

INFORMATION RETRIEVAL*

Gas absorption accompanied by an irreversible reaction of general order, Brian, P. L. T., *A.I.Ch.E. Journal*, **10**, No. 1, p. 5 (January, 1964).

Key Words: Gas-5, Liquid-5, Reaction Rate-6, Reaction Order-6, Absorption-8, Mass Transfer-8, Reaction Kinetics-8, Diffusion-8, Mathematics-10, Computations-10, Finite-Differences-10, Penetration Theory-10.

Abstract: The penetration theory differential equations are solved numerically for gas absorption accompanied by an irreversible chemical reaction. Solutions are obtained for a number of combinations of n and m , the orders of the reaction kinetic equation with respect to the concentrations of the absorbing species and of the solute reactant, respectively. A generalized definition of the relative rate parameter is found to render the solution quite insensitive to n when the diffusivities are equal, and an empirical correlation describes the effect of m . The effect of the diffusivity ratio is also illustrated.

Viscosity correlations for nonpolar dense fluids, Starling, Kenneth E., and Rex T. Ellington, *A.I.Ch.E. Journal*, **10**, No. 1, p. 11 (January, 1964).

Key Words: Viscosity-7, Density-6, Temperature-6, Correlation-9, Least-Square-10, Methane-8, Ethane-8, Propane-8, *n*-Butane-8, Isobutane-8, Ethylene-8, Nitrogen-8, Carbon Dioxide-8.

Abstract: Expressions for the coefficient of viscosity as a function of temperature and density are derived which describe behavior for the liquid, gas, and supercritical dense fluid regions of a number of nonpolar materials. Two expressions are derived from expressions in the Born and Green and Enskog theories; three others are derived from analyses of observed behavior for ethane, propane, and *n*-butane. Empirical constants in these equations were determined by an iterative, least-squares method. Standard deviations of the data calculated by use of one of these expressions are 0.87, 1.19, and 0.97% for ethane, propane, and *n*-butane, respectively. This equation also describes the viscosity of methane, isobutane, ethylene, nitrogen, and carbon dioxide within about 2%.

A new approach to the stability and control of nonlinear processes, Leathrum, J. F., E. F. Johnson, and L. Lapidus, *A.I.Ch.E. Journal*, **10**, No. 1, p. 16 (January, 1964).

Key Words: Control-8, Stability-8, Reactors-9, Nonlinearity-7, Geometric-10, Oscillations-2, Integration-10, Computers-10, Disturbances-1.

Abstract: The method of Lyapunov was applied to the problem of assuring stability for nonlinear systems and also an acceptable level of control quality for large disturbances. Geometrical considerations have led to stability criteria which avoid the search for analytical functions. This technique involves constructing an approximate integral for the system by choosing alternate extremes in the magnitude of the state vector. A number of different types of physical systems are examined and the technique predicts the existence and stability of limit cycles.

The thermal conductivity of nonpolar substances in the dense gaseous and liquid regions, Stiel, Leonard I., and George Thodos, *A.I.Ch.E. Journal*, **10**, No. 1, p. 26 (January, 1964).

Key Words: Correlation-8, Thermal Conductivity-8, Physical Properties-8, Fluids-9, Gases-9, Liquids-9, Dimensional Analysis-10, Residual Relationships-10.

Abstract: Thermal conductivities available in the literature for the gaseous and liquid states of 20 nonpolar substances, including inert gases, diatomic gases, carbon dioxide, and hydrocarbons of all types, were correlated with reduced density by the use of dimensional analysis and the residual relationship for thermal conductivity. A single generalized relationship was obtained for thermal conductivity and it is presented both graphically and analytically. The properties required for the calculation of thermal conductivity with the relationship are the molecular weight, the critical constants, and the density of the substance at the temperature and pressure considered.

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* For details on the use of these key words and the A.I.Ch.E. Information Retrieval Program, see *Chem. Eng. Progr.*, **57**, No. 5, p. 55 (May, 1961), No. 6, p. 73 (June, 1961); **58**, No. 7, p. 9 (July, 1962).

NOTE: Additional pages of information retrieval abstracts and key words in this issue are available on request.

The Thermodynamics of Gasification and Gas-Synthesis Reactions, N. V. Lavrov, V. V. Korobov, and V. I. Filippova, translated by G. H. Kinner, Pergamon Press, Macmillan Company, New York (1963). 116 pages. \$6.50.

This is essentially a handbook of thermodynamic parameters relevant to the equilibrium constants of carbon gasification, methane conversion and dissociation in the gas phase, the Fisher-Tropsch reaction, and synthesis from the carbon monoxide-steam reaction. It contains a valuable compilation of such data for several hundred hydrocarbons. A brief outline is given of the statistical mechanical methods used to determine the parameters. As it is a handbook some vagaries in definition of symbols, lack of units and logarithms of dimensional quantities can be overlooked, since we all know what is intended. The calculation of equilibrium constants from a simple form using standard state-standard temperature enthalpies and entropies of formation, the more precise Ulikh's formula or, more accurate still, the tabulated values of thermodynamic potential Φ^* defined by $F_0 = H_0^0 - \Phi^*T$, is described. Values of ΔF_0 could be tabulated instead of ΔH_0^0 and Φ^* , but the use of Φ^* makes it easier to compare the more accurate values with first approximation values. Equilibrium degrees of conversion and gas composition are given for a number of reactions. The $C + H_2O = CO + H_2$ equilibrium is treated independently of the associated $CO + H_2O = CO_2 + H_2$ and $C + 2H_2 = CH_4$ reactions, which is probably unrealistic in practice and the same criticism will apply to several of the other systems considered, unless extremely specific catalysts are available. (There is no kinetic or catalytic information in the book.) It is an excellent handbook for all chemical engineers concerned with these synthesis reactions. L. G. AUSTIN

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River Pollution, II: Causes and Effects, Louis Klein, Butterworths, London (1962). 456 pages. \$14.95.

Klein's 1957 "Aspects of River Pollution" was well received and is currently being updated and reissued in three volumes of more convenient size. The first, on "Chemical Analysis," appeared in 1959. The present volume deals with pollution and polluted streams per se: the historical and legal background, the nature and sources of pollution, and the effects of pollution on uses of the stream, including its use as an environment for fish and other organisms. A final volume, not yet announced, will presumably be concerned with the treatment of municipal and industrial wastewaters in order to reduce and control pollution and standards for such control.