said to be reasonably well understood and it has many similarities with theories of phase transitions, but non-equilibrium phenomena show many more idiosyncrasies than do equilibrium ones. Why, for example, can many liquids be obtained in a glassy state but others, such as water, can never be supercooled below a certain limiting temperature? When ice is formed from supercooled vapour, why can its crystal habit be changed quite a number of times within quite a small range of temperature? These are a few of the fascinating questions which are poorly understood, yet are likely to be of great technical significance.

Mention of the phase transitions of water reminds one of their meteorological importance. Condensation of water vapour plays a dominant part in cloud formation and is one of the main sources of energy of tornadoes and hurricanes. Many problems of cloud physics, such as the icing of aircraft, are closely related to the problems of the supercooling of water and of nucleation effects. So far, the progress of experiments in "rain making", and in modifying the course of hurricanes, by the artificial seeding of clouds has proved rather disappointing, but this is not a reason for saying that theoretical and experimental study of these matters is useless. The mechanism of electrification of thunderclouds is, according to some theories anyway, intimately associated with the freezing transition. The suggestion that an artificial thundercloud could be produced in the laboratory and then used as a cheap high voltage generator probably belongs to science fiction, but there is a strong case for careful study of effects associated with the freezing and evaporation of polar liquids (on which very little is known theoretically). One question of very considerable technical importance is a study of the factors that determine the rate of evaporation of a water surface. Can it be significantly retarded by any feasible surface treatment? If so, this would be of importance in irrigation and the management of reservoirs. Or can it be hastened? This would be of importance in the distillation of sea water and the design of boilers and related equipment.

Until very recently, it has been almost taken for granted that the interactions between ions in a liquid metal were of "many body" type. However, recent work by March[12] and his colleagues suggests that there is an effective interaction between ions not differing greatly from the "screened coulomb" interaction between ions in an electrolyte. Such work must lead, in due course, to better understanding of the crystallization and melting of metals. If the interaction can indeed be treated as effectively between pairs of ions only, the theoretical treatment becomes very much simpler than if it is of the many body type. Thus, we may expect this work to have considerable impact on metallurgy.

These are some of the likely direct benefits to various sciences of a study of the liquid state. Among indirect benefits mention can be made of the study of fluidized powders and slurries. A powder can be brought into a state bearing striking resemblances to a liquid if a gas is blown through it from below. The effect is that each particle is no longer completely imprisoned by its neighbours, but migrates over a certain "free volume". This relationship is very like that between neighbouring molecules in a liquid. Indeed, a fluidized powder can have a "free surface" and a "vapour phase" and can "find its own level" and have other properties very like those of a liquid. So far the study of fluidized powders has been mainly on empirical lines, but comparison with the "rigid sphere" model of a liquid is likely to be extremely fruitful, and should throw light on the transport of solid particles through pipes by liquids or by gases—a subject of considerable technological importance.

We indeed see a strange history of fundamental advances such as the discovery of the van der Waals equation, Kirkwood's pioneer work on the liquid distribution function and on transport coefficients and modern machine calculations on the equations of state of simple models having been separated by long gaps. At the 1963 conference in London a large number of experimental studies were reported, using techniques ranging from neutron scattering to spectroscopic study of melts, while theoretical work ranged from studies of "lattice" and other idealized models to the thermodynamics of mixtures. Although the subject is still mainly one for specialists it calls for relatively small investments of money and technical effort. Because it is hard to think of a science that is not in some way concerned with the properties of liquids and solutions, any advances in our knowledge seem certain to find applications somewhere. If one were asked to name a field in which a given expenditure of money and man-power were likely to produce a good return in the form of technological fall-out, this would be a likely choice.

This subject is also one in which cross-fertilization between industrial and university research is likely to benefit both. It may be quite feasible to carry out a continuous industrial process with a supersaturated solution which "ought", on equilibrium theory, to deposit a solid or to emit a gas, but a small alteration in the conditions may take one "over the hump" and thus bring the process to rest. At present, much effort is going into the study of the statistical mechanics of steady state and other non-equilibrium situations. This is just one example of cross-fertilization possibilities. Because virtually every science is concerned in some way with liquids and solutions other possibilities must abound.

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So many of the properties of matter, especially when in the gaseous form, can be deduced from the hypothesis that their minute parts are in rapid motion, the velocity increasing with the temperature, that the precise nature of this motion becomes a subject of rational curiosity. Daniel Bernouilli, Herapath, Joule, Krönig, Clausius, etc., have shewn that the relations between pressure, temperature, and density in a perfect gas can be explained by supposing the particles to move with uniform velocity in straight lines, striking against the sides of the containing vessel and thus producing pressure. It is not necessary to suppose each particle to travel to any great distance in the same straight line; for the effect in producing pressure will be the same if the particles strike against each other; so that the straight line described may be very short. M. Clausius has determined the mean length of path in terms of the average distance of the particles, and the distance between the centres of two particles when collision takes place. We have at present no means of ascertaining either of these distances; but certain phenomena, such as the internal friction of gases, the conduction of heat through a gas, and the diffusion of one gas through another, seem to indicate the possibility of determining accurately the mean length of path which a particle describes between two successive collisions. In order to lay the foundation of such investigations on strict mechanical principles, I shall demonstrate the laws of motion of an indefinite number of small, hard, and perfectly elastic spheres acting on one another only during impact.

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