COMPONENTS:	EVALUATOR:
1. Stibine; SbH_3; [7803-52-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, N7 8DB, UNITED KINGDOM. August 1983

CRITICAL EVALUATION:

Distribution constants for systems consisting of the gas and eight different liquids have been measured by Devyatykh *et al.* (1) using a chromatographic technique. (See comments under arsine evaluation and on compiled tables.) It is, however, unwise to equate these constants with Ostwald coefficients in order to calculate solubilities for a particular partial pressure of gas. Analogy with measurements on phosphine reported by these authors makes it likely that such estimates could be several hundred per cent too large. The data may perhaps be used to estimate relative solubilities of stibine in different solvents but such estimates are unlikely to be very precise.

References

1. Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V. *Zh. Neorgan. Khim.* 1963, *8*, 1307 (*Russ. J. Inorg. Chem.* 1963, *8*, 678).

COMPONENTS:

1. Stibine; SbH_3; [7803-52-3]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682

VARIABLES:

Temperature

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

Solvent	Distribution constant $vol_{SbH_3}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Furancarboxaldehyde; $C_5H_4O_2$; [98-01-1]	25.2	-4.1
Triethoxysilane; $C_6H_{16}O_3Si$; [998-30-1]	39.8	-6.0
Silicic acid, tetraethyl ester; $C_8H_{20}O_4Si$; [78-10-4]	28.5	-5.4
Silicone VKZh-94B	58.8	-6.2

Temperature = 293.2 K.

Distribution constants were measured between 278.2 K and 323.2 K. The partial pressures of stibine at which these measurements were made were not stated. The total pressure of stibine and carrier gas was about 760 mmHg in each case. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given.

If it is assumed that distribution constants vary with temperature according to equations of the form :

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation:

$$V_R = V_g + KV_l$$

where V_R is the retention volume for stibine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from $SbCl_3$ and aqueous sodium tetrahydroborate; purified by vacuum distillation; chromatographic analysis indicated about 5% H_2.

   H_2 & N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Stibine; SbH_3; [7803-52-3]
2. Various liquids.

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form :

$$K = \exp\,[A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Furancarboxaldehyde	-3.814	2064
Triethoxysilane	-6.620	3021
Silicic acid, tetraethyl ester	-5.924	2719
Silicone VKZh-94B	-6.573	3122

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition,possible adsorption of stibine at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Stibine; SbH_3; [7803-52-3] 2. Various liquids	Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V. *Russ. J. Inorg. Chem.* <u>1963</u>, *8*, 678-682.
VARIABLES:	PREPARED BY:
Temperature	P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	P_{SbH_3}/mmHg	Distribution constant vol_{SbH_3} /$vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Ethoxyethanol; $C_4H_{10}O_2$; [110-80-5]	0.3	40.7	-1.2
1,1'-oxybis[2-chloroethane]; $C_4H_8Cl_2O$; [111-44-4]	0.2	28.9	-3.5
Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	0.2	22.9	-1.82
Liquid paraffin	0.3	39.7	-

Temperature = 293.2 K. 760 mmHg = 1 atm = 1.013×10^5 Pa.

Distribution constants were measured between 278.2 K and 323.2 K with a total pressure of stibine and carrier gas of about 760 mmHg. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given. If it is assumed that distribution constants vary with temperature according to equations of the form:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_ℓ, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation:

$$V_R = V_g + KV_\ell$$

where V_R is the retention volume for stibine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from $SbCl_3$ and aqueous sodium tetrahydroborate; purified by vacuum distillation; chromatographic analysis indicated about 5% H_2.

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ESTIMATED ERROR:

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COMPONENTS:	ORIGINAL MEASUREMENTS:
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EXPERIMENTAL VALUES:

of solution of stibine in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form:

$$K = \exp\ [A + (B/T)].$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Ethoxyethanol	1.645	604
1,1'-oxybis[2-chloroethane]	-2.647	1762
Nitrobenzene	0.006	916

In the opinion of the compiler these distribution constants can not be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition, possible adsorption of stibine at the stationary phase-carrier gas interface may have lowered the accuracy of the results.