ings, addressed to observers on the immediate track, or more than ten miles from it; and, if carefully read, they will serve as good training for those who desire to take part in the investigation of these most disastrous upsettings of the atmosphere. Circular 18 relates to observations to be made 'concerning the presence of electricity in tornadoes,' and asks thirty-two questions to this end. It is to be hoped that all persons living in the tornado districts of the country, and desiring to take part in the work as volunteer observers, will apply to the chief signal-officer for circulars of instructions.

It is worth mentioning, that the single waterspout recorded in the supplement to the pilot-chart of the North Atlantic for March occurred on Feb. 19, eighty miles east of Charleston, where it struck the schooner Three sisters, "carrying away main gaff, mainsail and foresail, and flattening in the after-hatches." This is evidently connected with the group of tornadoes above described.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible.*

Law connecting physical constants.

IT may be of interest to some of your readers to know how the two formulae published in the advertising columns of Science, No. 54, can be derived from the magnetic theory of molecular cohesion.

The work necessary to separate completely the particles of a body occupying the unit of volume can easily be calculated if we know the original attraction between every two particles, and its rate of change during expansion. For small magnetized spheres, this work is equal to the resultant attraction across the unit of surface. The latter, moreover, is necessarily equal to the pressure which the particles keep up by their incessant motion; which, again, is shown, by a well-known dynamical theorem, to be equal to the continued product of the coefficients of expansion and of resilience and the absolute temperature. This product is therefore finally the mechanical equivalent of the internal latent heat of the unit of volume of a liquid.

The theory does not apply to such liquids as water, in which, at low temperatures, a molecular re-arrangement is evidently going on; but in general, the higher the temperature, the more closely is the law fulfilled. The grouping of the atoms, and their vibration within the molecule, recently treated by Professor Eddy of Cincinnati, produce in the most unfavorable cases a variation of about thirty per cent from the theory: nevertheless, the general agreement is too great to attribute to chance, and becomes almost perfect when the causes alluded to are considered. The average value of the latent heat for ordinary liquids may be shown to be about 1.2 times greater than for simple substances.

The molecules of all liquids appear to be very close together, notwithstanding the common prejudice that they are far apart; and, taking into account the comparative shortness of their free path, the coefficients alluded to may be obtained approximately by processes of ordinary differentiation, while their rate of change as the temperature increases can be determined as accurately as by actual observation.

The latent heat is found to vary inversely, the coefficient of expansion almost directly, as the free path of the molecule; and their continued product with the molecular weight is therefore nearly, but not quite, constant. The average value is about eight and a half; and any slight variations from this average are accounted for by the complete formula.

With these hints, and remembering that the inductive attraction between two small magnets varies as the seventh power of the distance inversely, while their normal attraction is inversely as the fourth, any mathematician familiar with the principles of physics may verify the laws already enunciated, and deduce others of equal importance in the same way.

The difference, for instance, between the specific heats in the state of liquid and vapor, is evidently the derivative of any true expression for the latent heat; and the critical temperature is found by supposing the latent heat equal to zero. The relations between all these quantities are represented with a remarkable degree of approximation.

The magnetic theory of cohesion promises to be, in molecular physics, what the law of universal gravitation has proved to be in astronomy. While carrying on the development as rapidly as possible myself, I would urge others, independently, to do the same, in the belief that this theory affords a most magnificent field, both for work and for discovery.

HAROLD WHITING.

Cambridge, March 17.

Relics in Ventura county, Cal.

Rincon Creek, fourteen miles west of San Buenaventura, is the dividing-line between Ventura and Santa Barbara counties. Where this creek flows into the ocean, at least a hundred acres are covered with shells, bones, fish-scales, and other kitchen *débris* of the Indians, who have lived here from time immemorial. The creek, which is fed by mountain springs, afforded good water; the ocean yielded fish and mollusks; while the foot-hills and mountains furnished wild game. A large variety of mollusks are still found at this point, and the shell-heaps indicate their great abundance in past time. Edible clams especially abounded; as Pachydesma crassatelloides, Tapes staminea, T. diversa, also Mytilus californianus.

Rincon Point was doubtless long a favorite resort for the early race that inhabited this coast. In one spot I found human bones, a few years since, which were in a semi-fossil state. They had been buried on the brow of a high bluff overlooking the sea, and were about four feet below the surface. One skull, that of an aged person, was perforated at the apex. The perforation seems to have been made by a sharp instrument, and some time before death, but for what purpose it is difficult to say. In another spot on the mesa, and three hundred yards from the ocean, occurred a burial-place in which the skeletons were reduced to an impalpable dust. In this dry soil and climate it must have required centuries for them to decay. In this place I found many 'sinkers' from three to twelve inches long, carved from sandstone, limestone, etc. They were from three-fourths of an