lous motion in the wood, which sets the air in motion all round about; and this makes a sort of circular wave, beginning from a point which gradually enlarges, one circle of the air of the atmosphere striking against another, until it reaches the ear, unless it meets with some hinderance in the way; just as when you throw a stone into a smooth pond, a wave, beginning from the stone, spreads in every direction, until it reaches the bank. The air is as necessary to continue the sound up to your ear as the water is to make the wave come up to the bank.

Sound goes much quicker in water—nearly four times as quick as in air, and in solids from ten to twenty times quicker; so that if you splash in the water at one end of a pond, the fish would hear you much sooner than a boy standing at the opposite side would do.

Now, in order that you may understand how well solids convey sounds, the next time you see a solid log of deal, or timber not very knotty and broken in the grain, at the carpenter's shop, set one of the boys to scratch at one end of it, and the rest of you go and listen at the other. Try the same on a block of stone, marble, etc.

But perhaps this will amuse you more: when you see the kettle on the fire, and you cannot tell whether it boils or not, place one end of the poker on the lid, the other to your ear, and it will tell you. If you strike with a hammer on a solid wall at one end, and some of you go and fix your ears against the other, you will most likely hear the sound of the blow twice—the first going along the wall you may call the wall-wave (coming more quickly), the second, a little after, through the air, coming with the air-wave, we have talked of before. Try if you can hear two reports of the same knock by tapping with a hammer at the end of a log of wood—one along the wood, the other along the air.

You have heard of the wild natives of America—when they think their enemies are near, they lie down on the ground, and, by applying their ears to it, they can judge of the distance, and hear sooner than through the air.

Did you ever hear what is called an echo?

Supposing you were to clap your hands violently together, that creates a wave in the air which carries the sound along with it; now, if this wave happens to meet with a wall or a rock, or any obstacle in its way, it is checked and beaten back, and so brings the sound with it a second time to your ear; and again, after passing you, if it met with the same sort of obstacle on the other side, it would be sent back again, and so strike your ear in passing and repassing, losing a little every time until it entirely died away. This would be called an echo; people living in a flat country have not so many opportunities of observing it as those who inhabit a craggy and mountainous one.

Water—a fluid at the common temperature of the atmosphere. Have you ever seen it solid? In winter—in frost—it is then ice. —How high does the thermometer stand when water begins to freeze? 32o.—Look at the thermometer in the room, how high is it? 52o.—How many degrees above the freezing point?—Does it increase in volume when it becomes ice? Water from the temperature of about 29o, expands as it grows colder, and at 32o, when it becomes ice, expands so as to crack water-bottles, water-pipes; a piece of ice floats in water, part of it being above the surface; if it were of equal weight with the same volume of water, it would just sink so as to have no part above.—You should never let water stand in leaden pipes, or in vessels likely to be broken by its freezing in severe frosts. This expansion of water in becoming ice, how serviceable to the farmer, in some soils, in pulverizing and making them fit for vegetation—good for gardens, etc.

"That water contracts in reducing the temperature to about 40o, and below that again expands, is easily shown, by taking two equal thermometers, the one filled with water and the other with spirit; placing them in melting ice, the spirit one will gradually fall to the freezing point, but the other will fall to about 40o, and then begin to rise. By Act of Parliament, the temperature at which the specific gravity of spirits is determined by the excise, and at which the standard weights and measures are adjusted, is 62o of Fahrenheit."—DANIEL's *Chemical Philosophy*.

Quicksilver, unlike water in this respect, contracts and becomes denser in becoming solid. It has been ascertained, by leaving it exposed to the cold in high latitudes, where it has assumed a solid form, and observing the temperature at which it begins to thaw, that the freezing point is about 40o below zero of Fahrenheit.

Attention may be called to the way in which the roads are raised up in winter by the freezing of the moisture within them—how after a thaw a loaded cart or waggon sinks in, causing deep ruts—how rocks and stone, which have absorbed much moisture, split after frost—parts of buildings peel off, etc.

Can water be made into a vapour—something you cannot see? By heat it becomes steam, thermometer 212o at the average pressure of the atmosphere; one inch of water makes about a cubic foot, 1728 inches, if further heated it exerts a greater pressure in trying to escape, pressing on the surface of the vessel in which it is. This is the property which makes it so serviceable to us in grinding our corn, moving the machinery for spinning and weaving, of steam-boats, etc., and as a motive power on our railroads, carrying us forty or fifty miles in an hour. If cooled below 212o it immediately falls back, shrinks up into one inch, and becomes visible water again, giving out a great deal of heat;—instance steam raising the kettle-lid.

Why does the tea kettle, just before boiling, very often force out a quantity of water from the spout? Because the air, driven from the water by heat, and the steam which is forming from the water, rise to the top, and the lid happening to be air-tight, it cannot escape, and being lighter than water it cannot descend, so the vapour or steam under the lid increases and expands, and, pressing upon the surface of the water, forces it out at the pipe.—Did you ever see on a frosty day, when you were going with a team, what you call the breath of the horses, or your own breath?—Yes, Sir.

Teacher. The warm air from the horses' mouths, or from your own mouth, containing vapour which you cannot see when the air has a certain degree of warmth in it, as soon as it comes in contact with the colder air gets cooled, and the steam or vapour becomes water (is what they call condensed), or perhaps watery vapour, which you can see, instead of a vapour which you could not see.

Did you ever see sugar or salt melted in water? No, Sir; but we have seen sugar in tea.—Then the teacher takes a small phial containing water, and puts in a certain quantity of salt, when entirely melted they see the fluid perfectly clear; increase the quantity beyond what the water will take up, this remains undissolved. If the temperature of the water were increased, it would take up more; in the same way the air will take up a greater quantity of vapour the warmer it is, and coming from the mouth warm, it holds more vapour than it is able to do, when it comes in contact with the cold air, and throws some of it down, so that you can see it; thus water on the inside of the window in frosty weather—dew on the outer surface of a bottle of cold water in hot weather, etc.—the quantity of watery vapour in the air in hot climates greater than in cold, hence torrents of rain when it is suddenly cooled, etc.

About London, latitude 51o 30', the average fall of rain in the year is about 23 inches; while in Rome, latitude 41o 54', it is 38 inches; at Calcutta, latitude 22o 34', it is 81 inches; and in climates like the West Indies upwards of 100 inches; but though the quantity of rain falling in hot countries is greater than in the temperate ones, the number of wet days is greater in the latter than in the former; there is more moisture in the air in our climate in summer than in winter; but from the greater temperature it is held up, and is not so sensible to us. By inches of rain is meant the depth at which it would stand on every square inch of surface on which it falls, supposing none to be absorbed by the soil or to evaporate.

Two fluids in the same vessel, one lighter than the other, which would get to the bottom? The heavier one.—Give instances. Milk and cream, water and oil, quicksilver and water, water and air.

The teacher, holding up a glass; What is this glass full of? Atmospheric air.—If I pour in water, what does that do? Drives out the air, because it is the heavier fluid?—If I pour quicksilver into a glass of water, what would take place? The quicksilver would drive out the water for the same reason.—If water upon mercury, or oil upon water? The water or oil being the lighter fluids, would rest on the top, and the same thing would take place if carbonic acid or any gas heavier than air were poured in.—Another instance: fill a small phial with water, leaving room for a bubble of air, then cork it; holding it in a horizontal position the bubble rests in the middle, elevate one end, the bubble rises to the top; show how this may be used as a spirit-level.

Look at that cubical vessel on the table, divided into two equal parts by a division in the middle. Suppose one division full of mercury, the other of water, and the partition suddenly withdrawn, what happens? The mercury immediately covers the bottom of both parts, and the water rises to the top.

Take a bottle of water from a cool spring or from the pump; place it in the sun or in a room—for instance, as you see it sometimes in a bedroom. You will observe air-bubbles form themselves on the surface of the glass—at the bottom and the sides—this is air contained in the water. As it takes the temperature of the room these air-bubbles form themselves, expand as they rise, come suddenly to the top, the water being of equal temperature through-