paper.

Sequence

The litmus paper turned pink

Conclusions

The liquid was an acid

Remarks

So this liquid then is acetic acid which makes the litmus paper pink. Also wood alcohol which gives it a strong odor, also wood tar which makes it brown.

Theme- Distillation of Bituminous coal VII

Apparatus- It is the same as used in the previous Experiment

Experiment- The same experiment was performed before was performed but bituminous coal was used instead of wood.

Sequence

When the ~~wood~~ coal was heated it became porous, lighter in weight and silvery in color. The test tube was filled with a yellow smoke. Drops of a brown liquid were seen on the sides of the tube. A flame appeared at the end of the test tube when a lighted taper was applied.

Conclusions

The drops of liquid came from the moisture in the wood. The wood changed to coke when heated. The yellow smoke was a gas and caused a flame when it came in contact with the lighted taper. The liquid was caused by the condensation of the gas.

Theme- Was the vapor a base or an acid?

Experiment

A piece of pink litmus paper was held in the gas given off by the coal.

Sequence

The paper turned blue.

Conclusion

The gas was a base

Remarks

The vapor contains ammonia (NH_4OH)

Three kinds of Solid Fuel

a- The coal on 'a' was dull black in color, rather smooth and very hard. This is called Anthracite coal.

b- The coal on (b)" was very shiny, very rough and rather soft that is, it crumbles easily The coal is called "bituminous coal.

c- The specimen on c was brown in color, lighter than the coal and had a rough surface. Veins or fibers ran through it. This is called peat.

Description of Liquid Fuels.

Grain alcohol, wood alcohol, crude petroleum, refined petroleum, gasoline. (ethyl alcohol), (methyl "), (kerosene)

Grain alcohol is colorless. It has a strong odor. It is $\frac{8}{100}$ as heavy as water

Wood alcohol is dark orange in color, when impure, and colorless when refined. It has a strong odor and color which is more penetrating than that of grain alcohol. It is as heavy as grain alcohol.

Crude Petroleum - very dark in color. It smells like pitch. It is 1.1 times as heavy ~~as~~ heavier than water

Refined petroleum is colorless, has a strong odor. It is $\frac{4}{5}$ as heavy as water.

Gasolene is colorless. Its smell is like that of kerosene. It is $\frac{3}{4}$ as heavy as water.

Theme. The Formation of Acetylene XI

Experiment

Some calcium carbide was placed in a tube and water poured into the tube. In the neck of the tube was placed a rubber stopper into which had been inserted a bent delivery tube. A lighted taper was applied to the end of the delivery tube.

Sequence

When the water was applied the calcium carbide became a bubbling grayish liquid. A flame appeared at the end of the bent tube. The flame was a bright orange color and smoke came from the end of the flame.

Conclusions

The chemical action of the water on the calcium carbide caused a gas (acetylene) to be given and it was the burning of this gas which caused a flame.

Theme. Test for the Liquid

Experiment

A piece of blue litmus paper was dipped into the liquid.

Sequence

The pink litmus turned blue.

Conclusions

We now know that the liquid was a base

Remarks

These are the formulas for both experiments:-

$CaC_2 + 2H_2O = Ca(OH)_2 + C_2H_2$

calcium carbide + water = calcium hydroxide + acetylene

Acetylene is a hydro-carbon because it consists of hydrogen and carbon

A

Theme-Formation of Carbon Monoxide from Carbon Dioxide.

Experiment

Fresh coals were added red-hot glowing coals.

Sequence

a blue flame was seen. XII

Conclusion

Coal contains carbon which unites with oxygen glows, and forms CO_2 (carbon dioxide). When fresh coal is added, more carbon is added, and that forms C_2O_2 or $2CO$. This is carbon monoxide and it causes the blue flame. These formulas explain it.

$C + O_2 = CO_2$, $CO_2 + C = C_2O_2 = 2CO$; $CO + O = CO_2$

Theme-Why does a Fire Smoke? XIII

Apparatus-

Experiment

The candle in the chimney was lit. Then the chimney opposite the candle was closed with a piece of glass. After a while the chimney containing the candle was closed also.

Sequence

When the candle was lit it burned steadily. When one chimney was closed the candle flickered. When the other chimney was closed burned very unsteadily and finally went out.

Conclusions

When one chimney was closed the candle flickered because there was not a steady flow of air. When the other chimney was closed the flame smoked & went out because not enough oxygen was there to burn up the carbon.

Theme- The Formation of CO_2 from a Carbonate. XIV

Experiment:- Into a flask fitted with a rubber cork, thistle tube, bent delivery tube, was poured carbonate of soda and water. Then some sulphuric acid was added. Then the end of the delivery tube was held in a tube containing limewater.

Sequence:- When the sulphuric acid was added to the solution of sodium carbonate and water bubbles formed. These bubbles passed up the flask and into the delivery tube. When the delivery tube was held in the limewater the limewater turned milky.

Conclusion:- The formation of bubbles was a chemical action. The gas formed was Carbon Dioxide because it turned the limewater milky.

nc- The Formation of Carbon Dioxide from a Carbonate.

Experiment

into a flask, fitted with a rubber cork thistle tube and bent delivery tube, containing [illegible] and [illegible] poured sulphuric acid. The end

(omit)

Theme - Does a Bunsen Burner give more heat than an alcohol stove XV

Experiment

200 Grams of water were heated over an alcohol stove, and the same amount of water was heated over a Bunsen burner. They were both heated in three minutes. Before the water was heated the temperature was taken.

Sequence

The temperature of the water before heating was 19 ± °C. After being heated in an alcohol stove the temperature was 41 ½ °C. When heated with a Bunsen burner the temperature was 66 ½ °C.

Conclusions

The Bunsen burner gives more than the alcohol stove. The Bunsen Burner gives 5000 calories of heat more than the alcohol stove.

Remarks.

Theme - The Comparative Heat Capacity of Brick, Iron and Water.

Experiment - Into three beakers containing 1000 gr. of water were placed, respectively, a brick whose temperature was 100°C, an iron weight at the same temperature, and ½ pound of water also at the same temperature. The temperature of the water was taken before and after adding the heated substances which were added.

Sequence: Before adding the heated substances the temperature of the water was 18°C. After adding the materials the water in the first was 25°C, that in the second 21°C, in the third 41°C.

Conclusions: The brick gives 3500 calories of heat, the iron 1500 calories of heat, and the water 1150 calories. The water gives 5000 more calories of heat than the brick, and 1000 more calories of heat than the iron.

Theme- Which is a better cooking vessel- copper aluminum or agate. XVI

Experiment- Five hundred grams of water were poured into copper agate and aluminum saucepans. A thermometer was held in each saucepan. The water in each pan was heated for three minutes. Then the temperature was taken again.

Sequence- When the temperature was first taken the in the copper and aluminum it was 18°C and in the agate 19°C. After heating the temperature in the aluminum vessel was 52°C. in the copper it was 44°C, and in the agate it was 33+°C.

Conclusions- The aluminum vessel is the best for cooking because it received 4000 more calories of heat than the copper and 10000 more calories than the agate. Copper is better than agate because it receives 6000 more calories of heat than the agate.

Theme- Heat capacity of Steam and Water XVII

Experiment- Fifty grams of steam were passed into 500 gr. of cold water. Fifty grams of boiling water were poured into a copper bowl containing 500 grams of cold water. The temperature of the water was taken before and after adding the heated substances.

Sequence- The temperature of the water in the first vessel was, before adding the steam, 17°C. In the second vessel, before adding the boiling water, the temperature of the water was 16.5°C. after heating the water in the first vessel had a temperature of 41.5°C, in the second it was 25°C.

not doing neat.

Conclusion:- It is better to cook with steam than by boiling. The boiling water gave off 12,250 calories, the steam gave off 4,250 calories, so the steam gave off 8000 more calories than the boiling water.

Remarks:- ~~Before~~ Because of its greater heat capacity steam may be used to a greater advantage in cooking than boiling water. Hence, the value of double boilers.

Extraction of Copper from its Oxide

Experiment:- Some copper oxide and charcoal were heated in a test tube. A delivery tube led from the test tube into a jar of limewater.

Sequence:- The limewater gradually became milky. In the test tube some red spots were seen on the copper oxide.

Conclusion:- The oxygen in the copper oxide united with the carbon of the flame forming carbon dioxide. The red spots in the test tube were copper.

$$2CuO + C = CO_2 + Cu_2$$

Theme - The Chemical Effect of Sodium on Water.

XXII

Experiment (1) - Some sodium was put on water and allowed to float a while. Then it was enclosed in a test tube.

Sequence - When the sodium was put on the water it turned into a little ball and began to bubble and hiss. In the test tube it slowly melted away and the water gradually sank.

Conclusion - The sodium bubbled and slowly disappeared because it was combining with the water. The sodium gas of a gas which replaced the water in the test tube and made the it sink.

Theme - Test for the Gas.

XXIII

Experiment - A match was held in the test tube.

Sequence - A yellow flame was seen. A slight pop was heard

Conclusion - The flame was due to ~~a~~ burning hydrogen. ~~The flame was yellow instead of being blue because there was sodium in the gas which made the flame yellow.~~ $Na + H_2O = NaOH + H$ (sodium + water = sodium hydroxide + hydrogen)

Theme - Test for the liquid

XXIV

Experiment - a piece of pink litmus paper was dipped in the liquid

Sequence - The litmus turned blue

Conclusion - The liquid was a base ($NaOH$) sodium hydroxide

$Na + H_2O = NaOH + H$

Theme:- The effect of Sodium on a luminous flame

Experiment:- A small piece of sodium was held in a non luminous flame of a Bunsen burner.

Sequence:- The flame became yellow

Conclusion:- The sodium caused the flame to become yellow. That is the reason why the hydrogen in the previous experiment burned with a yellow instead of a blue flame.

Theme:- Formation of Magnesium Oxide and Magnesium Hydroxide.

XXVI

Experiment:- A piece of magnesium wire was burned. Then the burnt wire was ~~taken~~ placed on pink moist litmus paper.

Sequence:- The wire burned with a bright silvery flame. The litmus paper turned blue when the powder which was left from the burnt wire was placed on it.

Conclusion:- The powder was burnt magnesium wire. The magnesium when it burned combined with oxygen forming MgO (magnesium oxide). The magnesium oxide when it was placed on moist litmus paper formed $Mg(OH)_2$ (magnesium hydroxide) and made the litmus turn blue because it was a base.

Remarks:- Magnesium is burned sometimes to produce a bright light for taking photographs

Theme:-

Experiment:- A match was held on a piece of magnesium wire. Then the burnt wire was dropped on pink litmus paper ~~water~~.

Sequence:- The wire burned with a large bright, [illegible] flame. The

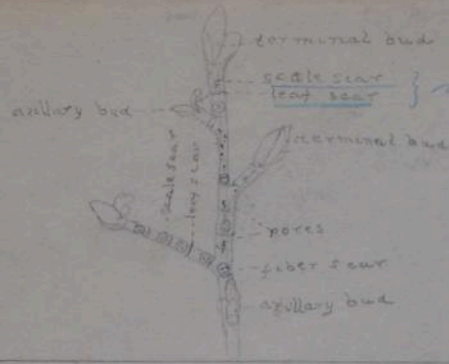
(omit)

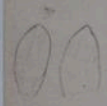
Theme:- Electrical Plating

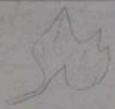
Experiment:- A solution of copper sulphate and water was poured into a jar. A current of electricity was passed through the solution by means of copper plate attached to a wire. A tin spoon was placed in the solution. A wire which was attached to the spoon and the other wire were attached to a battery.

Sequence:- When the spoon was removed it was copper color. The copper plate was also brighter in color.

Conclusion:- The current of electricity decomposed the copper sulphate into copper and SO_4. The copper settled on the spoon changing it to copper color. The SO_4 settled on the plate of copper. The copper united with the SO_4 forming copper sulphate again which passed off leaving the plate brighter in color.




Bud scales


Leaf

Buds of the Tulip Tree

XXIX Descriptions of Building Stones and Minerals.

On number "a" there were three specimens. One was gray in color and opaque. It is made of granules and rather rough. It is red in color and opaque. It is made of crystals and comparatively smooth. The last was orange color and also opaque. It also was composed of ~~crystals~~ granules and also rough. All are very porous. These are specimens of sandstone

On number "b" there was one specimen. It is dark gray in color and opaque. It is made in layers and very smooth. It is called slate

On number "c" there was a crystalline specimen of a salt and pepper color. It was also opaque but not as smooth as the slate. This is quartz

On number "d" was a brown and blueish white specimen. It was opaque and composed of layers. It was smoother than the specimen "c". This is ~~smooth~~

Number one in the box was a thin, transparent smooth, scaly substance. This is mica

Number two was a creamy white, smooth, opaque substance. It was composed of many layers or scales.

Number three was a translucent, substance. It was smooth and made of many crystals

Number four was snow white in color and opaque. It is composed of many small crystals and not very rough. It is also porous.

It is marble

Theme - The Decomposition of Marble.

Experiment - A mixture of one half HCl and water was poured over some pieces of marble in a test tube. The delivery tube leading from the test tube, was held in a jar of limewater.

Sequence - (a) The mixture began to bubble very rapidly and a fine spray was given off. The mixture looked very milky.
(b) The limewater became milky.

Conclusion - A chemical action caused the bubbles. The mixture looked milky because of bubbles given off by the marble.
(a) The limewater because of the presence of the carbon dioxide coming from the test tube. Incomplete

Remarks - The formula for marble is $CaCO_3$

$CaCO_3 + 2HCl = CO_2 + CaCl_2 + H_2O$.
marble + hydrochloric acid = carbon dioxide + calcium chloride + water

This experiment is similar to the one with sodium carbonate and sulphuric acid. Acids produce carbon dioxide when added to salt carbonates.

Observations on Paper

1- Blotting Paper

This blotting paper is green, rough, made in layers and consists of many fibers. There are no spaces between the fibers.

2- Tissue Paper. This is translucent, rather smooth, consists of one layer and is made of fibers. There are many spaces between the fibers.

3- Writing Paper-

This is white, very smooth, opaque, consists of one layer and is made of fibers. There are no spaces between the fibers.

Remarks

The substance which fills the spaces between the fibers is called a filler. Finely clay, talc or calcium sulphate ($CaSO_4$) is often used for this purpose. The substance which gives a smooth, glossy surface is called sizing. Resin gelatin, or casein is often used for this purpose.

Observations on Papers

1- Blotting Paper

This blotting paper is green rough, made in layers and consists of many fibers. There are no spaces between the fibers

2- Tissue Paper

Theme - The Effect of Heat on Glass

Experiment - A glass rod was held in the blue flame of a Bunsen burner. Then we blew through the cold end of the rod. Then we held the same end of the rod from another rod and gradually pulled them apart.

Sequence - The end in the flame gradually melted. A bubble was formed when we blew through the rod. A thin wire was formed when we pulled the rods apart. The blue flame turned yellow.

Conclusions - The heat caused the rod to melt. The bubble contained air. We had known the flame turned yellow because of the presence of sodium.

Remarks: The heat makes glass soft and ductile. The softness and ductility of glass are chiefly due to sodium carbonate Na_2CO_3 which is formed with sand in making it. Calcium carbonate $CaCO_3$ is mixed with the other materials in making glass.

We performed another experiment to show that

Parts of a One-Year Old Dicotyledonous Stem.

B+

Functions of the Parts of the Stem.

Bark - The outer bark protects the plant. The ~~inner~~ middle bark produces nourishment for the plant. The inner bark carries fluids down the stem and protects the cambium.

Cambium - The Cambium causes the stem to grow larger each year.

Wood - The wood carries nourishment up the stem.

Pith - The pith transfers nourishment from one side of the stem to the other.

XXXVII

Leaves

Ida Kapland
grade III

The silver maple is a simple leaf. It is lobed rather deeply. The leaf is smooth and has a reddish tinge sometimes. The leaf is rather broad.

Silver Maple

The leaf of the sycamore is a simple leaf. It is slightly lobed. The leaf has a fuzz on the under side.

Sycamore

Theme - acids in Soils

XI

Experiment:- A piece of moist litmus paper was put into sand, clay loam and ~~soil~~ soil from a swamp, respectively.

Sequence - No change was seen in the sand, clay and loam, but in the swamp soil the litmus paper turned pink.

Conclusion:- There was acid in the ~~soil~~ swamp soil which turned the litmus pink.

Potato - Tuber

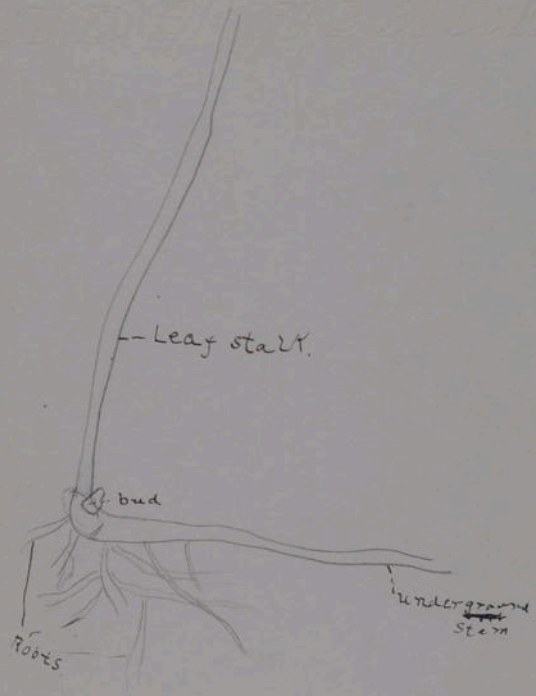
XII

Onion ~~Bubb~~ (Bulb)

Cross Section

XLII

May Apple - Underground Stem



XLIII

Parsley

Wild Carrot - Tap & Fibrous Root

Garlic - Fibrous Root

Theme-

Experiment- Two tumblers were filled with loam. Equal amounts of water were added. Then sand was added to one tumbler, and both tumblers were placed on the scales. Thirty-three and one-half grams Weights were placed beside the tumbler without sand to make the scales balance. At intervals of one, four days, and eight days weights were added to make the scales balance.

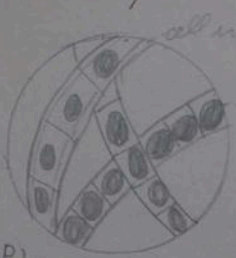
Sequence- Thirty-three and one half grams ~~weights~~ were added to balance the sand. After one day 3 grams were added, after four days 6 grams were added, after eight 11 thirteen grams were added.

Conclusion- ~~Thirty three and one half grams weights~~ were added at first because that was the weight of the extra sand. We added three grams after one day to make up for the evaporated water. After four days and eight days, six and 13 grams respectively were added to make up for more evaporated water.

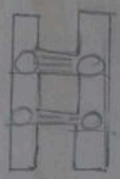
Remarks: For this reason farmers hoe up their ground, so that there will be more spaces between the loam soil and capillarity will not occur so readily.

Ida Kaplan
Science 7th a

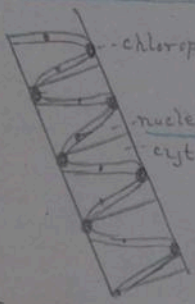
Microscopic Plants and Animals



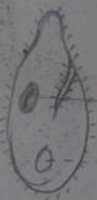
Pleurococcus X



Sexual Reproduction

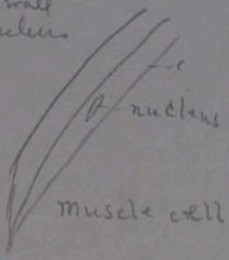


Spirogyrae

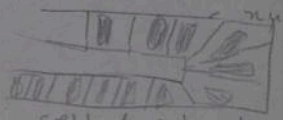


Paramoecium under high power.

Egg cell



muscle cell



cell of intestine

Skin cell

Effect of iodine on Spirogyra

Classification of Plants and Animals

Protozoa - single celled animals, first animals
Ex paramoecium

Metazoa - later animals

Invertebrates
- hydra
- jelly fish
- star fish
- insects

Vertebrates
- fish
- Amphibia
  - frogs, newts, salamanders
- reptiles (snakes, lizards)
- birds
- mammals

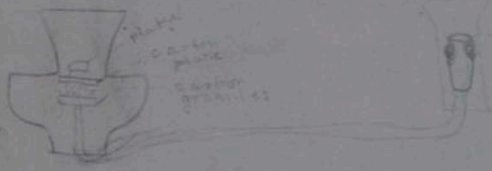
Protophyta - single celled plants, first plants
Ex pleurococcus, bacteria

Metaphyta - later plants
- algae - with chlorophyll
- fungi - without "
- spore bearing plants - mosses, ferns
- seed bearing " - trees, vegetables

G+

Ida Kaplan
Science III a

The Telephone

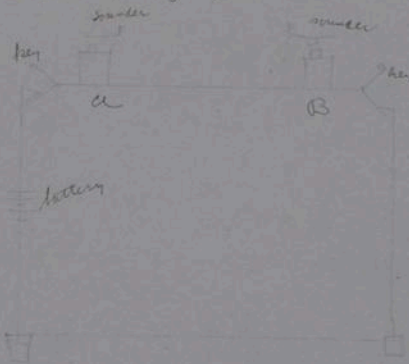


Poor drawing

When a person speaks into the transmitter of a telephone the vibrations of his voice set the carbon plate in motion, then in turn the carbon granules and the second carbon plate in motion. The vibrations of the granules produce an electric current the strength of which depends on the number of the granules and their vibrations. The current then passes to a primary coil where it is reinforced and then to a secondary coil, there causing a new induced current. When the current comes to the receiver it sets the disk in motion, then produces a current in the magnet the latter attracts the disk in accordance with loudness and strength of the voice. So we hear the same vibrations as were stirred the transmitter.

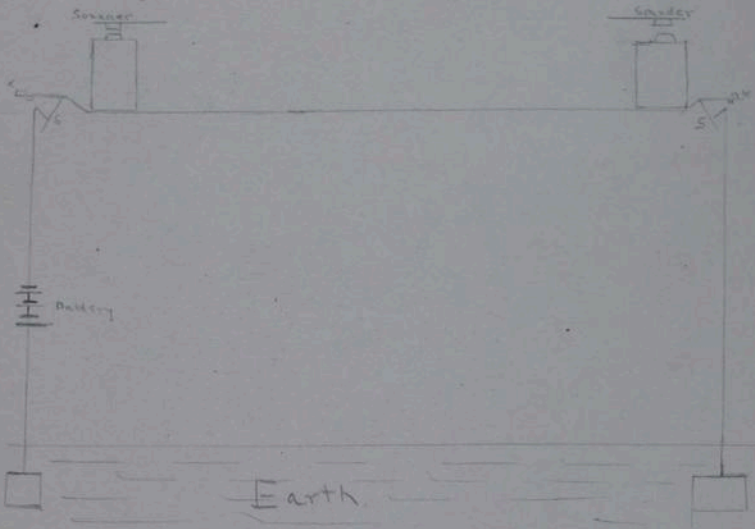
Ida Kaplan
Science Ext a

The Telegraph



In a telegraphic circuit the earth is used to complete the circuit. Therefore at each end of the line, the wire is joined to a metal plate buried in the ground. When the operator at A wishes to send a message to B he uses a code. When he presses the key down that breaks the circuit, and when he release the key, the circuit is completed. Then action take place at the other end of the line. The sounder clicks or causes means letters and the operator at B understanding them reads the message.

In a long distance circuit a relay, instead of a battery is used, to energize the current.



Telegraph

Ida Kaplan
Lesson XII a

Theme:- Converting Energy into Heat.

Experiment:-

a) A coin was rubbed briskly over a wooden block.

b) A piece of copper wire was bent quickly backward and forward.

Sequence:-

b) The wire became very warm and finally broke.

a) The coin became very warm.

Conclusion:- We conclude that part of the energy we used in rubbing the coin or bending the wire was converted into work (in one case, breaking the wire) and part was converted into heat.

Remarks:- The heat is caused because the molecules in the coin are made to move more quickly. Heat is a form of kinetic energy. It is the kinetic energy of molecular motion. This energy can be converted into mechanical energy as in the steam and gasoline engine.

Ida Kaplan

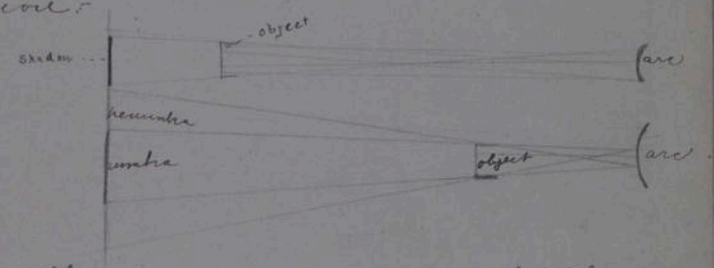
Science VII a

Theme- Formation of a Shadow

Experiment- The room was darkened, and an arc light was thrown on a screen. A tablet was held near the screen and was then moved further away

Sequence:- A shadow was thrown on the screen. When the object was near the screen, the shadow was small and very distinct and dark. As the object was moved further away, the shadow became larger and had a blurred edge

Conclusion:



The shadow was caused by the obstruction of the light rays by the book. When the book is near the screen, the shadow is smaller because less diverging rays are cut off. When the book was near the light more rays were cut off and therefore the shadow is larger.

The larger image was blurred, because all the rays in the center were cut off making the outer dark, while some light rays went to the side, that combination of light rays and the darkness made a blurred edge.

(continued on next page)

2/14/19 Ida Kaplan

Science VII a

Minerals

I Marble may be found in different colors such as
a- Old Tennessee - dull red, splotched with white
b- Sienna - yellow, with dull red spots
c- Florentine Vermont, - slate blue
d- Alps Green - dull green, streaked with lighter green
e- Mexican Onyx - white with van-colored streaks
f- African Marble - dull red with light red bands.

II Feldspar may also be found in different colors
a- Amazonstone - green
b- Labradonte - purple
c- " - streaked and veined with many colors.
d- Sunstone - red
e- Moonstone - purple streaked with yellow

III Feldspar is sometimes crystalline, as in the form of amazonstone.

IV The colors of crystalline quartz are-
a- Quartz crystal - colorless
B- Garnet - bright red
C- Amethyst - purple
D- Rose quartz - flesh
E- Smokey " - purplish gray

V All quartz colors are not the same size

VI The names given to obscurely crystalline quartz are bloodstone, tiger eye, chrysoprase, agate, jasper, ribbon jasper.

VII Agate is found ringed or banded in combinations of colors the separate rings being of different colors.

VIII An ore is a mixture of a mineral oxide & other substances, mainly oxygen, sulphur or calcium. One iron ore is Fe_2O_3; a copper ore is CuS; an ore of lead $PbSO_4$. compound

IX The varieties of coal are peat, lignite, bituminous and anthracite coal.

1- peat is brown and looks like vegetation pressed together with soil.

2- Lignite is black, rather soft and is dull looking

3- Bituminous coal is harder and shinier than lignite.

4- Anthracite coal is the hardest and shinest of them all.

Feb 19, 1912

Ida Kaplan
Science VIIIa

I Marble may be in different colors, such as
A - Old Tennessee - dull red, splotched with white
B - Sienna - yellow with dull red veining
C - Florentine Vermont - slate blue
D - Alps Green - dull green, streaked with light green
E - Mexican Onyx - white with various colored streaks
F - African Marble - dull red with lighter red bands

II Felspar may also be in different colors.
A - Amazonstone - green
B - Labradorite - purple
C - " - streaked and veined with many colors
D - Sunstone - red
E - Moonstone - purple streaked with yellow

III Felspar may sometimes be crystalline, as in the form of Amazonstone.

IV The colors of crystalline quartz are:-
A - quartz crystal - colorless
B - Garnet - light red
C - Amethyst - purple
D - Rose quartz - flesh color
E - Smoky quartz - purple ~~gray~~ from

V all the crystals of quartz are not the same ~~color~~ size.

VI The names given to obscurely crystalline quartz are bloodstone, tigereye, chrysoprase, agate, jasper, ribbon jasper

VII Agate is usually found ringed or banded, and always in combinations of colors, the separate rings being of different colors.

VIII An ore is a mixture of a mineral with other substances, mainly oxygen, sulphur, ~~oxide~~ calcium
The iron ore is Fe_2S, a copper ore - Cu_2S, an ore of lead - $PbSO_4$

The varieties of coal are peat, lignite, bituminous and anthracite coal.

1- peat is brown and looks like stems and leaves pressed together with soil

2- Lignite is black but rather soft and it does not glisten

3- Bituminous coal is harder than lignite and is very shiny

4- Anthracite coal is the hardest of all and cleanest of all

3/22/19

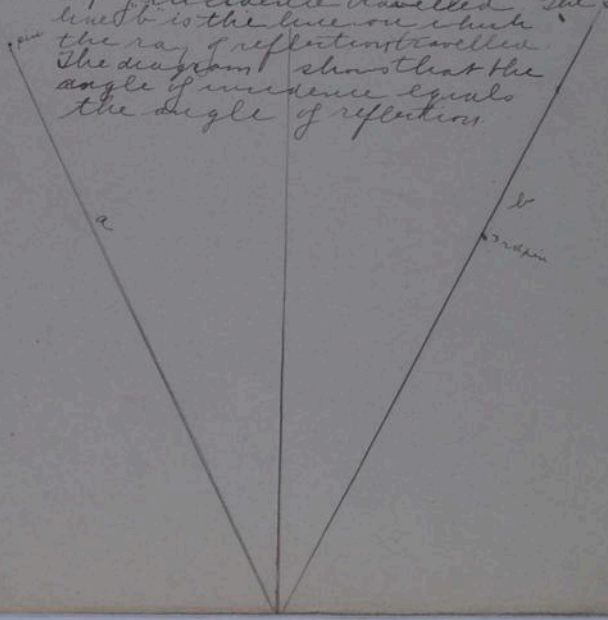
Ida Kaplan
Science VII a

Theme- The Principle of Reflection

Experiment- We placed a mirror upright against a wooden block and we placed a sheet of paper on the desk adjacent to the mirror. Then we stuck a pen in the paper. Then we placed two pins on the paper in such a position that they formed a straight line with the image of the first pin in the mirror. Then we connected the two pins and then connected the first pin with the end of the first line. We then drew a perpendicular to the edge of the sheet.

Sequence:- The diagram shows the result.

Conclusion:- Line "a" is the line on which the ray of incidence travelled. Line b is the line on which the ray of reflection travelled. The diagram shows that the angle of incidence equals the angle of reflection.



3/31/19

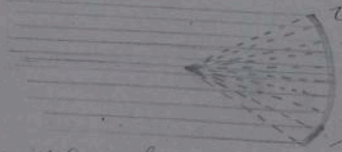
Ida Kaplan
Science VIII a

Theme:- Focusing Light with a Concave Mirror

Experiment:- A concave mirror was held in the light of the sun, so that the rays of sunlight were perpendicular to the center of the mirror. A paper was held in front of the mirror

Sequence:- A bright spot of light was seen on the paper

Conclusion:-



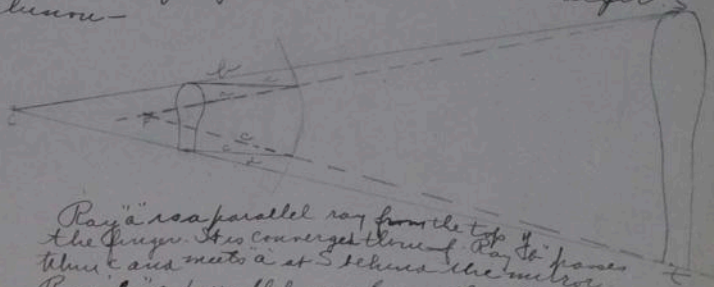
We conclude that when the rays of light strike the mirror, they are converged to one spot. Therefore we see the bright spot of light.

Theme- Can a Concave Mirror Form a Virtual Image?

Experiment- We looked at our finger thru a concave mirror.

Sequence- The finger appears much larger.

Conclusion-



Ray "a" was a parallel ray from the top of the finger. It converges thru F. to F. passes thru c and meets a at t. thus the mirror Ray "c" a parallel ray from the bottom of the finger is converged thru F. and meets ray a at t. Thus we get the position for the finger.

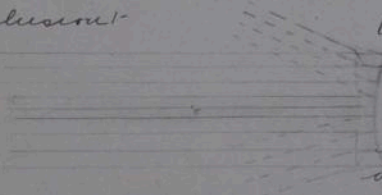
Ida Kaplan
Science 11a

Theme - The Effect of a Convex Mirror on Parallel Rays from the Sun.

Experiment - We tried to focus the light from the sun. Incomplete statement.

Sequence - We could get no bright spot of light on the paper.

Conclusion -



We conclude that when the rays of light strike the mirror they are diverged and so they do not collect in one spot

Theme - Can a Real Image be Formed by a Convex Mirror.

" "Tested " " Formed by a Convex "?

Experiment - a) We held a lighted candle between the screen and mirror.
b) We looked at the candle in the mirror.

Sequence - a) There was no image on the screen.
b) We saw a small upright image of the candle in the mirror.

Conclusion - A real image cannot be formed because, as we have shown in the previous experiment, the rays are diverged instead of converged by the convex mirror

"a" is a parallel ray, converged to F. B" meets at a' locating the top of the image.
"c" is a parallel ray converged to F. d" meets at b' locating the bottom of the image.

Ida Kaplan
Seventh a

Remarks:- A shadow is a dark space, made so by the obstruction of rays of light wholly or partially, by an opaque object. The darkest part of the shadow is the umbra. The indistinct part is called the penumbra.

Ida Kaplan
Seventh a

Theme:- The Formation of an image by a Concave Mirror when a Screen is Held Between the Candle & Mirror

Experiment:- The room was darkened and a screen was placed between the lighted candle and mirror. The mirror was moved backward and forward until the desired result was obtained

Sequence- The image of the candle on the screen was small and inverted.

Ray "a", a parallel ray strikes the mirror and is converged to F. Ray "b" passes through C meeting "a" at S.
Ray "c" a parallel ray strikes the mirror and is converged through F. Ray d passes thru C and meets "c" at t.

Why is ed not best?

Mr Kaplan

Sequence

Theme - The Formation of an Image by a Concave Mirror when the object is between the candle and mirror. screen

Experiment:- The room was darkened and a lighted candle was placed between a screen and the mirror. The mirror was moved backward and forward until the desired result was obtained.

Sequence - The image of the candle on the screen was large and inverted.

Conclusion:-

Ray a is a parallel ray from the top of the candle strikes the mirror and is converged thru f. Ray b goes thru c meeting a at t. Here we get the point for the position of the top of the candle.

Ray c is a parallel ray from the bottom of the candle strikes the mirror and is converges thru f. Ray a passes thru c meeting c at S. Here we get the position of the top bottom of the candle.

Ida Kaplan

Science III a

Theme- The Effect of a Convex Lens on Rays from the Sun

Experiment- A convex lens was held perpendicular to the rays of the Sun. A screen was held opposite and behind it. The lens was moved until the desired result was obtained.

Sequence- A bright spot of light was seen on the screen.

Conclusion:-

We conclude that the rays of light are converged and brought to a focus behind the lens.

Therefore we see a bright spot on the screen

Theme- Can a Convex Lens Form a Real Image?

Experiment- The room was darkened and a convex lens was placed between a lighted candle and the screen. The lens was moved until the desired result was obtained.

Sequence- A small and inverted image of the candle was seen.

Conclusion:-

Ray "a" is converged thru F. "b" meets at 1 locating the top of the image. "c" is converged thru F. "d" meets at at 5 locating the bottom of the image.

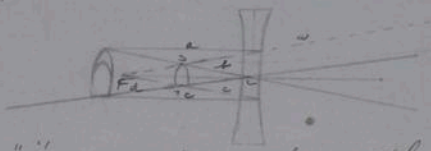
G Arrange papers in order.

Ida Kaplan
Science 11a

Theme- Can a Convex Lens Form a Virtual Image?
Experiment- We looked at our finger thru a convex lens.
Sequence- The finger appeared much smaller.
Conclusion:

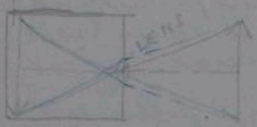
Ray "a" a parallel ray from the top of the finger converges thru F. Ray "b" passes thru C and meets "a" at S locating the top of the image. The bottom of the image is found in a similar way.

Theme- Can a concave lens form a Virtual Image?
Experiment- We looked at our finger thru a concave mirror lens.
Sequence- Our finger looked smaller.
Conclusion:



Ray "a" a parallel ray from the top of the finger is diverged and seems to come from F. It meets b at S and so locates the top of the image. In a similar manner, the bottom of the image is found.

Do not crowd your writing.



In taking a picture of the arrow, the first thing after getting the focus as shown above is to get the picture on the film. When the light strikes the film (a gelatin film covered with Ag Br) the Ag Br is broken the Br passes away and silver is left in dark particles on the image. Then since the breaking up process must be continued, in a dark room the film is put in a developer and a negative is formed. The next thing is to put the film in a fixer. This brings out the picture more distinctly and washes off the Ag Br, not affected by the light. The last process is printing

Cathode and X. Rays.

Cathode rays are swiftly moving particles charged with negative electricity. They rays travel at the rate of 50,000 miles a second.

X. Rays are formed in the following way. The Cathode rays are sent through a very high vacuum. There they strike a platinum plate and new rays are formed which are turned down. These rays are vibrations in the ether but the waves are very, very violent, so much so that we cannot feel, see or perceive them in anyway.

If a film with the object to be photographed on it is placed in the path of the rays, a picture will be formed. The X. Rays have the same effect on a film as light waves have. X. Rays can pass through black objects, through solids, through flesh etc. This fact is used in taking pictures of internally injured parts of our bodies, so that any human harm could be repaired easily and quickly.

7/28/19

Ida Kaplow
Science VIIa

Uses of Mirrors

Mirrors are used in periscopes, autos, bus bodies, globes in miniature gardens, microscopes and telescopes.

Mirrors suitably inclined in the periscope make objects on the surface of the water visible below the water.

A reflecting telescope consists of a large concave mirror which forms a real, small inverted image, which is enlarged by a convex lens.

Uses of Prisms

The use of the prism is to distinguish the lines in the spectra of the constituents of the solar system.

A spectroscope is an instrument in which there is a combination of lenses and mirrors prisms. By these we are enabled to distinguish the composition of the sun and fixed stars.

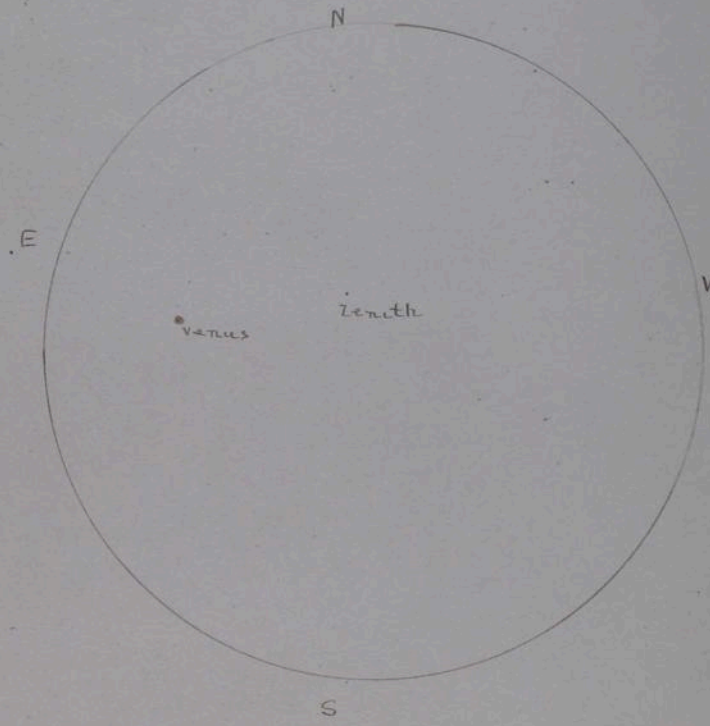
Uses of Lenses

Bi-convex lenses are used as magnifying glasses. When an object is placed between the principal focus and the lens, a large, erect and virtual image can be seen. Such a lens is also used in a camera, to produce a real image on a sensitive plate.

The crystalline lens of the eye is also convex. Both convex and concave lenses are in eye-glasses to correct defective eyesight. When a person is far sighted convex lenses are used to converge the rays of light to a focus on the retina. In near sightedness, concave lenses are used for the opposite reason. A bi-convex lens is used in a magic lantern, opera glass and microscope.

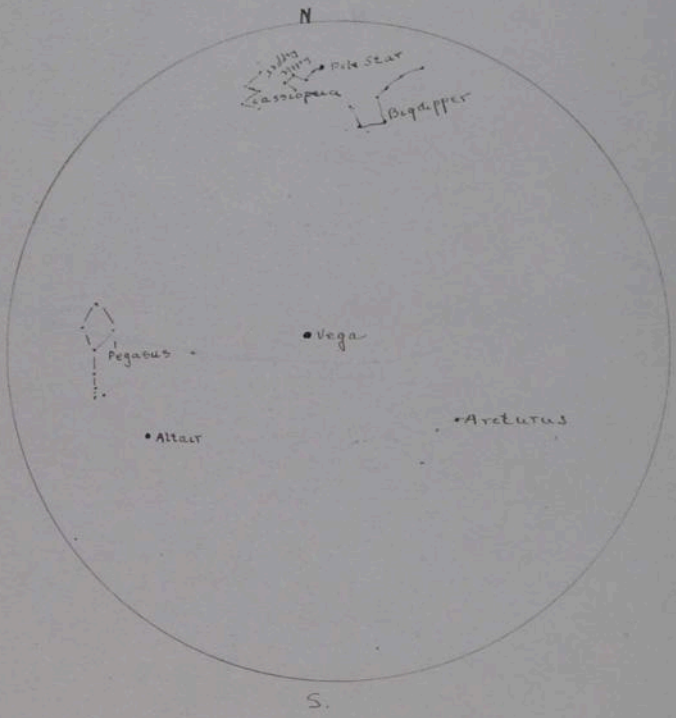
Ida Kaplan
Section VIII a

The Heavens before Sunrise on September



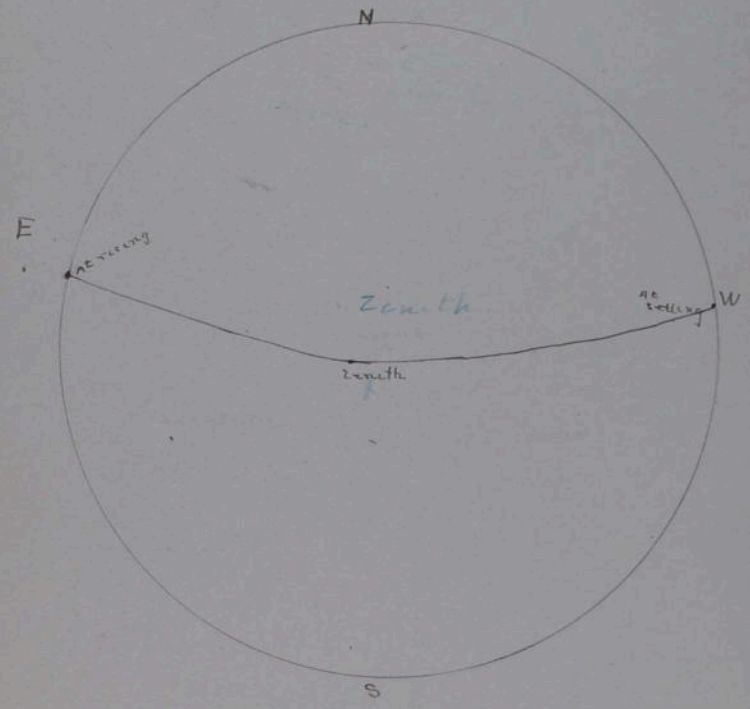
Ida Kaplan
Section VIII a

The Heavens in September



Ida Kaplan
Section VIII a

The Path of the Sun in September.



The Paths of the

Ida Kaplan
Science VII a

V. Comets

Planets in order of size
Mercury
Mars
Venus
Earth
Uranus
Neptune
Saturn
Jupiter

Ida Kaplan
Science VII a

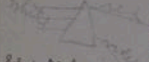
Theme:- a Effect of a Prism on Objects
b Effect of a Prism on Light

Experiment:- a We looked at objects in the room thru a prism.
b- We looked at the luminous and non luminous flames of a Bunsen burner thru a prism. We held a piece of asbestos dipped in salt, in the flame, and looked at the latter thru a prism.

Sequence:- a The objects in the room were either higher or lower than normal, according to the way the prism was held.
(b) The colors seen in the luminous flame thru the prism were red, orange, yellow, green, blue, indigo, violet. The ~~[illegible]~~ non luminous flame thru the prism was purple, blue green. The third flame was yellow.

Conclusion:- Objects seen thru a prism are not in their normal position, because the rays of light are refracted (and dispersed) by the prism. Light is made up of many different colors ~~[illegible]~~ and we saw the different colors in the luminous flame because the prism separated the various colors from each other. In the non-luminous flame, the carbon is oxidizing and absorbs all colors except the purple, blue and green. The salt in the asbestos absorbed all colors except yellow.

Remarks- The combination of colors seen in the luminous ~~co~~ flame is called the spectrum. When the rays of different light ~~colors~~ are separated into a spectrum the process is called dispersion. Heat waves are longer than light waves. The red light travels in longer (rays) than the violet rays. The light of longest wave length (red) is refracted least by a prism. The light of shortest wave length (violet) is refracted most. A continuous spectrum, of [illegible] light, produced by the dispersion of the same rays, by falling [illegible]



Solid or liquid substances give continuous spectra. Incandescent gases give incomplete or absorption spectra.

12/17/20

Section VIII a

Classification of Subject-Matter of Physics

I- Matter

A- Simple States

1- Gases

2- Liquids

3- Solids

B- Mixtures

1- Solutions

a- Saturated

b- Unsaturated

1'- concentrated

2'- dilute

2- Suspensions

a- Temporary

b- Permanent

1'- emulsion

2'- colloid

C- Properties of Matter

1- General properties

a- Extension

1'- Size

2'- Shape

b- Mass

c- Inertia

d- Impenetrability

2- Special properties

a- Solubility

b- Buoyancy

c- Inflammability

d- Elasticity

e- Transparency

f- Color

g- Malleability

d- Ductility

II- Motions

A- Molar

1- Centrifugal motions

2- Capillarity

3- Mechanical motions

4.

Ida Kaplan
Section VIII a

Science 6

Classification of Chemical Substances

A- Elements
1- Non metals
C, N, P, S, I, Ca, Cl.
2- ~~Non~~ Metals
Fe, Pb, Na, Zn, Au, Cu, Sn, Hg, Ag, K.

B- Compounds
1- Inorganic
a- Oxides
CO_2, CO, H_2O, H_2O_2, Fe_3O_4, SO_4, CaO
B- Sulphides
CS_2, FeS
c- Carbides
CaC_2
D- Acids
HCl, H_2SO_4, HNO_3,
E- Bases
NH_4OH, $NaOH$, $Ca(OH)_2$
F- Salts
$CaCO_3$, $NaNO_3$, $CaSO_4$, $NaHCO_3$, $AgNO_3$,
KNO_3, $HgCl_2$, $KMnO_4$
2- Organic
a- Hydro-Carbons
1- Saturated
CH_4, C_3H_6
2- Unsaturated
C_2H_2, C_6H_6

B- Alcohols
C_6H_5OH, CH_3OH, C_2H_5OH, $C_3H_5(OH)_3$
C- Ethers
$(C_2H_5)_2O$ - ether
D- Aldehydes
$HCOH$ - formaldehyde
E- Acids
$CH_3(COOH)$ - acetic acid
$(COOH)_2$ oxalic acid
H_2CO_2 - formic acid
F- Esters
$CH_3COOC_2H_5$ - ethyl acetate
Oils.
stearin - in tallow
palmatin - in palm oil
olein - in olive oil
G- Carbohydrates
$C_6H_{10}O_5$ - starch
$C_{12}H_{22}O_{11}$ sucrose
$C_6H_{12}O_6$ - grape sugar
H- Proteins
Albumen, casein, gelatin, gluten
I- Alkaloids
Caffeine, cocaine, atrophine, quinine, nicotine

Isa Kaplan
Section XIII a.

Science

Experiment- We heated some red powder in a test tube. A lighted taper was held in the mouth of the tube. The sides of the tube were scraped and a piece of paper held at the mouth of the tube

Did you see this?

Sequence:- A gas came out of the tube and the taper burned more. Little silvery balls were found on the sides of the tube. When the tube was scraped these rolled ~~off~~ and rolled around on the paper.

Conclusion:- We conclude that the gas was more oxygen because it supported combustion. We also conclude that the silvery balls were mercury, because mercury is the only metal that will roll around in balls.

Remarks- In 1774 this same experiment was performed by Joseph Priestley (born 1733) an English clergyman. He heated HgO and collected the

gas in large quantities. He found that candles and glowing coal burned brightly in it, and that mice lived in it and live. Scheele, a Swede, in 1775, discovered the same gas and called it empyreal air. La Voisier repeated Priestley's experiment, and found that the weight of the gas driven off equaled the loss of weight in the mercury oxide. He called it oxygen, because when combined with carbon, sulphur, or phosphorus it renders them acid in water.

Ida Kaplan
Section VIII a

Science

The Law of Definite Proportions is that the composition of every pure chemical substance is always the same.

The Law of Multiple Proportions is as follows—

If two elements A and B unite to form more than one compound, the weights of the element B that combine with a fixed weight of element A bear a simple ratio to each other.

The formulation of these laws was made possible by Lavoisier in 1789 and Dalton in 1804. Lavoisier helped to prove that substances like air and water, supposed to be elements, were really mixtures of compounds of simple substances. He also proved that a number of compounds are made up of definite weights. Dalton investigated CH_4 and C_2H_4O, and found that C, O, and H combine by weight, not always in the same proportions that have a simple relation to each other.

He explained this by the hypothesis that substances were composed of extremely small particles or atoms with definite weights and definite attraction for each other (Law of atomic weights)

Ida Kaplan
Section VIII a

Science

Theme- The Effect of HCl on $AgNO_3$. Incomplete

Experiment:- HCl was poured on a solution of $AgNO_3$. The mixture was filtered and the residue placed in the sun.

Sequence:- The mixture turned purplish gray and slowly turned black.

Conclusion:-

$$HCl + AgNO_3 \rightarrow AgCl + HNO_3$$

Remarks:- All silver compounds, but especially the bromide, chloride and iodide are decomposed by light, and darken because of a fine deposit of metallic silver. Daguerre in 1839, was the first to take a picture by the action of light on silver salts. He used a polished silver plate which had been exposed to the vapor of iodine and therefore covered with a film of silver iodide

Ida Kaplan
Section VIII a

Science

Theme - Action of H_2SO_4 on Metals and Salts

Experiments

a - We had four test tubes containing zinc, iron filings, magnesium, copper. We poured sulphuric acid into each tube

b - Into four tubes, each containing a calcite powder, we poured H_2SO_4

Sequence -

a - The zinc bubbled, the mixture became milky and the zinc slowly dissolved. The iron filings rose to the top. The magnesium bubbled very quickly dissolved and turned the mixture white. The H_2SO_4 had no effect on the copper.

b - Two of the mixtures bubbled quickly, one more violently than the other. The two other powders were unaffected by the H_2SO_4.

Conclusion -

a $\begin{cases} Zn + H_2SO_4 = ZnSO_4 + H_2 \\ Fe + H_2SO_4 = FeSO_4 + H_2 \\ Mg + H_2SO_4 = MgSO_4 + H_2 \end{cases}$

b $CaCO_3 + H_2SO_4 = CaSO_4 + H_2O + CO_2$

Remarks: When acids act on metals, they set free hydrogen and produce salt. In 1766 Cavendish, an Englishman, by placing Fe, Sn Zn and other metals in H_2SO_4, set free hydrogen, and collected it in large vessels. He discovered that it burned easily, but would not support combustion or life and that it formed with the air an explosive mixture which produced water. He called it "inflammable air." Lavoisier repeated these experiments and discovered that two parts of hydrogen combined with one of oxygen. He named the gas hydrogen, (water producer).

Carbon dioxide dissolved in water is a weak acid. It combines easily with NaOH and KOH, $Ca(OH)_2$ to form carbonates. The action of other stronger acids on these carbonates is to liberate CO_2. About the middle of the 18th century, Dr. Joseph Black, a Scotchman, poured an acid on $CaCO_3$, and collected the CO_2.

Isa Kaplan
Section VIII a

Science

Experiment- Each girl was given a little dye to dissolve in water. She tested the dye with a splint.

Sequence

1- ~~Brn~~ The dye was brown in powder form but turned blue in solution. The splint dyed blue.
2- The dye was dark blue in powder form and too would not dissolve in water. It dissolved in alcohol and formed a black solution. It had no effect on the splint.
3- The dye was green in powder form and turned purple in solution. It dyed the splint purple.
4- It was dark brownish red and turned red in solution. The splint dyed red.
5- The dye was green in powder and turned bright red in solution. The dye made the splint red.
6- The dye was red in powder and turned to greenish blue in solution. The splint dyed green.

Conclusion:

Incomplete

Dissolved from the substances absorbed all colors and reflected only the one we saw. In solution, the, they absorbed a different color and transmitted that to our eyes. different colors to our eyes.

Remarks:- Since the dyes are made by adding different chemical substances to distillates of coal tar, they differ in chemical constitution. It has required a great deal of experiment to determine their exact constitution and suitability for dyeing of different fibers. Owing to their ready solubility in water, it is necessary to use with almost all dyes a mordant, such as soap, salt, vinegar, alum. The mordant sets the color.

The first coal tar dye was made discovered by Perkin in 1856 while he was trying to manufacture quinine.

Ida Kaplan
Section XIII

Science

Theme- The weight of an Element before and after Burning.

Experiment:- We weighed forty milligrams of magnesium and burned it. We then weighed it again.

Sequence- The magnesium was heavier after burning than before. The powder also turned white.

Conclusion- The mixture was heavier after burning because it contained oxygen.

Remarks:- Lavoisier found that metals after burning in the air, weigh more than before by an amount equal to the loss of weight in the air.

Isa Kaplan
Section III a

Science

The Fractional Distillation of Coal Tar.

Light Oils - Benzol - C_6H_6
Toluol - $C_6H_5CH_3$

Medium Oils - Phenol - C_6H_5OH
Naphthalene - mothballs perfume

Heavy Oils - Creosote
Paraffin -

Residue - pitch.

Destructive Distillation of Coal

Tetra

Benzol

Nitro-Benzol

aniline oil

dyes

drugs

explosives

developer for films

artificial vanilla

Toluol

dyes

explosives

saccharine

artificial cinnamon

Phenol

salicylic acid

aspirin

oil of wintergreen

Naphthalene

Indigo

essence of orange blossoms.

Id a Kaplan
Section VIII a

Science

Object - To see which food is best for the growth of yeast.

Experiment - Into four fermentation tubes, like the one illustrated, a solution of yeast and water and the following substances respectively were placed. 1st tube distilled water, 2nd tube flour, 3rd tube sucrose, 4th tube glucose. After several hours, they were examined.

Sequence - In the first tube, the water was clear; in the second tube, the water was cloudy; in the third, the water was cloudy and filled with bubbles; and in the fourth tube, all the water has disappeared and the tube was cloudy and filled with bubbles.

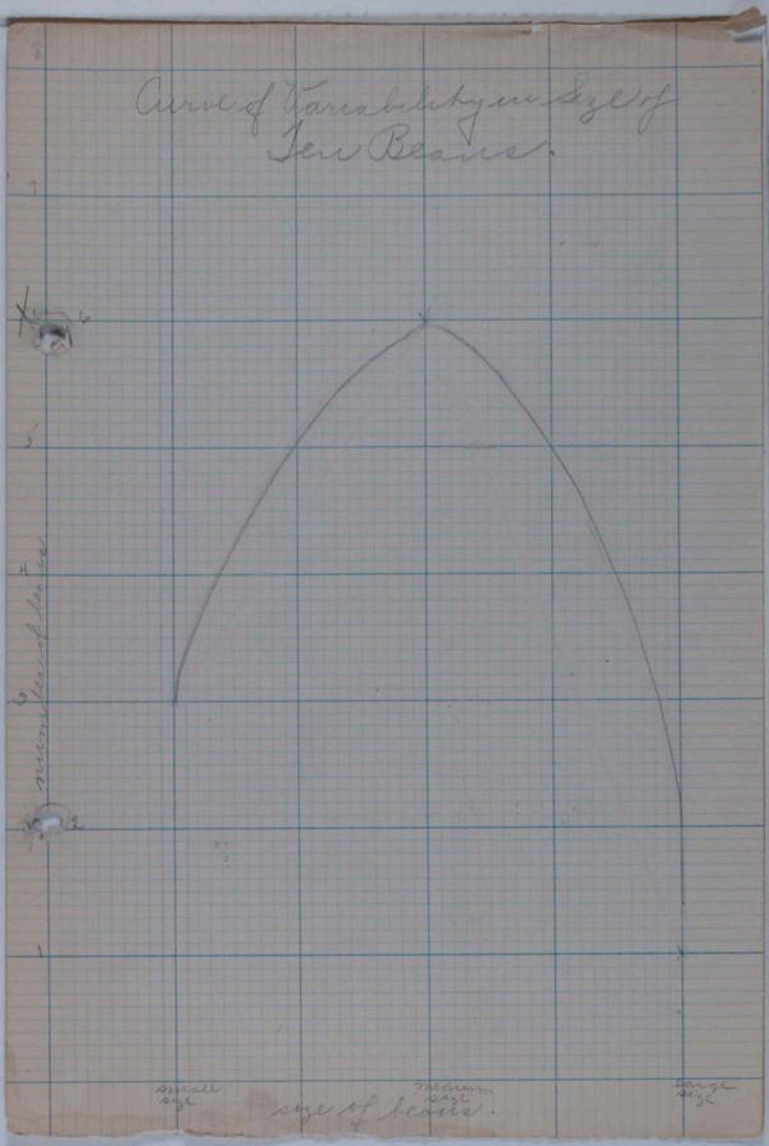
Conclusion - We therefore conclude that glucose is the most favorable food for the growth of yeast, because all the water disappeared and CO_2 took its place.

Theme - To find whether yeast gives off CO_2.

Experiment - An apparatus like the above was put up. It was allowed to stand for several hours and then examined.

Sequence - The lime water was cloudy.

Conclusion - We conclude that yeast gives off CO_2, because the lime water turned milky.



Pulse Rates under Different Conditions

	Standing	Sitting	Lying down	After exercise
Highest:	~~87~~ 98	87	80	114
Lowest:	72	66	55	90

Conclusions

Pulse rates differ in various people. The normal pulse rate is 72. The pulse beats more quickly after exercise than any other time as can be seen by the table above. The pulse rate is higher when we stand than when we sit because more muscles are used in standing and then need more blood. The pulse rate is lowest when we lie down because no muscles are used when we relax.

Ida Kaplan
Section VIII 2a

Science

What We Observed on the Class Trip Thru Fairmount Park.

I- On the trees and plants
Caterpillars
Moths
Horntail
Ants
Butterflies
Bees
Spiders

II- On the Water
Dragonflies
Water striders
Bugs that make nests on rocks

III- On the ground
salamanders
locusts
beetles
grasshoppers
Katydids
earthworms
daddylonglegs.

A mi muy estimada y fina amiga
la Srta. Profesa Sida Langman, con
el respetuoso afecto de
su S. que B. S. L. b.
Manuel Mestre Ghiglia[illegible]

México, Julio 12 de 1[illegible]
— Avenida Hidalgo 11[illegible] —
— Apartado Postal 1057 —

Manuel
Mestre
Ghigliazza

Chemistry
Note
Normal School

1921-22

NOTE BOOK

OF THE

PHILADELPHIA NORMAL SCHOOL

SEPTEMBER, 1919

PROPERTY OF THE BOARD OF PUBLIC EDUCATION

PHILADELPHIA

SUGGESTIONS

TO BE CAREFULLY OBSERVED

After entering the room, proceed at once to obtain aprons, etc., from the lockers, and go thence directly to the tables.

Inspect table and drawers to see if the equipment is complete, and report if anything is missing or superfluous.

Give exclusive attention to the general direction and instruction for the hour. Do not handle apparatus nor proceed with any work when the instructor is speaking to the class.

In setting up apparatus follow exactly the instructions given. Never mix chemicals except as directed, or with the advice of the instructor, as serious accidents may otherwise happen.

Give undivided attention to your own work and do not regard at all what is being done at other tables.

Do not attempt to make results agree with what you think they should be. If you suspect error, trace it out, or verify by another trial.

Keep lighted burners well back upon the tables, unless using them directly. Never reach for anything over or past a lighted burner.

Do not throw any solid material into the sink, nor matches that have not been ignited into the waste-buckets.

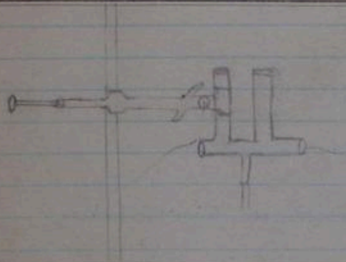
Do not leave the table during the hour to seek the instructor.

As a rule stop work about five minutes before the end of the hour, return everything to its proper place and leave your table in good order. Leave your notebook on the middle of your table, unless the latter should be wet, in which case it may be placed in the drawer.

Miss Ida Kaplan Day April 21, 1921 No. 1

Theme Solutions, Ionization, Electrolysis

Materials and Apparatus



Experimentation	Sequence
into molecules and finally form of course the original substance. That is the theory and it does work out. It can be proved by the copper sulphate solution. When the current is passed thru the solution the copper cations move to the cathode and we finally see the reddish copper on the cathode plate. The submolecule SO_4 is a negative ion (anion) and moves to the other end.	

Statement

If copper sulphate is put in water we get a uniformly blue liquid. This a solution and our definition of a solution a homogeneous mixture of two or more substances. The water in this case is the solvent the copper sulphate the solute. Some other very good solvents are alcohol, benzine, ether. In dissolving the CuSO4 the change only physical. We can tell this because the taste is unchanged and if we evaporate the water we shall get our copper sulphate back. In dissolving a compound in a liquid the compound breaks down into molecules. However, all solutions do not act in this same way. An electric current sent thru a salt solution strikes up immediately while no change at all is noticeable when the same thing is done to a sugar solution. This leads us to the belief that not all solutions are alike. We believe that the difference lies in the fact that in some solutions (salt for instance) the molecules are further broken down into atoms — atoms charged with electricity, called ions. This process called ionization sometimes electrolytic dissociation. We have to begin with electrically charged particles. Now if an electric current is passed thru an ionized liquid or (electrolyte) of course, enters at the anode or positive end and leaves at the cathode or negative end. The electrically charged ions are divided into those negatively charged and those positively charged. Those positively charged move to the negative pole and are consequently called cations. Those negatively charged go to the positive end and are called anions. When they reach their respective poles they give up their charge and become neutral atoms or groups of atoms. Such atoms, they are called

Performance Mode

Miss Ida Kaplan Day April 27, 1921 No. 2

Theme Electrolysis of Copper Sulphate

Materials and Apparatus

Experimentation	Sequence
I – A current of electricity was passed thru a copper sulphate solution. Anode and cathode were platinum	I Cathode – red solid Anode – bubbles Electrolyte becomes colorless
II – Copper sulphate solution was electrolyzed. Anode copper – cathode platinum	II Cathode – red solid Anode – becomes cleaned no bubbles
III – A copper plate was coated with wax and initials scratched in the wax. The plate was suspended in a copper sulphate solution as the anode with another copper plate as the cathode. The current was turned on.	III – red solid on cathode Anode – copper seen thru the wax where initials were scratched. A few holes found thru.
copper is taken. If the experiment were continued long enough the copper anode would be worn away. In electro-plating for commerce, the cathode is the object to be plated. If we're going to plate with silver, we dissolve a silver salt like potassium silver	cyanide. To make the result more effective we use an anode of silver. Just as in our third experiment letters were etched the thing to be etched hung was coated as the anode.

Statement

I

Copper sulphate in its dry state is a blue crystalline solid and being a compound, of course the smallest unit is the molecule. When it is dissolved in water we have a blue liquid. The molecules are broken into ions of copper or cuprous and ions of SO_4 or sulphanions. Copper being a metal is positively charged while the sulphanions carry a negative charge. When the current is passed thru the electrolyte, we get a deposit of copper at the cathode and bubbles appear at the anode. Although the deposit at the cathode often looks black, it can be proved to be copper. At the anode we would expect to get sulphur, assuming that is that the bubbles are oxygen bubbles. These can be proved to be bubbles of oxygen but we see no sulphur, which, if present, would show itself by a yellow color. Consequently, the SO_4 must not have been broken up. The only other thing from which we could get oxygen is the water therefore we conclude that the SO_4 combined with the H_2 forming H_2SO_4 - sulphuric acid or hydrogen sulphate, and liberated oxygen. We can prove that sulphuric acid is formed because after awhile the liquid becomes clear, showing that $CuSO_4$ has been replaced by H_2SO_4.

II Since the cathode and cations are the same we get the same result as in Exp. I. At the cathode however we find that the copper anode has been cleaned. Since there is no efflorescence we conclude that the SO_4 did not combine with the H_2 but the other thing left for it to combine with is the copper. It must therefore have combined with copper and formed $CuSO_4$. We should expect a blue solid, there but since $CuSO_4$ is soluble it dissolved into the liquid again. We believe that copper sulphate is formed because the liquid retains its blue color, the liquid doesn't ionize, and there is more copper found at the anode showing that there was an increase in the substance from which the

Performance +

Mode

Miss Ida Kaplan Day April 28, 1921 No. 3

Theme Electrolysis of Sulphates - continued

Materials and Apparatus

Experimentation	*Sequence*
I Electrolyzed ferric sulphate solution	V Anode - bubbles Cathode - bubbles and orange color -
II - Electrolyzed dilute solution of sulphuric acid	VI Anode - bubbles Cathode bubbles
III - Electrolyzed water.	III - No action.

Statement

Ferric sulphate $Fe_2(SO_4)_3$ and water added
a little when put into water turns yellow or light
brown. When the current is turned on and fine bubbles
at both poles. Comparing this experiment with
the last one we might expect to find iron at the
cathode. Sometimes we do find iron (a grayish solid)
but the most important result is the presence of the gases
which from before known of we might be
iron rust. That would mean that it had combined
either with O from the water leaving H_2, or with
OH leaving H_2O. To decide whether the orange
solid therefore is iron hydroxide or iron oxide, we might
analyze them or else we could distinguish them by color.
The substance we had formed was hydroxide.
The bubbles at the cathode are hydrogen. We are hydrogen
as a metal. The only other gas we could get which
would go to the anode is oxygen. The sulphurous
at the anode unite with the water and form
sulphuric acid.

At the anode the sulphurous
ions upon their charge become Radicle SO_4 taking
H_2 from the water, forming sulphuric
acid. However the oxygen gets to the anode to
becomes neutralized and passes off into the
collecting tube. At the cathode the hydrogen
becomes neutralized too and passes off. We
can test these gases by applying a lighted taper. The
oxygen burns or flame and the hydrogen
supports combustion.

Distinguished where ions
discharged from

Performance +

Mode

Miss Lisa Kapland Day May 4, 1921 No. 4

Theme Electrolysis of Halogen Compounds

Materials and Apparatus

Experimentation	Sequence
I= Electrolyzed $CaCl_2$ Blue litmus at anode turned pink II= Electrolyzed KBr III- Electrolyzed KI little hydrogen combines with the iodine set from hydrogen iodide. At the cathode, no bubbles and therefore conclude that the potassium has taken the OH from the water to form potassium hydroxide. Since it is soluble we cannot see it but know it is there because the litmus turns blue. The milky appearance is due to the presence of hydrogen. It is not a precipitate because as soon as the current is turned off the milkiness gradually disappears. In each experiment the non-metal moves to the anode and some of it dissolves in the water. The	I Anode- bubbles of litmus turns pink then white Cathode- white solid bubbles II Anode- brown liquid bubbles blue litmus turns pink then white Cathode- bubbles milky appearance which disappears litmus turns blue III- Anode- brown liquid slight effervescence litmus turns red then white Cathode- colorless liquid bubbles. Put a few drops of the water and form an acid with the hydrogen leaving the oxygen to pass off.

Statement

Calcium chloride is a white solid and has an affinity for water, that is, it absorbs water when it is present. This affinity is so great that it has been suggested to spread calcium on roads to keep down the dust. In solution $CaCl_2$ is a colorless liquid. The ions in the solution are chloridions and calcions. When the current is turned on, the chloridions move to the anode. Chlorine in nature state is a gas. Consequently we should expect to get at the anode a yellowish green powerfully smelling gas. However, chlorine is soluble and on passing the water might be expected to dissolve. In that case the chlorine would still be a bleaching agent. We know that there is chlorine water, because the litmus turned white. However before this last change the litmus turned pink showing the presence of an acid. Some an elementary substance cannot be an acid, the chlorine must have united with another substance. H forming HCl. The oxygen being insoluble, passes off. The chlorine therefore destroys things - forms chlorine water and hydrochloric acid. At the cathode, we would expect to get a grey solid, calcium. But we get a white solid. We conclude that since calcium rusts very quickly, it has combined with OH and formed $Ca(OH)_2$ (Slaked lime substance). We know however that Calcium hydroxide is soluble. We know that lime water is formed by letting water with litmus in it turned blue. But since there is still a white solid there we conclude that there was too much $Ca(OH)_2$ for the water to dissolve. The remaining H passes off as a gas.

Potassium iodide is a white solid and forms a colorless solution. The ions are potassions and iodions. The iodions move to the anode and show themselves by brown color, characteristic odor and by turning starch blue. There was a slight effervescence. This means that some of a little oxygen is mixed

Performance

Mode

Miss Ida Kaplan Day May 11, 1921 No. 5

Theme

Materials and Apparatus

Experimentation	Sequence
b If we put salt into solution and electrolyze the solution we get action but a sugar solution under the same conditions exhibits no effervescence. We know that in a solution of a compound the smallest unit would be a molecule. But seeing the difference in the behavior of the solutions we conclude that some solutions break down further into ions which are different from atoms in that they are electrically charged.	different
We know that chlorine dissolved in water has its characteristic odor. However sodium chloride dissolved in water we don't smell the chlorine. We conclude that the chlorine isn't in the form of atoms (when it would have its odor) but in the form of ions which are	

I

Statement

Electrolysis is the series of chemical changes accompanying the passage of an electric current thru a dissolved, melted or fused compound. In electroplating the page of type is reproduced in wood or plaster. This is coated in graphite to make it conduct electricity and is then hung in a copper salt solution at the cathode. The anode is a bar of copper which will keep the bath from exhausting. When the current is turned on the copper ions go to the type and coat the wax page. The sulphate ions if we use copper sulphate go to the anode and form more copper sulphate. The wax is coated the desired thickness and then the copper copy is stripped off backed with metal and used in place of the original type.

II

ferric sulphate + water
$Fe_2SO_4 + H_2O$

$2Fe^{+}(OH) + H^{-} = H_2SO_4 + O$

ferric hydroxide — hydrogen — sulphuric acid — oxygen

sodium sulphate + water
$Na_2SO_4 + H_2O$

$2Na^{+}(OH) + H^{-} = H_2SO_4 + O$

sodium hydroxide — hydrogen — sulphuric acid — oxygen

calcium chloride + water
$CaCl_2 + H_2O$

$Ca(OH)_2 + H^{+} = Cl^{-}$ (dissolved in water)

calcium hydroxide — hydrogen — HCl - hydrochloric acid — O - oxygen

A hydroxide is a compound of a metal and the OH radical. A salt is a compound of a metal and a non metal. An acid is composed of hydrogen and a non metal. All metals are positively charged, non metals are negatively charged.

III HNO_3 - nitric acid and oxygen. At the cathode we get $Na(OH)$ sodium hydroxide and hydrogen.

Performance

Mode

Miss Ida Kepler Day No. 6

Theme Oxygen and Oxides.

Materials and Apparatus

[illegible] both the air and earth water and organic matter. Without life can not exist.

Experimentation	Sequence
I a - Heat clean copper.	
b - " magnesium	a. white light and white smoke
II a - Burn sulphur in a closed jar	II a. blue flame - white mist
b - add water	b. looks less misty
c - add litmus	c - turns red
III - Repeat the three steps of No. 2 - with phosphorus.	III a - yellow flame + white smoke b - water rises - mist clears c - litmus turns red
IV Heat in a t.t. copper oxide and charcoal using a delivery tube, lead the escaping gas into calcium hydroxide	IV - Bubbles and milky appearance. red copper in tube
V Heat lead oxide on charcoal by means of a blowpipe	V - small balls of lead
VI Heat mercuric oxide and test the escaping gas by a taper from which the spark has just died out	VI taper got on fire

Many metals are purified after being taken from the mine.
The last experiment is [illegible]

This is how Priestley discovered oxygen. It may also be prepared from potassium chlorate and manganese dioxide and barium oxide.
Oxygen is a colorless, tasteless, odorless gas slightly heavier than air. It is present in very great

If we should perform the first two experiments in a closed vessel so that anything that formed during the burning would remain and then weighed the substances we would find that we should have more than we started with. The metal must have combined with something in the air and that is oxygen. This process of combining with oxygen is called oxidation. Some substances like copper unite slowly and with no very violent actions. Others shown like magnesium burst into flame while oxidizing. This process is then called combustion. These formulas show what happens in both cases.

$Mg + O = MgO$ $\quad Cu + O = CuO$

Since they are combinations of metals and oxygen they are called metallic oxides. Because the change the formation of these oxides is called rust. From these first two experiments we conclude that oxygen combines with metals.

Now when we burn sulphur we get white fumes and a lessening of the amount of sulphur. The sulphur therefore must have united with oxygen. The gas therefore is an oxide - SO_2. We see from this experiment that not may have non-metallic oxides formed that oxygen exist in different states - solid, gases, liquids (water). Sulphuric acid is also formed during this process $SO_2 + H_2O = H_2SO_3$ This acid is used as a bleaching agent. Sulphurous SO_2 is a non-metallic oxide.

Since combination with water will form an acid they are called an acid oxide. Similarly metallic oxides forming bases are therefore called base oxides.

From the reaction experiments we see that by heating an oxide with a substance that has a greater affinity for oxygen, we can remove the oxygen by the latter. Frequently the carbon in $2CuO + C = CO_2 + 2Cu$ is a reducing agent and the CuO because it gives up oxygen is an oxidizing agent. In blowing

Miss Ida Kapland Day May 15, 1921 No. 7

Theme Potency

Materials and Apparatus

Experimentation | Sequence

Statement

1 $CaCl_2$
2 $AlCl_3$
3 CCl_4
4 PCl_3
5 PCl_5
6 CaO
7 Al_2O_3
8 C^2O_2
9 P_2O_3
10 P^2O_5
11 $Ag_2(SO_4)$
12 $Ba(SO_4)$
13 $Fe(SO_4)$
14 $Fe_2(SO_4)_3$
15 $Mg(SO_4)$
16 $Cr_2(SO_4)_3$
17 $Ag(NO_3)$
18 $Ba(NO_3)_2$
19 $Fe(NO_3)_2$
20 $Fe(NO_3)_3$
21 $Mg(NO_3)_2$
22 $Cr(NO_3)_3$
23 $Fe(OH)_3$
24 $Cu(OH)_2$
25 $Al(OH)_3$
26 $Cr(OH)_3$
27 $Zn(OH)_2$
28 $Sn(OH)_4$
29 $H_2(CO_3)$
30 $Mg(CO_3)$
31 $Pb(CO_3)$
32 $K_3(PO_4)$
33 $Ca_3(PO_4)_2$
34 $Na_4(SiO_4)$
35 $Mg_4(SiO_4)_2$

36 $(NH_4)Cl$
37 $(NH_4)O$
38 $(NH_4)SO_4$
39 $(NH_4)(NO_3)$
40 $(NH_4)_4(PO_4)$
41 KCN
42 $Ag(CN)$
43 $KAg(CN)$
44 $Na_2(SO_4)$
45 $Na_2(CO_3)$
46 PbO
47 $Ag(NO_3)$
48 $BaBr_2$
49 $Al(OH)_3$
50 HgO

Performance

Mode

Miss Ida Kaplan Day May 19, 1921 No. 8

Theme Carbon Dioxide

Materials and Apparatus

Experimentation	Sequence
I- Hold glowing charcoal in bell jar	I- white ppt.
II- Breathe into lime water	II- " "
III- Generate CO_2 from marble and HCl. Pass the evolved gas over four burning candles of different heights	III- Candle nearest out smallest first.
IV- Lead CO_2 into water. Test solution with litmus	IV- Litmus turns red
V- Pass CO_2 from generator into lime water until the precipitate which first appears has disappeared. Divide the clear solution into three parts. A- add lime water - B- apply heat - C- add KOH solution.	V- B- Cloudy A- " C- white ppt

Statement

Carbon dioxide is one of the most common substances. It is a product of the combustion of wood, oil, wax, cotton, cigarettes. The body is often compared with a stove. The food the fuel and the CO_2 given off just as in a stove in respiration. Even after death we are causes of CO_2 because it is a product of decay. Carbon dioxide is also a product of fermentation. It is found also in water and in air. We can make carbon dioxide by pouring an acid on a carbonate

$CaCO_3 + 2HCl = CaCl_2 + CO_2 + H_2O$

If we heat $CaCO_3$ we get CO_2 $CaCO_3 \rightarrow CO_2 + CaO$

Carbon dioxide is a colorless gas, 1½ times heavier than air. It has a slight taste and odor. It does not support combustion and does not burn. It is soluble in water producing the acid H_2CO_3 (carbonic acid). If put thru limewater it produces a precipitate.

$Ca(OH)_2 + CO_2 = CaCO_3 + H_2O$. The calcium carbonate is insoluble and is visible. If more CO_2 is added we get the following

$CaCO_3 + H_2O + CO_2 = H_2Ca(CO_3)_2$ - which is acid calcium carbonate (soluble). In this way we can use limewater as a test for CO_2 and CO_2 as a test for $Ca(OH)_2$. The $CaCO_3$ and $H_2Ca(CO_3)_2$ are at the base of temporary hard water. This is the explanation. CO_2 in the air unites with water forming H_2CO_3. This passing over limestone forms hard water. $H_2CO_3 + CaCO_3 = H_2Ca(CO_3)_2$. If this is heated it resolves itself into $CaCO_3 + H_2O + CO_2$. The calcium carbonate (insoluble) which falls to the bottom or becomes a crust on the container. The water which passes off is soft and can be used.

CO_2 is a substance necessary for life because of the oxygen it contains. It is a necessary part of every plant's food. The carbonic acid which is made from CO_2 is used in soda water. In fire extinguishers it is used as follows. A solution of sodium bicarbonate is allowed to mix with sulphuric acid. CO_2 is given off and a solution of this poured on the flame extinguishes it.

$2NaHCO_3 + H_2SO_4 = 2H_2O + 2CO_2 + Na_2SO_4$

Performance Mode

Miss Ida Kaplan Day May 26, 1921 No. 9

Theme Silicon Dioxide

Materials and Apparatus

Experimentation	Sequence
Silicon Dioxide and sodium carbonate were heated together in a platinum cup, the substance thus formed dissolved in water and hydrochloric acid added.	A gelatinous substance was formed.
In our experiment we went halfway in the manufacture of glass. We mixed SiO_2 with Na_2CO_3 but the resulting silicate would not be hard enough to resist heat and air and water and so in the commercial process besides silicon dioxide (sand) and an alkali (Na_2CO_3) they use a calcium compound ($CaCO_3$) and a lead compound (Pb_3O_4). These substances are heated and after the gases pass off and the scum [illegible] removed the mass is allowed to cool. It is then [illegible] and can be molded [illegible].	Before being used it must be gradually cooled—that is annealed. To make colored glass other substances are used: chromium (green), cobalt (blue), manganese dioxide (green). Glass is used for receptacles, lenses, mirror glass etc.

Silicon - Si - is not found freely in nature, but can be prepared by heating together silicon dioxide with carbon in an electric furnace. It exists in three allotropic forms - a brown powder, a grey mass and steel colored crystals.

Silicon dioxide, one of the most important compounds of silicon, is distributed very widely - forming one fourth of the earth's crust. It exists as sand, sandstone, gravel, quartz (rock crystal, rose, milky, smoky) agate, opal, flint, jasper etc. Quartz constitutes a great part of granite, gneiss. Silicon dioxide is insoluble except in hydrofluoric acid, infusible, (so is quartz) resists heat and weathering agents. It is used as the names suggest in gems, building materials, sandpaper, glass cement, dynamite, porcelain, for scouring & polishing agents.

When we heated the silicon dioxide with the sodium carbonate we got a silicate

$$SiO_2 + Na_2CO_3 = Na_2SiO_3 + CO_2$$

sodium silicate = water glass. used for preserving eggs & water purifying.

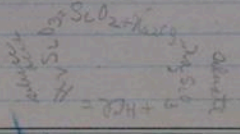
We could have used potassium in place of sodium and the resulting silicate together with the first are the only ones in the group that are soluble. These dissolved in water and mixed with HCl give the acid

$$Na_2SiO_3 + 2HCl = H_2SiO_3 + 2NaCl$$

silicic acid

The silicates are also very common substances. Silicates of iron, calcium, aluminum etc. form the substances clay, hornblende, mica, felspar, [illegible] garnet, beryl etc. Silicic acid if heated breaks down into silicon dioxide and water.

$$H_2SiO_3 = SiO_2 + H_2O$$ The whole cycle is as follows -



Performance Mode

Miss Ida Kaplan Day June 1, 1921 No. 18

Theme Hydrochloric Acid

Materials and Apparatus

Experimentation	Sequence
I- To salt (NaCl) add sulphuric acid. Lead the evolved gas into an empty test tube. Invert the tube in an evaporating dish of water.	I- Effervescence
B- In litmus	B- Turned litmus pink
C- Over ammonium hydroxide	D- Curdy precipitate
d- into silver nitrate	C- White fumes
II To commercial HCl add either MnO_2 or potassium permanganate. Warm gently testing the evolved gas with moist litmus paper.	II- Turn litmus white
III Chlorine water. Lead into the powdered mass Chlorine. Add to the resulting substance some acid and hold to the escaping gas litmus	III- Bleached

Hydrochloric acid is a transparent colorless gas, heavier than air, very soluble in water. It is not found free except in volcanic gases. It is one of the constituents of the gastric juice. It is usually most frequently described as a by-product in the preparation of sulphuric acid from sodium chloride.

$NaCl + H_2SO_4 = HCl + NaHSO_4$.

In the first experiment we generated chlorine according to the equation. Let us suppose that the tube was almost filled with HCl. Of course the air originally in the tube had been displaced by the gas. When the tube was inverted over the water, some HCl is very soluble it immediately joined with the water. The space left by the chlorine was filled by water which rushed in to take its place, rising to the top. The next three experiments show the chemical properties of HCl and prove that it is an acid. If turned litmus red, united with NH_4OH and let the silver from silver chloride replace its hydrogen.

$HCl + NH_4OH = NH_4Cl + H_2O$ HCl in contact with moist air gives off white fumes

$HCl + AgNO_3 = AgCl + HNO_3$

If hydrochloric acid is mixed with a substance rich in oxygen like $KMnO_4$ or MnO_2 we get chlorine. Chlorine is a greenish yellow gas, heavier than air, of very pungent odor, soluble in water, not combustible but allowing other substances to burn, combines readily with hydrogen and is a very strong bleaching agent. It can be made by electrolyzing some chlorides or by heating HCl gas with air and leading the gas through pipes lined with brick soaked in copper chloride. For bleaching, the chlorine liberates oxygen which decomposes the coloring matter.

$MnO_2 + 4HCl = Cl_2 + MnCl_2 + 2H_2O$

HCl is used in chlorine laboratories, in making chlorine and bleaching powder.

Chlorine is used for bleaching and for making chlorides

Performance Mode

Miss Ida Kaplan Day June 2, 1921 No. 11

Theme Sodium Chloride

Materials and Apparatus

The last experiment shows how we can see the crystalline form & means of identifying it.

Sodium [illegible] salt - it is a colorless or white crystalline, clear, soluble in water. It is found in all food. It is used in making sodium carbonate, chlorine and baking powder.

Experimentation	Sequence
To NaOH in an evaporating dish, add HCl until litmus shows no change.	
To five grams of sodium chloride add 15 cc. of water. If the solid is not dissolved add more water 5 g. at a time until solution is effected.	It took 15 cc. of water to dissolve the salt
Allow a solution of salt to evaporate.	Crystals were formed.
Test salt solution with platinum wire.	A yellow flame was seen.
Test with silver nitrate.	A white precipitate was formed which turned dark on standing
Treat a beef extract with water. Examine crystals after evaporation of solvent	The crystals were cubes

Sodium chloride or salt is one of the most common substances found. It appears in the earth, in oceans, lakes, and in a great many foods. The first experiment shows how salt may be made in the laboratory. In fact it shows how any salt (chemically speaking) may be made. An acid and an hydroxide mixed will form a salt (compound of metal and non-metal). This process is called neutralization from its effect on litmus. An acid, of course, turns litmus pink, and a base turns it blue. A salt has no effect thereon—it is neutral. In reality the neutralization has even a broader meaning as it is used. Any number of hydroxides or acids may be used and corresponding different salts will be formed, but water will always be a product. Of course the water is made from the OH in the hydroxide and the H in the acid. Considered in the light of ionization we may say that in solution we get hydroxyl ions from the hydroxide and hydrogen ions from the acid. These unite to form the water. $Na(OH) + HCl = NaCl + H_2O$.

Commercially, however, salt is never made chemically. In warm countries it is evaporated by the sun from salt water and in cold countries the water is frozen. In freezing the water crystals form on top and a concentrated salt solution is found below. Of course salt is mined from the earth too [illegible] then it sometimes has to be purified.

It takes three times as much water as [illegible] salt to make a solution.

The yellow flame on the platinum wire shows that sodium was present and the formation of the white solid, [illegible] turned dark (although insoluble) of AgCl showed that Cl was there.

Performance Mode

Miss Ida Kaplan Day June 8, 1921 No. 12

Theme Ammonium Chloride

Materials and Apparatus

introduced to make water with the hydrogen.

NH_3 is used in cleaning, as a restorative in dyeing and printing cloth, and in making ice. In the latter liquefied ammonia, which in evaporating takes up heat from the surroundings, is used.

Experimentation	Sequence
I - Dissolve 5 gr. of NH_4Cl in 15 cc. of water added a little at a time	I - 3 times as much water used
II - Crystallize some NH_4Cl solution by evaporation	II - Soluble - temperature lessened
III - Test composition of NH_4Cl by	
a - $AgNO_3$	white precipitate
b - by heating with lime holding over the escaping gas moist red litmus	litmus turned blue; odor of ammonium
IV Soak a dry cell in water. Filter the solution if necessary and test as in preceding experiment	white precipitate; litmus turns blue
experiment we get the odor of ammonia and the litmus turns blue proving the formation of a base $NH_4(OH)$	we get the same results as in the preceding experiment
In the last experiment we show that sal ammoniac is present because	In the Leclanché cell you have $Zn + 2NH_4Cl + C = ZnCl_2 + 2NH_3 + H_2$ If too much hydrogen collects on the C some oxidizing agent like manganese dioxide is

Statement

NH_3 Ammonia is a substance found in the air when animal or vegetable matter, containing N and H decay. It is also a product of the destructive distillation of coal and illuminating gas. It can be made in the laboratory by heating together $2NH_4Cl + Ca(OH)_2 = 2NH_4(OH) + CaCl_2$

$2NH_3 + 2H_2O$

Ammonia is a colorless gas with a pungent irritating odor. It is a little more than ½ the weight of air, does not burn nor support combustion, it is easily liquified, is a strong (1) alkali and is very soluble.

When NH_3 is dissolved in water we get $NH_4(OH)$. We have placed an NH_4 for the reason the substance formed acts very much like sodium hydroxide. Therefore we conclude the OH radical is present. That leaves NH_4 as the rest of the formula. NH_4 is never free but always acts like a metal in that it displaces H in acids to form salts. It is a strong alkali (2)

One of these salts is NH_4Cl

$NH_4OH + HCl = NH_4Cl + H_2O$

NH_4Cl is a white granular or crystalline solid; soluble in three times its amount of water. In dissolving the temperature falls. If heated till it evaporates and is then crystallized it is ammonium chloride or sal ammoniac.

We can test its composition as follows

$NH_4Cl + AgNO_3 = AgCl + NH_4NO_3$

$2NH_4Cl + Ca(OH)_2 = 2NH_4OH + CaCl_2$

$2NH_3 + 2H_2O$

The substance produced in the first experiment turns black showing to be AgCl. In the second

Performance Mode

Miss Ida Kaplan Day November 19, 1925 No. 13

Theme Bromides and Iodides

Materials and Apparatus

Experimentation

I - Dissolve potassium bromide in water.
a - to solution add Cl
b - add CS_2 and shake well

II - Dissolve KI in water
a - to solution add Cl
b - add CS_2 and shake well

III. To solid KBr add H_2SO_4. heating in the escaping vapor moist blue litmus

IV - To KI add H_2SO_4 dilute solution until almost colorless then add a little starch

Sequence

I - colorless solution
a - turned yellow
b - two layers of liquids one colorless at bottom turns brown-yellow at top

II - colorless solution
a - reddish brown
b - 2 layers of liquid turned purple at bottom

III - effervescence - yellow fumes - litmus turned purple

IV brown effervescence brown fumes - paper eaten away and turned white.

V - purple fumes - gray deposit on tube - brown liquid - starch turned liquid blue

Miss Ida Kaplan Day November 18 1921 No. 14

Theme Fluorine

Materials and Apparatus

Experimentation	Sequence
I- Put some CaF_2 into lead dishes and pour a little H_2SO_4 on.	I- fumes a) litmus turned pink b.
II- a- hold litmus in escaping fumes b. hold Ammonium hydroxide in fumes	II- design etched.
II- Coat a plate with wax scratch design on it and hold over mixture of CaF_2 + H_2SO_4	

upon water and hydrocarbons. Most metals combine with it to form a salt - fluoride and during the union oxidation takes place. Fluorine unlike its acid has no effect on glass or silicates.

Statement

$CaF_2 + H_2SO_4 = H_2F_2 + CaSO_4$

$NaCl + H_2SO_4 = 2HCl + Na_2SO_4$

$2KBr + H_2SO_4 = 2HBr + K_2SO_4$ which changes to

$2HBr + H_2SO_4 = Br + 2H_2O + SO_2$

$2KI + H_2SO_4 = 2HI + K_2SO_4$ which changes to

$2HI + H_2SO_4 = I + 2H_2O + SO_2$

I used the above order because Cl + Fl are stable and since the acids of Br + I are unstable. They are in the order given a strong gas, weak gas, liquid, solid. In teaching this I should use Cl first because it is more common and easier to understand. Then I take the next two together because they are more familiar than F and naturally go together. The F is least common although most dangerous.

HF is a colorless gas (of the liquefying at 19°) with a not very pleasant odor. It turns litmus [illegible] pink and fumes in the presence of $(NH_4)OH$. It has a very corrosive action on most metals excepting lead and platinum. Because it contains H it does not break up hydro carbons (wax) or water for their hydrogen. It acts very strongly on glass and silicates breaking them into silicon tetrafluoride.

$2H_2F_2 + SiO_2 = SiF_4 + 2H_2O$. Since glass is a combination of silicates this also happens when HF etches glass

$6HF + Na_2SiO_3 = SiF_4 + Na_2F_2 + 3H_2O$.

Fluorine is prepared by electrolysis. It is also impossible to use to dissolve it in water because it immediately produces oxygen. It is found in the form of such as potassium fluoride. Fluorine is a gas and does not liquefy till -200°. It has a greenish yellow color paler than chlorine and a disagreeable odor. Because of its strong affinity for H it breaks

Performance ~~H~~ Mode

Miss Martin Day November 22, 1920 No. 15

Theme Sulphur

Materials and Apparatus

Experimentation	Sequence
I- Sublimate sulphur ore by mixing sulphur and clay. Heat in a test tube collecting the vapors on an extra cold tube	I- yellow fumes - reddish brown liquid - yellow solid on top of tube - green odor.
II Melt a piece of sulphur, noticing variously its gas, liquid into water	II- thin amber liquid dark thick mass " thin again insoluble rubberlike
III- Melt sulphur in a beaker, let cool until a crust is formed. Pierce this crust & bring crystals within	III-
IV- Dissolve sulphur in CS_2 notice crystals after evaporation	IV Monoclinic - needle like crystals form
V Burn Sulphur in a closed jar a- ash b- " water c- " litmus	V- a- stifling fumes - blue flame b- fog clears c- turned pink

Sulphur is one of the oldest known substances. It is one of the most important in industries. Either free or combined it is abundant and widely distributed. It is present free in volcanic regions and around gypsum beds. The gypsum may have been reduced to S and limestone by microorganisms. It is found combined in volcanic gases, in substances of animal and vegetable origin, and as sulphides and sulphates. Important as metals are sulphides of Pb, Zn, Cu, mercury, antimony. Common sulphates are those of Mg, Ca and Ba. There is about ¼ lb of combined S in the body.

S was originally mined in Sicily but now a great deal is gotten from Louisiana. In Sicily piles of crude S are covered with earth, then heaps ignited, and the sulphur that burns melts the rest of the S which flows off. In Louisiana the S is melted by hot water in pipes and the S is forced to the surface by compressed air. The crude sulphur to be purified must be melted then slowly distilled. On the sides of the chamber are found yellow granules — flowers of sulphur. This process is therefore sublimation. Not all the S condenses in the same flowers of brimstone.

Sulphur is a yellow, brittle, usually crystalline solid. It is insoluble (except in CS_2, turpentine $C_{10}H_{16}$), a poor conductor of heat, it burns with a blue flame forming SO_2, in moist air it forms H_2SO_4. It combines very readily with many elements especially metals, to form sulphides. It melts at a low temperature showing the stages which occurred in the second experiment. S exists in three allotropic forms two crystalline and amorphous (irregular shape). The 2 crystalline forms are orthorhombic (when molten S crystallizes) needle type monoclinic (when solution of CS_2 is crystallized). Amorphous sulphur is tough plastic formed by pouring boiling S in water. It resumes the yellow brittle form. The S is used to make H_2SO_4, gunpowder, fireworks, matches, vulcanizing, germicide.

SO_2 is found in volcanic gases and slightly in the air. When S burns we have SO_2. It may be prepared as follows

$Cu + 2H_2SO_4 = SO_2 + CuSO_4 + 2H_2O$.

SO_2 is a colorless gas, with a suffocating odor. It does not burn nor support combustion (usually). It is soluble in water forming H_2SO_3. Moist SO_2 is used to bleach vegetable coloring matter and delicate substances like hay, straw, wool. When bleached with SO_2 the color comes back. SO_2 is used to make H_2SO_4, preservative, fumigation, paper making, tanning, sugar refining

Performance ~~H~~ ? Mode ✓

Miss Ida Kaplan Day December 13, 1921 No. 16

Theme Nitric Acid and Oxide.

Materials and Apparatus

Experimentation	Sequence
I- To $NaNO_3$ in a retort add H_2SO_4 heat very cautiously leading the outlet gas into a cold tube	I- yellow liquid
II- Pour very cautiously some HNO_3 made in No. I on glowing charcoal	II- flame and sparks
III a- Pour some HNO_3 from No. I on copper. b- Repeat with conc. acid	III a- blue liquid brown smoke ~~white smoke~~ b- action not so vigorous
IV- To cold ferrous sulphate solution add a little H_2SO_4 - cool under running water now add a drop of a soluble nitrate	IV
V. Burn collodion cotton	V- Burst into flame and disappeared
These nitrates are soluble and so differ from most constituents of the soil. When heated they act differently KNO_3 + heat = nitrite. (KNO_2) KNO_3 sprinkled on hot charcoal the charcoal burns - the process is called	Deflagration. $Cu(NO_3)_2 + Heat = CuO + NO + O$

Nitre and is one of the commonest and oldest salts which has been known for a long time. Although it was discovering gold. It is formed in the soil when nitrogenous or animal matter decays in the presence of an alkali. The alkali has essentially to be KHO_3 to nitrates. This process is called nitrification and has been the cause of the deposits of nitrates in desert and tropical countries. It is formed in the air when electricity in a thunderstorm unites the N and the O, the resulting oxide dissolving to an acid in the presence of water. This fact is utilized in the manufacture of HNO_3 in Norway. The air is charged with electricity and the resulting peroxide unites with water N_2O_5 the anhydride of HNO_3 is the acid one would most naturally think of in this method by making HNO_3 but the other lower oxides act the same way (as shown by the thunderstorm) and of course the cheapest reagents can be used. HNO_3 can be made also by adding H_2SO_4 to a salt (one of the usual methods)

$H_2SO_4 + NaKNO_3 = HNO_3 + HNaSO_4$ (low temperature)

$H_2SO_4 + 2NaKNO_3 = 2HNO_3 + Na_2SO_4$ ✓ (high temperature)

HNO_3 when pure is colorless but is usually yellowish brown, because of impurities or because it sometimes breaks down as follows: $4HNO_3 = 4NO_2 + 2H_2O + O$ (nitrogen tetroxide) $NO + O = NO_2$

$2HNO_3 = 2NO_2 + H_2O + O$

HNO_3 decomposes in sunlight and easily it absorbs water and fumes in damp air. When exposed to the air it corrosive and forms yellow stains on the skin and may sometimes burn. It gives up its O readily so strongly by the effect on the flame and many substances like hydrogen will burn in it. Since it is an oxidizing agent we would expect in the Cu experiment to see CuO. Instead, the CuO is acted on also by the HNO_3 and we get $Cu(NO_3)_2$

$3Cu + 8HNO_3 = 3Cu(NO_3)_2 + 4H_2O + 2NO$ [$NO + O = NO_2$]

The blue color is due to the copper. The brown fumes show the presence of NO_2

HNO_3 is used in making nitrates, dyestuffs, H_2SO_4, guncotton, nitroglycerine, etching, in copper, gold.

Since HNO_3 is usually (as it comes from its source) called (aqua fortis) it forms a great many salts (nitrates)

Miss Ida Kaplan Day December 20 1921 No. 17

Theme Potassium and Sodium Compounds

Materials and Apparatus

Experimentation

I - Float K on water
B - Test solution with litmus
II - Grind $KClO_3$ and charcoal together, ignite a mass of the powder wrapped in filter paper

III - a Float Na on water, writing and on the paper
b - Test solution with litmus
IV
a - To 6 gr. Na_2SO_4 add 5 gr H_2O
b - Warm
C - Cool in ice water
D - Add an extra crystal of Na_2SO_4
V - Test composition of Na_2SO_4
a - with platinum wire
b - by barium chloride

Sequence

I Floats over water, turns into ball, violet flame
b - litmus turns blue
II = sparks + occasional violet flame
III - Melts on the ~~water~~ paper turns into ball - on paper - yellow flame
b - litmus turns blue
IV - a - little disappears - dilute
b - Na_2SO_4 dissolved - saturated
c - solution still - super-saturated
d - liquid solidifies - saturated
V - yellow flame
b - white precipitate

K and N stand first among metals in reference to metallic properties. They are neither of them found free but their salts make up 5% of the earth's surface. Both are silver white solids, soft easily molded and cut, and ~~[illegible]~~ oxidize or tarnish very quickly. Both melt at low temperatures, as shown, when the heat produced as a result of their forming KOH and NaOH in the water was sufficient to melt both metals into balls. In the formation of the KOH the heat produced set the liberated hydrogen on fire. The blue flame as a result was changed to a purple by the K. Na on water also produces a hydroxide (as shown by the blue litmus) but the heat is not sufficient to set the H on fire unless the process is confined to a small space (on paper). Then we see the yellow flame which is a test for Na. In order to keep the metals from tarnishing they should be kept under oil or in liquids free from water. Both decompose water altho K is more active.

E 43 $Na + H_2O = NaOH + H$ $\qquad$ $K + H_2O = KOH + H$

In the second experiment a kind of gunpowder was made

$2KNO_3 + 3C = CO + CO_2 + N_2 + K_2CO_3$

The rose violet flame showed the presence of K. The reason this was not a good explosive is because there was too much [illegible] produced. To have an explosion the amount of gas produced must be more than the solid began with and the space should be large enough to hold the surplus gas.

In the fourth experiment the first two stages seem natural enough, but the peculiar thing is that when the temperature was lowered the solution remained saturated and crystallization [illegible] of the salt. I [illegible] that the addition of the salt should hasten crystallization.

The last experiment is a test for sodium. The white precipitate formed may have been either $BaSO_4$ ~~$CaSO_4$~~ ~~[illegible]~~ SO_4 because either $BaCl_2$ / $CaCl_2$ or lead acetate when added to a sulphate gives a white precipitate

$BaCl_2 + Na_2SO_4 = BaSO_4 + 2NaCl$

But the yellow flame proved conclusively that the substance was sodium sulphate.

Na is used to separate water from alcohol, ether, in making Na_2O_2, NaCN and NaOH. K is used for making lye.

Performance +? $\qquad$ Mode ✓

Miss Ida Kaplan Day December 21, 1921 No. 18

Theme Sodium Compounds (cont'd)

Materials and Apparatus

Experimentation	Sequence
I-a- Dissolve Na_2CO_3 in H_2O	I-a- soluble
b- Test solution with litmus	b- blue
c- " " " HCl	c- effervescence
d- " " " $BaCl_2$	d- white ppt.
II- a- to $NaHCO_3$ add HCl	II- effervescence
b- " " " tartaric acid	b- "
c- " " " KH tartrate	c- slight effervescence
III-a- to 5 gr. of borax add 15cc. boiling water	III-a- clear solution
b. test solution with litmus	b- blue
c- add very cautiously 1cc H_2SO_4	c-
d- let cool. Ppt. is?	
Place the ppt in alcohol and set fire to it	
IV- Heat borax in a loop of platinum wire until a glass like mass results. Flame color? Moisten the transparent bead with H_2SO_4. Flame color? Dip this bead into a solution of a mineral compound. Notice color of bead now on heating	IV- yellow flame - effervescence glassy bead. Green flame with H_2SO_4, bead turned blue

Na_2CO_3 is found in small quantities in Egypt, Russia, California and Nevada. It was formerly made from marine plants but is now made of NaCl by two processes the Leblanc and Solvay. This is the Leblanc.

$2NaCl + H_2SO_4 = HNaSO_4 + HCl + NaCl$
$HNaSO_4 + NaCl = Na_2SO_4 + HCl$
$Na_2SO_4 + 2C = Na_2S + 2CO_2$
$Na_2S + CaCO_3 = Na_2CO_3 + CaS$

The first two steps are the salt cake process & the last two

1 Na_2CO_3
2 $NaHCO_3$
3 base
4 salt
5 alkali-turn litmus blue
6 on heating or the addition of acid or acid salt they liberate CO_2 + [illegible]
7 liberates CO_2 which is enemy of fire by taking place of O in air
8 sulphate or carbonate
9 salt in water ?
10 $NaK(C_4H_4O_6)$
11 $Na_2B_4O_7$
12 $H_2SO_4 + H_2O$
13 water in borax
14 boron
15 cobalt
16 as the temperature decreased the water lost it power to hold so much borax [illegible]
17
18
19
20

Performance H

Mode

Miss Ida Kaplan   Day January 3, 1921   No. 19

Theme Zinc

Materials and Apparatus

Experimentation

I – Burn Zn in crucible

II a – to zinc add dilute HCl

b – " " " H_2SO_4

(a few drops of $CuSO_4$ will hasten action)

c – to zinc add HNO_3

III a – to a few drops of $Zn(NO_3)_2$ from Z – add a little NaOH – excess of the reagent

IV to a Zn salt in solution add H_2S (if necessary a few drops $NH_4(OH)$)

Sequence

I – burns with greenish blue flame – white compound

II – a bubbles – gas explodes

b " + blue flame

c = brown smoke

III – white ppt clear solution

Statement

1 oxides, carbonates
2 sulphides, silicates, hydroxides
3 reduction
4 roasting
5 CO
6 SO_2
7 sodium zinc
8 potassium, mercury, zinc
9 zinc oxide
10 zinc sulphide ZnS
11 $Zn + 2HCl = ZnCl_2 + 2H$
12 ~~Carbon~~ precipitate O_2,
13 $2Zn + O_2 = 2ZnO$
14 a- $Zn(NO_3)_2 + 2NaOH = Zn(OH)_2 + Na_2NO_3$
~~b- $ZnCl_2 + NaOH =$~~

b- $Zn(OH)_2 + 2NaOH = ZnO + Na_2O + 2H_2O$
15- $ZnCl_2 + 2NaOH = Zn(OH)_2 + 2NaCl$

Performance

Mode

Miss Lia Kaplan Day January 5, 1921 No.

Theme Copper - No 1

Materials and Apparatus

Experimentation	Sequence
I a- Heat copper in outer cone of flame	black color
b- remove coat of copper in inner cone	red "
II a- $CuSO_4$ add $NaOH$	II - blue precipitate
b- heat	brown "
III Heat a mixture of $CuSO_4$, $NaOH$ ordinary sugar (sucrose)	III green precipitate
IV- Repeat III using grape sugar (glucose)	IV brown, red, yellow precipitate
V Repeat III using milk sugar (lactose)	V. blue precipitate orange "
VI Repeat III using milk	VI reddish precipitate

Statement

Copper was one of the oldest known metals. It occurs in the earth's crust both free and combined. It most common ores are oxide, carbonates and sulphides (as pyrites). The hydroxides with the carbonates and the silicates are not very common. An example of the common ores follows: Cu_2O, cuprous oxide (cuprite); $Cu(OH)_2CuCO_3$ (malachite-azurite); Cu_2S copper sulphide (chalocite); $CuFeS_2$ copper iron sulphide (chalcopyrite).

When native copper or ores mined (Michigan) the ore is crushed, washed, smelted to get rid of physical impurities. The carbonates must be roasted

$CuCO_3 \cdot Cu(OH)_2 = CO_2 + H_2O + CuO$ or $2CuO$

The oxides are reduced. The sulphides are roasted

$Cu_2S + O_2 = Cu_2 + SO_2$ $\quad Cu_2O + C = 2Cu + CO$

The $CuFeS_2$ after crushing and washing is roasted. This gets rid a great deal of SO_2. The iron oxide is fused and is mixed with sand producing a slag which runs off as a slag. There remains mainly Cu_2S which is roasted and changed to Cu_2O. The $Cu_2S + CO_2$ are melted together and SO_2 goes off leaving $2Cu$.

When put in the outer flame, near the great amount of oxygen we have Cu_2O base valence two and some superficial CuO. In the inner flame, however there is not enough oxygen and Cu_2O (red) is formed in which Cu has a valence of one. Sometimes there is enough O in the outer flame to produce CuO and so we don't get the pure color.

The equation for the second experiment follows

$CuSO_4H_2 + NaOH = Cu(OH) + Na_2SO_4$

$Cu(OH) + heat = H_2O + CuO$

The blue precipitate is the cupric oxide. The red-dish color in the last three experiments is due to the presence of Cu_2O cuprous oxide. The CuO from the above formula is reduced by the glucose, lactose and dimethyl to Cu_2O. As soon as by the absence of the reducing agent (oxygen) does not act as reducing agent

Performance Mode

Miss Ida Kaplan Day January 10, 1921 No.

Theme Aluminum

Materials and Apparatus

constituents and then in turn combine with the O and H of the water. The compounds formed help to entangle the impurities and thus clear the water.

Experimentation	Sequence
I - To Al add dilute HCl. Let it escape upon a lighted match	gray solution - effervesces violently. Blue flame -
II - To $AlCl_3$ add NaOH. Divide ppt. into 2 parts	white ppt. jelly like
III - To one portion add HCl	III - Ppt. disappears } solution
IV - " other " " NaOH	IV "
V To $Al_2(SO_4)_3$ solution add $NaHCO_3$	V - Effervescence clear white jelly foamy mass, increased bulk
Try same experiment in presence of licorice	VI - It also floats at top, color at top
VI Heat alum in dry tube	
VII To strong solution of alum add NaOH	VII - white ppt.
VIII Heat alum on charcoal by a blowpipe. Moisten with Cobalt Nitrate. Heat again.	VIII - blue color
IX To alum add $BaCl_2$	IX - white ppt -
X 1 - To 2 tall cylinders of water add a charcoal powder until liquid looks very cloudy. To one add a small amount $Al_2(SO_4)_3$. Let stand	X - solution clarifies
- If the experiment with cobalt nitrate had been	performed with a zinc compound the color obtained would have been green instead of blue color and got. $Al_2(SO_4)_3 + 6H_2O = 2Al(OH)_3 + 3H_2SO_4$ the $Al_2(SO_4)_3$ is broken down into its

Statement

Al is never found free but is very common as a compound. Al_2O_3 the oxide is sometimes called corundum emery. $H_4Al_2O_6$ the hydroxide is known as bauxite. Na_3AlF_6 the fluoride is cryolite important in the metallurgy.

Al is extracted from its ores very cheaply now by means of electricity. Acting as a cathode is a box lined with carbon. There is filled with cryolite. Carbon bars suspended from a copper rod act as the anode. When the current is turned on in trying to pass thru the cryolite enough heat is generated to melt the cryolite. This acts as a solvent for the Al_2O_3 which is introduced dry. In the cryolite the Al_2O_3 breaks down into its constituents. The Al being heavy drops to the bottom and flows out while the O combines with Carbon into CO and burns. Al is a light bluish white metal ductile malleable, not easily oxidized not very soluble can be cast and rolled. It is acted on by HCl as in the first experiment

$2Al + 6HCl = 2AlCl_3 + 3H_2$ burned with the flame.

2nd $2AlCl_3 + 6NaOH = 2Al(OH)_3 + 6NaCl$ white ppt

3rd $Al(OH)_3 + 3HCl = AlCl_3 + 3H_2O$

4th $2Al(OH)_3 + 6NaOH = Al_2O_3 + 3Na_2O + 6H_2O$

The last two equations illustrate a very peculiar action of Al. When $Al(OH)_3$ is combined with an acid it acts like a hydroxide naturally. But when combined with a hydroxide (which in itself requires a hydroxide combined) it acts like an acid. When combined with a acid, the Al in $Al(OH)_3$ acts as a metal, in the other equation it acts as a non metal. This property helps to impress the fact that there is no sharp line between metals and nonmetals and Al helps to fill the gap or merge the two divisions.

$Al_2(SO_4)_3 + 3Na_2CO_3 = Al_2(CO_3)_3 + 3Na_2SO_4$ (which is logical but incorrect because it all goes off as gas

$Al_2(CO_3)_3 + 3H_2O = 3CO_2 + 2Al(OH)_3$ (explains its use in baking powder) releases CO_2

Same substance as in second experiment

Alum one of the most familiar compounds of Al is a double sulphate: water Al sulphate + K sulphate water. The first experiment with alum revealed the water in its make up. The one with $BaCl_2$ showed the sulphate in it because S ulphates + $BaCl_2$ = white ppt.

Performance Mode

Miss Ida Kaplan Day January 17, 1922 No.

Theme Iron

Materials and Apparatus

Experimentation	Sequence
Steel is iron with an intermediate amount of carbon. It is quite malleable, therefore can be rolled, cast, forged. It varies in hardness with the amount of carbon it contains. To heat very hot and cool quickly it is brittle. To heat and cool slowly it is tough and ductile. To harden iron successfully heated again and carefully cooled it is said to be tempered. Every tool must have iron of a certain temper. In manufacturing steel the impurities in the iron must be just the right amount of carbon. In the open hearth process cast iron, scrap iron and iron ore are placed in the hearth of an open hearth furnace which is heated by hot gas & burners.	then a checkerboard of bricks. When the iron has the right proportion of carbon as determined by the color, ferro manganese is added and then the steel is poured into molds and hardened

Statement

Iron the most useful of our metals is found free only in the form of meteorites. Combined iron is widely distributed. The following ores being most used for the extraction of iron.

Hematite Fe_2O_3 (oxide), limonite $2Fe_2O_3 \cdot 3H_2O$ (oxide with hydroxide), magnetite Fe_3O_4, siderite $FeCO_3$ carbonate

Iron is extracted from its oxides in a blast furnace kept at a high temperature. The furnace is very huge and is kept at this high temperature by the introduction of hot gases in pipes at the bottom called tuyeres. There is an opening at the top for the escape of the hot waste gases which are usually used in different parts of the plant as fuel. The charge, consisting of ore, coke and limestone is drawn to the top of the furnace and emptied in from there (thus making possible continuous operation). The ore which has been crushed and roasted to Fe_2O_3 is reduced by the C to iron and CO. The limestone, called a flux, unites with the impurities to form compounds which melt (called slag) and because lighter than the iron stay above it and prevent it from uniting with the C there. There are consequently two openings at the bottom - one for the melted iron to pass off, the other for the slag. The iron passes into molds (pigs) and is called cast iron or pig iron. Cast iron is white (when the C chemically joined with the Fe) and gray when C is physically combined. Cast iron is brittle but can stand great pressure. It can not be forged (hammered into shape) or welded (united by heat). Therefore it contains the most carbon.

Wrought iron is made from cast iron by puddling. The cast iron is put in a furnace lined with Fe_2O_3 which melts in the heat. When the iron is puddled or stirred the O from the air + Fe_2O_3 unites with the C and Si in the cast iron and this slag can be rolled or pressed out leaving a pure iron with very little carbon in it. Wrought iron is malleable, tough, ductile can be forged and welded and can withstand great weight.

Performance H Mode 33

Miss Ida Kaplan Day No.

Theme Iron cmt II

Materials and Apparatus

Experimentation	Sequence
I- To Iron filings add HCl until vigorous effervescence results. Apply match to escaping gas	I- effervescence pale-yellow liquid black residue on filter paper
II- To part of filtrate from No 1 add NaOH	II- effervescence green ppt.
III- To another part of filtrate from No 1 - add few drops of H_2O_2 and HCl Warm gently	III- brown solution
IV- To a third part of solution made in No 3 add NaOH	IV- orange ppt
V a- To ferrous sulphate add HCl & KCN b- To ferric sulphate add HCl & KCN	V a- light green with blue b- dark blue
VI a- To ferrous sulphate add HCl & KCNS b- To ferric sulphate add HCl & KCNS	VI a- pink color b- red color
VII- To blue ppt made in No 3 add NaOH (shows development of rust stains on clothes)	VII- rusty color

No.

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Junior 9

monoclinic

Granite and Gneiss

Granite

or, although it gives
of grayness

e, pink or yellow)

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e minerals are in
tals

from granite
composed of
es and the
arranged in

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Junior 9

mineralogy

Granite and Gneiss

Granite

1. Crystalline
2. No uniform color, although it gives the impression of grayness
3. Composed of
   - feldspar - (white, pink or yellow)
   - quartz - glassy
   - mica - black
4. Coarse and the minerals are in irregular particles

Gneiss.

Gneiss differs from granite in that it is composed of finer particles and the minerals are arranged in lines or strata

February 24, 1920
7

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Snow

What we call snow is a precipitation of minute snow flakes. These snow flakes are white in color and of very many and very beautiful shapes based on the hexagon. The presence of air in snow renders it opaque, otherwise it would be transparent like ice.

Snow is formed in the following way. When the temperature of the air is lowered below freezing point, the water vapor in the air condenses and is precipitated as snow.

Snow is of great value to man. By melting on mountain tops, it forms streams. It cools the air in hot countries, it protects the vegetation in the northern countries from frost and provides shelter for animals.

June 2, 1920

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Junior 9

The Parts of a Flower

Calyx - sepals, under side of the flower
Corolla - petals of the flower
Stamens - in the corolla, consist of the filament and anther. The latter contains the pollen
Pistil - made of a stigma and style and ovary. The ovary contains the seeds. The ovary may be either a superior ovary in which case it is in the flower and cannot be seen or an inferior ovary and then it is below the flower and can be seen on the outside

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Jr 3

Classification of Animal Kingdom

I- Protozoa - one celled animals
Ex- paramoecium, amoeba

II- Metazoa - many celled animals
A- Porifera - sponges
B- Coelenterates - body is a food bag
Ex- hydra, jellyfish, coral
C- Worms
Ex- earthworm, tapeworm, leech
D- Echinoderms - live in salt waters have radial symmetry
Ex- starfish, sea urchin
E- Arthropoda - jointed body and legs
1- Insecta - 3 parts to body and 3 pairs of legs
Ex- bees and butterflies
2- Crustacea - 2 parts to body - live in water
Ex- crayfish and lobster
3- Arachnida - 4 pairs of legs
Ex- spiders, scorpions
4- Myriapoda - numerous pairs of legs
Ex- centipedes
F- Mollusca - soft, unsegmented body
Ex- slugs, oysters, clams, snails

Invertebrates - no backbone

G. Vertebrates

1- Fishes- have scales and fins
Ex- codfish, salmon

2- Amphibia- live in water and land
Early stage live in water
Ex- frogs, salamanders, newts

3- Reptiles- have scaly skin and lay eggs
Ex- reptiles, alligator, snake

4- Birds- have feathers and wings
Ex- chicken, robin

5. Mammals- feed young with milk
Ex- dogs, bats, man

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Lt 3

Evolution

1. Definitions
   - Biology - the study of life
   - Botany - the study of plants
   - Zoology - the study of animals
   - Organ - a group of tissues working together, doing a definite function
   - Organism - a living thing
   - Organic - pertaining to an organ or an organism
   - Inorganic - without life
   - Flora - collective plants or vegetable species of a region
   - Fauna - animals of a region
   - Speculation - contemplation
   - Rudimentary - in the first stage of development and developing no further
   - Vestiges - structures no longer used
   - Vestigial - relating to vestiges

Fossil - petrified remains of an animal or plant found embedded in the strata of the earth's crust

Embryology - study of the development of plant and animal bodies from the egg to the adult stage, noting every stage

Embryo - plant or animal in the earliest stage of development

Geology - science of the history, development and structure of the earth's crust together with the several flora and fauna which have successively clothed and peopled it.

Paleontology - study of fossils

Morphology - " " structure

Homology - similarity in structure

Analogy - " " use

Adaptation

September 2, 1920

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Jr 3

What is Evolution from Chap 1 Schmucker

I- Meaning of Evolution
Evolution is the production of new things from a change in the old.

II- Reasons for studying evolution
A- Evolution is used in every subject
B- The Meaning of evolution is usually misunderstood
C- It has been a means of solving the food supply

III- What is Organic Evolution
Organic evolution means that the plants and animals (organisms) of today are modified descendants of earlier forms.
1- Special creation
Old view was that each kind of plant or animal sprang into existence by itself and was unrelated to anything else.

Wells, Matthew [1731] Wallace Alfred - 1858 -
Variation, superfecundity, struggle for existence
survival of fittest, heredity

Periods in the study of Evolution

Chapter 3. Subsection

VI - History

I The Period of Speculation

At this time evolution was just an idea. Men thought about it and discussed it but did no special work to get definite results

II The Period of Observation

Began in the close of the 18th century. Men began to observe plants and animals, to compare them and note the differences and resemblances. Then they made such conclusions as seemed connected with these facts.

III The Period of Experimentation

Began at opening of 20th century. They actually produced new plants and animals. This has been of the most practical importance.

October 6, 1920

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Life of Darwin (Schmucker-Chap. 2)

Charles Darwin was the man who first collected all the material to prove to the world the theory of evolution and can be called the father of evolution. His theory is entirely correct but to best understand evolution we must study his work and so his life.

Darwin was born in 1809 on the banks of the Severn in England. He was a grandson of a scientist and a pottery maker, thus getting the good qualities of both. Being of a delicate nature, Darwin spent a great deal of his youth in the open. He was chiefly interested in collecting beetles. He went first to day school and then to preparatory school, but in either of these, the results were not very satisfactory.

At the age of sixteen, he went to Edinburgh to study medicine

but couldn't stand the work. At the age of nineteen he went to Cambridge to study ministry. He soon found that he was suited to that station. While there, however, he contracted a great friendship with Henslow, professor of botany and Sedgwick, professor of geology. Two years after his graduation, he spent with Sedgwick

Then thru Henslow's influence, he was offered the position of naturalist on the Beagle. England, being the greatest commercial nation needed accurate charts of seas and lands. She frequently sent out expeditions to do this work, and it was customary to send a young man along to study the natural history of the countries visited. The Beagle was one of such ships and was ready in 1831. At first Darwin couldn't get the consent of his father for the trip, but with the aid of his uncle, he

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Life of Darwin

finally gained the permission and at the age of twenty-two, Darwin started off on the journey that was to change his whole life.

On his way across the Atlantic, Darwin read the two volumes of Lyell's "Elements of Geology." He was greatly influenced by the subject matter of this book. Lyell's theory was that "the present is the clue of the past - that everything now has come from the past." He applies his belief only to geology.

The Beagle went first to Brazil where Darwin was most interested in two animals - the sloth - a creature that climbs around trees, and the armadillo - an animal whose skin is like a plated armour. After leaving Brazil they went to the La Plata region. There they found gigantic

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skeletons of 1- glyptodon and 2. megatherium. Here Darwin discovered that the glyptodon resembled the sloth and the megatherium the armadillo.

After that they went thru the straits of Magellan and up to Peru. Darwin studied the birds and insects there and then went west to the Galapagos Islands. Here Darwin discovered several things.

1- that the birds and insects there were like those of Peru.
2- the animals and plants of each island resembled each other.
3- the greater the distance between the islands, the smaller was the resemblance. He concluded that these islands were all one connected and joined to the mainland.

Then he studied the

coral islands in the Pacific.

The Beagle returned to England in 1836. Back at home again Darwin wrote a report on the voyage called "The Voyage of the Beagle. It is considered one of the classics of travel in the English literature. Three years later he married his cousin Maria Wedgewood.

As was usual then, Darwin gave out his collections of different things to various experts. He could find no one interested in barnacles, so he studied them himself for eight years. Later he published a book on them called "The Manual of Conspecies."

Meanwhile he worked on his species theory for proof. He studied the methods of plant cultivators and animal breeders. In 1838 he read a book by Malthus "An Essay on Population" which showed that since animals increase more rapidly than the food supply - only those who by

their cunning or strength can secure food are the ones that exist and survive. Here is the underlying principle of natural selection. Darwin did not publish his theory until 1859

Wallace had been studying the animal life in the Malay Archipelago and had also read Malthus book. He had no idea of what Darwin was doing but reached separately the same conclusion. He sent his essay to Darwin for reading. Darwin first impulse was to have his own publication but his friends would not consent and so both papers were read at a meeting of the Linnean Society. Wallace in his essay first used the phrase "the struggle for existence". Both papers met with opposition. In 1859 the publication of Darwins "The Origin of the Species by Natural Selection"

around still more discussion. The opposition continued but grew weaker year by year.

Darwin died 1882 and so greatly had opinion changed about him that he was buried in Westminster Abbey.

10/17/20

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Jr 3

Adaptation for the Species
Schmucker - Chap 5

I = Primary Sexual Character
Differentiation of sexual organs

II = Secondary Sexual Characters - more marked

A - Coloration
1 - Male more attractively colored
a - birds - robin, cardinal, tanager
b - insects - butterfly, bee

B - Song
1. Males have power of song to attract females
a - Birds -
b - Insects - grasshopper - wing & hind leg
katydid - " "
cricket - "
cicada - tymbal organ under side of abdomen

C - Peculiar performances or antics
1 - Flicker - dances
2 - Catbird - turns somersaults in air
3 - Ovenbird - flys upward and tumbles down
3 - Ostrich - sways from side to side on bare legs

D. Odor
1 - Moths.

E. Organs of prehension, mammary glands, combs,

E- Ornamentation
appearance of male more striking - for the love
1- Rooster
2- Peacock - tail feathers
3- Bird of paradise - "
F- Battling over the enemies for mate
1- canine teeth of bull seal
2- larger size " " "
3- horns of male deer in mating season
(male much larger than female (mice))
G. Caring for young
1- building homes - nest of birds
2- Provision for food of young
a- Ichneumon fly pierces body of potato-
stomato worm and lays eggs on body
b- Katydid lays eggs on tips of branches
to serve buds for food
c- Spiders lay so many eggs that larvae
eat each other

Japan - men large, women nice, kind,

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Facts that Suggest Evolution
Chapter 3 - Coulter

I - Intergrading Species

Various species are not always sharply distinguished from each other. This suggested to me the possibility that the exceptional individuals of one species or subspecies were beginning changes - to another.

Ex - 150 species of asters exist, but it is hard to tell them apart.

II - Adaptation -

Plants and animals become changed by new conditions of living.

Ex - 2 species of ranunculus - having one grows near water, smooth one in water. When the conditions of growth are reversed, the hairy form becomes smooth and the smooth form develops hair.

III - Rudimentary structures

Many plants and animals contain structures no longer used. This led to the conclusion

that these structures were used by ancestors and consequently these ancestors must have been different.

Ex- Teeth began to form in young parrots but do not mature.

IV- Testimony of Geology

In examining the record of geology, we find that long ago plants and animals existed utterly unlike those of today. Gradually, new plants and animals appeared until finally resemblances to the present forms were noted. At last our present plants and animals appeared.

V- Testimony of Embryology

In studying embryos we find structures that disappear before maturity, but these structures are often features of the adult bodies of other organisms. This suggests relationship between different forms.

VI- Changes under Domestication.

This topic has been discussed in the previous chapter. Man can produce and changes why can't nature?

VII- Morphology.

Homology

Analogy

October 20, 1920 Ida Kaplan Jr B

Evidences of Natural Selection
Chapter 4 - Coulter

I Effect of Domestication
Many cultivated plants look entirely different from their wild originals
Ex - Wild cabbage - small plant with rosette of leaves at base, long stem, and flowers. Its descendants are cultivated cabbage, brussels sprouts, collards, kohlrabi, kale cauliflower.

II Control of Changes
Man selects the changes he wishes to produce.
Ex - wild potato has small tubers. Man chose the variation of larger tubers for propagation. This process is called artificial selection

III Natural Selection
Darwin concluded that the same sort of selection is going on in nature. More individuals are born than can survive. Nature has provided a competition among individuals and selects favored variations. The favored variation

so best equipped to live in the existing
conditions. As long as the conditions
exist, the war nation will be increased,
and finally a new species formed.

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Adaptation for the Individual

Schmucker – Chap 5

Adaptation – is the fittedness of an animal to its environment. The fittedness ~~has~~ has been brought about by modification or adjustment.

I – Specialization [illegible] adaptation [illegible]
Adaptation in the struggle for food

A – Insects
1 – Biting mouth parts – grasshopper
solid food
2 – Sucking mouth parts – butterfly
liquid food
3 – " and biting mouth parts – bee
4. " "piercing" " – mosquito

B – Birds
1 – Bills – robin, sparrow, eagle
worms, seeds, flesh
2 – Claws ——— ——— "

C – Mammals
1 – Teeth
a – Canine – tearing, best in carnivorous beasts
b – Incisors – gnawing – " " rodents – rat
c – Molars – grinding – " herbivorous " horse,
2 – Long neck of giraffe helps it to get food high up in tree

II- Adaptation in the struggle for shelter

A. Brave cold and the changes of seasons
1. warm blooded animals
a- Birds - feathers } to
b- Mammals - fur and hair } cold
c - Birds - migrate or alter their diet
d - Mammals - shed hair and fur in summer
hibernate in winter
store food

2- Cold blooded animals - change temperature of body with the surroundings.
a- fish may freeze under ice & thaw and come to life again
b- amphibians hibernate

III- Adaptation for Protection from Enemies
A- Structures that serve as weapons
1- Horns - rhinoceros - goats
2- Tusks - walrus, dog
3- Claws - eagle

B- Coloration
1- Protective - grasshopper family. female birds, fish (both sexes) caterpillars, moths (wings & trees like bark of tree)
2. Variable - chameleon, - changes with surroundings
weasel - white in winter,
ermine - brown in summer
quail -
ptarmigan } "

3- Bright color as warning
Hornet, monarch butterfly.
4- Protective mimicry
monarch - viceroy
bee - bee fly.

C- Power to make themselves disagreeable
1- Odor - skunk, toad squash bugs
2- Taste - monarch butterfly
3- Spines - porcupine
4- Stings - bees, wasps
5- Fangs - snake
6- Shells - turtle
7- Scales - reptiles

II - Habit of remaining quiet
1- playing dead - opposum, rabbit
C- Protective forms
1- Walking stick - twig - Kallima butterfly
2- Katydid - leaf
V Adaptation for Flight
1 Wings
a - Birds - swift or jerky flight
b - Insects " butterfly
2. Strong hind legs - grasshopper
locust
katydid
3- Long slender legs - deer
4- Running toes - horse

December 1st 1920 Schmucker Chap 7

How the Mammals Developed

I- Methods of Reproduction

A- Asexual

one parent - a part of the old parent grows into the offspring

1- Division {fission - bacteria
budding - {yeast, coral polyps
pouch, offspring, yeast

2- {Grafting - apple tree
bud, stem, stock
Budding - peach tree

3- Spore formation - mushrooms

4- Cuttings - potato - geranium

B- Sexual

There must be union of male and female element - takes place in higher plant and animal life

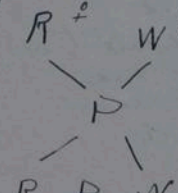
II- Plant Breeding

A- Artificial Selection

The best are selected to produce better species

B- Hybridization

Placing pollen of one variety of plant on stigma of another variety the offspring is the hybrid.



By "pure" type we mean planting only the seeds of the pink plant in order to give only pink flowers. By disregarding all but seeds from pink flowers, we would get more pink flowers every succeeding generation. After a certain time we get all pink plants we say that they are coming true to seed. If a red flower blooms on a plant later we say it has reverted to type.

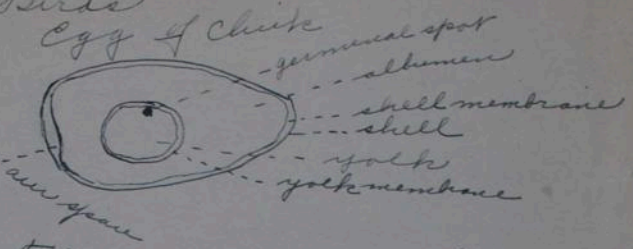
A Results of Hybridizing
1- able to change size, quality and form of plant
2- have been able to change time of maturing which allows greater number of crops and ability to grow in new conditions of soil and climate
3- Secured plants immune from fungi
B. Plants that have been hybridized
Corn, sweet peas, grapes, plums, blackberries, orchids, gladiola wheat (made free from rust) Sea Isle Cotton, citron and watermelon
C- Limits of Hybridization
Plants must belong to the same family

III- Development of Mammals
A- Classes of vertebrates
1- Fish
2- Amphibians
3- Reptiles
4- Birds
5- Mammals
B. Method of Reproduction
1- Sexual
a. Fish
The female fish lays eggs which passes to the water. They are left to chance that the sperm

cells and the male will meet them
Provision for the young - the
fish live on the yolk until the
food is used up. The sun
fish provides shelter for the young
b. Amphibians
The eggs leave the body of
the female and are fertilized by the male. A bitter
gelatinous substance forms around
them so that no other animal
will be tempted to eat them
The eggs are larger than
fish eggs and contain more food
thus giving greater chance for
development
The males have the power of
attracting the females (frogs sing)
c. Reptiles
turtle
Lays only 20 eggs. These are
not laid at random in the
water but are deposited in a pit
scraped out by the female. The
eggs are large and fattened
with yolk and so they are
more fully developed when the
eggs are hatched. The egg is en-
closed in a tough leathery shell
and therefore must be fertilized
before laid.

Birds

Egg of chick



The amnion is a bag which encloses the embryo. This is filled with a watery fluid and protects against shock and jar. The allantois is a sac which acts as a lung. It connects to the air and to the chick. The position of the egg must be changed to prevent the allantois from becoming fastened to the shell. The chick gets food by absorbing it from the yolk. At the place where the food is absorbed, the allantois is also attached. Any food left over slips into the abdomen and the place heals over

Comparison of Reptiles and Birds

1 - Large eggs and abundant food
2 - Covering of eggs - tough shell (lime)
3 - Fertilization in body of female
4 - Scaly body of reptile - scaly legs of bird

E - Mammals

1 - Born alive and comparatively well developed
2 - Feeding habits - first food - milk of mother from mammary glands.

(not completed)

A heavy brass knocker now hangs as of yore,
Peacefully, silently, outside on the door.
A century ago when this house was built
And the beds all bedecked with home-spun quilt,
This same knocker - from England it came -
Hung on the door, and in the window frame
There burned a candle in a holder of brass
To light the way of the lover to his lass.
She was a sweet maid and unusually fair,
Gracious, kind, and quite debonair.
There by the window she invited her lover to hold
As he rode down Briar Lane, then gallantly told
Of the love that he bore her. One happy day
Far off into town he took her away.
In parting, she said to Dame Pickwick,
"Mother, do give me this knocker and yon candlestick,
For often have I sat by the light of the one
And so often has Charles struck the other when the sun
Was sinking o'er Briar Lane, that to have both would please
It would give me! And they left with their treasure.
Now you, dear Lady, with the other sweet lasses,
Have given to me these same pretty brasses.
In an ancient old shop in Philadelphia town,
Some of you this knocker and candlestick found.
Always will the knocker hang on the door;
Always the candle will burn as of yore
To welcome each one of you whose kindness of heart
Has helped me the better to play my part.

This belongs with material sent Dr. Seifriz

By Dr. William Seifriz
thanking Botany class at U of Pa
for gifts (late 1920's)