T. That will do. Extinguish the lamp, take your seats and let us see what the meaning of this experiment is. How cold was the ice when it was put in the vessel to be heated?

S. About 32 degrees, because it was melting in the room before it was put in, and ice water is always about that cold.

T. When we heated the ice for seven minutes what was the result?

S. It was all changed into water which was as cold as the ice itself.

T. Quite correct. Seven minutes heat of our lamp flame simply changed the ice into water without raising the temperature. But how many minutes of heating raised the 32 degree water to about 212?

S. Nine.

T. The nine minutes of the flame caused the temperature to rise from 32 to 212 degrees. How many degrees of heat were added to the temperature of the water in these nine minutes?

S. 212 less 32 180 degrees.

T. Well, if nine minutes of flame raised that water 180 degrees in temperature, how many degrees do you think the seven minutes of flame should raise cold water?

S. 9 : 7 :: 180 to 9 : 7 :: 180 : 140 140 degrees.

ANOTHER S. If nine minutes give 180 degrees, one minute will give twenty degrees. Therefore seven minutes should give 140 degrees.

T. Very good. You see then that to melt the ice without making it any warmer to the thermometer you had to spend as much lamp flame or heat, as would raise the water 140 degrees. I may tell you that if we had more accurate means of trying this experiment we would get, as others who have tried it, something over 142 degrees of warming of water as equal to that heat which hid itself when the same water was simply melted from ice into ice-cold water. That heat which appeared to be lost or hid in the melting of the ice is called the *latent* heat of ice, from a Latin word which means hidden.

Now, does water freeze solid as soon as it is cooled down to 32?

S. No. First a thin skiff of ice comes over it. Then the ice grows thicker and thicker the longer the great cold lasts. It takes quite a time for ice to form quite thick, just as it takes time for the ice to melt.

T. If cold is due to heat being taken away from it, then as the ice grows thicker and thicker, will heat be going into the water that is freezing or will it be leaving it?

S. Heat must be leaving it and going into the colder air around it, because the more of water which is frozen, the more cold there must be in it, which is the same as saying the less heat in it.

T. Very well: if the heat of the freezing water is passing into the colder air freezing it, what effect will that have on the air?

S. It must make the cold air somewhat warmer than it was before.

T. Then, when the cold winds of November and December come here what must happen?

S. When the water in the clouds, and in the earth, and in the swamps, and in the brooks, and in the rivers freeze, it must make the cold air warmer.

T. Then the cold air made by the low sun at the commencement of winter must be warmed by the cooling waters, even when the process of freezing is going on. What effect should that have on early winter weather after the 22nd of September?

S. It would tend to make the weather warmer than would be natural simply to the warming effect of the sun.

T. Now let us see what would happen before all the ice which now lies in the shape of snow and frost over all the country is melted. Can we expect warm summer weather while there is ice around?

S. No. For the ice will keep the weather cool until it is all melted, as the ice kept the water cool in the vessel we were just heating.

T. Very good. Suppose there are a million tons of water in a state of ice or snow over these provinces, how much heat would be required to melt it before the weather could be expected to begin to grow warm?

S. Well, I suppose, as much heat as would raise the same amount of water 142 degrees in temperature. But as melted water is 32 degrees, 142 degrees more would make it 174 degrees hot, which would be scalding hot.

T. Correct. As much of the sun's heat will become hidden in melting the snow and ice formed all over the country as would raise the same water, ice-cold to the scalding heat of 174 degrees. And only then would the water begin to warm up. That is a very good reason why the 22nd of March is as much colder than would be due to the height of the sun, as the 22nd of September is warmer than the same average temperature.

JACK. Then, we really borrow a great lot of heat from the water everywhere in the fall, and have to pay back the whole in the spring.

T. That is just it. We borrow at least a month in the fall; but we have to pay it back in the spring. For the 22nd of October is more like the 22nd of April than is the 22nd of September like the 22nd of March. And all this is due to the borrowing of heat from the water before winter, every unit of which must be paid back in spring to liquefy the ice, after which it is possible for the country to become warm. That is why winter lingers in the lap of spring,—lingers for the liquidation of the heat debts of the fall and winter, which are represented by the great snow banks and the cold watered stock of the season.