size of the complex particles increases with increasing silver concentration. The size of the particles would also be expected to increase with increasing concentration of other ions present ; such a mechanism readily explains the results illustrated in Fig. 2. In addition, ammonium acetate in the comparatively high concentration used should be efficient in causing the aggregation of the particles ; the appearance of a fine red precipitate in the presence of ammonium acetate is clear evidence that this is the case.

That the silver–rhodanine complex does not form a true solution was, in fact, realized by Schoonover. It must be concluded that the method, either in its initial or modified forms, is unsatisfactory for quantitative work.

J. A. ALLEN
D. G. HOLLOWAY

H. H. Wills Physical Laboratory,
University of Bristol. April 20.

[1] Schoonover, I. C., *J. Res. Nat. Bur. Stand.*, **15**, 377 (1935).
[2] Welcher, F. J., "Organic Analytical Reagents", **3**, 421 (1947).

Evaporation and Mobility of Naphthalene Molecules

THE rates of evaporation, into a vacuum, of solid naphthalene from different crystal faces have been measured directly. Two crystals of naphthalene, masked so as to leave exposed only portions of the faces under study, were mounted so that evaporation from the exposed portions produced a torque which was measured with a quartz suspension fibre. It has been found that both the absolute rates of evaporation and their temperature coefficients are different for different faces, indicating variations in condensation coefficients and energies.

Certain anomalies appeared in the results, which suggested that naphthalene molecules might be mobile over the surfaces of the solid phase and of the glass supports. This was studied, by the following technique, before continuing with the exact measurement of evaporation rates.

A spot of solid naphthalene was placed at the centre of a thin glass disk (microscope cover-slip, 20 mm. diam.). Over this was clipped a thin glass hemisphere, about 7 mm. in diameter, the edge of which was ground flat so that it rested in close contact with the surface of the disk. If lateral mobility on glass occurred, molecules of naphthalene would travel radially outwards from the periphery of the hemisphere for some distance prior to evaporating off the surface of the disk when the assembly was placed in a vacuum. Two such assemblies were mounted, facing in opposite directions, to produce a torque when evaporation took place. Measurements of the torque would give a measure of the total number of molecules emitted irrespective of distance travelled on the surface, since radial migration was symmetrical about the centre of the assembly. One half of the periphery aperture (that facing towards the axis of suspension) was then closed and the torque again measured. Now, since any surface migration was directed away from the axis of suspension, the moment was increased by a simple multiple of the mean distance travelled by a molecule before evaporation. By difference, the mean distance of travel was obtained. The aperture between hemispheres and disks was of dimensions such that the torques measured were ascribable to mobile molecules ; interference by gas-phase molecules streaming out was negligible.

Similar measurements were made using other substrates. In each case it was found that the plot of the logarithm of the torque measured against the reciprocal of the temperature yielded a straight line. Equations of the form $\log_{10} F = A - B/T$ (where F is force in dynes per mm. of periphery of hemisphere, T is temperature in $^{\circ}$K, A and B are constants) were fitted by the method of least squares. From B an energy in kcal. per gram mole was calculated. Typical values, some with repeat determinations, with various substrata were :

Substratum	A (arbitrary units)	E (kcal.)
Mica (freshly cleaved)	5·60 ; 5·80	13·1 ; 13·3
Tin (foil, washed with solvents)	8·33	14·2
Graphite (oriented)	7·33 ; 7·50	15·3 ; 15·2
Glass (washed with solvents)	7·11	15·0
Glass (as manufactured)	7·81	15·7
Glass (greasy)	7·93 ; 8·00 ; 8·10	16·2 ; 16·2 ; 16·2

The estimation of the mean distance travelled along the solid surface, involving a difference calculation, was not very accurate. However, it was found to be of the order of 1 mm. on glass and 3 mm. on graphite. Further work is being done in the hope of obtaining more accurate data.

It is clear that surface mobility does exist, and that the energies of translation and desorption may be obtained from the observations obtained by this technique. A full description of the work and the calculations will be published elsewhere.

V. J. CLANCEY

Davy Faraday Laboratory,
Royal Institution,
London, W.1.
June 1.

Size-Frequency Distributions

IN the determination of the size-frequency distribution of a particulate material by sieve analysis, it is often assumed[1] that the rate of sieving is proportional to the quantity of material on the sieve. If y is the amount of material of size smaller than the sieve mesh at any time t, this assumption leads to the equation $y/y_0 = \exp(-at)$, where a is a constant, and y_0 is the value of y at $t = 0$. In practice, the equation $y = at^{-m} + b$ (equat. 1) has been found to apply[2].

During the course of some experiments on the variation of the statistical parameters in eroded, naturally occurring, granular material, subsidiary experiments were performed to determine the approximate time of sieving necessary to give the amount of any particular size to about 0·5 per cent. The material used was a quantity of washed river sand which had previously passed a No. 7 B.S.S. sieve, and the time-quantity relation was of the form given by equation 1. To an extended scale, however, the relation takes the form shown in the accompanying graph, where two linear relations of the form $y_0 - y = a \log t + c$ are evident. The results from a repetition of the experiment, with the same quantity (100 gm.) of lead shot, show an even more marked transition point (X). It has not yet been possible to extend the investigation to other