IN COLD WEATHER THEY STUDY HEAT

Nature Classes at State Normal Show How to Read Science In Winter.

SUNSHINE AS ENERGY.

Familiar Facts That Seem Wonderful When Their Causes Are Ascertained.

IN nature study, what shall we teach in the schools from December to March? Within range of easy observation there are no plants growing, no weeds in the fields, no leaves on the trees, no birds except sparrows, few animals except those domesticated. What, then, is the most obtrusive and insistent feature of nature at this time? Various answers to this question were given by normal students at the state university. One said the weather; another, the cold weather; a third, the snow and the storms; a fourth, heating and ventilation; a fifth, clothing and the housing of animals; a sixth, the heat of the sun; a seventh, coal and fuel; and an eighth, the starry heavens. If we are to consider at this time that aspect of nature which impresses us most, these spontaneous responses indicate that we should investigate the subject of heat, especially the heat of the sun, and such other topics as naturally relate to this center and source of all heat, light, life and motion upon the earth.

WHERE TO BEGIN.

Sir Henry Ball begins a series of lessons on this subject by calling attention to the familiar fact that the nearer we are to the source of heat, say to the fire on the hearth, the hotter it is. We may take an imaginary journey to the sun, carrying in our hands a wax candle, a leaden bullet, a penny, a poker, and a piece of flint. Then, supposing ourselves able to endure any degree of heat in our journey towards "the light of the world," what will happen to the materials we have agreed to take with us? The wax candle will soon begin to melt from the increasing heat. Before long, as we get nearer to the source of heat, the leaden bullet, which has been growing hotter and hotter, will also melt and flow from our grasp, just as the candle did.

The penny is only hot, and has not melted yet, for we are still far from the sun; but it finally gets red-hot as we pursue our journey, till it melts into a liquid, while the poker, already red hot, begins to turn white as we come nearer to the great fire. When it becomes so brilliant in its whiteness that we can no longer bear to look at it, the iron poker follows the example of the other materials, and only the flint, glowing with the same fervor, remains unmelted. Finally it yields also and becomes a liquid from the intensity of the heat. Yet we are far, far from the surface of the great globe of fire toward which we started. It is now hot enough to melt flint; but at the sun's surface, scientists tell us, the heat is many times greater than that necessaray to melt the hardest rock. Since, however, no one has ever taken such a journey as we have imagined, how do we know that the heat of the sun will be sufficient to melt all known substances, before they even arrive at its surface? Let us see.

HOW THIS IS PROVED.

Take a burning or reading glass or an ordinary lens and let the sun shine through it at midday. Hold one hand at the brightest spot, or focus of the lens; it gets hot. On a summer day the focus will give heat enough to set fire to fine paper or wood cinders, and will readily ignite matches. Why does the lens have this power? It collects the rays of sunlight and brings them to a point (focus). Each ray contributes a little light and heat; and the sum of these contributions makes considerable.

Now try the lens with a candle flame. Gather its rays and place your hand in the focus. It is not hot. The lens simply cuts off some of the heat from the candle. What does this show? That a lens cannot increase the total amount of heat coming from any heated object. Try an electric lamp with the lens. It will light matches; still it is less hot than at the point of light itself. And this is always true. Yet lenses have been made, which by concentrating the sun's rays have melted steel and other substances which the hottest furnaces would not melt. What, therefore, must be the temperature of the sun? Since, from the above experiments the heat in the focus of the great lens must be many times less than the heat at the surface of the sun itself, it follows that the heat at the sun's surface is many times greater than that which will melt the most refractory substances found on the earth's surface.

WHY HIGH PLACES ARE COLD.

Now arises a peculiar difficulty. Why does it become colder the higher we go upon the mountains? If, as above explained, the nearer we get to the sun, the greater will be the heat, why are the tops of the mountains always covered with snow? This is primarily due to the action of the earth's atmosphere. While the sun's rays are passing through the air to reach the earth, not much of the heat is retained in the air unless the air is very cloudy. That is the soil, or the rock, of the earth gets hotter than the air. When the earth has been heated by the sun's rays, it proceeds to give out its heat to the cooler air in contact with it. Now, however, the air can absorb more of this heat, and can reflect more of it back to the earth, than it can when the heat comes directly from the sun. The power of the heat radiated from the earth appears insufficient to pierce the atmosphere; and on its return journey from the earth toward the sun, the heat is largely retained by the atmosphere or is reflected back to the earth. This is especially true if the atmosphere contains much vapor of water. Moreover, the heat is naturally greatest where the atmosphere is the most dense and heavy. But the air is heaviest at the lowest places, in the valleys and at the sea level, since if these places it must be pressed down by the weight of all the air that is above it. Therefore the layers of air that are heaviest, which are also the lowest,, will retain the most heat; while those which are higher and therefore lighter, will retain less of the earth's heat and will let the earth get cold at great elevations, because of the loss of the heat radiated from the earth itself.

A COMPARISON.

It is true that we are nearer the sun, the source of heat, when at the top of a mountain, than when in the valley; but if we should ascend to the top of the highest known mountain, we should have gone only one ten-millionth of the distance to the sun. If there were a small bonfire on the mountains yonder, a little further than two miles away, say 200,000 inches, how far should we have to approach toward the fire on the mountain to equal the same relative proportion of the whole distance, as the highest mountain is of the distance to the sun? Making the calculation we see that one-fiftieth of an inch is the same proportion of 200,000 inches that 30,000 feet is of the sun's mean distance. And we know that to approach one-fiftieth of an inch nearer to a bonfire two miles away would not make any appreciable difference in the amount of heat we receive from it.

WORK OF SUNSHINE.

Sunshine is a sort of motion that travels by oscillations, or waves, of the invisible ether that fills all space. This vibration comes from the sun at the rate of 186,000 miles per second. The oscillations, or waves, of the mysterious ether are so rapid, the ether being so fine and light, that the earth's atmosphere, composed of particles so large and gross in comparison with ether, does not take up the wave motion of the either—does not get warmed much by the passage of the heat from the sun to the earth. But upon striking the earth's surface, the soil grains take up a portion of this motion and transmit it to the molecules of air in contact with the earth, causing the air molecules to oscillate or vibrate more rapidly in little circuits called "waves." This vibration expands the air, which rises, being displaced or forced upward by the cooler and heavier air round about. This is a wind—the energy that drives the sailship, turns the windmill, etc., and is an effect of transformed sunshine.

HEAT ENERGY IN WATER.

When sunshine falls on water, the molecules at the surface are thrown into violent motion, are separated from one another, and rise as vapor into the air, thence to fall as rain or snow, and to return to the ocean, whence they came.

Some of the energy of the sunshine, however, does not rise in air currents stored in the vapor of water, but goes deeper into the soil there to be stored in the form of the increased motion which it causes among the soil molecules. This soil motion increases from spring to midsummer and then gradually slows down during fall and winter. The annual increase or income of heat from the sun is about equal to the annual out-go from the earth, since the soil molecules can give up their motion (heat) only by transmitting it to other molecules—those of the air, the water, the rocks. This work of the sun in giving to the earth the energy of motion that causes plants to grow and to turn all of our machinery, Lord Kelvin estimates to be, for each cubic mile at the earth's surface, 22 horse power; and since 186,680 cubic miles of sunshine arrive each second at any square foot of the earth's surface, there is about one-seventh of a horse power of energy exerted every second by the sunshine.

WORK OF THE AIR.

Thus it is the atmosphere that keeps the earth warm. It permits the short either waves to pass through as they come from the sun; but the motion which these waves set up among the earth molecules of the soil is slower, and these longer waves cannot pass back through the air without setting its molecules swinging. Heat is this motion, and atmospheric warmth is imprisoned sunshine. Without an atmosphere, Langley has shown that the earth's surface, under the equator at noon, would be 328 degrees F. below zero, and no form of life would be possible on this planet. Composed primarily of 20.61 cubic feet of oxygen, 77.18 of nitrogen, and .78 cubic feet of a recently discovered gas called argon, with varying quantities of water vapor (average 1.4) and of carbon dioxide (.04), as well as smaller quantities of nitric acid, ozone, and ammonia, the last six forming 97 per cent of all the materials built into plants, the air performs a very important work in transporting both the food elements and the waste products to and from every living thing. It carries water and oxygen to animals, the other ingredients to plants; and the cycle which these substances make through the bodies of animals and plants, through air and sea, through land and rock, is the central theme of this line of science.

HERE IS MORE PROOF

THAT DR. WILLIAMS' PINK PILLS CURE RHEUMATISM.

Efforts to Get Relief Often Unsuccessful Until the Tonic Treatment Is Given a Trial.

"When I was a boy of sixteen," says Mr. Otto H. Rose, a retired grocer, of 1226 Lexington Avenue, Indianapolis, Ind., "I met with a serious accident which injured the bone of my head over the right eye. I recovered from the accident to all appearances, but not many years after I began to have intense pains in the injured bone, which came on every year and would last from a few days to several weeks.

"I consulted the doctors who told me that I was suffering from neuralgia. The sight of my right eye was affected, so that at times I could scarcely see out of it, while both eyes watered constantly. During these attacks I was often dizzy from the terrible pains. The pains came on every morning and passed away in the afternoon. I never suffered from the pain at night.

"I tried without success to get relief until a friend told me to try Dr. Williams' Pink Pills. When I had taken a few boxes I felt the pain growing less intense and in a much shorter time than I had hoped for I was entirely cured. I have recommended the pills to several persons, who have used them with good results.

"My wife uses Dr. Williams' Pink Pills for nervous headaches and finds them the best medicine she has ever used as they give relief where all others fail."

Dr. Williams' Pink Pills have cured neuralgia, nervous headaches and prostration, dizziness, partial paralysis, St. Vitus' dance and locomotor ataxia, because they feed the nerves and give health to every tissue of the body. They are unequalled as a blood builder and are especially valuable in rheumatism, anaemia, after-effects of the grip and fevers, because they reach these diseases at their root and also start right in to tone up the whole body.

Dr. Williams' Pink Pills are sold by all druggists or sent, postpaid on receipt of price, 50 cents per box, six boxes $2.50, by the Dr. Williams Medicine Company, Schenectady, N. Y.

An instructive booklet, entitled "Nervous Disorders," will be sent free on request to anyone interested.

Piles Quickly Cured at Home

Instant Relief. Permanent Cure — Trial Package Mailed Free to All In Plain Wrapper.

Piles is a fearful disease, but easy to cure if you go at it right.

An operation with the knife is dangerous, cruel, humiliating and unnecessary.

There is just one other sure way to be cured—painless, safe and in the privacy of your own home—it is Pyramid Pile Cure.

We mail a trial package free to all who write.

It will give you instant relief, show you the harmless, painless nature of this great remedy and start you well on the way toward a perfect cure.

Then you can get a full-sized box from any druggist for 50 cents, and often one box cures.

If the druggist tries to sell you something just as good, it is because he makes more money on the substitute.

Insist on having what you call for.

The cure begins at once and continues rapidly until it is complete and permanent.

You can go right ahead with your work and be easy and comfortable all the time.

It is well worth trying.

Just send your name and address to Pyramid Drug Co., 65 Pyramid Building, Marshall, Mich., and receive free by return mail the trial package in a plain wrapper.

Thousands have been cured in this easy, painless and inexpensive way, in the privacy of the home.

No knife and its torture.

No doctor and his bills.

All druggists, 50 cents. Write today for a free package.

CIVIL SERVICE EXAMS.

For Positions Ranging From $900 to $2,500 a Year.

There will be civil service examinations in this city Feb. 27, for the position of second class (or assistant) steam engineer, custodian service, at $900 per annum, in the federal building in this city; also for the position of assistant assayer, mint and assay service, at $1,250 per annum. The duties of the assistant assayer are to receive, weigh, and melt deposits of bullion; to assay gold bullion of various characters and fineness; to make the necessary computations to determine the value of each deposit, and to determine gold, silver, lead, zinc, and iron in ores in general.

There will also be an examination, March 6, for the position of irrigation manager, department of agriculture, at $1,800 to $2,500 per annum. Applicatns for this position must indicate in their applications that they have had scientific education equivalent to that required for graduation in the agricultural colleges in the United States, and also five years' experience in canal management or irrigation practise. The duties of irrigation managers will be to direct experiments to determine the best methods of operating canals and applying water to crops, and to give practical advice and direction to farmers about methods of irrigation to be followed.

The examinations also include those for the position of supervising drainage engineer, department of agriculture, at salaries of $2,000 to $2,500 per annum. Applicants for this position must indicate in their applications that they have had five years' experience in responsible charge of drainage work, and are able to design and direct the carrying out of important projects in land drainage. Supervising drainage engineers will be required to supervise surveys and investigations looking to the reclamation of agricultural lands by drainage and to conduct experimental investigations of special problems in farm drainage.

Then there will be examinations for irrigation farmer, department of agriculture, with salaries $720 to $1,200 per annum. Applicants for this position must indicate in their applications that they have had five years' practise in the operation of ditches or irrigating crops. Irrigation farmers will take charge of the irrigation of the experimental farms carried on as a part of the irrigation extension work of the office of experiment stations.

ELY BANK MERGER.

H. P. Clark, a Salt Lake Cashier, to be The President.

The White Pine Counay Bank of Nevada will be merged with the First National bank, both of Ely, and the consolidated concern is to occupy the present quarters of the former until the completion of the $50,000 Myers building. H. P. Clark, cashier of the Commercial National bank of this city, will be the president of the First National bank, with A. D. Myers as vice president, A. B. Witcher, formerly manager of the Utah Savings Bank & Trust company of this city, is to be cashier, with John Biggane as assistant cashier. This does not necessitate Mr. Clark's removal from this city; but he will make periodical trips to Ely in connection with the business of the bank there.

NEW REGULATIONS

Whereby Militia Forces Are Enabled to Secure Share of Govt. Appropriation.

Conolenl H. M. H. Lund is in receipt of a copy of the new regulations which the militia forces of the country must conform to in order to secure any share of the government appropriation. These regulations prescribe that the minimum strength of company commands in the infantry, cavalry, engineer and signal branches shall be 58 enlisted men. An ambulance company must have 43 men, field hospital 33, coast artillery 63, and field artillery 133 men. There is only one company command in this state that has over 50 enlisted men, and that is C company, First infantry, of this city. However, Colonel Lund believes that with special effort, the various company commands in this state can be increased to the statutory strength, though some difficulty may be experienced in recruiting the battery up to 133 men, in time to pass the April inspection.

It is interesting to note that the war department proposes to utilize the national guard of the states into a national reserve; and to expedite the mobilization of the organized militia, ordered into service, the war department, after consultation with the state authorities, will designate convenient places in the states for assembling of forces, the federal government meeting all authorized expenses incident to this preliminary concentration from the day the militia appear at their places of company rendezvous.

It is also stated that in addition to equipping the men, the states must purchase cooked food for them when they can not use rations in kind, and for that purpose an allowance of 60 cents per day is authorized for each man, which is increased to 75 cents when traveling. These bills are to be by the United States, as well as for transportation. States that the U. S. standard of physical examinations for recruits can have their troops mustered in at once, but it is provided that in every case a physical examination must be made by an army medical officer later on, and "to facilitate the settlement of pension claims," the militiamen will again be examined prior to being mustered out. After the state troops are mustered into the federal service, they will lose their identity as part of the organized militia, and become a similar unit in the volunteer army, complying with all conditions and requirements of the same.

EVENING OF MUSIC.

Prof. Evan Stephens to Lecture at Emerson Ward Tomorrow.

The previously announced lecture and song recital at Emerson ward will take place tomorrow evening at 6:30 and the public is invited. Prof. Evan Stephens will lecture on "Music," and a number of his compositions will be rendered by the choir under the direction of Fred. C. Sanford. Mr. Will D. Phillips, tenor, will also render a number of selections. The program is as follows:

Anthem, "In Our Redeemer's Name," ..... Stephens
Choir.
Duet, "Larboard Watch," ....Williams
Messrs. Will D. Phillips and Fred C. Sanford.
Tenor solo, "The Heavenly Song," ..... Gray
Mr. Will D. Phillips.
Remarks ..... Prof. Stephens
Tenor solo, "He Leadeth Me,"... ..... Ashford
Mr. Will D. Phillips.
Remarks ..... Prof. Stephens
Anthem, "Song of the Redeemed," ..... Stephens
Choir.
Tenor solo, "The Ransomed of the King," .....W. A. Phillips
Mr. Will D. Phillips.
Remarks ..... Prof. Stephens
Anthem, "Let the Mountains Shout for Joy,"..... Stephens
Choir.

Marriage Licenses.

The county clerk issued marriage licenses during the past week to the following couples:

Cleveland Chase, Springville; Hazel R. Robinson, Bingham.

W. T. Jones, Cobra, Nev.; Gladys Thomas, Ogden, Utah.

John G. Sulivan, Park City; Mrs. M. A. Conydon, Greenwater, Cal.

George W. Rauch, Salt Lake; Addie Mundinger, Salt Lake.

Frank R. Robinson, Salt Lake; May Johnston, Salt Lake.

J. W. Pearce, Salt Lake; Helen Wachter, Denver.

Fred A. Groth, St. Louis; Elsie Strach, Salt Lake.

Rex Pehrson, Wilford; Hildur Petterson, American Fork.

Joseph R. Anderson, Salt Lake; Ida M. Heath, Salt Lake.

John S. Earley, Salt Lake; Maude A. Pringle, Salt Lake.

Frank M. Williams, Salt Lake; Edna M. Giles, Salt Lake.

Walter East, Salt Lake; Hilda Pearson, Sandy.

John Hagerman, Goldfield, Nev.; Katherine Bowes, New York.

Joseph H. Horrocks, Salt Lake; Myrtle I. Peterson, Salt Lake.

Austen M. Ericksen, Salt Lake; Margaret Ryan, Salt Lake.

Herbert J. Willard, St. Johnsbury, Vt.; Mrs. Jennie Gannett, Canyon City, Colo.

Henry F. Webb, Salt Lake; Mattie Glenn, Salt Lake.

Elliott C. Moore, St. Louis; Clara Wheeler, St. Louis.

Henry Holeman, Salt Lake; Esther Purcell, Salt Lake.

James H. Tripp, Salt Lake; Sarah E. Page, Salt Lake.

Walter C. Cooper, Bingham; Emma Monkhouse, Bingham.

Albert L. Davis, Ogden; Mary G. Meyer, Ogden.

Oto C. Millerburg, Salt Lake; Minnie E. Shettle, Salt Lake.

Thomas E. Cochran, Del Norte, Colo.; Clara H. Fairbanks, Del Norte, Colo.

Earthquake Money Unclaimed.

FRANCIS G. LUKE.

The heirs of the following people can recover the unclaimed money in San Francisco banks by communicating with us and proving their relationship:

Sarah W. Allen, formerly Mass.
R. S. Seymore, formerly Mass.
William H. Baxter, Cal.
Dan Cameron, Nev.
William Cox, Cal.
Winfield S. Davies, Cal.
William H. and F. P. Dunphy, Me.
Christian F. Helmkamp, Cal.
Ellen M. Stevens, Cal.
George H. Talbot, Mass.
Peter Wilkinson, Cal.
Charles Habersang, Cal.
Carl Schwartz, Cal.
Fannie Carlton Batcheller, Colo.
Michael Buckley, Cal.
Richard Corbett, Ariz.
John S. Dugan, Mont.
C. B. Freskeberg, Cal.
James C. Gilligan, Ariz.
James Graham, Cal.
Charles Hughes, Cal.
Joseph Klenger, Cal.
Charles W. Lynch, Cal.
Anna B. Kuster, Cal.
Joseph Loreton, Cal.
Dennis Minihan, Nev.
Catherine Murphy, Cal.
Thomas Murphy, Ore.
Mrs. Maggie P. McCarthy, Mont.
T. J. McCullough, Wash.
Lawrence or Emma Stross, Mexico.
Miss Ellie Sullivan, Nev.
Joseph Thompson, Cal.

¶Addresses of all the above people are lost. Money will be confiscated to the State unless claimed by relatives. Interested parties should communicate with us at once, and to enable us to identify the subject matter, always refer to the earthquake money.

MERCHANTS' PROTECTIVE ASSOCIATION
Scientific Collectors of Honest Debts,
FRANCIS G. LUKE, Gen'l Manager.
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"SOME PEOPLE DON'T LIKE US."