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PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION

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SUMMARY

The equilibrium composition and thermodynamic properties of the products of cyanogen-oxygen combustion at input mole ratios of C_2N_2/O_2 from 1/0.9 to 1/4.0, for pressures between 10^{-2} and 10^2 atmospheres and temperatures from 2000° to 6000° K, are calculated by using a program developed for a high-speed electronic computer. The calculations are based on the existence of 11 gaseous species for the computation of the neutral-product concentration. The free-electron concentration is calculated separately by using the results of the computation for the 11 neutral species and 13 additional charge reactions. Flame temperatures at the different pressures and mixture ratios are obtained separately by using a heat-balance technique. In addition the neutral species and free-electron concentrations for a certain flame temperature, reactant mixture, and combustion pressure are obtained by graphical interpolation of the computer results to establish the variation in flame composition when the oxygen concentration is changed in the precombustion mixture. The thermodynamic data based on the neutral-species computation are presented in the form of Mollier charts for three input mixtures of cyanogen and oxygen.

INTRODUCTION

The determination of the equilibrium composition and the thermodynamic properties of the products of cyanogen-oxygen combustion is important in studies where a high-temperature research tool is used. The combustion products produced (carbon monoxide and nitrogen for a stoichiometric 1/1 mole ratio flame) have a high degree of thermal stability so that the heat of reaction liberated goes into raising the temperature of the gases. The temperature produced is one of the highest that can be obtained by a chemical reaction. The products generated have a high degree of chemical inertness which makes them useful as a high-temperature test medium.

In recent years reports of several studies dealing with the combustion of cyanogen and oxygen such as references 1 to 7 have appeared in the literature. These reports are concerned with experimental studies aimed at determining the characteristics of the cyanogen-oxygen flame. Applications of the flame have also appeared in the literature; reference 8, for example, deals with an application of the flame in the field of analytical chemistry, and reference 9 discusses the use of the flame for aerodynamic-heating studies. The use of the combustion products of the cyanogen-oxygen flame seeded with a material having a low ionization potential such as cesium has been advanced (ref. 10) for magnetohydrodynamic generator work. The cyanogen-oxygen flame reported in reference 11 was used as a plasma source in studying the attenuation of radio signals as they are transmitted through the flame products. The free-electron content of the flame is an important factor in the study of reference 11. Since the free-electron concentration can depend on trace species (such as nitric oxide (see refs. 11 to 13)) present in the combustion products, computations had to be made to establish the overall properties of the plasma and to establish the sensitivity of the free-electron concentration to small changes in the fuel-oxidant ratios.

The present report is concerned with the computation of the equilibrium concentration of the neutral and charged species, flame temperatures, and thermodynamic properties of the products of cyanogen-oxygen combustion. Two of the most widely used analytical approaches to the calculation of chemical compositions are the "equilibrium constant" method given in references 14 to 16 and the "free energy" method given in reference 17. A comparison of these methods can be found in reference 18. With the use of high-speed computers, programs based on these methods (see refs. 19 to 23) have been written for solving the equations needed to calculate chemical compositions. The iterative method of computing the equilibrium composition of reaction systems described in reference 14 was adapted to provide a program for an IBM 7090 electronic computer. The computations are carried out for a pressure range between 10^{-2} and 10^{2} atmospheres and for a temperature range between 2000° and 6000° K. The precombustion mole ratios of cyanogen to oxygen vary from 1/0.9 to 1/4.0. The calculations are carried out by assuming adiabatic combustion which takes place at constant pressure and produces mixtures of perfect gases in chemical equilibrium.

Calculated values for the composition and flame temperature for the stoichiometric 1/1 mole ratio combustion of a cyanogen-oxygen mixture have appeared in references 5, 11, 24, 25, and 26, for example; cyanogen-air-combustion calculations have appeared in reference 27. Computations are presented in references 28 and 29 for a cyanogen-oxygen detonation wave at various fuel-oxidant mixture ratios.

SYMBOLS

A	number of formula weights of equivalent formula $C_{a_o}N_{b_o}O_{c_o}$
a	number of moles or gram atoms of C per equivalent formula
a_o	assigned value of number of atoms of C within equivalent formula
B	ratio of statistical weights in Saha equation (eq. (38))

b	number of moles or gram atoms of N per equivalent formula
b_o	assigned value of number of atoms of N within equivalent formula
c	number of moles or gram atoms of O per equivalent formula
c_o	assigned value of number of atoms of O within equivalent formula
E	reaction energy for $T = 0^\circ$ K, electron volts
H	enthalpy of combustion products, kcal/mole
H_T^o	sum of sensible and chemical energy of a specie in a standard state at temperature T, kcal/mole
ΔH_F^o	enthalpy change due to formation of substance from its elements in standard states, kcal/mole
$H_T^o - H_{298}^o$	sensible enthalpy at temperature T and standard state less the enthalpy in the standard state at 298° K, kcal/mole
K	equilibrium constant for dissociation or ionization where the partial pressures of the species are expressed in atmospheres
M	molecular weight
m	number of moles of oxidant
N_e	electron concentration, cm^{-3}
N_o	Loschmidt's number at standard conditions, 2.687×10^{19} cm^{-3}
n	number of moles of combustion products
P	total equilibrium combustion pressure, atm
p	partial pressure, atm
Q	heat transferred, calories (eq. (39))
R	universal gas constant, 1.987 cal/mole-$^\circ$K
S	entropy of combustion products, cal/mole-$^\circ$K
S_T^o	entropy of a specie in a standard state at temperature T, cal/mole-$^\circ$K
T	temperature, $^\circ$K
V	ionization potential, electron volts

X mole fraction

x correction variables

Z dimensionless ratio of average molecular weights of reactants to products (eq. (42))

δ error parameter

Subscripts:

o standard conditions, 273° K and 1 atm

1,2,3,...11 product index numbers for neutral species

A number of formula weights of reactants

a_o, b_o, c_o total number of atoms of carbon, nitrogen, and oxygen in initial reactant mixture

e electron

f flame

i ith component (neutral)

i^+ species with positive charge

r initial reactant mixture

t true or assigned value

PROCEDURE

The procedure used for the computation of the equilibrium composition and thermodynamic properties of the species present as the result of a combustion reaction is based on the method given in reference 14 and is adapted for use with an IBM 7090 electronic computer. The program is divided into two parts where the neutral-species concentrations and thermodynamic properties - enthalpy, entropy, and ratio of molecular weights Z - are calculated in the main computer program for various input mixture ratios, temperatures, and pressures. The results of the neutral-species program are then used to calculate the concentrations of charged species in the second part of the program.

The flame temperatures for the various input conditions are calculated separately by using the neutral-species data and additional thermodynamic data.

The assumptions and conditions used in the calculations are as follows:

(1) All species produced are in the gaseous state throughout the range of temperatures and pressure used.

(2) All gases behave ideally and form ideal-gas mixtures so that the ideal-gas equation of state will be valid.

(3) The precombustion mixtures of cyanogen and oxygen are introduced as gases at 298° K for the purpose of calculating the flame temperature T_f.

(4) Thermal and chemical equilibria exist after combustion.

(5) The combustion process is adiabatic.

(6) Combustion takes place at constant pressure.

(7) The concentrations of the charged species are small enough so that there will be no changes in the calculation of the neutral-species concentrations when the computation for the charged species is undertaken as a separate part of the program.

(8) The calculations of the flame temperatures and thermodynamic properties are based only on the neutral-species concentrations.

Gas Composition

Neutral species.- For given initial conditions, the composition of the neutral species present following a combustion reaction is to be calculated. The temperature and pressure are selected as independent variables along with the mole ratio of cyanogen to oxygen $\left(C_2N_2/O_2\right)$ entering the reaction. The values for the temperature are from 2000° to 6000° K in 400° increments. The equilibrium pressures are 0.01, 0.1, 1, 4, 10, 40, and 100 atmospheres and the initial mole ratios of C_2N_2 to O_2 are 1/0.90, 1/0.95, 1/1.0, 1/1.05, 1/1.10, 1/1.20, 1/1.40, 1/1.60, 1/2.0, and 1/4.0.

The substances entering the reaction are designated by an equivalent formula $C_{a_o}N_{b_o}O_{c_o}$ where a_o and b_o remain constant throughout the program with values of 2 each; the value of c_o changes according to the number of moles m of oxygen that are used $(c_o = 2m)$. The values of m are given in the preceding list of mole-ratio inputs.

The calculations are based on the following general reaction equation which produces 11 neutral gaseous species:

$$A\left(C_{a_o}N_{b_o}O_{c_o}\right) \rightarrow n_1O_2 + n_2CO_2 + n_3CO + n_4N_2 + n_5NO + n_6CN + n_7C_2N_2 + n_8C_2 + n_9C + n_{10}N + n_{11}O \tag{1}$$

The index number for the product is given as a subscript to each n and refers to a specific specie. For these calculations A and n_i are determined so that $n_i = p_i$; thus the volume of the products of reaction will be numerically equal to RT. The total number of moles of gaseous equilibrium products will then be numerically equal to the total pressure P. For the remainder of this report p_i will be used in place of n_i for denoting concentrations.

The equations needed for the solution of p_i and A are: the dissociative-equilibrium equations with one for each molecular type, the conservation of mass equations or mass-balance equations with one for each chemical element, and the total-pressure equation. This gives a total of 12 equations to solve.

The mass-balance equations are as follows for the combustion of $C_2N_2 + mO_2$:

$$a = \frac{1}{A}\left(1p_2 + 1p_3 + 1p_6 + 2p_7 + 2p_8 + 1p_9\right) = \frac{1}{A} \sum_i a_i p_i \tag{2}$$

$$b = \frac{1}{A}\left(2p_4 + 1p_5 + 1p_6 + 2p_7 + 1p_{10}\right) = \frac{1}{A} \sum_i b_i p_i \tag{3}$$

$$c = \frac{1}{A}\left(2p_1 + 2p_2 + 1p_3 + 1p_5 + 1p_{11}\right) = \frac{1}{A} \sum_i c_i p_i \tag{4}$$

The species are given in terms of their index numbers according to equation (1). Trial compositions will give values of a, b, and c which differ from a_o, b_o, and c_o, but the differences will disappear when the correct compositions have been found and $a = a_o = 2$, $b = b_o = 2$, and $c = c_o = 2m$.

The total-pressure equation is as follows:

$$P = \sum_i p_i \tag{5}$$

With an assigned pressure, the value of P in equation (5) must equal the true or input pressure P_t for final solution.

The dissociative equations are written in terms of the atomic gases with the reactions given in table I along with the appropriate reaction energies E. Only the first eight reactions in the table are used with the following equilibrium constants:

$$K_1 = \frac{(p_{O_2})}{(p_O)^2} \tag{6}$$

$$K_2 = \frac{(p_{CO_2})}{(p_C)(p_O)^2} \tag{7}$$

$$K_3 = \frac{(p_{CO})}{(p_C)(p_O)} \tag{8}$$

$$K_4 = \frac{(p_{N_2})}{(p_N)^2} \tag{9}$$

$$K_5 = \frac{(p_{NO})}{(p_N)(p_O)} \tag{10}$$

$$K_6 = \frac{(p_{CN})}{(p_C)(p_N)} \tag{11}$$

$$K_7 = \frac{(p_{C_2N_2})}{(p_C)^2(p_N)^2} \tag{12}$$

$$K_8 = \frac{(p_{C_2})}{(p_C)^2} \tag{13}$$

The values for the equilibrium constants were taken from references 30 to 32 for the specific input temperatures. Since the trial composition probably will not correspond to those at chemical equilibrium, variables δ_i are defined according to reference 14 as

$$\delta_i = \log_e p_i - a_i \log_e p_C - b_i \log_e p_N - c_i \log_e p_O - \log_e (K_i)_t \tag{14}$$

The criterion for equilibrium for a reaction at constant temperature and pressure is that $\delta_i = 0$.

Since equations (2) to (5) and (14) are not all linear, the Newton-Raphson method for solving nonlinear simultaneous equations is used (see refs. 14, 19, and pp. 53 to 57 of ref. 23) to obtain a set of simultaneous linear correction equations which were solved for by writing them in matrix form for solution with the IBM 7090 computer. The equations are

$$\left.\begin{aligned} \sum_i a_i p_i x_i - Aax_A &= Aa \log_e \frac{a_o}{a} \\ \sum_i b_i p_i x_i - Abx_A &= Ab \log_e \frac{b_o}{b} \\ \sum_i c_i p_i x_i - Acx_A &= Ac \log_e \frac{c_o}{c} \end{aligned}\right\} \tag{15}$$

$$\sum_i p_i x_i = P \log_e \frac{P_t}{P} \tag{16}$$

$$x_i - a_i x_C - b_i x_N - c_i x_O = -\delta_i = \log_e \frac{\left(K_i\right)_t}{K_i} \tag{17}$$

An example of a general matrix for the combustion of 1 mole of C_2N_2 with 1 mole of O_2 at 1 atmosphere of pressure and an arbitrarily assigned temperature is given in figure 1. The values of a_o, b_o, and c_o are equal to 2 and $P_t = 1$. Initial estimates for A and p_i are made. Values for a_i, b_i, and c_i are taken from equations (2) to (4); values of δ_i are calculated by using the $\left(K_i\right)_t$ values at the assigned temperatures and values of estimated p_i as shown in equation (14). The other constant terms in figure 1 are calculated by use of the following relations: $Aa = \sum_i a_i p_i$ and $\frac{Aa}{A} = a$. Similar relations exist for the other terms - Ab, Ac, b, and c. The pressure P is found by summing all the partial pressures. If the conditions for convergence $\left(a = 2, b = 2, c = 2m, \frac{P}{P_t} = 1, \text{ and } \delta_i = 0 \text{ within a factor of } \approx 10^{-4}\right)$ do not occur, the output values of p_i and A are fed back to provide new estimates and the iteration is carried out until convergence is achieved. The values of the partial pressure of the species will then have the desired accuracy of four figures.

The output of the program gives values of A and the partial pressures of as many as 11 species. Some molecular species can be omitted for a few mole input ratios because their concentrations are so small that no error is introduced in the computation. In this case the output of the program will show fewer species.

Charged species.- The equations used to obtain the charged-species concentrations present in the flame are given in the following discussion. The number of ions is taken to be 13 including 2 negative ions (O^- and CN^-) along with the 11 positive ions that are produced from the 11 neutral species. The charged-species reactions 9 to 21 and the reaction energies are given in table I. The equations for the equilibrium constants for ionization of the species are as follows:

$$K_9 = \frac{\left(p_{O_2^+}\right)\left(p_{e^-}\right)}{\left(p_{O_2}\right)} \tag{18}$$

$$K_{10} = \frac{\left(p_{CO_2^+}\right)\left(p_{e^-}\right)}{\left(p_{CO_2}\right)} \tag{19}$$

$$K_{11} = \frac{\left(p_{CO^+}\right)\left(p_{e^-}\right)}{\left(p_{CO}\right)} \tag{20}$$

$$K_{12} = \frac{\left(p_{N_2^+}\right)\left(p_{e^-}\right)}{\left(p_{N_2}\right)} \tag{21}$$

$$K_{13} = \frac{\left(p_{NO^+}\right)\left(p_{e^-}\right)}{\left(p_{NO}\right)} \tag{22}$$

$$K_{14} = \frac{\left(p_{CN^+}\right)\left(p_{e^-}\right)}{\left(p_{CN}\right)} \tag{23}$$

$$K_{15} = \frac{\left(p_{C_2N_2^+}\right)\left(p_{e^-}\right)}{\left(p_{C_2N_2}\right)} \tag{24}$$

$$K_{16} = \frac{\left(p_{C_2^+}\right)\left(p_{e^-}\right)}{\left(p_{C_2}\right)} \tag{25}$$

$$K_{17} = \frac{\left(p_{C^+}\right)\left(p_{e^-}\right)}{\left(p_{C}\right)} \tag{26}$$

$$K_{18} = \frac{\left(p_{N^+}\right)\left(p_{e^-}\right)}{\left(p_{N}\right)} \tag{27}$$

$$K_{19} = \frac{\left(p_{O^+}\right)\left(p_{e^-}\right)}{\left(p_{O}\right)} \tag{28}$$

$$K_{20} = \frac{\left(p_{O}\right)\left(p_{e^-}\right)}{\left(p_{O^-}\right)} \tag{29}$$

$$K_{21} = \frac{\left(p_{CN}\right)\left(p_{e^-}\right)}{\left(p_{CN^-}\right)} \tag{30}$$

The equation for the conservation of charge is

$$\sum_{i^+} p_{i^+} = \left(p_{e^-}\right) + \left(p_{O^-}\right) + \left(p_{CN^-}\right) \tag{31}$$

Equations (18) to (28) can be written in the form

$$\left(p_{i^+}\right)\left(p_{e^-}\right) = \left(K_{i^+}\right)\left(p_i\right) \tag{32}$$

and equations (29) and (30), respectively, in the form

$$\left(p_{O^-}\right) = \frac{\left(p_O\right)\left(p_{e^-}\right)}{K_{20}} \tag{33}$$

$$\left(p_{CN^-}\right) = \frac{\left(p_{CN}\right)\left(p_{e^-}\right)}{K_{21}} \tag{34}$$

Multiplying equation (31) by p_{e^-} and substituting equations (32) to (34) will give

$$\sum_{i^+} \left(K_{i^+}\right)\left(p_i\right) = \left(p_{e^-}\right)^2 + \frac{\left(p_O\right)\left(p_{e^-}\right)^2}{K_{20}} + \frac{\left(p_{CN}\right)\left(p_{e^-}\right)^2}{K_{21}} \tag{35}$$

and

$$\left(p_{e^-}\right) = \left[\frac{\sum_{i^+} \left(K_{i^+}\right)\left(p_i\right)}{1 + \frac{\left(p_O\right)}{K_{20}} + \frac{\left(p_{CN}\right)}{K_{21}}}\right]^{1/2} \tag{36}$$

Values of p_{e^-} are changed to N_e values by the use of the following relation:

$$N_e = \left(p_{e^-}\right) N_o \frac{T_o}{T} \tag{37}$$

The concentration of each ion can then be calculated by using equations (18) to (30). The values of K_9, K_{12}, K_{13}, K_{18} to K_{20} were taken from references 31, 32, and 33 while the other equilibrium constants were calculated from Saha's equation (see, for example, ref. 34) which is

$$\log_{10} K = -\frac{23060\ V}{4.573\ T} + \frac{5}{2} \log_{10} T + \log_{10} B - 6.49 \tag{38}$$

The values for the ionization potentials needed for this equation were taken from reference 35 and are given in table I along with the values of the statistical weight ratios.

Flame temperature.- The flame temperature for a given pressure, initial temperature of precombustion mixture, and equivalent formula is calculated according to the following equation (see, for example, ref. 36):

$$\sum_i p_i\left[\left(\Delta H_F^o\right)_i + \left(H_T^o - H_{298}^o\right)_i\right] - A\left[\left(\Delta H_F^o\right)_{C_2N_2} + \left(H_T^o - H_{298}^o\right)_{C_2N_2}\right.$$

$$\left. + m\left(\Delta H_F^o\right)_{O_2} + m\left(H_T^o - H_{298}^o\right)_{O_2}\right] = Q \tag{39}$$

A graphical scheme is used to obtain a flame temperature where $Q = 0$. The initial temperature of the C_2N_2 and O_2 gaseous mixture is assumed to be 298° K. Values for the heats of formation at 298° K are taken from references 30 and 37 while the $\left(H_T^o - H_{298}^o\right)_i$ values are taken from reference 37.

Thermodynamic Properties

The thermodynamic properties for the neutral combustion products are calculated by using the following equations. The input values of $\left(H_T^o\right)_i$ and $\left(S_T^o\right)_i$ at the different temperatures were either obtained directly from references 14, 30, and 37 or calculated as in the case of $\left(H_T^o\right)_i$ by using the procedure given in reference 14. The reference temperature for the enthalpy calculation is 273.2° K.

Enthalpy.- The enthalpy of the mixture is defined as (see ref. 19 and pp. 53 to 57 of ref. 23)

$$\frac{H}{RT_o} = \frac{1}{ART_o} \sum_i p_i\left(H_T^o\right)_i \tag{40}$$

Entropy.- The entropy of the mixture is defined as (see ref. 19 and pp. 53 to 57 of ref. 23)

$$\frac{S}{R} = \frac{1}{AR} \sum_i p_i\left(S_T^o\right)_i - \frac{1}{A} \sum_i p_i \log_e p_i \tag{41}$$

Ratio of molecular weights of reactants to products.- The ratio of molecular weights Z is defined as (see pp. 53 to 57 of ref. 23)

$$Z = \frac{PM_r}{\sum_i p_i M_i} = \frac{P}{A} \tag{42}$$

These three thermodynamic properties are used to form Mollier charts for temperatures from 2000° to 6000° K and for pressures from 10^{-2} to 10^{2} atmospheres for three input mole ratios of C_2N_2/O_2 of 1/1, 1/1.05, and 1/2.0.

RESULTS AND DISCUSSION

The results of the main computer program for the equilibrium concentrations of the neutral species expressed in atmospheres at the various input temperatures, partial pressures, and mole ratios are presented in table II along with the electron concentration expressed as electrons/cm^3.

The results of the flame-temperature calculations are plotted in figure 2 and presented in table III for the different input pressures and mole ratios. The flame temperatures show a peak where there are an equal number of moles of fuel and oxidant. For comparison the theoretical temperature for the following reaction is given in figure 2

$$C_2N_2 + O_2 \rightarrow 2CO + N_2$$

and is called the stoichiometric reaction for the production of CO and N_2. The products formed from the combustion of one mole of C_2N_2 and one mole of O_2 have large dissociation-energy values leading to their high thermal stability. These large dissociation energies make the flame temperature one of the highest that can be produced by chemical means - 5119° K for the flame at a pressure of 100 atmospheres, 4848° K for the flame at a pressure of 1 atmosphere, and 4370° K for the flame at a pressure of 0.01 atmosphere. All of these values are at a mole ratio of 1/1.

The flame temperatures of the stoichiometric C_2N_2/O_2 flame (1/1 mole) are plotted as a function of pressure in figure 3. Calculated values of temperature from references 5 and 24 to 26 are also given for comparison. The fact that the data points show some scatter can be traced to the difference in the number of species chosen for the combustion products and the different values of heats of formation and dissociation energies for CN, C_2, and $C_2N_2^*$ that were used.

The electron-concentration values at the adiabatic flame temperatures are presented in table III. They were obtained by making plots similar to figure 4 where N_e is plotted against input temperature for various precombustion mole ratios. For each adiabatic flame temperature taken from table III, a specific value of N_e can be obtained from this type of plot for a given reactant mixture and combustion pressure.

The electron concentrations from table III are plotted in figure 5 as functions of the O_2 concentration in the reactant mixture for the different combustion pressures to establish the changes in electron content when the amount of O_2 is changed in the precombustion mixture. The electron-concentration curves for all the pressures with the exception of the 0.01-atmosphere curve show an increase when a small amount of O_2 is added to the stoichiometric mixture flame (50 percent by volume of O_2). The N_e peaks appear where the precombustion mixture contains between 50 and 55 percent O_2 by volume and are much more pronounced for the high-pressure cases - by a factor of 1.5 to 2 times the N_e values produced by the stoichiometric flame at pressures from 1 atmosphere to 100 atmospheres. These N_e peaks occur despite the fact that the flame temperature is decreasing as O_2 is added to the 1/1 mole reactant mixture. There is a similar increase in the NO^+ concentration in the flame products as shown in figure 6 where the mole fraction of NO^+ is plotted as a function of flame temperature for various pressures. The peaks in the NO^+ concentration curves occur at flame temperatures produced by a reactant mixture containing 50 to 55 percent O_2 by volume. Curves for X_{e^-} as a function of flame temperature are also shown in figure 6 and indicate that the peak N_e values of figure 5 follow closely the peak values of the mole fraction of NO^+, thus 85 to 95 percent of the free electrons produced where the N_e peaks occur in figure 5 are due to free electrons produced by the ionization of nitric oxide. It is possible to obtain N_e values as high as 4×10^{14} electrons/cm^3 for the 100-atmosphere flame, 1×10^{13} electrons/cm^3 for the 1-atmosphere flame, and 1.6×10^{11} electrons/cm^3 for the 0.01-atmosphere flame making this flame an attractive research tool which has been used in reference 11 in studying attenuation of radio signals through a plasma.

If the data in table II are plotted as a function of input temperature for different mole ratios and pressures as shown in the example in figure 7 for the stoichiometric 1-atmosphere flame, the concentration of the neutral species present for a given adiabatic flame temperature from table III can be obtained graphically. The concentrations of the species expressed as mole fraction X obtained by this method are presented in table IV and plotted in figure 8 as a function of percent by volume O_2 in the reactant mixture for five equilibrium pressures of 100, 10, 1, 0.1, and 0.01 atmospheres. It can be seen from this type of plot that the NO concentration increases as the amount of O_2 increases in the precombustion mixture. This is similar to the results obtained in references 27 to 29. Since nitric oxide has the lowest ionization potential of any of the flame products, the increase in the concentration of NO results in an increase in the free-electron content and the NO^+ concentration as shown in figures 5 and 6.

The thermodynamic data are used to obtain Mollier charts for the neutral combustion products. The enthalpy and entropy are expressed in a dimensionless form for these plots. The Mollier charts are presented in figure 9 and are made for the 1/1.0, 1/1.05, and 1/2.0 mole-ratio mixtures. The enthalpy H/RT_o is plotted against S/R for lines of constant temperature, pressure (expressed as P/P_o), and Z. These charts are based on the equivalent formula for the input mixture so that the enthalpy and entropy obtained are per mole of input $\left(C_2N_2 + mO_2\right)$. In figure 10 the electron concentration is plotted against H/RT_o for lines of constant pressure P/P_o for the three input mixtures of cyanogen and oxygen.

CONCLUDING REMARKS

Computations were made by using an IBM 7090 electronic computer to obtain the equilibrium composition and thermodynamic properties of the products of cyanogen-oxygen combustion at input mole ratios of C_2N_2/O_2 from 1/0.90 to 1/4.0, for pressures between 10^{-2} to 10^{2} atmospheres, and temperatures from 2000° to 6000° K. Flame temperatures for the different pressures and reactant mixtures were calculated separately by using a heat-balance technique. The neutral-species and free-electron concentrations were obtained for each flame temperature, reactant mixture, and pressure by graphical interpolation of the computer results. Mollier charts were prepared for three input mixtures of cyanogen and oxygen.

Calculations indicate that the peak electron concentration of the flame occurs when the oxygen concentration in the precombustion mixture is 50 to 55 percent by volume for equilibrium pressures between 0.1 and 100 atmospheres. The increase in the electron concentration, when a small amount of oxygen is added to the 1/1 mole ratio precombustion mixture, can be attributed to the increase of nitric oxide in the flame producing more free electrons when it is ionized.

The electron concentration can range from a peak value of 4×10^{14} electron/cm^3 for the 100-atmosphere flame to a peak value of 1.6×10^{11} electron/cm^3 for the 0.01-atmosphere flame making this flame an attractive tool in studying the attenuation of radio signals through a plasma.

The maximum flame temperatures for all pressures occur when there are equal moles of fuel and oxidant in the reactant mixture as expected and range from a high temperature of 5119° K for the flame at a pressure of 100 atmospheres to 4370° K for the flame at a pressure of 0.01 atmosphere.

Langley Research Center,
National Aeronautics and Space Administration,
Langley Station, Hampton, Va., April 24, 1964.

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TABLE I.- REACTIONS, APPROPRIATE REACTION ENERGIES AT $T = 0^\circ$ K, AND RATIOS OF STATISTICAL WEIGHTS FROM SAHA EQUATION

Reaction	Reaction energy, E, e.v.	Ratio of statistical weights, B (a)	Reference
(1) $O + O \leftrightarrows O_2$	5.1155	----	31,32
(2) $C + 2O \leftrightarrows CO_2$	16.555	----	30
(3) $C + O \leftrightarrows CO$	11.108	----	30
(4) $N + N \leftrightarrows N_2$	9.756	----	30,31
(5) $N + O \leftrightarrows NO$	6.49	----	30,31
(6) $C + N \leftrightarrows CN$	7.6	----	30
(7) $2C + 2N \leftrightarrows C_2N_2$	21.33	----	30
(8) $C + C \leftrightarrows C_2$	6.07	----	30
(9) $O_2 \leftrightarrows O_2^+ + e^-$	12.05	----	31,32
(10) $CO_2 \leftrightarrows CO_2^+ + e^-$	13.79	(4)	35
(11) $CO \leftrightarrows CO^+ + e^-$	14.01	4	35
(12) $N_2 \leftrightarrows N_2^+ + e^-$	15.576	----	31
(13) $NO \leftrightarrows NO^+ + e^-$	9.258	----	31,33
(14) $CN \leftrightarrows CN^+ + e^-$	14.6	(2)	35
(15) $C_2N_2 \leftrightarrows C_2N_2^+ + e^-$	13.57	(2)	35
(16) $C_2 \leftrightarrows C_2^+ + e^-$	12.0	(2)	35
(17) $C \leftrightarrows C^+ + e^-$	11.26	1.33	35
(18) $N \leftrightarrows N^+ + e^-$	14.54	----	31
(19) $O \leftrightarrows O^+ + e^-$	13.614	----	31,32
(20) $O^- \leftrightarrows O + e^-$	1.4	----	31
(21) $CN^- \leftrightarrows CN + e^-$	3.2	4	35

[a]Approximate values shown in parentheses.

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
100	1/0.90	6000	6.850×10^{-5}	6.923×10^{-3}	6.037×10^{1}	3.118×10^{1}	3.201×10^{-2}	3.593×10^{0}	2.921×10^{-3}	1.334×10^{-2}	3.307×10^{0}	1.329×10^{0}	1.624×10^{-1}	1.394×10^{15}
	1/0.95		2.585×10^{-4}	1.401×10^{-2}	6.290	3.165	6.265×10^{-2}	1.941×10^{0}	8.529×10^{-4}	3.839×10^{-3}	1.774×10^{0}	1.339	3.155	1.330
	1/1.0		2.500×10^{-3}	4.464×10^{-2}	6.444	3.177	1.952×10^{-1}	6.407×10^{-1}	9.290×10^{-5}	4.165×10^{-4}	5.843×10^{-1}	1.342	9.812	1.567
	1/1.05		2.154×10^{-2}	1.294×10^{-1}	6.363	3.103	5.663	2.130	1.027×10^{-5}	4.716×10^{-5}	2.000	1.326	2.879×10^{0}	2.337
	1/1.1		6.808×10^{-2}	2.242	6.203	3.003	9.905	1.149	------------	1.418×10^{-5}	1.078	1.305	5.120	2.997
	1/1.2		2.281×10^{-1}	3.889	5.878	2.810	1.754×10^{0}	5.755×10^{-2}	------------	------------	5.581×10^{-2}	1.262	9.371	3.892
	1/1.4		7.151×10^{-1}	6.220	5.309	2.482	2.918	2.759	------------	------------	2.846	1.186	1.659×10^{1}	4.900
	1/1.6		1.309×10^{0}	7.674	4.841	2.217	3.732	1.757	------------	------------	1.918	1.121	2.245	5.454
	1/2.0		2.559	9.129	4.119	1.818	4.725	9.686×10^{-3}	------------	------------	1.167	1.015	3.139	6.008
	1/4.0		7.227	8.820	2.368	9.112×10^{0}	5.261	2.345×10^{-3}	------------	------------	3.994×10^{-3}	7.188×10^{-1}	5.275	6.283
100	1/0.90	5600	9.857×10^{-6}	3.860×10^{-3}	6.099×10^{1}	3.151×10^{1}	1.070×10^{-2}	4.122×10^{0}	7.756×10^{-3}	4.968×10^{-2}	2.603×10^{0}	6.594×10^{-1}	4.235×10^{-2}	4.620×10^{14}
	1/0.95		4.143×10^{-5}	8.255×10^{-3}	6.361	3.214	2.217×10^{-2}	2.118×10^{0}	2.047×10^{-3}	1.286×10^{-2}	1.324×10^{0}	6.660	8.684×10^{-2}	4.440
	1/1.0		1.250×10^{-3}	4.670×10^{-2}	6.552	3.251	1.225×10^{-1}	3.993×10^{-1}	7.281×10^{-5}	4.520×10^{-4}	2.483×10^{-1}	6.698	4.770×10^{-1}	6.040
	1/1.05		3.264×10^{-2}	2.340×10^{-1}	6.426	3.163	6.173×10^{-1}	7.561×10^{-2}	------------	1.665×10^{-5}	4.766×10^{-2}	6.607	2.437×10^{0}	1.214×10^{15}
	1/1.1		1.146×10^{-1}	4.263	6.247	3.057	1.137×10^{0}	3.857	------------	4.483×10^{-6}	2.473	6.495	4.567	1.618
	1/1.2		3.920×10^{-1}	7.460	5.911	2.860	2.034	1.909	------------	------------	1.265	6.283	8.446	2.123
	1/1.4		1.216×10^{0}	1.187×10^{0}	5.342	2.532	3.370	9.216×10^{-3}	------------	------------	6.493×10^{-3}	5.912	1.487×10^{1}	2.666
	1/1.6		2.199	1.458	4.877	2.269	4.292	5.922	------------	------------	4.407	5.596	2.001	2.955
	1/2.0		4.235	1.727	4.163	1.872	5.409	3.308	------------	------------	2.711	5.083	2.776	3.236
	1/4.0		1.169×10^{1}	1.667	2.419	9.542×10^{0}	6.415	8.262×10^{-4}	------------	------------	9.483×10^{-4}	3.629	4.612	3.352
100	1/0.90	5200	1.175×10^{-6}	2.049×10^{-3}	6.139×10^{1}	3.167×10^{1}	3.208×10^{-3}	4.547×10^{0}	1.995×10^{-2}	1.969×10^{-1}	1.857×10^{0}	2.946×10^{-1}	9.541×10^{-3}	1.211×10^{14}
	1/0.95		4.917×10^{-6}	4.368	6.397	3.236	6.634×10^{-3}	2.341×10^{0}	5.286×10^{-3}	5.107×10^{-2}	9.457×10^{-1}	2.977	1.952×10^{-2}	1.197
	1/1.0		5.469×10^{-4}	4.761×10^{-2}	6.611	3.294	7.059×10^{-2}	2.314×10^{-1}	5.167×10^{-5}	4.904×10^{-4}	9.267×10^{-2}	3.004	2.059×10^{-1}	2.043
	1/1.05		5.316×10^{-2}	4.578×10^{-1}	6.447	3.198	6.857×10^{-1}	2.255×10^{-2}	------------	4.797×10^{-6}	9.166×10^{-3}	2.960	2.030×10^{0}	5.885
	1/1.1		1.916×10^{-1}	8.437×10^{-1}	6.259	3.093	1.280×10^{0}	1.134×10^{-2}	------------	1.254×10^{-6}	4.687	2.911	3.853	7.934
	1/1.2		6.487×10^{-1}	1.468×10^{0}	5.918	2.904	2.283	5.648×10^{-3}	------------	------------	2.408	2.821	7.091	1.039×10^{15}
	1/1.4		1.964×10^{0}	2.308	5.348	2.589	3.750	2.770	------------	------------	1.251	2.663	1.233×10^{1}	1.295
	1/1.6		3.496	2.814	4.888	2.334	4.751	1.801	------------	------------	8.569×10^{-4}	2.529	1.646	1.428
	1/2.0		6.607	3.309	4.180	1.946	5.963	1.023	------------	------------	5.331	2.309	2.263	1.554
	1/4.0		1.778×10^{1}	3.177	2.447	1.020	7.082	2.643×10^{-4}	------------	------------	1.902	1.671	3.712	1.599
100	1/0.90	4800	1.393×10^{-7}	1.170×10^{-3}	6.172×10^{1}	3.203×10^{1}	9.109×10^{-4}	4.324×10^{0}	4.125×10^{-2}	6.990×10^{-1}	1.058×10^{0}	1.153×10^{-1}	1.989×10^{-3}	2.484×10^{13}
	1/0.95		5.086×10^{-7}	2.324×10^{-3}	6.418	3.253	1.754×10^{-3}	2.371×10^{0}	1.240×10^{-2}	2.070×10^{-1}	5.760×10^{-1}	1.162	3.801×10^{-3}	2.484
	1/1.0		1.970×10^{-4}	4.732×10^{-2}	6.640	3.316	3.485×10^{-2}	1.259×10^{-1}	3.496×10^{-5}	5.721×10^{-4}	3.028×10^{-2}	1.173	7.480×10^{-2}	5.726
	1/1.05		7.952×10^{-2}	9.223×10^{-1}	6.441	3.226	6.906×10^{-1}	5.995×10^{-3}	------------	1.334×10^{-6}	1.462×10^{-3}	1.157	1.503×10^{0}	2.427×10^{14}
	1/1.1		2.865×10^{-1}	1.696×10^{0}	6.240	3.135	1.292×10^{0}	3.016	------------	3.474×10^{-7}	7.462×10^{-4}	1.140	2.853	3.278
	1/1.2		9.577×10^{-1}	2.923	5.882	2.967	2.298	1.513	------------	------------	3.847	1.109	5.215	4.281
	1/1.4		2.848×10^{0}	4.537	5.294	2.680	3.767	7.504×10^{-4}	------------	------------	2.008	1.054	8.993	5.312
	1/1.6		5.019	5.488	4.824	2.443	4.774	4.918	------------	------------	1.378	1.007	1.194×10^{1}	5.846
	1/2.0		9.384	6.393	4.110	2.069	6.008	2.820	------------	------------	8.588×10^{-5}	9.267×10^{-2}	1.632	6.354
	1/4.0		2.491×10^{1}	6.044	2.385	1.130	7.232	7.422×10^{-5}	------------	------------	3.059×10^{-5}	6.847×10^{-2}	2.659	6.535
100	1/0.90	4400	------------	8.163×10^{-4}	6.196×10^{1}	3.285×10^{1}	2.946×10^{-4}	2.993×10^{0}	5.449×10^{-2}	1.690×10^{0}	4.031×10^{-1}	3.853×10^{-2}	4.223×10^{-4}	4.321×10^{12}
	1/0.95		5.849×10^{-8}	1.437×10^{-3}	6.432	3.290	5.000×10^{-4}	1.834×10^{0}	2.044×10^{-2}	6.334×10^{-1}	2.468×10^{-1}	3.856	7.162×10^{-4}	4.140×10^{12}
	1/1.0		4.776×10^{-5}	4.247×10^{-2}	6.654	3.327	1.436×10^{-2}	6.675×10^{-2}	2.709×10^{-5}	8.301×10^{-4}	8.934×10^{-3}	3.878	2.046×10^{-2}	1.253×10^{13}
	1/1.05		8.179×10^{-2}	1.694×10^{0}	6.414	3.260	5.886×10^{-1}	1.539×10^{-3}	------------	------------	2.081×10^{-4}	3.839	8.469×10^{-1}	7.923×10^{13}
	1/1.1		3.028×10^{-1}	3.144	6.184	3.191	1.120×10^{0}	7.632×10^{-4}	------------	------------	1.043×10^{-4}	3.798	1.630×10^{0}	1.080×10^{14}
	1/1.2		1.050×10^{0}	5.470	5.778	3.058	2.043	3.747	------------	------------	5.230×10^{-5}	3.718	3.035	1.428
	1/1.4		3.269	8.552	5.120	2.813	3.456	1.805	------------	------------	2.627	3.566	5.354	1.798
	1/1.6		5.916	1.035×10^{1}	4.607	2.596	4.466	1.160	------------	------------	1.757	3.425	7.203	1.995
	1/2.0		1.138×10^{1}	1.199	3.849	2.235	5.749	6.486×10^{-5}	------------	------------	1.059	3.179	9.989	2.187
	1/4.0		3.124×10^{1}	1.103	2.137	1.261	7.155	1.632×10^{-5}	------------	------------	3.548×10^{-6}	2.388	1.655×10^{1}	2.273

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	N_e, cm^{-3}
100	1/0.90	4000	------------	7.212×10^{-4}	6.206×10^{1}	3.368×10^{1}	9.999×10^{-5}	1.484×10^{0}	4.774×10^{-2}	2.611×10^{0}	9.346×10^{-2}	1.035×10^{-2}	8.958×10^{-5}	6.642×10^{11}
	1/0.95		------------	1.168×10^{-3}	6.439	3.337	1.554×10^{-4}	9.818×10^{-1}	2.087×10^{-2}	1.152×10^{0}	6.208×10^{-2}	1.030	1.399×10^{-4}	5.961×10^{11}
	1/1.0		6.969×10^{-6}	3.368×10^{-2}	6.659	3.331	4.328×10^{-3}	3.639×10^{-2}	2.868×10^{-5}	1.587×10^{-3}	2.304×10^{-3}	1.029	3.899×10^{-3}	1.886×10^{12}
	1/1.05		4.437×10^{-2}	2.572×10^{0}	6.374	3.298	3.436×10^{-1}	4.343×10^{-4}	------------	------------	2.763×10^{-5}	1.024	3.111×10^{-1}	1.755×10^{13}
	1/1.1		1.779×10^{-1}	4.927	6.097	3.260	6.841×10^{-1}	2.063×10^{-4}	------------	------------	1.320×10^{-5}	1.018	6.230×10^{-1}	2.455
	1/1.2		7.041×10^{-1}	8.992	5.593	3.178	1.344×10^{0}	9.392×10^{-5}	------------	------------	6.086×10^{-6}	1.005	1.239×10^{0}	3.383
	1/1.4		2.630×10^{0}	1.481×10^{1}	4.766	2.997	2.522	4.021	------------	------------	2.684	9.762×10^{-3}	2.395	4.494
	1/1.6		5.319×10^{0}	1.829	4.139	2.810	3.473	2.378	------------	------------	1.639	9.453	3.407	5.142
	1/2.0		1.149×10^{1}	2.129	3.277	2.464	4.780	1.199	------------	------------	8.829×10^{-7}	8.852	5.008	5.810
	1/4.0		3.553×10^{1}	1.864	1.632	1.428	6.399	2.587×10^{-6}	------------	------------	2.501×10^{-7}	6.739	8.805	6.218
100	1/0.90	3600	------------	7.404×10^{-4}	6.208×10^{1}	3.420×10^{1}	3.067×10^{-5}	5.236×10^{-1}	2.799×10^{-2}	3.153×10^{0}	1.334×10^{-2}	2.067×10^{-3}	1.587×10^{-5}	8.222×10^{10}
	1/0.95		------------	1.156×10^{-3}	6.441	3.371	4.581×10^{-5}	3.584×10^{-1}	1.311×10^{-2}	1.499×10^{0}	9.202×10^{-3}	2.052	2.388×10^{-5}	7.098×10^{10}
	1/1.0		6.079×10^{-7}	2.459×10^{-2}	6.662	3.332	9.371×10^{-4}	1.792×10^{-2}	3.279×10^{-5}	3.790×10^{-3}	4.627×10^{-4}	2.041	4.912×10^{-4}	1.771×10^{11}
	1/1.05		1.076×10^{-2}	3.117×10^{0}	6.345	3.322	1.245×10^{-1}	1.281×10^{-4}	------------	------------	3.312×10^{-6}	2.038	6.537×10^{-2}	2.334×10^{12}
	1/1.1		4.652×10^{-2}	6.158×10^{0}	6.030	3.310	2.583	5.843×10^{-5}	------------	------------	1.514×10^{-6}	2.034	1.359×10^{-1}	3.351
	1/1.2		2.167×10^{-1}	1.194×10^{1}	5.419	3.279	5.550	2.422×10^{-5}	------------	------------	6.304×10^{-7}	2.024	2.933	4.868
	1/1.4		1.136×10^{0}	2.182	4.322	3.189	1.253×10^{0}	8.319×10^{-6}	------------	------------	2.195	1.996	6.717	7.160
	1/1.6		3.070	2.866	3.454	3.059	2.018	3.962	------------	------------	1.067	1.955	1.104×10^{0}	8.872
	1/2.0		9.276	3.431	2.379	2.739	3.318	1.485	------------	------------	4.230×10^{-8}	1.850	1.919	1.091×10^{13}
	1/4.0		3.760×10^{1}	2.775	9.559×10^{0}	1.609	5.122	2.272×10^{-7}	------------	------------	8.441×10^{-9}	1.418	3.863	1.243×10^{13}
100	1/0.90	3200	------------	8.418×10^{-4}	6.207×10^{1}	3.441×10^{1}	7.886×10^{-6}	1.277×10^{-1}	1.153×10^{-2}	3.373×10^{0}	1.075×10^{-3}	2.757×10^{-4}	2.006×10^{-6}	6.565×10^{9}
	1/0.95		------------	1.297×10^{-3}	6.441	3.385	1.162×10^{-5}	8.850×10^{-2}	5.532×10^{-3}	1.645×10^{0}	7.507×10^{-4}	2.735	2.980×10^{-6}	5.577×10^{9}
	1/1.0		4.835×10^{-8}	2.065×10^{-2}	6.663	3.333	1.774×10^{-4}	5.904×10^{-3}	2.462×10^{-5}	7.438×10^{-3}	5.047×10^{-5}	2.714	4.586×10^{-5}	1.044×10^{10}
	1/1.05		1.359×10^{-3}	3.292×10^{0}	6.336	3.331	2.973×10^{-2}	3.348×10^{-5}	------------	------------	2.863×10^{-7}	2.713	7.688×10^{-3}	1.730×10^{11}
	1/1.1		6.026×10^{-3}	6.572×10^{0}	6.006	3.328	6.259×10^{-2}	1.506×10^{-5}	------------	------------	1.288×10^{-7}	2.712	1.619×10^{-2}	2.510
	1/1.2		3.008×10^{-2}	1.308×10^{1}	5.349	3.322	1.397×10^{-1}	6.000×10^{-6}	------------	------------	5.138×10^{-8}	2.709	3.617	3.742
	1/1.4		2.008×10^{-1}	2.568	4.066	3.299	3.597	1.759×10^{-6}	------------	------------	1.511×10^{-8}	2.700	9.345	5.957
	1/1.6		8.225×10^{-1}	3.689	2.886	3.251	7.227	6.123×10^{-7}	------------	------------	5.300×10^{-9}	2.680	1.891×10^{-1}	8.334
	1/2.0		5.838×10^{0}	4.779	1.403	2.998	1.849×10^{0}	------------	------------	------------	9.671×10^{-10}	2.574	5.039×10^{-1}	1.279×10^{12}
	1/4.0		3.847×10^{1}	3.494	3.996×10^{0}	1.765	3.641×10^{0}	------------	------------	------------	1.073×10^{-10}	1.975	1.293×10^{0}	1.640×10^{12}
100	1/0.90	2800	------------	1.028×10^{-3}	6.207×10^{1}	3.447×10^{1}	1.376×10^{-6}	2.161×10^{-2}	3.976×10^{-3}	3.434×10^{0}	4.154×10^{-5}	2.076×10^{-5}	1.443×10^{-7}	2.552×10^{8}
	1/0.95		------------	1.580×10^{-3}	6.440	3.389	2.021×10^{-6}	1.501×10^{-2}	1.919×10^{-3}	1.686×10^{0}	2.911×10^{-5}	2.058	2.136×10^{-7}	2.151
	1/1.0		2.780×10^{-9}	2.168×10^{-2}	6.663	3.333	2.658×10^{-5}	1.162×10^{-3}	1.149×10^{-5}	1.026×10^{-2}	2.271×10^{-6}	2.041	2.833×10^{-6}	3.222
	1/1.05		7.252×10^{-5}	3.328×10^{0}	6.333	3.333	4.293×10^{-3}	6.837×10^{-6}	------------	3.554×10^{-7}	1.336×10^{-8}	2.041	4.576×10^{-4}	5.867×10^{9}
	1/1.1		3.231×10^{-4}	6.655×10^{0}	6.001	3.332	9.060×10^{-3}	3.069	------------	------------	5.999×10^{-9}	2.041	9.659×10^{-4}	8.537×10^{9}
	1/1.2		1.633×10^{-3}	1.330×10^{1}	5.335	3.332	2.037×10^{-2}	1.213	------------	------------	2.372×10^{-9}	2.041	2.172×10^{-3}	1.280×10^{10}
	1/1.4		1.155×10^{-2}	2.657	4.006	3.329	5.404×10^{-2}	3.425×10^{-7}	------------	------------	6.699×10^{-10}	2.040	5.776×10^{-3}	2.085
	1/1.6		5.728×10^{-2}	3.970	2.688	3.323	1.205×10^{-1}	1.031×10^{-7}	------------	------------	2.018×10^{-10}	2.038	1.286×10^{-2}	3.102
	1/2.0		2.544×10^{0}	5.869	5.962×10^{0}	3.193	7.871×10^{-1}	3.363×10^{-9}	------------	------------	6.716×10^{-12}	1.998	8.572×10^{-2}	7.693
	1/4.0		3.889×10^{1}	3.872	1.006×10^{0}	1.869	2.354×10^{0}	1.111×10^{-10}	------------	------------	2.900×10^{-13}	1.528	3.351×10^{-1}	1.214×10^{11}
100	1/0.90	2400	------------	1.366×10^{-3}	6.207×10^{1}	3.448×10^{1}	1.340×10^{-7}	1.986×10^{-3}	9.195×10^{-4}	3.447×10^{0}	5.499×10^{-7}	6.617×10^{-7}	4.327×10^{-9}	3.503×10^{6}
	1/0.95		------------	2.097×10^{-3}	6.440	3.389	1.966×10^{-7}	1.381×10^{-3}	4.444×10^{-4}	1.695×10^{0}	3.856×10^{-7}	6.561	6.404×10^{-9}	2.942
	1/1.0		7.838×10^{-11}	2.579×10^{-2}	6.662	3.334	2.318×10^{-6}	1.192×10^{-4}	3.310×10^{-6}	1.283×10^{-2}	3.355×10^{-8}	6.507	7.613×10^{-8}	3.465
	1/1.05		1.448×10^{-6}	3.333×10^{0}	6.333	3.333	3.151×10^{-4}	8.332×10^{-7}	------------	6.275×10^{-7}	2.346×10^{-10}	6.506	1.035×10^{-5}	6.407×10^{7}
	1/1.1		6.456×10^{-6}	6.666×10^{0}	6.000	3.333	6.652×10^{-4}	3.739	------------	------------	1.053×10^{-10}	6.506	2.185	9.339×10^{7}
	1/1.2		3.268×10^{-5}	1.333×10^{1}	5.333	3.333	1.496×10^{-3}	1.477	------------	------------	4.160×10^{-11}	6.506	4.916	1.403×10^{8}
	1/1.4		2.323×10^{-4}	2.666	4.000	3.333	3.990	4.156×10^{-8}	------------	------------	1.170×10^{-11}	6.506	1.311×10^{-4}	2.292
	1/1.6		1.175×10^{-3}	3.998	2.667	3.332	8.974	1.232×10^{-8}	------------	------------	3.469×10^{-12}	6.506	2.948×10^{-4}	3.437
	1/2.0		7.401×10^{-1}	6.438	1.711×10^{0}	3.293	2.239×10^{-1}	3.131×10^{-11}	------------	------------	$< 1.0 \times 10^{-14}$	6.467	7.397×10^{-3}	1.695×10^{9}
	1/4.0		3.938×10^{1}	3.981	1.451×10^{-1}	1.935	1.252×10^{0}	------------	------------	------------	$< 1.0 \times 10^{-15}$	4.958	5.396×10^{-2}	3.717×10^{9}

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
40	1/0.90	6000	4.214×10^{-5}	2.146×10^{-3}	2.386×10^{1}	1.234×10^{1}	1.580×10^{-2}	1.139×10^{0}	2.937×10^{-4}	3.389×10^{-3}	1.667×10^{0}	8.366×10^{-1}	1.274×10^{-1}	1.098×10^{15}
	1/0.95		1.431×10^{-4}	4.118×10^{-3}	2.484	1.246	2.925	6.464×10^{-1}	9.458×10^{-5}	1.081×10^{-3}	9.414×10^{-1}	8.405	2.348	9.923×10^{14}
	1/1.0		8.645×10^{-4}	1.034×10^{-2}	2.539	1.244	7.184	2.687	1.635×10^{-5}	1.871×10^{-4}	3.916	8.399	5.769	1.035×10^{15}
	1/1.05		4.744×10^{-3}	2.401	2.516	1.218	1.665×10^{-1}	1.124	------------	3.348×10^{-5}	1.656	8.310	1.351×10^{0}	1.329
	1/1.1		1.365×10^{-2}	3.980	2.458	1.181	2.781	6.380×10^{-2}	------------	1.111×10^{-5}	9.541×10^{-2}	8.184	2.292	1.639
	1/1.2		4.438×10^{-2}	6.805	2.331	1.108	4.856	3.249	------------	------------	5.018	7.925	4.133	2.101
	1/1.4		1.391×10^{-1}	1.087×10^{-1}	2.103	9.806×10^{0}	8.090	1.558	------------	------------	2.557	7.456	7.318	2.658
	1/1.6		2.558	1.341	1.914	8.774	1.038×10^{0}	9.888×10^{-3}	------------	------------	1.716	7.053	9.924	2.981
	1/2.0		5.036	1.595	1.622	7.215	1.320	5.416	------------	------------	1.036	6.396	1.392×10^{1}	3.322
	1/4.0		1.434×10^{0}	1.528	9.209×10^{0}	3.661	1.587	1.298	------------	------------	3.487×10^{-3}	4.556	2.349×10^{1}	3.566
40	1/0.90	5600	5.761×10^{-6}	1.172×10^{-3}	2.423×10^{1}	1.259×10^{1}	5.174×10^{-3}	1.354×10^{0}	8.369×10^{-4}	1.341×10^{-2}	1.353×10^{0}	4.169×10^{-1}	3.238×10^{-2}	3.999×10^{14}
	1/0.95		2.344×10^{-5}	2.469×10^{-3}	2.530	1.279	1.052×10^{-2}	7.063×10^{-1}	2.277×10^{-4}	3.594×10^{-3}	7.002×10^{-1}	4.201	6.532×10^{-2}	3.519
	1/1.0		4.328×10^{-4}	1.092×10^{-2}	2.603	1.287	4.534×10^{-2}	1.697×10^{-1}	1.314×10^{-5}	2.061×10^{-4}	1.677×10^{-1}	4.214	2.807×10^{-1}	3.926
	1/1.05		7.021×10^{-3}	4.324	2.560	1.254	1.803×10^{-1}	4.089×10^{-2}	------------	1.228×10^{-5}	4.094×10^{-2}	4.160	1.130×10^{0}	6.716
	1/1.1		2.402×10^{-2}	7.778	2.489	1.213	3.278	2.115	------------	3.398×10^{-6}	2.153	4.091	2.091	8.855
	1/1.2		8.244×10^{-2}	1.363×10^{-1}	2.355	1.135	5.877	1.044	------------	------------	1.099	3.958	3.873	1.166×10^{15}
	1/1.4		2.597×10^{-1}	2.181	2.123	1.005	9.814	4.992×10^{-3}	------------	------------	5.583×10^{-3}	3.724	6.875	1.484
	1/1.6		4.752	2.687	1.934	9.001×10^{0}	1.256×10^{0}	3.181	------------	------------	3.759	3.524	9.300	1.663
	1/2.0		9.271	3.188	1.643	7.418	1.593	1.756	------------	------------	2.286	3.199	1.299×10^{1}	1.848
	1/4.0		2.599×10^{0}	3.059	9.413×10^{0}	3.792	1.907	4.298×10^{-4}	------------	------------	7.825×10^{-4}	2.287	2.175×10^{1}	1.970
40	1/0.90	5200	6.168×10^{-7}	5.912×10^{-4}	2.444×10^{1}	1.270×10^{1}	1.472×10^{-3}	1.582×10^{0}	2.414×10^{-3}	5.944×10^{-2}	1.020×10^{0}	1.865×10^{-1}	6.914×10^{-3}	1.176×10^{14}
	1/0.95		2.600×10^{-6}	1.267×10^{-3}	2.551	1.293	3.050×10^{-3}	8.116×10^{-1}	6.356×10^{-4}	1.536×10^{-2}	5.186×10^{-1}	1.882	1.419×10^{-2}	1.047
	1/1.0		1.934×10^{-4}	1.129×10^{-2}	2.637	1.311	2.649×10^{-2}	9.797×10^{-2}	9.260×10^{-6}	2.207×10^{-4}	6.217×10^{-2}	1.896	1.224×10^{-1}	1.319
	1/1.05		1.259×10^{-2}	8.904×10^{-2}	2.576	1.273	2.106×10^{-1}	1.168×10^{-2}	------------	3.234×10^{-6}	7.526×10^{-3}	1.868	9.879×10^{-1}	3.304
	1/1.1		4.558×10^{-2}	1.645×10^{-1}	2.502	1.230	3.939	5.863×10^{-3}	------------	8.427×10^{-7}	3.841	1.836	1.879×10^{0}	4.466
	1/1.2		1.567×10^{-1}	2.883	2.365	1.153	7.069	2.893	------------	2.190×10^{-7}	1.958	1.777	3.485	5.911
	1/1.4		4.846	4.577	2.135	1.023	1.171×10^{0}	1.399	------------	------------	1.005	1.675	6.129	7.489
	1/1.6		8.740	5.610	1.948	9.198×10^{0}	1.491	9.017×10^{-4}	------------	------------	6.833×10^{-4}	1.587	8.230	8.354
	1/2.0		1.674×10^{0}	6.622	1.662	7.628	1.879	5.059	------------	------------	4.210	1.446	1.139×10^{1}	9.230
	1/4.0		4.574×10^{0}	6.354	9.648×10^{0}	3.969	2.241	1.282	------------	------------	1.479	1.043	1.883×10^{1}	9.752
40	1/0.90	4800	6.364×10^{-8}	3.152×10^{-4}	2.461×10^{1}	1.282×10^{1}	3.895×10^{-4}	1.614×10^{0}	5.749×10^{-3}	2.433×10^{-1}	6.244×10^{-1}	7.295×10^{-2}	1.344×10^{-3}	2.599×10^{13}
	1/0.95		2.390×10^{-7}	6.362×10^{-4}	2.563	1.301	7.604×10^{-4}	8.737×10^{-1}	1.684×10^{-3}	7.023×10^{-2}	3.355×10^{-1}	7.349	2.605×10^{-3}	2.408
	1/1.0		7.508×10^{-5}	1.168×10^{-2}	2.654	1.324	1.359×10^{-2}	5.150×10^{-2}	5.851×10^{-6}	2.398×10^{-4}	1.960×10^{-2}	7.413	4.617×10^{-2}	3.746
	1/1.05		2.358×10^{-2}	2.011×10^{-1}	2.580	1.284	2.373×10^{-1}	2.782×10^{-3}	------------	7.214×10^{-7}	1.075×10^{-3}	7.301	8.184×10^{-1}	1.435×10^{14}
	1/1.1		8.528×10^{-2}	3.711	2.503	1.244	4.441	1.397×10^{-3}	------------	1.878×10^{-7}	5.485×10^{-4}	7.185	1.556×10^{0}	1.947
	1/1.2		2.865×10^{-1}	6.426	2.364	1.171	7.899	6.984×10^{-4}	------------	------------	2.827	6.972	2.853	2.564
	1/1.4		8.567×10^{-1}	1.003×10^{0}	2.135	1.050	1.293×10^{0}	3.453	------------	------------	1.476	6.600	4.932	3.221
	1/1.6		1.513×10^{0}	1.218	1.950	9.512×10^{0}	1.635	2.260	------------	------------	1.015	6.283	6.554	3.575
	1/2.0		2.830	1.424	1.667	7.996	2.051	1.295	------------	------------	6.345×10^{-5}	5.760	8.965	3.928
	1/4.0		7.488	1.357	9.765×10^{0}	4.314	2.450	3.425×10^{-5}	------------	------------	2.284×10^{-5}	4.231	1.458×10^{1}	4.129
40	1/0.90	4400	------------	2.094×10^{-4}	2.474×10^{1}	1.314×10^{1}	1.197×10^{-4}	1.176×10^{0}	8.419×10^{-3}	6.531×10^{-1}	2.506×10^{-1}	2.437×10^{-2}	2.714×10^{-4}	4.478×10^{12}
	1/0.95		2.460×10^{-8}	3.724×10^{-4}	2.570	1.316	2.050×10^{-4}	7.146×10^{-1}	3.105×10^{-3}	2.405×10^{-1}	1.521×10^{-1}	2.439	4.645×10^{-4}	4.152
	1/1.0		2.137×10^{-5}	1.136×10^{-2}	2.661	1.330	6.077×10^{-3}	2.523×10^{-2}	3.872×10^{-6}	2.967×10^{-4}	5.341×10^{-3}	2.452	1.369×10^{-2}	8.565
	1/1.05		3.492×10^{-2}	4.443×10^{-1}	2.574	1.296	2.424×10^{-1}	5.960×10^{-4}	------------	------------	1.278×10^{-4}	2.420	5.534×10^{-1}	5.115×10^{13}
	1/1.1		1.258×10^{-1}	8.161×10^{-1}	2.490	1.262	4.542	2.998	------------	------------	6.515×10^{-5}	2.388	1.050×10^{0}	6.944
	1/1.2		4.193×10^{-1}	1.401×10^{0}	2.343	1.200	8.085	1.506	------------	------------	3.357	2.329	1.918	9.141
	1/1.4		1.242×10^{0}	2.164	2.102	1.092	1.327×10^{0}	7.494×10^{-5}	------------	------------	1.750	2.221	3.300	1.148×10^{14}
	1/1.6		2.183	2.609	1.911	1.001	1.685	4.920	------------	------------	1.200	2.127	4.375	1.274
	1/2.0		4.067	3.024	1.623	8.556×10^{0}	2.126	2.830	------------	------------	7.469×10^{-6}	1.966	5.972	1.401
	1/4.0		1.072×10^{1}	2.830	9.356×10^{0}	4.794×10^{0}	2.584	7.519×10^{-6}	------------	------------	2.651×10^{-6}	1.472	9.697	1.477

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	N_e, cm^{-3}
40	1/0.90	4000	------------	1.822×10^{-4}	2.481×10^{1}	1.347×10^{1}	3.998×10^{-5}	5.939×10^{-1}	7.638×10^{-3}	1.044×10^{0}	5.910×10^{-2}	6.546×10^{-3}	5.663×10^{-5}	6.561×10^{11}
	1/0.95		------------	2.961×10^{-4}	2.375	1.335	6.229×10^{-5}	3.918×10^{-1}	3.325×10^{-3}	4.590×10^{-1}	3.918×10^{-2}	6.515	8.865×10^{-5}	5.799×10^{11}
	1/1.0		3.749×10^{-6}	9.884×10^{-3}	2.664	1.332	2.007×10^{-3}	1.255×10^{-2}	3.412×10^{-6}	4.720×10^{-4}	1.256×10^{-3}	6.509	2.860×10^{-3}	1.381×10^{12}
	1/1.05		2.906×10^{-2}	8.357×10^{-1}	2.558	1.312	1.754×10^{-1}	1.358×10^{-4}	------------	------------	1.370×10^{-5}	6.459	2.518×10^{-1}	1.257×10^{13}
	1/1.1		1.103×10^{-1}	1.565×10^{0}	2.458	1.290	3.389	6.645×10^{-5}	------------	------------	6.759×10^{-6}	6.405	4.907	1.735
	1/1.2		3.974×10^{-1}	2.755	2.281	1.246	6.322	3.193	------------	------------	3.305	6.296	9.312	2.341
	1/1.4		1.295×10^{0}	4.352	1.996	1.160	1.101×10^{0}	1.493	------------	------------	1.602	6.074	1.681×10^{0}	3.027
	1/1.6		2.405	5.281	1.777	1.080	1.448	9.411×10^{-6}	------------	------------	1.046	5.860	2.291	3.416
	1/2.0		4.749	6.103	1.461	9.407×10^{0}	1.899	5.142	------------	------------	6.125×10^{-7}	5.469	3.219	3.823
	1/4.0		1.336×10^{1}	5.498	7.850×10^{0}	5.459×10^{0}	2.426	1.254	------------	------------	1.961×10^{-7}	4.166	5.399	4.112
40	1/0.90	3600	------------	1.869×10^{-4}	2.483×10^{1}	1.368×10^{1}	1.224×10^{-5}	2.098×10^{-1}	4.496×10^{-3}	1.265×10^{0}	8.456×10^{-3}	1.308×10^{-3}	1.001×10^{-5}	7.947×10^{10}
	1/0.95		------------	2.919×10^{-4}	2.576	1.348	1.830×10^{-5}	1.436×10^{-1}	2.105×10^{-3}	6.013×10^{-1}	5.828×10^{-3}	1.298	1.508×10^{-5}	6.760×10^{10}
	1/1.0		3.516×10^{-7}	7.484×10^{-3}	2.665	1.333	4.507×10^{-4}	5.962×10^{-3}	3.629×10^{-6}	1.048×10^{-3}	2.434×10^{-4}	1.291	3.736×10^{-4}	1.387×10^{11}
	1/1.05		9.532×10^{-3}	1.175×10^{0}	2.542	1.326	7.401×10^{-2}	3.444×10^{-5}	------------	------------	1.410×10^{-6}	1.287	6.151×10^{-2}	1.802×10^{12}
	1/1.1		4.001×10^{-2}	2.293	2.421	1.317	1.511×10^{-1}	1.596×10^{-5}	------------	------------	6.554×10^{-7}	1.283	1.260×10^{-1}	2.566
	1/1.2		1.738×10^{-1}	4.331	2.194	1.298	3.127	6.887×10^{-6}	------------	------------	2.850	1.274	2.627	3.661
	1/1.4		7.675×10^{-1}	7.498	1.807	1.246	6.439	2.646	------------	------------	1.117	1.248	5.520	5.167
	1/1.6		1.752×10^{0}	9.488	1.513	1.184	9.482	1.429	------------	------------	6.192×10^{-8}	1.216	8.340	6.173
	1/2.0		4.307×10^{0}	1.113×10^{1}	1.132	1.052	1.402×10^{0}	6.431×10^{-7}	------------	------------	2.955×10^{-8}	1.147	1.308×10^{0}	7.319
	1/4.0		1.484×10^{1}	9.358×10^{0}	5.130×10^{0}	6.242×10^{0}	2.003×10^{0}	1.209×10^{-7}	------------	------------	7.212×10^{-9}	8.833×10^{-4}	2.427×10^{0}	8.287
40	1/0.90	3200	------------	2.127×10^{-4}	2.483×10^{1}	1.376×10^{1}	3.151×10^{-6}	5.115×10^{-2}	1.848×10^{-3}	1.352×10^{0}	6.804×10^{-4}	1.744×10^{-4}	1.268×10^{-6}	6.338×10^{9}
	1/0.95		------------	3.279×10^{-4}	2.576	1.354	4.644×10^{-6}	3.543×10^{-2}	8.867×10^{-3}	6.593×10^{-1}	4.752×10^{-4}	1.730	1.883×10^{-6}	5.309
	1/1.0		2.701×10^{-8}	6.175×10^{-3}	2.665	1.333	8.386×10^{-5}	1.999×10^{-3}	2.822×10^{-6}	2.131×10^{-3}	2.701×10^{-5}	1.716	3.428×10^{-5}	8.543
	1/1.05		1.331×10^{-3}	1.304×10^{0}	2.535	1.332	1.861×10^{-2}	8.558×10^{-6}	------------	------------	1.157×10^{-7}	1.715	7.610×10^{-3}	1.371×10^{11}
	1/1.1		5.872×10^{-3}	2.597	2.404	1.330	3.905	3.861	------------	------------	5.225×10^{-8}	1.714	1.598×10^{-2}	1.985
	1/1.2		2.887×10^{-2}	5.139	2.145	1.325	8.645	1.551	------------	------------	2.103×10^{-8}	1.711	3.544	2.945
	1/1.4		1.808×10^{-1}	9.900	1.651	1.310	2.151×10^{-1}	4.743×10^{-7}	------------	------------	6.468×10^{-9}	1.701	8.870	4.611
	1/1.6		6.363×10^{-1}	1.376×10^{1}	1.224	1.280	3.988	1.852×10^{-7}	------------	------------	2.555×10^{-9}	1.682	1.664×10^{-1}	6.211
	1/2.0		2.947×10^{0}	1.711	7.073×10^{0}	1.168	8.201	------------	------------	------------	6.862×10^{-10}	1.607	3.580	8.681
	1/4.0		1.541×10^{1}	1.301	2.352×10^{0}	6.959×10^{0}	1.447×10^{0}	------------	------------	------------	9.979×10^{-11}	1.240	8.187	1.090×10^{12}
40	1/0.90	2800	------------	2.601×10^{-4}	2.483×10^{1}	1.379×10^{1}	5.504×10^{-7}	8.647×10^{-3}	6.366×10^{-4}	1.374×10^{0}	2.628×10^{-5}	1.313×10^{-5}	9.123×10^{-8}	2.478×10^{8}
	1/0.95		------------	3.996×10^{-4}	2.576	1.355	8.082×10^{-7}	6.008×10^{-3}	3.073×10^{-4}	6.748×10^{-1}	1.841×10^{-5}	1.302	1.351×10^{-7}	2.064
	1/1.0		1.517×10^{-9}	6.407×10^{-3}	2.665	1.333	1.241×10^{-5}	3.979×10^{-4}	1.348×10^{-6}	3.009×10^{-3}	1.230×10^{-6}	1.291	2.093×10^{-6}	2.742
	1/1.05		7.236×10^{-5}	1.330×10^{0}	2.533	1.333	2.712×10^{-3}	1.731×10^{-6}	------------	5.700×10^{-8}	5.352×10^{-9}	1.291	4.571×10^{-4}	4.675×10^{9}
	1/1.1		3.222×10^{-4}	2.659	2.400	1.333	5.722×10^{-3}	7.774×10^{-7}	------------	------------	2.403×10^{-9}	1.291	9.646×10^{-4}	6.793×10^{9}
	1/1.2		1.627×10^{-3}	5.313	2.134	1.332	1.285×10^{-2}	3.075×10^{-7}	------------	------------	9.509×10^{-10}	1.290	2.168×10^{-3}	1.018×10^{10}
	1/1.4		1.144×10^{-2}	1.059×10^{1}	1.605	1.330	3.407	8.713×10^{-8}	------------	------------	2.696×10^{-10}	1.289	5.749×10^{-3}	1.654
	1/1.6		5.553×10^{-2}	1.576	1.084	1.326	7.493	2.666×10^{-8}	------------	------------	8.264×10^{-11}	1.287	1.266×10^{-2}	2.446
	1/2.0		1.353×10^{0}	2.247	3.130×10^{0}	1.262	3.609×10^{-1}	1.522×10^{-9}	------------	------------	4.836×10^{-12}	1.256	6.252×10^{-2}	5.259
	1/4.0		1.557×10^{1}	1.521	6.246×10^{-1}	7.446×10^{0}	9.401×10^{-1}	6.878×10^{-11}	------------	------------	2.844×10^{-13}	9.648×10^{-6}	2.120×10^{-1}	8.013
10	1/0.90	6000	2.177×10^{-5}	3.736×10^{-4}	5.779×10^{0}	2.963×10^{0}	5.563×10^{-3}	1.881×10^{-1}	8.006×10^{-6}	3.848×10^{-4}	5.616×10^{-1}	4.099×10^{-1}	9.154×10^{-2}	6.621×10^{14}
	1/0.95		5.682×10^{-5}	6.253×10^{-4}	5.987	2.964	8.990×10^{-3}	1.206×10^{-1}	3.293	1.582×10^{-4}	3.601	4.100	1.479×10^{-1}	5.931
	1/1.0		1.762×10^{-4}	1.121×10^{-3}	6.096	2.940	1.577×10^{-2}	6.945×10^{-2}	1.091	5.288×10^{-5}	2.082	4.083	2.605	5.672
	1/1.05		5.128×10^{-4}	1.906	6.076	2.884	2.664	4.019	------------	1.806×10^{-5}	1.216	4.044	4.443	6.042
	1/1.1		1.162×10^{-3}	2.822	5.974	2.809	3.957	2.591	------------	7.703×10^{-6}	7.946×10^{-2}	3.991	6.689	6.726
	1/1.2		3.344×10^{-3}	4.566	5.698	2.647	6.518	1.414	------------	2.435×10^{-6}	4.468	3.874	1.135×10^{0}	8.083
	1/1.4		1.010×10^{-2}	7.175	5.153	2.355	1.068×10^{-1}	6.941×10^{-3}	------------	6.593×10^{-7}	2.325	3.654	1.972	9.996
	1/1.6		1.848	8.829	4.687	2.114	1.369	4.423	------------	2.983×10^{-7}	1.563	3.462	2.667	1.118×10^{15}
	1/2.0		3.634	1.047×10^{-2}	3.964	1.747	1.745	2.424	------------	------------	9.429×10^{-3}	3.147	3.740	1.251
	1/4.0		1.034×10^{-1}	9.942×10^{-3}	2.231	9.032×10^{-1}	2.117	5.816×10^{-4}	------------	------------	3.146×10^{-3}	2.263	6.310	1.365

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
10	1/0.90	5600	3.027×10^{-6}	2.093×10^{-4}	5.967×10^{0}	3.110×10^{0}	1.864×10^{-3}	2.286×10^{-1}	2.386×10^{-5}	1.548×10^{-3}	4.596×10^{-1}	2.072×10^{-1}	2.347×10^{-2}	2.572×10^{14}
	1/0.95		1.096×10^{-5}	4.156×10^{-4}	6.229	3.135	3.560×10^{-3}	1.259×10^{-1}	7.242×10^{-6}	4.662×10^{-4}	2.522×10^{-1}	2.080	4.466×10^{-2}	2.161
	1/1.0		8.728×10^{-5}	1.203×10^{-3}	6.386	3.131	1.004×10^{-2}	4.572×10^{-2}	9.542×10^{-7}	6.152×10^{-5}	9.161×10^{-2}	2.078	1.260×10^{-1}	2.070
	1/1.05		6.273×10^{-4}	3.188	6.315	3.060	2.661	1.667×10^{-2}	------------	8.371×10^{-6}	3.379	2.055	3.379	2.726
	1/1.1		1.925×10^{-3}	5.445	6.158	2.967	4.590	9.138×10^{-3}	------------	2.593×10^{-6}	1.881	2.023	5.918	3.421
	1/1.2		6.421×10^{-3}	9.412	5.827	2.784	8.122	4.587	------------	6.962×10^{-7}	9.746×10^{-3}	1.960	1.081×10^{0}	4.440
	1/1.4		2.029×10^{-2}	1.505×10^{-2}	5.243	2.471	1.360×10^{-1}	2.187	------------	1.784×10^{-7}	4.933	1.847	1.922	5.669
	1/1.6		3.738	1.856	4.763	2.218	1.749	1.387	------------	7.990×10^{-8}	3.301	1.749	2.608	6.392
	1/2.0		7.362	2.201	4.025	1.833	2.231	7.593×10^{-4}	------------	------------	1.988	1.590	3.660	7.179
	1/4.0		2.087×10^{-1}	2.089	2.268	9.524×10^{-1}	2.708	1.832×10^{-4}	------------	------------	6.655×10^{-4}	1.146	6.163	7.842
10	1/0.90	5200	2.829×10^{-7}	9.918×10^{-5}	6.055×10^{0}	3.175×10^{0}	4.984×10^{-4}	2.894×10^{-1}	8.080×10^{-5}	7.954×10^{-3}	3.732×10^{-1}	9.328×10^{-2}	4.682×10^{-3}	8.661×10^{13}
	1/0.95		1.179×10^{-6}	2.118×10^{-4}	6.335	3.218	1.024×10^{-3}	1.493×10^{-1}	2.150×10^{-5}	2.089×10^{-3}	1.913×10^{-1}	9.389	9.558×10^{-3}	6.967
	1/1.0		3.847×10^{-5}	1.249×10^{-3}	6.543	3.239	5.871×10^{-3}	2.708×10^{-2}	7.076×10^{-7}	6.828×10^{-5}	3.458×10^{-2}	9.421	5.460×10^{-2}	6.711
	1/1.05		1.107×10^{-3}	6.571×10^{-3}	6.413	3.151	3.106×10^{-2}	4.880×10^{-3}	------------	2.280×10^{-6}	6.319×10^{-3}	9.292	2.929×10^{-1}	1.294×10^{14}
	1/1.1		3.943×10^{-3}	1.204×10^{-2}	6.229	3.047	5.765×10^{-2}	2.470	------------	6.038×10^{-7}	3.252	9.138	5.528×10^{-1}	1.735
	1/1.2		1.372×10^{-2}	2.122	5.882	2.856	1.041×10^{-1}	1.210	------------	1.547×10^{-7}	1.646	8.846	1.031×10^{0}	2.310
	1/1.4		4.352	3.400	5.292	2.534	1.746	5.760×10^{-4}	------------	------------	8.315×10^{-4}	8.333	1.836	2.969
	1/1.6		7.985	4.187	4.811	2.275	2.242	3.663	------------	------------	5.581	7.896	2.487	3.348
	1/2.0		1.561×10^{-1}	4.958	4.074	1.884	2.852	2.019	------------	------------	3.381	7.184	3.478	3.755
	1/4.0		4.372×10^{-1}	4.714	2.315	9.828×10^{-1}	3.447	4.951×10^{-5}	------------	------------	1.148	5.189	5.821	4.085
10	1/0.90	4800	------------	4.677×10^{-5}	6.114×10^{0}	3.210×10^{0}	1.164×10^{-4}	3.359×10^{-1}	2.490×10^{-4}	4.209×10^{-2}	2.597×10^{-1}	3.650×10^{-2}	8.029×10^{-4}	2.270×10^{13}
	1/0.95		8.940×10^{-8}	9.689×10^{-5}	6.382	3.252	2.325×10^{-4}	1.779×10^{-1}	6.980×10^{-5}	1.165×10^{-2}	1.366×10^{-1}	3.674	1.593×10^{-3}	1.852
	1/1.0		1.525×10^{-5}	1.312×10^{-3}	6.618	3.295	3.056×10^{-3}	1.421×10^{-2}	4.456×10^{-7}	7.342×10^{-5}	1.085×10^{-2}	3.698	2.081×10^{-2}	1.870
	1/1.05		2.481×10^{-3}	1.630×10^{-2}	6.445	3.194	3.838×10^{-2}	1.068×10^{-3}	------------	4.281×10^{-7}	8.282×10^{-4}	3.640	2.654×10^{-1}	5.829
	1/1.1		9.110×10^{-3}	3.031	6.254	3.088	7.232×10^{-2}	5.321×10^{-4}	------------	------------	4.194	3.580	5.086	7.951
	1/1.2		3.151×10^{-2}	5.323	5.906	2.897	1.302×10^{-1}	2.617	------------	------------	2.129	3.467	9.459	1.061×10^{14}
	1/1.4		9.779×10^{-2}	8.452	5.322	2.579	2.165	1.263	------------	------------	1.089	3.271	1.666×10^{0}	1.358
	1/1.6		1.766×10^{-1}	1.035×10^{-1}	4.850	2.323	2.761	8.128×10^{-5}	------------	------------	7.387×10^{-5}	3.105	2.239	1.526
	1/2.0		3.385	1.219	4.126	1.935	3.489	4.559	------------	------------	4.539	2.834	3.100	1.703
	1/4.0		9.208	1.160	2.381	1.028	4.195	1.162	------------	------------	1.588	2.066	5.114	1.840
10	1/0.90	4400	------------	2.762×10^{-5}	6.166×10^{0}	3.281×10^{0}	3.166×10^{-5}	2.768×10^{-1}	4.661×10^{-4}	1.448×10^{-1}	1.180×10^{-1}	1.218×10^{-2}	1.436×10^{-4}	4.200×10^{12}
	1/0.95		7.186×10^{-9}	5.022×10^{-5}	6.414	3.287	5.539×10^{-5}	1.649×10^{-1}	1.653×10^{-4}	5.126×10^{-2}	7.020×10^{-2}	1.219	2.510×10^{-4}	3.580
	1/1.0		4.977×10^{-6}	1.370×10^{-3}	6.649	3.320	1.465×10^{-3}	6.527×10^{-3}	2.590×10^{-7}	7.954×10^{-5}	2.765×10^{-3}	1.225	6.607×10^{-3}	4.355
	1/1.05		5.575×10^{-3}	4.449×10^{-2}	6.450	3.217	4.827×10^{-2}	1.863×10^{-4}	------------	------------	8.016×10^{-5}	1.206	2.211×10^{-1}	2.297×10^{13}
	1/1.1		2.020×10^{-2}	8.214×10^{-2}	6.256	3.118	9.046×10^{-2}	9.342×10^{-5}	------------	------------	4.084	1.187	4.209	3.131
	1/1.2		6.783×10^{-2}	1.421×10^{-1}	5.907	2.938	1.609×10^{-1}	4.674	------------	------------	2.105	1.152	7.713	4.152
	1/1.4		2.022×10^{-1}	2.214	5.331	2.639	2.633	2.315	------------	------------	1.100	1.092	1.332×10^{0}	5.266
	1/1.6		3.563	2.684	4.868	2.396	3.330	1.517	------------	------------	7.567×10^{-6}	1.041	1.767	5.885
	1/2.0		6.641	3.131	4.159	2.022	4.177	8.725×10^{-6}	------------	------------	4.736	9.561×10^{-3}	2.413	6.532
	1/4.0		1.742×10^{0}	2.966	2.433	1.111	5.014	2.336×10^{-6}	------------	------------	1.711	7.086×10^{-3}	3.908	7.021
10	1/0.90	4000	------------	2.297×10^{-5}	6.197×10^{0}	3.367×10^{0}	1.008×10^{-5}	1.469×10^{-1}	4.673×10^{-4}	2.558×10^{-1}	2.924×10^{-2}	3.272×10^{-3}	2.858×10^{-5}	5.866×10^{11}
	1/0.95		------------	3.754×10^{-5}	6.433	3.336	1.580×10^{-5}	9.645×10^{-2}	2.014×10^{-4}	1.113×10^{-1}	1.929×10^{-2}	3.257	4.498×10^{-5}	4.944
	1/1.0		1.176×10^{-6}	1.384×10^{-3}	6.660	3.329	5.621×10^{-4}	2.801×10^{-3}	1.699×10^{-7}	9.405×10^{-5}	5.608×10^{-4}	3.254	1.602×10^{-3}	7.554
	1/1.05		9.205×10^{-3}	1.182×10^{-1}	6.430	3.248	4.912×10^{-2}	3.019×10^{-5}	------------	------------	6.121×10^{-6}	3.214	1.417×10^{-1}	6.677×10^{12}
	1/1.1		3.307×10^{-2}	2.166	6.217	3.169	9.197×10^{-2}	1.521×10^{-5}	------------	------------	3.122	3.174	2.686	9.101×10^{12}
	1/1.2		1.096×10^{-1}	3.705	5.841	3.022	1.635×10^{-1}	7.667×10^{-6}	------------	------------	1.611	3.100	4.891	1.206×10^{13}
	1/1.4		3.223	5.693	5.233	2.765	2.682	3.831	------------	------------	8.417×10^{-7}	2.965	8.387	1.529
	1/1.6		5.640	6.839	4.752	2.546	3.404	2.524	------------	------------	5.779	2.845	1.109×10^{0}	1.711
	1/2.0		1.045×10^{0}	7.893	4.030	2.193	4.300	1.459	------------	------------	3.600	2.641	1.510	1.902
	1/4.0		2.724×10^{0}	7.325	2.316	1.260	5.263	3.937×10^{-7}	------------	------------	1.281	2.002	2.438	2.058

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
10	1/0.90	3600	------------	2.336×10^{-5}	6.205×10^{0}	3.421×10^{0}	3.061×10^{-6}	5.244×10^{-2}	2.808×10^{-4}	3.161×10^{-1}	4.226×10^{-3}	6.539×10^{-4}	5.010×10^{-6}	6.834×10^{10}
	1/0.95		------------	3.653×10^{-5}	6.439	3.371	4.579×10^{-6}	3.585×10^{-2}	1.312×10^{-4}	1.499×10^{-1}	2.911×10^{-3}	6.491	7.548×10^{-6}	5.554
	1/1.0		1.439×10^{-7}	1.197×10^{-3}	6.664	3.332	1.442×10^{-4}	1.165×10^{-3}	1.385×10^{-7}	1.601×10^{-4}	9.512×10^{-5}	6.454	2.390×10^{-4}	8.266
	1/1.05		6.247×10^{-3}	2.388×10^{-1}	6.380	3.294	2.986×10^{-2}	5.323×10^{-6}	------------	------------	4.371×10^{-7}	6.414	4.980×10^{-2}	1.146×10^{12}
	1/1.1		2.429×10^{-2}	4.512	6.114	3.253	5.852×10^{-2}	2.570	------------	------------	2.124	6.377	9.820×10^{-2}	1.600
	1/1.2		9.092×10^{-2}	8.049	5.637	3.165	1.117×10^{-1}	1.208	------------	------------	1.012	6.289	1.900×10^{-1}	2.198
	1/1.4		3.116×10^{-1}	1.287×10^{0}	4.870	2.978	2.005	5.469×10^{-7}	------------	------------	4.724×10^{-8}	6.101	3.517	2.918
	1/1.6		5.956×10^{-1}	1.567	4.288	2.793	2.685	3.374	------------	------------	3.009	5.909	4.863	3.351
	1/2.0		1.209×10^{0}	1.807	3.471	2.459	3.591	1.798	------------	------------	1.709	5.544	6.929	3.831
	1/4.0		3.483×10^{0}	1.596	1.806	1.466	4.705	4.258×10^{-8}	------------	------------	5.242×10^{-9}	4.281	1.176×10^{0}	4.276
10	1/0.90	3200	------------	2.658×10^{-5}	6.206×10^{0}	3.441×10^{0}	7.876×10^{-7}	1.279×10^{-2}	1.156×10^{-4}	3.381×10^{-1}	3.403×10^{-4}	8.721×10^{-5}	6.336×10^{-7}	5.466×10^{9}
	1/0.95		------------	4.098×10^{-5}	6.440	3.385	1.161×10^{-6}	8.860×10^{-3}	5.545×10^{-5}	1.649×10^{-1}	2.376×10^{-4}	8.649	9.415×10^{-7}	4.374
	1/1.0		1.118×10^{-8}	9.935×10^{-4}	6.665	3.333	2.698×10^{-5}	3.883×10^{-4}	1.065×10^{-7}	3.218×10^{-4}	1.050×10^{-5}	8.583	2.205×10^{-5}	5.297
	1/1.05		1.234×10^{-3}	3.141×10^{-1}	6.344	3.324	8.951×10^{-3}	1.111×10^{-6}	------------	------------	3.008×10^{-8}	8.571	7.327×10^{-3}	9.515×10^{10}
	1/1.1		5.330×10^{-3}	6.202×10^{-1}	6.026	3.314	1.857×10^{-2}	5.072×10^{-7}	------------	------------	1.375×10^{-8}	8.558	1.522×10^{-2}	1.369×10^{11}
	1/1.2		2.475×10^{-2}	1.201×10^{0}	5.414	3.287	3.986	2.106×10^{-7}	------------	------------	5.731×10^{-9}	8.523	3.281	2.001
	1/1.4		1.281×10^{-1}	2.180	4.321	3.206	8.956	7.296×10^{-8}	------------	------------	2.011×10^{-9}	8.417	7.465	2.981
	1/1.6		3.389	2.845	3.467	3.084	1.429×10^{-1}	3.530×10^{-8}	------------	------------	9.919×10^{-10}	8.256	1.214×10^{-1}	3.741
	1/2.0		9.872	3.380	2.413	2.780	2.315	------------	------------	------------	4.045×10^{-10}	7.839	2.072	4.707
	1/4.0		3.833×10^{0}	2.731	9.895×10^{-1}	1.683	3.549	------------	------------	------------	8.417×10^{-11}	6.098	4.083	5.678
10	1/0.90	2800	------------	3.250×10^{-5}	6.207×10^{0}	3.447×10^{0}	1.376×10^{-7}	2.162×10^{-3}	3.980×10^{-5}	3.437×10^{-1}	1.314×10^{-5}	6.564×10^{-6}	4.561×10^{-8}	2.182×10^{8}
	1/0.95		------------	4.995×10^{-5}	6.440	3.389	2.020×10^{-7}	1.502×10^{-3}	1.921×10^{-5}	1.687×10^{-1}	9.208×10^{-6}	6.508	6.754×10^{-8}	1.744
	1/1.0		6.075×10^{-10}	1.013×10^{-3}	6.665	3.333	3.929×10^{-6}	7.861×10^{-5}	5.261×10^{-8}	4.699×10^{-4}	4.859×10^{-7}	6.455	1.324×10^{-6}	1.755
	1/1.05		7.185×10^{-5}	3.313×10^{-1}	6.334	3.332	1.351×10^{-3}	2.172×10^{-7}	------------	3.588×10^{-9}	1.343×10^{-9}	6.454	4.555×10^{-4}	3.302×10^{9}
	1/1.1		3.194×10^{-4}	6.620×10^{-1}	6.003	3.331	2.848	9.761×10^{-8}	------------	------------	6.035×10^{-10}	6.453	9.604×10^{-4}	4.794
	1/1.2		1.605×10^{-3}	1.320×10^{0}	5.341	3.328	6.382	3.872	------------	------------	2.395×10^{-10}	6.449	2.153×10^{-3}	7.173
	1/1.4		1.104×10^{-2}	2.615	4.034	3.316	1.670×10^{-2}	1.113	------------	------------	6.900×10^{-11}	6.439	5.646×10^{-3}	1.158×10^{10}
	1/1.6		4.926×10^{-2}	3.823	2.791	3.289	3.515×10^{-2}	3.632×10^{-9}	------------	------------	2.260×10^{-11}	6.412	1.192×10^{-2}	1.676
	1/2.0		5.071×10^{-1}	5.105	1.161	3.078	1.091×10^{-1}	------------	------------	------------	2.931×10^{-12}	6.203	3.827×10^{-2}	2.921
	1/4.0		3.898×10^{0}	3.622	2.973×10^{-1}	1.842	2.340×10^{-1}	------------	------------	------------	2.706×10^{-13}	4.799	1.061×10^{-1}	4.162
10	1/0.90	2400	------------	4.319×10^{-5}	6.207×10^{0}	3.448×10^{0}	1.340×10^{-8}	1.986×10^{-4}	9.196×10^{-6}	3.447×10^{-1}	1.739×10^{-7}	2.092×10^{-7}	1.368×10^{-9}	3.070×10^{6}
	1/0.95		------------	6.633×10^{-5}	6.440	3.390	1.966×10^{-8}	1.381×10^{-4}	4.444×10^{-6}	1.694×10^{-1}	1.219×10^{-7}	2.075	2.025×10^{-9}	2.461
	1/1.0		1.691×10^{-11}	1.198×10^{-3}	6.664	3.333	3.404×10^{-7}	8.116×10^{-6}	1.535×10^{-8}	5.953×10^{-4}	7.226×10^{-9}	2.057	3.536×10^{-8}	2.036
	1/1.05		1.448×10^{-6}	3.332×10^{-1}	6.333	3.333	9.962×10^{-5}	2.635×10^{-8}	------------	------------	2.347×10^{-11}	2.057	1.034×10^{-5}	3.623×10^{7}
	1/1.1		6.452×10^{-6}	6.664×10^{-1}	6.000	3.333	2.103×10^{-4}	1.183×10^{-8}	------------	------------	1.053×10^{-11}	2.057	2.184	5.264
	1/1.2		3.265×10^{-5}	1.333×10^{0}	5.334	3.333	4.731×10^{-4}	4.673×10^{-9}	------------	------------	4.161×10^{-12}	2.057	4.914	7.896
	1/1.4		2.319×10^{-4}	2.664	4.001	3.332	1.260×10^{-3}	1.315×10^{-9}	------------	------------	1.171×10^{-12}	2.057	1.309×10^{-4}	1.289×10^{8}
	1/1.6		1.169×10^{-3}	3.994	2.671	3.331	2.829×10^{-3}	3.911×10^{-10}	------------	------------	3.484×10^{-13}	2.056	2.940×10^{-4}	1.930
	1/2.0		1.593×10^{-1}	6.192	3.548×10^{-1}	3.257	3.267×10^{-2}	4.399×10^{-12}	------------	------------	$< 1.0 \times 10^{-14}$	2.034	3.432×10^{-3}	6.522
	1/4.0		3.939×10^{0}	3.942	4.542×10^{-2}	1.931	1.251×10^{-1}	------------	------------	------------	$< 1.0 \times 10^{-15}$	1.566	1.706×10^{-2}	1.246×10^{9}
4	1/0.90	6000	1.354×10^{-5}	1.133×10^{-4}	2.222×10^{0}	1.120×10^{0}	2.699×10^{-3}	5.637×10^{-2}	7.192×10^{-7}	9.142×10^{-5}	2.737×10^{-1}	2.521×10^{-1}	7.222×10^{-2}	4.603×10^{14}
	1/0.95		2.840	1.691	2.290	1.115	3.898	4.002	3.625	4.631	1.949	2.514	1.046×10^{-1}	4.186
	1/1.0		6.229	2.543	2.326	1.102	5.739	2.729	1.686	2.179	1.336	2.500	1.548	3.932
	1/1.05		1.304×10^{-4}	3.682	2.326	1.082	8.229	1.869	------------	1.041	9.236×10^{-2}	2.476	2.241	3.892
	1/1.1		2.436	4.975	2.301	1.056	1.111×10^{-2}	1.336	------------	5.450×10^{-6}	6.684	2.447	3.062	4.015
	1/1.2		6.041	7.535	2.213	9.996×10^{-1}	1.702	7.940×10^{-3}	------------	2.033×10^{-6}	4.082	2.381	4.822	4.437
	1/1.4		1.709×10^{-3}	1.154×10^{-3}	2.014	8.929	2.706	4.061	------------	5.955×10^{-7}	2.209	2.250	8.113	5.221
	1/1.6		3.083	1.413	1.837	8.030	3.447	2.616	------------	2.747×10^{-7}	1.500	2.134	1.089×10^{0}	5.765
	1/2.0		6.017	1.673	1.557	6.648	4.381	1.443	------------	------------	9.100×10^{-3}	1.941	1.522	6.396
	1/4.0		1.706×10^{-2}	1.588	8.777×10^{-1}	3.447	5.311	3.480×10^{-4}	------------	------------	3.047×10^{-3}	1.398	2.562	6.957

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
4	1/0.90	5600	2.122×10^{-6}	6.897×10^{-5}	2.348×10^{0}	1.217×10^{0}	9.764×10^{-4}	6.723×10^{-2}	2.063×10^{-6}	3.421×10^{-4}	2.160×10^{-1}	1.296×10^{-1}	1.965×10^{-2}	1.788×10^{14}
	1/0.95		6.626×10^{-6}	1.269×10^{-4}	2.445	1.221	1.728×10^{-3}	3.968	7.188×10^{-7}	1.188×10^{-4}	1.273×10^{-1}	1.298	3.473	1.518
	1/1.0		3.089×10^{-5}	2.800	2.499	1.213	3.719	1.872	1.600×10^{-7}	2.662×10^{-5}	6.026×10^{-2}	1.294	7.498	1.396
	1/1.05		1.326×10^{-4}	5.762	2.482	1.188	7.624	8.881×10^{-3}	------------	6.118×10^{-6}	2.889	1.280	1.553×10^{-1}	1.572
	1/1.1		3.542×10^{-4}	9.216	2.429	1.154	1.228×10^{-2}	5.242	------------	2.193×10^{-6}	1.730	1.262	2.540	1.846
	1/1.2		1.116×10^{-3}	1.552×10^{-3}	2.305	1.086	2.115	2.718	------------	6.266×10^{-7}	9.246×10^{-3}	1.224	4.507	2.315
	1/1.4		3.474	2.467	2.076	9.662×10^{-1}	3.519	1.308	------------	1.633×10^{-7}	4.720	1.155	7.952	2.923
	1/1.6		6.388	3.037	1.885	8.683	4.524	8.308×10^{-4}	------------	7.324×10^{-8}	3.161	1.094	1.078×10^{0}	3.291
	1/2.0		1.258×10^{-2}	3.597	1.591	7.197	5.779	4.550	------------	------------	1.901	9.965×10^{-2}	1.513	3.698
	1/4.0		3.565×10^{-2}	3.399	8.931×10^{-1}	3.772	7.044	1.098	------------	------------	6.339×10^{-4}	7.215	2.547	4.062
4	1/0.90	5200	1.917×10^{-7}	3.241×10^{-5}	2.403×10^{0}	1.264×10^{0}	2.589×10^{-4}	8.801×10^{-2}	7.473×10^{-6}	1.848×10^{-3}	1.799×10^{-1}	5.884×10^{-2}	3.855×10^{-3}	6.244×10^{13}
	1/0.95		7.703×10^{-7}	6.800×10^{-5}	2.516	1.276	5.213×10^{-4}	4.619	2.058×10^{-6}	5.043×10^{-4}	9.398×10^{-2}	5.912	7.726×10^{-3}	4.934
	1/1.0		1.339×10^{-5}	2.223×10^{-4}	2.593	1.278	2.176×10^{-3}	1.142	1.259×10^{-7}	3.081×10^{-5}	2.323×10^{-2}	5.917	3.222×10^{-2}	4.375
	1/1.05		2.071×10^{-4}	1.130×10^{-3}	2.551	1.245	8.446×10^{-3}	2.822×10^{-3}	------------	1.928×10^{-6}	5.811×10^{-3}	5.842	1.267×10^{-1}	6.900
	1/1.1		7.084×10^{-4}	2.032	2.479	1.206	1.537×10^{-2}	1.459×10^{-3}	------------	5.326×10^{-7}	3.054	5.748	2.343	9.068
	1/1.2		2.448×10^{-3}	3.567	2.341	1.131	2.768	7.180×10^{-4}	------------	1.374×10^{-7}	1.551	5.568	4.355	1.201×10^{14}
	1/1.4		7.797×10^{-3}	5.720	2.103	1.005	4.656	3.407	------------	------------	7.809×10^{-4}	5.249	7.773	1.546
	1/1.6		1.437×10^{-2}	7.048	1.909	9.036×10^{-1}	5.993	2.160	------------	------------	5.221	4.976	1.055×10^{0}	1.748
	1/2.0		2.825	8.344	1.612	7.494	7.653	1.184	------------	------------	3.144	4.531	1.480	1.969
	1/4.0		7.966	7.884	9.070×10^{-1}	3.944	9.323	2.879×10^{-5}	------------	------------	1.053	3.287	2.485	2.164
4	1/0.90	4800	------------	1.411×10^{-5}	2.432×10^{0}	1.284×10^{0}	5.582×10^{-5}	1.115×10^{-1}	2.742×10^{-5}	1.159×10^{-2}	1.363×10^{-1}	2.309×10^{-2}	6.088×10^{-4}	1.784×10^{13}
	1/0.95		5.288×10^{-8}	2.971×10^{-5}	2.544	1.299	1.130×10^{-4}	5.826×10^{-2}	7.488×10^{-6}	3.129×10^{-3}	7.081×10^{-2}	2.322	1.225×10^{-3}	1.382
	1/1.0		5.201×10^{-6}	3.055×10^{-4}	2.638	1.311	1.126×10^{-3}	6.121×10^{-3}	8.265×10^{-8}	3.422×10^{-5}	7.405×10^{-3}	2.332	1.215×10^{-2}	1.183
	1/1.05		4.731×10^{-4}	2.842×10^{-3}	2.574	1.272	1.057×10^{-2}	6.166×10^{-4}	------------	3.579×10^{-7}	7.574×10^{-4}	2.297	1.159×10^{-1}	3.079
	1/1.1		1.740×10^{-3}	5.289	2.497	1.230	1.995	3.068	------------	------------	3.832	2.259	2.223	4.197
	1/1.2		6.090×10^{-3}	9.337	2.356	1.154	3.614	1.498	------------	------------	1.932	2.188	4.159	5.622
	1/1.4		1.926×10^{-2}	1.493×10^{-2}	2.118	1.026	6.061	7.145×10^{-5}	------------	------------	9.771×10^{-5}	2.063	7.396	7.250
	1/1.6		3.521	1.835×10^{-2}	1.925	9.233×10^{-1}	7.774	4.556	------------	------------	6.568	1.957	1.000×10^{0}	8.189
	1/2.0		6.850	2.167×10^{-2}	1.630	7.677	9.887	2.522	------------	------------	3.987	1.785	1.395	9.204
	1/4.0		1.899×10^{-1}	2.051×10^{-2}	9.270×10^{-1}	4.073	1.199×10^{-1}	6.272×10^{-6}	------------	------------	1.361	1.300	2.322	1.007×10^{14}
4	1/0.90	4400	------------	7.452×10^{-6}	2.458×10^{0}	1.310×10^{0}	1.354×10^{-5}	1.031×10^{-1}	6.464×10^{-5}	5.027×10^{-2}	6.953×10^{-2}	7.696×10^{-3}	9.717×10^{-5}	3.575×10^{12}
	1/0.95		3.434×10^{-9}	1.386×10^{-5}	2.560	1.314	2.421×10^{-5}	6.020×10^{-2}	2.203×10^{-5}	1.710×10^{-2}	4.054×10^{-2}	7.706	1.735×10^{-4}	2.888
	1/1.0		1.721×10^{-6}	3.220×10^{-4}	2.657	1.325	5.445×10^{-4}	2.803×10^{-3}	4.776×10^{-8}	3.673×10^{-5}	1.879×10^{-3}	7.740	3.885×10^{-3}	2.713
	1/1.05		1.241×10^{-3}	8.398×10^{-3}	2.580	1.283	1.439×10^{-2}	9.973×10^{-5}	------------	------------	6.795×10^{-5}	7.616	1.043×10^{-1}	1.257×10^{13}
	1/1.1		4.564×10^{-3}	1.562×10^{-2}	2.503	1.242	2.714	4.963	------------	------------	3.438	7.492	2.001	1.722
	1/1.2		1.567×10^{-2}	2.732	2.363	1.167	4.874	2.451	------------	------------	1.751	7.263	3.707	2.300
	1/1.4		4.805	4.312	2.129	1.042	8.067	1.192	------------	------------	9.014×10^{-6}	6.864	6.492	2.946
	1/1.6		8.607	5.260	1.941	9.422×10^{-1}	1.026×10^{-1}	7.720×10^{-6}	------------	------------	6.139	6.526	8.688	3.312
	1/2.0		1.633×10^{-1}	6.171	1.653	7.896	1.294	4.369	------------	------------	3.795	5.974	1.197×10^{0}	3.703
	1/4.0		4.374×10^{-1}	5.849	9.574×10^{-1}	4.278	1.559	1.138	------------	------------	1.343	4.397	1.958×10^{0}	4.026
4	1/0.90	4000	------------	5.884×10^{-6}	2.476×10^{0}	1.345×10^{0}	4.086×10^{-6}	5.791×10^{-2}	7.262×10^{-5}	9.945×10^{-2}	1.823×10^{-2}	2.068×10^{-3}	1.831×10^{-5}	4.941×10^{11}
	1/0.95		------------	9.674×10^{-6}	2.571	1.333	6.440×10^{-6}	3.781×10^{-2}	3.096×10^{-5}	4.278×10^{-2}	1.196×10^{-2}	2.059	2.900×10^{-5}	4.023
	1/1.0		4.591×10^{-7}	3.458×10^{-4}	2.664	1.331	2.221×10^{-4}	1.134×10^{-3}	2.783×10^{-8}	3.853×10^{-5}	3.590×10^{-4}	2.057	1.001×10^{-3}	4.797
	1/1.05		2.939×10^{-3}	2.678×10^{-2}	2.578	1.292	1.751×10^{-2}	1.351×10^{-5}	------------	------------	4.342×10^{-6}	2.027	8.008×10^{-2}	3.994×10^{12}
	1/1.1		1.055×10^{-2}	4.916	2.498	1.256	3.270	6.812×10^{-6}	------------	------------	2.220	1.998	1.517×10^{-1}	5.446
	1/1.2		3.489×10^{-2}	8.429	2.355	1.190	5.788	3.437	------------	------------	1.151	1.945	2.759	7.219
	1/1.4		1.021×10^{-1}	1.299×10^{-1}	2.122	1.078	9.426	1.722	------------	------------	6.062×10^{-7}	1.851	4.721	9.163
	1/1.6		1.781	1.565	1.935	9.856×10^{-1}	1.190×10^{-1}	1.138	------------	------------	4.188	1.770	6.234	1.025×10^{13}
	1/2.0		3.282	1.813	1.652	8.412	1.492	6.611×10^{-7}	------------	------------	2.633	1.635	8.463	1.141
	1/4.0		8.472	1.701	9.647×10^{-1}	4.765	1.805	1.809×10^{-7}	------------	------------	9.572×10^{-8}	1.231	1.359×10^{0}	1.240

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
4	1/0.90	3600	------------	5.919×10^{-6}	2.482×10^{0}	1.368×10^{0}	1.226×10^{-6}	2.094×10^{-2}	4.477×10^{-5}	1.260×10^{-1}	2.668×10^{-3}	4.135×10^{-4}	3.173×10^{-6}	5.557×10^{10}
	1/0.95		------------	9.262×10^{-6}	2.575	1.348	1.836×10^{-6}	1.430×10^{-2}	2.089×10^{-5}	5.969×10^{-2}	1.836×10^{-3}	4.105	4.785×10^{-6}	4.356
	1/1.0		7.206×10^{-8}	3.388×10^{-4}	2.665	1.333	6.452×10^{-5}	4.165×10^{-4}	1.771×10^{-8}	5.118×10^{-5}	5.377×10^{-5}	4.082	1.691×10^{-4}	5.565
	1/1.05		3.581×10^{-3}	7.259×10^{-2}	2.561	1.310	1.426×10^{-2}	1.780×10^{-6}	------------	------------	2.318×10^{-7}	4.046	3.770×10^{-2}	7.926×10^{11}
	1/1.1		1.319×10^{-2}	1.341×10^{-1}	2.466	1.286	2.712	8.847×10^{-7}	------------	------------	1.162×10^{-7}	4.010	7.238×10^{-2}	1.091×10^{12}
	1/1.2		4.535×10^{-2}	2.318	2.298	1.240	4.938	4.367	------------	------------	5.845×10^{-8}	3.937	1.342×10^{-1}	1.466
	1/1.4		1.392×10^{-1}	3.587	2.030	1.153	8.340	2.122	------------	------------	2.947	3.796	2.351	1.895
	1/1.6		2.495	4.312	1.823	1.073	1.077×10^{-1}	1.374	------------	------------	1.976	3.662	3.147	2.144
	1/2.0		4.737	4.954	1.520	9.381×10^{-1}	1.388	7.770×10^{-8}	------------	------------	1.196	3.424	4.336	2.417
	1/4.0		1.268×10^{0}	4.486	8.412×10^{-1}	5.572×10^{-1}	1.750	2.026×10^{-8}	------------	------------	4.045×10^{-9}	2.639	7.095	2.675
4	1/0.90	3200	------------	6.724×10^{-6}	2.482×10^{0}	1.376×10^{0}	3.150×10^{-7}	5.116×10^{-3}	1.849×10^{-5}	1.352×10^{-1}	2.152×10^{-4}	5.516×10^{-5}	4.007×10^{-7}	4.445×10^{9}
	1/0.95		------------	1.037×10^{-5}	2.576	1.354	4.643×10^{-7}	3.543×10^{-3}	8.869×10^{-6}	6.594×10^{-2}	1.503×10^{-4}	5.470	5.955×10^{-7}	3.417
	1/1.0		6.174×10^{-9}	2.953×10^{-4}	2.666	1.333	1.268×10^{-5}	1.322×10^{-4}	1.235×10^{-8}	9.327×10^{-5}	5.652×10^{-6}	5.428	1.639×10^{-5}	3.676
	1/1.05		1.095×10^{-3}	1.185×10^{-1}	2.541	1.327	5.328×10^{-3}	2.985×10^{-7}	------------	------------	1.279×10^{-8}	5.415	6.903×10^{-3}	7.342×10^{10}
	1/1.1		4.583×10^{-3}	2.309	2.419	1.320	1.087×10^{-2}	1.386×10^{-7}	------------	------------	5.953×10^{-9}	5.401	1.412×10^{-2}	1.047×10^{11}
	1/1.2		1.973×10^{-2}	4.341	2.192	1.302	2.240	6.010×10^{-8}	------------	------------	2.599	5.364	2.930	1.500
	1/1.4		8.522×10^{-2}	7.446	1.809	1.254	4.569	2.343×10^{-8}	------------	------------	1.032	5.264	6.088	2.133
	1/1.6		1.904×10^{-1}	9.356	1.521	1.195	6.666	------------	------------	------------	5.807×10^{-10}	5.139	9.100	2.566
	1/2.0		4.545×10^{-1}	1.090×10^{0}	1.147	1.070	9.746	------------	------------	------------	2.834×10^{-10}	4.862	1.406×10^{-1}	3.082
	1/4.0		1.509×10^{0}	9.149×10^{-1}	5.282×10^{-1}	6.522×10^{-1}	1.387×10^{-1}	------------	------------	------------	7.160×10^{-11}	3.796	2.563×10^{-1}	3.621
4	1/0.90	2800	------------	8.223×10^{-6}	2.483×10^{0}	1.379×10^{0}	5.503×10^{-8}	8.649×10^{-4}	6.368×10^{-6}	1.375×10^{-1}	8.312×10^{-6}	4.151×10^{-6}	2.884×10^{-8}	1.812×10^{8}
	1/0.95		------------	1.264×10^{-5}	2.576	1.355	8.081×10^{-8}	6.008×10^{-4}	3.073×10^{-6}	6.749×10^{-2}	5.824×10^{-6}	4.116	4.272×10^{-8}	1.391
	1/1.0		3.318×10^{-10}	2.997×10^{-4}	2.666	1.333	1.836×10^{-6}	2.691×10^{-5}	6.166×10^{-9}	1.376×10^{-4}	2.630×10^{-7}	4.082	9.788×10^{-7}	1.226
	1/1.05		7.109×10^{-5}	1.318×10^{-1}	2.534	1.332	8.499×10^{-4}	5.524×10^{-8}	------------	5.804×10^{-10}	5.401×10^{-10}	4.081	4.531×10^{-4}	2.619×10^{9}
	1/1.1		3.151×10^{-4}	2.631	2.402	1.332	1.789×10^{-3}	2.486×10^{-8}	------------	------------	2.431×10^{-10}	4.080	9.540×10^{-4}	3.799
	1/1.2		1.571×10^{-3}	5.233	2.139	1.329	3.990×10^{-3}	9.910×10^{-9}	------------	------------	9.700×10^{-11}	4.076	2.130×10^{-3}	5.672
	1/1.4		1.040×10^{-2}	1.024×10^{0}	1.628	1.321	1.023×10^{-2}	2.922	------------	------------	2.869	4.064	5.480×10^{-3}	9.070
	1/1.6		4.138×10^{-2}	1.461	1.164	1.302	2.027	1.040	------------	------------	1.028	4.035	1.093×10^{-2}	1.273×10^{10}
	1/2.0		2.589×10^{-1}	1.865	5.940×10^{-1}	1.205	4.878	------------	------------	------------	2.098×10^{-12}	3.881	2.735	1.962
	1/4.0		1.560×10^{0}	1.373	1.781×10^{-1}	7.289×10^{-1}	9.310	------------	------------	------------	2.563×10^{-13}	3.018	6.712	2.667
1	1/0.90	6000	5.341×10^{-6}	1.583×10^{-5}	4.943×10^{-1}	2.373×10^{-1}	7.798×10^{-4}	9.192×10^{-3}	1.912×10^{-8}	1.148×10^{-5}	9.699×10^{-2}	1.160×10^{-1}	4.534×10^{-2}	2.671×10^{14}
	1/0.95		8.290×10^{-6}	2.017	5.056	2.345	9.658×10^{-4}	7.500	1.273×10^{-8}	7.734×10^{-6}	7.962	1.153	5.649	2.499
	1/1.0		1.272×10^{-5}	2.531	5.122	2.309	1.187×10^{-3}	6.088	8.387×10^{-9}	5.174	6.512	1.144	6.998	2.358
	1/1.05		1.902	3.109	5.145	2.266	1.438	4.953	------------	3.490	5.348	1.133	8.558	2.252
	1/1.1		2.745	3.724	5.130	2.218	1.709	4.067	------------	2.404	4.439	1.121	1.028×10^{-1}	2.181
	1/1.2		5.078	4.959	5.022	2.113	2.269	2.858	------------	1.246	3.196	1.094	1.398	2.119
	1/1.4		1.181×10^{-4}	7.048	4.680	1.902	3.284	1.656	------------	4.649×10^{-7}	1.952	1.038	2.133	2.149
	1/1.6		2.015	8.496	4.320	1.716	4.073	1.112	------------	------------	1.380	9.863×10^{-2}	2.785	2.225
	1/2.0		3.809	1.001×10^{-4}	3.703	1.421	5.096	6.310×10^{-4}	------------	------------	8.604×10^{-3}	8.976	3.829	2.349
	1/4.0		1.067×10^{-3}	9.601×10^{-5}	2.121	7.250×10^{-2}	6.092	1.543×10^{-4}	------------	------------	2.945×10^{-3}	6.411	6.408	2.453
1	1/0.90	5600	1.195×10^{-6}	1.235×10^{-5}	5.602×10^{-1}	2.831×10^{-1}	3.533×10^{-4}	1.030×10^{-2}	4.849×10^{-8}	3.457×10^{-5}	6.867×10^{-2}	6.250×10^{-2}	1.475×10^{-2}	1.009×10^{14}
	1/0.95		2.695	1.916	5.789	2.817	5.292	7.074×10^{-3}	2.284×10^{-8}	1.637×10^{-5}	4.726	6.235	2.214	8.912×10^{13}
	1/1.0		6.558	3.039	5.888	2.784	8.208	4.585	9.599×10^{-9}	6.959×10^{-6}	3.081	6.198	3.455	8.116
	1/1.05		1.156×10^{-5}	4.618	5.884	2.731	1.236×10^{-3}	2.985	------------	3.007	2.025	6.138	5.252	7.901
	1/1.1		3.017	6.431	5.808	2.663	1.722	2.063	------------	1.472	1.417	6.063	7.410	8.135
	1/1.2		7.901	9.977	5.568	2.518	2.709	1.188	------------	5.166×10^{-7}	8.395×10^{-3}	5.895	1.199×10^{-1}	9.051
	1/1.4		2.293×10^{-4}	1.542×10^{-4}	5.052	2.249	4.362	5.981×10^{-4}	------------	------------	4.471	5.571	2.043	1.074×10^{14}
	1/1.6		4.156	1.891	4.601	2.024	5.571	3.838	------------	------------	3.024	5.285	2.750	1.189
	1/2.0		8.124	2.236	3.891	1.680	7.096	2.115	------------	------------	1.830	4.815	3.845	1.324
	1/4.0		2.296×10^{-3}	2.113	2.188	8.808×10^{-2}	8.638	5.124×10^{-5}	------------	------------	6.121×10^{-4}	3.486	6.464	1.446

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
1	1/0.90	5200	1.220×10^{-7}	6.351×10^{-6}	5.903×10^{-1}	3.084×10^{-1}	1.020×10^{-4}	1.338×10^{-2}	1.729×10^{-7}	1.752×10^{-4}	5.539×10^{-2}	2.907×10^{-2}	3.075×10^{-3}	3.514×10^{13}
	1/0.95		4.234×10^{-7}	1.236×10^{-5}	6.169	3.094	1.903	7.522×10^{-3}	5.459×10^{-8}	5.516×10^{-5}	3.108	2.911	5.728×10^{-3}	2.830
	1/1.0		2.827×10^{-6}	3.275	6.326	3.077	4.905	2.977	8.552×10^{-9}	8.688×10^{-6}	1.233	2.904	1.480×10^{-2}	2.415
	1/1.05		1.716×10^{-5}	7.994	6.265	3.008	1.195×10^{-3}	1.183	------------	1.403×10^{-6}	4.958×10^{-3}	2.871	3.647	2.820
	1/1.1		5.074×10^{-5}	1.341×10^{-4}	6.113	2.920	2.024	6.615×10^{-4}	------------	4.519×10^{-7}	2.813	2.828	6.271	3.427
	1/1.2		1.670×10^{-4}	2.302	5.784	2.746	3.561	3.345	------------	------------	1.467	2.743	1.138×10^{-1}	4.393
	1/1.4		5.263	3.672	5.198	2.445	5.966	1.598	------------	------------	7.428×10^{-4}	2.588	2.019	5.601
	1/1.6		9.693	4.521	4.715	2.201	7.682	1.013	------------	------------	4.965	2.456	2.741	6.326
	1/2.0		1.908×10^{-3}	5.346	3.974	1.830	9.827	5.553×10^{-5}	------------	------------	2.983	2.239	3.845	7.130
	1/4.0		5.383×10^{-3}	5.025	2.224	9.732×10^{-2}	1.204×10^{-2}	1.349×10^{-5}	------------	------------	9.938×10^{-5}	1.633	6.459	7.871
1	1/0.90	4800	------------	------------	6.022×10^{-1}	3.197×10^{-1}	2.042×10^{-5}	1.878×10^{-2}	7.779×10^{-7}	1.321×10^{-3}	4.601×10^{-2}	1.152×10^{-2}	4.464×10^{-4}	1.071×10^{13}
	1/0.95		------------	------------	6.314	3.221	4.159×10^{-5}	9.744×10^{-3}	2.094×10^{-7}	3.529×10^{-4}	2.378×10^{-2}	1.156	9.057×10^{-4}	8.088×10^{12}
	1/1.0		1.056×10^{-6}	3.411×10^{-5}	6.538	3.230	2.518×10^{-4}	1.671×10^{-3}	6.160×10^{-9}	1.035×10^{-5}	4.072×10^{-3}	1.158	5.476×10^{-3}	6.148×10^{12}
	1/1.05		3.465×10^{-5}	1.914×10^{-4}	6.404	3.142	1.423×10^{-3}	2.817×10^{-4}	------------	------------	6.962×10^{-4}	1.142	3.137×10^{-2}	1.149×10^{13}
	1/1.1		1.245×10^{-4}	3.522	6.215	3.041	2.654	1.419×10^{-4}	------------	------------	3.564	1.123	5.948×10^{-2}	1.545
	1/1.2		4.364×10^{-4}	6.216	5.861	2.856	4.813	6.927×10^{-5}	------------	------------	1.795	1.088	1.113×10^{-1}	2.065
	1/1.4		1.394×10^{-3}	9.970	5.258	2.542	8.118	3.281	------------	------------	9.013×10^{-5}	1.027	1.990	2.671
	1/1.6		2.569	1.227×10^{-3}	4.768	2.289	1.045×10^{-2}	2.079	------------	------------	6.021	9.747×10^{-3}	2.701	3.027
	1/2.0		5.047	1.450	4.020	1.906	1.337	1.141	------------	------------	3.621	8.894	3.786	3.418
	1/4.0		1.416×10^{-2}	1.362	2.254	1.019	1.638	2.793×10^{-6}	------------	------------	1.212	6.504	6.342	3.778
1	1/0.90	4400	------------	------------	6.104×10^{-1}	3.265×10^{-1}	4.026×10^{-6}	2.145×10^{-2}	2.797×10^{-6}	8.732×10^{-3}	2.897×10^{-2}	3.841×10^{-3}	5.789×10^{-5}	2.413×10^{12}
	1/0.95		------------	------------	6.374	3.276	7.533×10^{-6}	1.201×10^{-2}	8.773×10^{-7}	2.729×10^{-3}	1.620×10^{-2}	3.848	1.081×10^{-4}	1.851
	1/1.0		3.361×10^{-7}	3.548×10^{-5}	6.625	3.298	1.200×10^{-4}	7.890×10^{-4}	3.785×10^{-9}	1.170×10^{-5}	1.060×10^{-3}	3.861	1.717×10^{-3}	1.336
	1/1.05		9.942×10^{-5}	5.934×10^{-4}	6.443	3.195	2.031×10^{-3}	4.390×10^{-5}	------------	------------	5.996×10^{-5}	3.800	2.953×10^{-2}	4.745
	1/1.1		3.697×10^{-4}	1.109×10^{-3}	6.248	3.091	3.853	2.171	------------	------------	3.015	3.738	5.694×10^{-2}	6.513
	1/1.2		1.298×10^{-3}	1.961	5.891	2.902	6.996	1.059	------------	------------	1.517	3.622	1.067×10^{-1}	8.757
	1/1.4		4.109	3.133	5.291	2.586	1.175×10^{-2}	5.045×10^{-6}	------------	------------	7.660×10^{-6}	3.418	1.898	1.133×10^{13}
	1/1.6		7.514	3.848	4.805	2.330	1.508	3.217	------------	------------	5.144	3.245	2.567	1.282
	1/2.0		1.461×10^{-2}	4.537	4.063	1.943	1.920	1.781	------------	------------	3.119	2.964	3.579	1.444
	1/4.0		4.038×10^{-2}	4.273	2.302	1.044	2.341	4.451×10^{-7}	------------	------------	1.063	2.173	5.951	1.591
1	1/0.90	4000	------------	7.614×10^{-7}	6.176×10^{-1}	3.356×10^{-1}	1.059×10^{-6}	1.390×10^{-2}	4.185×10^{-6}	2.298×10^{-2}	8.767×10^{-3}	1.033×10^{-3}	9.503×10^{-6}	3.366×10^{11}
	1/0.95		------------	1.272×10^{-6}	6.419	3.328	1.696×10^{-6}	8.945×10^{-3}	1.733×10^{-6}	9.594×10^{-3}	5.664×10^{-3}	1.029	1.528×10^{-5}	2.664
	1/1.0		9.267×10^{-8}	3.882×10^{-5}	6.655	3.323	4.985×10^{-5}	3.150×10^{-4}	2.149×10^{-9}	1.192×10^{-5}	1.996×10^{-4}	1.028	4.497×10^{-4}	2.319
	1/1.05		3.243×10^{-4}	2.226×10^{-3}	6.452	3.217	2.901×10^{-3}	5.080×10^{-6}	------------	------------	3.272×10^{-6}	1.011	2.660×10^{-2}	1.629×10^{12}
	1/1.1		1.191×10^{-3}	4.137	6.256	3.116	5.473	2.529	------------	------------	1.655×10^{-6}	9.954×10^{-4}	5.098	2.235
	1/1.2		4.076×10^{-3}	7.220	5.902	2.933	9.822	1.251	------------	------------	8.443×10^{-7}	9.658	9.430	2.990
	1/1.4		1.243×10^{-2}	1.135×10^{-2}	5.315	2.628	1.624×10^{-2}	6.109×10^{-7}	------------	------------	4.353	9.142	1.647×10^{-1}	3.837
	1/1.6		2.218	1.382	4.842	2.382	2.065	3.967	------------	------------	2.969	8.704	2.200	4.321
	1/2.0		4.188	1.616	4.121	2.007	2.604	2.255	------------	------------	1.839	7.989	3.023	4.842
	1/4.0		1.110×10^{-1}	1.523	2.385	1.108	3.151	5.954×10^{-8}	------------	------------	6.535×10^{-8}	5.936	4.923	5.305
1	1/0.90	3600	------------	7.431×10^{-7}	6.202×10^{-1}	3.418×10^{-1}	3.080×10^{-7}	5.207×10^{-3}	2.768×10^{-6}	3.119×10^{-2}	1.327×10^{-3}	2.067×10^{-4}	1.594×10^{-6}	3.483×10^{10}
	1/0.95		------------	1.165×10^{-6}	6.437	3.369	4.621×10^{-7}	3.550×10^{-3}	1.286×10^{-6}	1.471×10^{-2}	9.116×10^{-4}	2.052	2.409×10^{-6}	2.651
	1/1.0		1.958×10^{-8}	4.415×10^{-5}	6.664	3.331	1.681×10^{-5}	9.985×10^{-5}	1.018×10^{-9}	1.177×10^{-5}	2.579×10^{-5}	2.040	8.817×10^{-5}	2.854
	1/1.05		8.607×10^{-4}	8.941×10^{-3}	6.436	3.244	3.479×10^{-3}	4.539×10^{-7}	------------	2.498×10^{-10}	1.188×10^{-7}	2.014	1.848×10^{-2}	3.920×10^{11}
	1/1.1		3.073×10^{-3}	1.635×10^{-2}	6.227	3.162	6.489×10^{-3}	2.295	------------	------------	6.083×10^{-8}	1.988	3.493	5.348
	1/1.2		1.008×10^{-2}	2.786	5.860	3.011	1.147×10^{-2}	1.163	------------	------------	3.160	1.940	6.327	7.099
	1/1.4		2.926	4.263	5.264	2.751	1.868	5.863×10^{-8}	------------	------------	1.666	1.854	1.078×10^{-1}	9.036
	1/1.6		5.075	5.111	4.791	2.532	2.360	3.888	------------	------------	1.152	1.779	1.419	1.014×10^{12}
	1/2.0		9.298	5.888	4.077	2.184	2.967	2.270	------------	------------	7.241×10^{-9}	1.652	1.921	1.133
	1/4.0		2.377×10^{-1}	5.463	2.366	1.274	3.624	6.292×10^{-9}	------------	------------	2.627×10^{-9}	1.262	3.072	1.246

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
1	1/0.90	3200	------------	8.408×10^{-7}	6.206×10^{-1}	3.441×10^{-1}	7.879×10^{-8}	1.278×10^{-3}	1.155×10^{-6}	3.378×10^{-2}	1.075×10^{-4}	2.758×10^{-5}	2.004×10^{-7}	2.718×10^{9}
	1/0.95		------------	1.297×10^{-6}	6.440	3.385	1.161×10^{-7}	8.854×10^{-4}	5.537×10^{-7}	1.647×10^{-2}	7.510×10^{-5}	2.735	2.979×10^{-7}	2.001
	1/1.0		2.354×10^{-9}	4.559×10^{-5}	6.665	3.333	3.914×10^{-6}	2.677×10^{-5}	5.061×10^{-10}	1.529×10^{-5}	2.288×10^{-6}	2.714	1.012×10^{-5}	2.045
	1/1.05		7.106×10^{-4}	2.397×10^{-2}	6.378	3.298	2.139×10^{-3}	4.637×10^{-8}	------------	------------	3.985×10^{-9}	2.699	5.560×10^{-3}	4.653×10^{10}
	1/1.1		2.736×10^{-3}	4.506	6.111	3.260	4.173	2.251	------------	------------	1.946×10^{-9}	2.684	1.091×10^{-2}	6.494
	1/1.2		1.006×10^{-2}	7.971	5.636	3.177	7.903	1.069	------------	------------	9.357×10^{-10}	2.650	2.092	8.924
	1/1.4		3.362	1.261×10^{-1}	4.879	3.000	1.403×10^{-2}	------------	------------	------------	4.433	2.575	3.824	1.186×10^{11}
	1/1.6		6.316	1.526	4.307	2.823	1.866	------------	------------	------------	2.855	2.498	5.242	1.365
	1/2.0		1.257×10^{-1}	1.750	3.502	2.502	2.479	------------	------------	------------	1.645	2.351	7.395	1.569
	1/4.0		3.523×10^{-1}	1.541	1.842	1.529	3.244	------------	------------	------------	5.169×10^{-11}	1.838	1.238×10^{-1}	1.784
1	1/0.90	2800	------------	1.028×10^{-6}	6.207×10^{-1}	3.447×10^{-1}	1.376×10^{-8}	2.162×10^{-4}	3.230×10^{-7}	3.437×10^{-2}	4.156×10^{-6}	2.076×10^{-6}	1.442×10^{-8}	1.135×10^{8}
	1/0.95		------------	1.580×10^{-6}	6.440	3.389	2.020×10^{-8}	1.502×10^{-4}	2.153×10^{-7}	1.687×10^{-2}	2.912×10^{-6}	2.058	2.136×10^{-8}	8.289×10^{7}
	1/1.0		1.320×10^{-10}	4.734×10^{-5}	6.666	3.333	5.800×10^{-7}	5.320×10^{-6}	------------	2.100×10^{-5}	1.041×10^{-7}	2.040	6.185×10^{-7}	6.938×10^{7}
	1/1.05		6.824×10^{-5}	3.231×10^{-2}	6.339	3.329	4.162×10^{-4}	7.049×10^{-9}	------------	------------	1.379×10^{-10}	2.040	4.439×10^{-4}	1.833×10^{9}
	1/1.1		2.989×10^{-4}	6.416×10^{-2}	6.014	3.323	8.702×10^{-4}	3.193	------------	------------	6.251×10^{-11}	2.038	9.290×10^{-4}	2.650
	1/1.2		1.439×10^{-3}	1.259×10^{-1}	5.378	3.309	1.906×10^{-3}	1.298	------------	------------	2.547×10^{-11}	2.034	2.039×10^{-3}	3.920
	1/1.4		8.325×10^{-3}	2.364	4.199	3.259	4.548	4.183×10^{-10}	------------	------------	8.269×10^{-12}	2.018	4.903	6.048
	1/1.6		2.533×10^{-2}	3.178	3.236	3.168	7.822	------------	------------	------------	3.654	1.990	8.553	7.919
	1/2.0		8.910×10^{-2}	3.836	2.082	2.889	1.401×10^{-2}	------------	------------	------------	1.254	1.900	1.604×10^{-2}	1.056×10^{10}
	1/4.0		3.884×10^{-1}	2.997	7.794×10^{-2}	1.774	2.292×10^{-2}	------------	------------	------------	2.247×10^{-13}	1.489	3.349×10^{-2}	1.342×10^{10}
1	1/0.90	2400	------------	1.366×10^{-6}	6.207×10^{-1}	3.448×10^{-1}	1.340×10^{-9}	1.986×10^{-5}	9.196×10^{-8}	3.447×10^{-2}	5.499×10^{-8}	6.617×10^{-8}	4.327×10^{-10}	1.684×10^{6}
	1/0.95		------------	2.098×10^{-6}	6.440	3.389	1.966×10^{-9}	1.381×10^{-5}	4.443×10^{-8}	1.694×10^{-2}	3.855×10^{-8}	6.561	6.405×10^{-10}	1.230×10^{6}
	1/1.0		------------	5.567×10^{-5}	6.666	3.333	5.001×10^{-8}	5.525×10^{-7}	------------	2.759×10^{-5}	1.555×10^{-9}	6.506	1.642×10^{-8}	8.156×10^{5}
	1/1.05		1.445×10^{-6}	3.329×10^{-2}	6.333	3.333	3.147×10^{-5}	8.343×10^{-10}	------------	------------	2.349×10^{-12}	6.506	1.033×10^{-5}	2.036×10^{7}
	1/1.1		6.436×10^{-6}	6.656×10^{-2}	6.000	3.332	6.641×10^{-5}	3.746×10^{-10}	------------	------------	1.054×10^{-12}	6.506	2.181	2.958
	1/1.2		3.253×10^{-5}	1.330×10^{-1}	5.335	3.332	1.493×10^{-4}	------------	------------	------------	4.171×10^{-13}	6.505	4.904	4.436
	1/1.4		2.296×10^{-4}	2.655	4.007	3.329	3.965	------------	------------	------------	1.179×10^{-13}	6.502	1.303×10^{-4}	7.228
	1/1.6		1.127×10^{-3}	3.958	2.696	3.323	8.777	------------	------------	------------	3.579×10^{-14}	6.496	2.887×10^{-4}	1.075×10^{8}
	1/2.0		3.286×10^{-2}	5.702	7.193×10^{-2}	3.187	4.641×10^{-3}	------------	------------	------------	$< 1.0 \times 10^{-14}$	6.362	1.559×10^{-3}	2.466
	1/4.0		3.941×10^{-1}	3.822	1.392×10^{-2}	1.918	1.247×10^{-2}	------------	------------	------------	$< 1.0 \times 10^{-16}$	4.936	5.398×10^{-3}	4.016
1	1/0.90	2000	------------	2.069×10^{-6}	6.207×10^{-1}	3.448×10^{-1}	5.117×10^{-11}	7.133×10^{-7}	1.273×10^{-8}	3.448×10^{-2}	1.306×10^{-10}	5.372×10^{-10}	3.218×10^{-12}	4.710×10^{3}
	1/0.95		------------	3.178×10^{-6}	6.440	3.390	7.509×10^{-11}	4.958×10^{-7}	6.152×10^{-9}	1.695×10^{-2}	9.160×10^{-11}	5.326	4.763×10^{-12}	3.454
	1/1.0		2.549×10^{-14}	7.324×10^{-5}	6.665	3.333	1.658×10^{-9}	2.285×10^{-8}	1.306×10^{-11}	3.661×10^{-5}	4.257×10^{-12}	5.282	1.061×10^{-10}	1.705
	1/1.05		5.849×10^{-9}	3.333×10^{-2}	6.333	3.333	7.941×10^{-7}	4.533×10^{-11}	------------	------------	8.445×10^{-15}	5.282	5.080×10^{-8}	3.726×10^{4}
	1/1.1		2.606×10^{-8}	6.666×10^{-2}	6.000	3.333	1.676×10^{-6}	------------	------------	------------	3.790	5.282	1.072×10^{-7}	5.414
	1/1.2		1.319×10^{-7}	1.333×10^{-1}	5.333	3.333	3.772×10^{-6}	------------	------------	------------	1.497	5.282	2.413	8.122
	1/1.4		9.383×10^{-7}	2.666	4.000	3.333	1.006×10^{-5}	------------	------------	------------	$< 1.0 \times 10^{-15}$	5.282	6.435	1.326×10^{5}
	1/1.6		4.749×10^{-6}	3.999	2.667	3.333	2.263×10^{-5}	------------	------------	------------	$< 1.0 \times 10^{-15}$	5.282	1.447×10^{-6}	1.989×10^{5}
	1/2.0		5.789×10^{-3}	6.501	1.241×10^{-2}	3.308	7.872×10^{-4}	------------	------------	------------	$< 1.0 \times 10^{-18}$	5.262	5.054×10^{-5}	1.172×10^{6}
	1/4.0		3.974×10^{-1}	3.988	9.192×10^{-4}	1.973	5.037×10^{-3}	------------	------------	------------	$< 1.0 \times 10^{-20}$	4.064	4.188×10^{-4}	2.951×10^{6}
0.1	1/0.90	5200	5.283×10^{-8}	3.846×10^{-7}	5.433×10^{-2}	2.675×10^{-2}	1.977×10^{-5}	5.515×10^{-4}	2.935×10^{-10}	3.429×10^{-6}	7.749×10^{-3}	8.562×10^{-3}	2.023×10^{-3}	1.315×10^{13}
	1/0.95		1.071×10^{-7}	5.646	5.601	2.654	2.804×10^{-5}	3.977	1.526×10^{-10}	1.797×10^{-6}	5.610	8.527	2.881×10^{-3}	1.161
	1/1.0		2.247×10^{-7}	8.311	5.692	2.618	4.034×10^{-5}	2.771	7.409×10^{-11}	8.847×10^{-7}	3.936	8.469	4.173×10^{-3}	1.037
	1/1.05		4.515	1.179×10^{-6}	5.699	2.567	5.662	1.938	------------	4.415	2.781	8.386	5.915	9.642×10^{12}
	1/1.1		8.192	1.573	5.642	2.505	7.535	1.407	------------	2.385	2.044	8.286	7.968	9.371
	1/1.2		1.976×10^{-6}	2.353	5.436	2.373	1.139×10^{-4}	8.496×10^{-5}	------------	------------	1.267	8.063	1.237×10^{-2}	9.590
	1/1.4		5.508	3.582	4.956	2.122	1.798	4.388	------------	------------	6.922×10^{-4}	7.626	2.066	1.068×10^{13}
	1/1.6		9.888	4.379	4.522	1.911	2.286	2.836	------------	------------	4.714	7.237	2.768	1.159
	1/2.0		1.922×10^{-5}	5.175	3.832	1.586	2.904	1.570	------------	------------	2.865	6.593	3.860	1.273
	1/4.0		5.418×10^{-5}	4.900	2.162	8.299×10^{-3}	3.527	3.816×10^{-6}	------------	------------	9.627×10^{-5}	4.768	6.480	1.377

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
0.1	1/0.90	4800	------------	1.840×10^{-7}	5.864×10^{-2}	3.059×10^{-2}	4.660×10^{-6}	7.669×10^{-4}	1.297×10^{-9}	2.302×10^{-5}	6.074×10^{-3}	3.563×10^{-3}	3.293×10^{-4}	3.918×10^{12}
	1/0.95		------------	3.563	6.134	3.060	8.629×10^{-6}	4.334	4.143×10^{-10}	7.348×10^{-6}	3.431	3.564	6.097×10^{-4}	3.077
	1/1.0		8.399×10^{-8}	9.261	6.294	3.038	2.178×10^{-5}	1.749	6.747×10^{-11}	1.205×10^{-6}	1.390	3.550	1.544×10^{-3}	2.409
	1/1.05		4.913×10^{-7}	2.220×10^{-6}	6.237	2.969	5.207	7.083×10^{-5}	------------	------------	5.695×10^{-4}	3.510	3.735	2.552
	1/1.1		1.439×10^{-6}	3.708	6.086	2.882	8.782	3.980	------------	------------	3.247	3.458	6.393	3.010
	1/1.2		4.718×10^{-6}	6.351	5.758	2.712	1.542×10^{-4}	2.017	------------	------------	1.697	3.355	1.157×10^{-2}	3.807
	1/1.4		1.484×10^{-5}	1.012×10^{-5}	5.172	2.420	2.583	9.650×10^{-6}	------------	------------	8.594×10^{-5}	3.169	2.053	4.836
	1/1.6		2.730	1.244	4.689	2.181	3.327	6.124	------------	------------	5.744	3.008	2.785	5.460
	1/2.0		5.366	1.469	3.949	1.818	4.259	3.359	------------	------------	3.451	2.747	3.903	6.156
	1/4.0		1.508×10^{-4}	1.376	2.206	9.776×10^{-3}	5.235	8.208×10^{-7}	------------	------------	1.150	2.014	6.544	6.810
0.1	1/0.90	4400	------------	------------	6.009×10^{-2}	3.221×10^{-2}	7.183×10^{-7}	1.167×10^{-3}	8.290×10^{-9}	2.623×10^{-4}	5.022×10^{-3}	1.207×10^{-3}	3.288×10^{-5}	9.982×10^{11}
	1/0.95		------------	1.295×10^{-7}	6.308	3.232	1.440×10^{-6}	6.133×10^{-4}	2.287×10^{-9}	7.212×10^{-5}	2.633×10^{-3}	1.209	6.582×10^{-5}	7.384
	1/1.0		2.487×10^{-8}	9.542×10^{-7}	6.550	3.233	1.022×10^{-5}	8.977×10^{-5}	4.900×10^{-11}	1.544×10^{-6}	3.854×10^{-4}	1.209	4.670×10^{-4}	4.611
	1/1.05		1.164×10^{-6}	6.384×10^{-6}	6.404	3.142	6.895×10^{-5}	1.264×10^{-5}	------------	------------	5.507×10^{-5}	1.191	3.196×10^{-3}	8.905
	1/1.1		4.244×10^{-6}	1.182×10^{-5}	6.212	3.043	1.295×10^{-4}	6.322×10^{-6}	------------	------------	2.798	1.172	6.101×10^{-3}	1.204×10^{12}
	1/1.2		1.493×10^{-5}	2.089	5.853	2.859	2.355	3.078	------------	------------	1.405	1.137	1.144×10^{-2}	1.615
	1/1.4		4.781	3.350	5.245	2.551	3.981	1.456	------------	------------	7.038×10^{-6}	1.074	2.048	2.094
	1/1.6		8.818	4.121	4.751	2.301	5.134	9.225×10^{-7}	------------	------------	4.695	1.020	2.781	2.377
	1/2.0		1.733×10^{-4}	4.861	3.998	1.922	6.578	5.061	------------	------------	2.818	9.321×10^{-4}	3.898	2.689
	1/4.0		4.852×10^{-4}	4.539	2.231	1.043	8.108	1.243	------------	------------	9.397×10^{-7}	6.865×10^{-4}	6.523	2.984
0.1	1/0.90	4000	------------	2.797×10^{-8}	6.123×10^{-2}	3.327×10^{-2}	1.235×10^{-7}	1.171×10^{-3}	2.971×10^{-8}	1.645×10^{-3}	2.346×10^{-3}	3.253×10^{-4}	3.521×10^{-6}	1.581×10^{11}
	1/0.95		------------	4.984×10^{-8}	6.383	3.308	2.105×10^{-7}	7.121×10^{-4}	1.098×10^{-8}	6.118×10^{-4}	1.430×10^{-3}	3.243	6.020×10^{-6}	1.226×10^{11}
	1/1.0		6.071×10^{-9}	9.909×10^{-7}	6.637	3.306	4.025×10^{-6}	3.872×10^{-5}	3.246×10^{-11}	1.809×10^{-6}	7.779×10^{-5}	3.245	1.151×10^{-4}	7.106×10^{10}
	1/1.05		4.366×10^{-6}	2.580×10^{-5}	6.443	3.202	1.062×10^{-4}	1.379×10^{-6}	------------	------------	2.816×10^{-6}	3.191	3.086×10^{-3}	3.126×10^{11}
	1/1.1		1.633×10^{-5}	4.836	6.245	3.099	2.021	6.801×10^{-7}	------------	------------	1.411×10^{-6}	3.139	5.969×10^{-3}	4.305
	1/1.2		5.766×10^{-5}	8.561	5.884	2.912	3.681	3.305	------------	------------	7.076×10^{-7}	3.043	1.122×10^{-2}	5.805
	1/1.4		1.838×10^{-4}	1.370×10^{-4}	5.275	2.599	6.209	1.567	------------	------------	3.552	2.875	2.003	7.535
	1/1.6		3.378	1.684	4.781	2.345	7.996	9.960×10^{-8}	------------	------------	2.376	2.731	2.715	8.549
	1/2.0		6.603	1.984	4.030	1.961	1.022×10^{-3}	5.490	------------	------------	1.432	2.497	3.795	9.664
	1/4.0		1.834×10^{-3}	1.855	2.260	1.067	1.257×10^{-3}	1.363	------------	------------	4.820×10^{-8}	1.842	6.326	1.071×10^{12}
0.1	1/0.90	3600	------------	2.395×10^{-8}	6.192×10^{-2}	3.411×10^{-2}	3.142×10^{-8}	5.085×10^{-4}	2.640×10^{-8}	2.981×10^{-3}	4.104×10^{-4}	6.530×10^{-5}	5.148×10^{-7}	1.406×10^{10}
	1/0.95		------------	3.795×10^{-8}	6.429	3.363	4.759×10^{-8}	3.436×10^{-4}	1.206×10^{-8}	1.381×10^{-3}	2.793×10^{-4}	6.484	7.854×10^{-7}	1.084×10^{10}
	1/1.0		1.327×10^{-9}	1.149×10^{-6}	6.661	3.328	1.383×10^{-6}	1.212×10^{-5}	1.499×10^{-11}	1.735×10^{-6}	9.901×10^{-6}	6.449	2.295×10^{-5}	8.380×10^{9}
	1/1.05		2.090×10^{-5}	1.396×10^{-4}	6.451	3.221	1.708×10^{-4}	9.201×10^{-8}	------------	------------	7.641×10^{-8}	6.345	2.880×10^{-3}	8.696×10^{10}
	1/1.1		7.733×10^{-5}	2.604	6.253	3.120	3.234	4.563	------------	------------	3.850	6.245	5.541×10^{-3}	1.196×10^{11}
	1/1.2		2.675×10^{-4}	4.565	5.894	2.938	5.836	2.244	------------	------------	1.951	6.060	1.030×10^{-2}	1.606
	1/1.4		8.276×10^{-4}	7.215	5.296	2.633	9.718	1.085	------------	------------	9.970×10^{-9}	5.737	1.812	2.072
	1/1.6		1.489×10^{-3}	8.799	4.815	2.386	1.241×10^{-3}	7.002×10^{-9}	------------	------------	6.756	5.462	2.432	2.341
	1/2.0		2.839	1.030×10^{-3}	4.082	2.011	1.573	3.947	------------	------------	4.149	5.014	3.357	2.634
	1/4.0		7.598	9.646×10^{-4}	2.337	1.119	1.919	1.030	------------	------------	1.452	3.739	5.492	2.908
0.1	1/0.90	3200	------------	2.663×10^{-8}	6.205×10^{-2}	3.441×10^{-2}	7.891×10^{-9}	1.276×10^{-4}	1.150×10^{-8}	3.367×10^{-3}	3.395×10^{-5}	8.720×10^{-6}	6.349×10^{-8}	9.552×10^{8}
	1/0.95		------------	4.110×10^{-8}	6.439	3.384	1.164×10^{-8}	8.831×10^{-5}	5.508×10^{-9}	1.638×10^{-3}	2.369×10^{-5}	8.648	9.443×10^{-8}	6.944
	1/1.0		2.882×10^{-10}	1.595×10^{-6}	6.665	3.332	4.331×10^{-7}	2.419×10^{-6}	4.133×10^{-12}	1.249×10^{-6}	6.539×10^{-7}	8.582	3.541×10^{-6}	6.803
	1/1.05		9.011×10^{-5}	8.610×10^{-4}	6.434	3.248	2.391×10^{-4}	4.123×10^{-9}	------------	------------	1.129×10^{-9}	8.472	1.980×10^{-3}	1.556×10^{10}
	1/1.1		3.196×10^{-4}	1.569×10^{-3}	6.225	3.168	4.447	2.091	------------	------------	5.799×10^{-10}	8.367	3.729	2.122
	1/1.2		1.039×10^{-3}	2.661	5.856	3.022	7.831	1.066	------------	------------	3.026	8.172	6.723	2.815
	1/1.4		2.980	4.049	5.261	2.769	1.269×10^{-3}	------------	------------	------------	1.605	7.823	1.138×10^{-2}	3.582
	1/1.6		5.133	4.838	4.791	2.557	1.601	------------	------------	------------	1.114	7.517	1.494	4.021
	1/2.0		9.324	5.553	4.080	2.217	2.009	------------	------------	------------	7.037×10^{-11}	6.999	2.014	4.502
	1/4.0		2.350×10^{-2}	5.128	2.373	1.319	2.461	------------	------------	------------	2.578×10^{-11}	5.400	3.197	4.976

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Continued

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
0.1	1/0.90	2800	------------	3.251×10^{-8}	6.207×10^{-2}	3.447×10^{-2}	1.376×10^{-9}	2.162×10^{-5}	3.979×10^{-9}	3.437×10^{-3}	1.314×10^{-6}	6.564×10^{-7}	4.561×10^{-9}	3.946×10^{7}
	1/0.95		------------	4.996×10^{-8}	6.440	3.389	2.020×10^{-9}	1.502×10^{-5}	1.920×10^{-9}	1.687×10^{-3}	9.207×10^{-7}	6.508	6.755×10^{-9}	2.810
	1/1.0		2.707×10^{-11}	2.140×10^{-6}	6.666	3.333	8.295×10^{-8}	3.724×10^{-7}	1.181×10^{-12}	1.055×10^{-6}	2.302×10^{-8}	6.455	2.796×10^{-7}	2.617
	1/1.05		4.855×10^{-5}	2.735×10^{-3}	6.361	3.312	1.107×10^{-4}	2.645×10^{-10}	------------	------------	1.640×10^{-11}	6.434	3.744×10^{-4}	9.455×10^{8}
	1/1.1		1.951×10^{-4}	5.234	6.073	3.287	2.211	1.255×10^{-10}	------------	------------	7.813×10^{-12}	6.410	7.506×10^{-4}	1.336×10^{9}
	1/1.2		7.736×10^{-4}	9.523	5.548	3.228	4.364	5.707×10^{-11}	------------	------------	3.585	6.353	1.495×10^{-3}	1.876
	1/1.4		2.878×10^{-3}	1.556×10^{-2}	4.699	3.086	8.229	2.450×10^{-11}	------------	------------	1.574	6.211	2.883	2.575
	1/1.6		5.774×10^{-3}	1.906	4.065	2.929	1.135×10^{-3}	------------	------------	------------	9.614×10^{-13}	6.051	4.083	3.023
	1/2.0		1.227×10^{-2}	2.192	3.207	2.621	1.566	------------	------------	------------	5.201	5.724	5.954	3.548
	1/4.0		3.653×10^{-2}	1.881	1.594	1.631	2.131	------------	------------	------------	1.499	4.515	1.027×10^{-2}	4.132
0.1	1/0.90	2400	------------	4.319×10^{-8}	6.207×10^{-2}	3.448×10^{-2}	1.340×10^{-10}	1.986×10^{-6}	9.196×10^{-10}	3.447×10^{-3}	1.739×10^{-8}	2.092×10^{-8}	1.368×10^{-10}	5.960×10^{5}
	1/0.95		------------	6.633×10^{-8}	6.440	3.389	1.966×10^{-10}	1.380×10^{-6}	4.443×10^{-10}	1.694×10^{-3}	1.219×10^{-8}	2.075	2.025×10^{-10}	4.221
	1/1.0		7.863×10^{-13}	2.584×10^{-6}	6.666	3.333	7.341×10^{-9}	3.764×10^{-8}	3.303×10^{-13}	1.281×10^{-6}	3.352×10^{-10}	2.057	7.625×10^{-9}	3.125
	1/1.05		1.428×10^{-6}	3.309×10^{-3}	6.334	3.332	9.891×10^{-6}	2.654×10^{-11}	------------	------------	2.363×10^{-13}	2.057	1.027×10^{-5}	1.142×10^{7}
	1/1.1		6.339×10^{-6}	6.609×10^{-3}	6.003	3.331	2.084×10^{-5}	1.193×10^{-11}	------------	------------	1.063×10^{-13}	2.056	2.165	1.657
	1/1.2		3.173×10^{-5}	1.316×10^{-2}	5.343	3.327	4.659×10^{-5}	------------	------------	------------	4.230×10^{-14}	2.055	4.843	2.478
	1/1.4		2.135×10^{-4}	2.588	4.051	3.314	1.206×10^{-4}	------------	------------	------------	1.236	2.051	1.256×10^{-4}	3.987
	1/1.6		8.859×10^{-4}	3.722	2.860	3.279	2.444	------------	------------	------------	< 1.0	2.040	2.559	5.673
	1/2.0		6.272×10^{-3}	4.797	1.385	3.059	6.281	------------	------------	------------	$< 1.0 \times 10^{-15}$	1.971	6.810	9.089
	1/4.0		3.939×10^{-2}	3.484	4.014×10^{-3}	1.881	1.234×10^{-3}	------------	------------	------------	$< 1.0 \times 10^{-16}$	1.545	1.706×10^{-3}	1.272×10^{8}
0.1	1/0.90	2000	------------	6.544×10^{-8}	6.207×10^{-2}	3.448×10^{-2}	5.117×10^{-12}	7.133×10^{-8}	1.273×10^{-10}	3.448×10^{-3}	4.131×10^{-11}	1.699×10^{-10}	1.018×10^{-12}	1.706×10^{3}
	1/0.95		------------	1.005×10^{-7}	6.440	3.390	7.509×10^{-12}	4.958×10^{-8}	6.151×10^{-11}	1.695×10^{-3}	2.896×10^{-11}	1.684	1.506×10^{-12}	1.206×10^{3}
	1/1.0		5.493×10^{-15}	3.400×10^{-6}	6.666	3.333	2.433×10^{-10}	1.557×10^{-9}	6.066×10^{-14}	1.699×10^{-6}	9.173×10^{-13}	1.670	4.923×10^{-11}	6.540×10^{2}
	1/1.05		5.848×10^{-9}	3.330×10^{-3}	6.333	3.333	2.511×10^{-7}	1.433×10^{-12}	------------	------------	8.446×10^{-16}	1.670	5.080×10^{-8}	2.095×10^{4}
	1/1.1		2.606×10^{-8}	6.666×10^{-3}	6.000	3.333	5.301×10^{-7}	------------	------------	------------	3.790	1.670	1.072×10^{-7}	3.045
	1/1.2		1.319×10^{-7}	1.333×10^{-2}	5.333	3.333	1.193×10^{-6}	------------	------------	------------	1.497	1.670	2.413	4.567
	1/1.4		9.378×10^{-7}	2.666	4.000	3.333	3.180	------------	------------	------------	$< 1.0 \times 10^{-16}$	1.670	6.433	7.457
	1/1.6		4.740×10^{-6}	3.998	2.668	3.332	7.149	------------	------------	------------	$< 1.0 \times 10^{-16}$	1.670	1.446×10^{-6}	1.118×10^{5}
	1/2.0		1.236×10^{-3}	6.318	2.610×10^{-3}	3.283	1.146×10^{-4}	------------	------------	------------	$< 1.0 \times 10^{-19}$	1.658	2.336×10^{-5}	4.475
	1/4.0		3.974×10^{-2}	3.962	2.888×10^{-4}	1.970	5.033×10^{-4}	------------	------------	------------	$< 1.0 \times 10^{-20}$	1.284	1.324×10^{-4}	9.365
0.01	1/0.95	4800	------------	1.643×10^{-8}	5.502×10^{-3}	2.537×10^{-3}	1.277×10^{-6}	2.177×10^{-5}	1.045×10^{-12}	2.236×10^{-7}	5.986×10^{-4}	1.026×10^{-3}	3.134×10^{-4}	1.259×10^{12}
	1/1.0		6.932×10^{-9}	2.363	5.590	2.500	1.795	1.551	5.308×10^{-13}	1.152×10^{-7}	4.298	1.018	4.437	1.110
	1/1.05		1.333×10^{-8}	3.284	5.601	2.450	2.464	1.109	------------	------------	3.105	1.008	6.152	1.004
	1/1.1		2.345×10^{-8}	4.317	5.552	2.392	3.229	8.192×10^{-6}	------------	------------	2.320	9.963×10^{-4}	8.161	9.440×10^{11}
0.01	1/0.95	4400	2.692×10^{-10}	9.313×10^{-9}	6.144×10^{-3}	3.061×10^{-3}	3.272×10^{-7}	2.490×10^{-5}	3.771×10^{-12}	1.256×10^{-6}	3.475×10^{-4}	3.719×10^{-4}	4.859×10^{-5}	2.690×10^{11}
	1/1.0		2.111×10^{-9}	2.682×10^{-8}	6.318	3.037	9.128×10^{-7}	9.108×10^{-6}	5.044×10^{-13}	1.693×10^{-7}	1.276×10^{-4}	3.705	1.361×10^{-4}	1.922
	1/1.05		1.504×10^{-8}	7.084×10^{-8}	6.252	2.965	2.407×10^{-6}	3.336	------------	------------	4.729×10^{-5}	3.661	3.632	1.951
	1/1.1		4.612×10^{-8}	1.209×10^{-7}	6.093	2.877	4.152	1.829	------------	------------	2.633	3.606	6.359	2.307
	1/1.2		1.538×10^{-7}	2.086×10^{-7}	5.758	2.708	7.355	9.185×10^{-7}	------------	------------	1.362	3.498	1.161×10^{-3}	2.931

TABLE II.- COMPOSITION OF THE PRODUCTS OF CYANOGEN-OXYGEN COMBUSTION - Concluded

P, atm	C_2N_2/O_2 mole ratio	T, °K	Partial pressure, atm											N_e, cm^{-3}
			O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O	
0.01	1/0.95	4000	------------	2.723×10^{-9}	6.321×10^{-3}	3.257×10^{-3}	3.646×10^{-8}	4.010×10^{-5}	3.483×10^{-11}	1.970×10^{-5}	2.567×10^{-4}	1.018×10^{-4}	3.321×10^{-6}	5.014×10^{10}
	1/1.0		4.715×10^{-10}	2.738×10^{-8}	6.580	3.253	3.518×10^{-7}	4.321×10^{-6}	4.043×10^{-13}	2.290×10^{-7}	2.767×10^{-5}	1.017	3.207×10^{-5}	2.537
	1/1.05		4.700×10^{-8}	2.665×10^{-7}	6.415	3.157	3.460×10^{-6}	4.156×10^{-7}	------------	------------	2.702×10^{-6}	1.002	3.202×10^{-4}	5.703
	1/1.1		1.740×10^{-7}	4.971	6.218	3.057	6.553×10^{-6}	2.060	------------	------------	1.361×10^{-6}	9.860×10^{-5}	6.162×10^{-4}	7.789
	1/1.2		6.149×10^{-7}	8.799	5.856	2.875	1.194×10^{-5}	1.001	------------	------------	6.820×10^{-7}	9.562	1.158×10^{-3}	1.048×10^{11}
	1/1.4		1.970×10^{-6}	1.410×10^{-6}	5.244	2.568	2.020	4.733×10^{-8}	------------	------------	3.412	9.036	2.073	1.361
	1/1.6		3.632×10^{-6}	1.734×10^{-6}	4.748	2.319	2.607	2.999×10^{-8}	------------	------------	2.275	8.587	2.815	1.546
0.01	1/1	3600	8.509×10^{-11}	2.905×10^{-8}	6.650×10^{-3}	3.317×10^{-3}	1.106×10^{-7}	1.508×10^{-6}	2.323×10^{-13}	2.698×10^{-7}	3.904×10^{-6}	2.036×10^{-5}	5.812×10^{-6}	2.545×10^{9}
	1/1.10		9.344×10^{-7}	2.859×10^{-6}	6.247	3.109	1.122×10^{-5}	1.309×10^{-8}	------------	------------	3.499×10^{-8}	1.971	6.090×10^{-4}	2.229×10^{10}
	1/1.20		3.304×10^{-6}	5.064	5.882	2.924	2.046	6.357×10^{-9}	------------	------------	1.752×10^{-8}	1.912	1.145×10^{-3}	3.010
	1/1.40		1.055×10^{-5}	8.106	5.269	2.612	3.457	3.011	------------	------------	8.782×10^{-9}	1.807	2.047	3.911
	1/1.60		1.941	9.957	4.772	2.360	4.456	1.912	------------	------------	5.865	1.717	2.776	4.441
	1/2.00		3.798	1.172×10^{-5}	4.016	1.977	5.706	1.053	------------	------------	3.529	1.572	3.883	5.025
0.01	1/1	3200	1.813×10^{-11}	4.000×10^{-8}	6.664×10^{-3}	3.331×10^{-3}	3.434×10^{-8}	3.049×10^{-7}	6.566×10^{-14}	1.984×10^{-7}	2.607×10^{-7}	2.713×10^{-6}	8.880×10^{-7}	1.941×10^{8}
	1/1.10		7.403×10^{-6}	2.398×10^{-5}	6.251	3.126	2.126×10^{-5}	4.335×10^{-10}	------------	------------	3.827×10^{-10}	2.628	5.675×10^{-4}	4.642×10^{9}
	1/1.20		2.558×10^{-5}	4.200	5.890	2.946	3.837	2.133	------------	------------	1.939×10^{-10}	2.551	1.055×10^{-3}	6.235
	1/1.40		7.903×10^{-5}	6.628	5.289	2.644	6.389	1.033	------------	------------	9.911×10^{-11}	2.417	1.854	8.046
	1/1.60		1.420×10^{-4}	8.074	4.806	2.401	8.162	------------	------------	------------	6.717	2.304	2.485	9.094
	1/2.00		2.701	9.433	4.072	2.030	1.035×10^{-4}	------------	------------	------------	4.126	2.118	3.428	1.024×10^{10}
	1/4.00		7.192	8.799	2.327	1.143	1.267×10^{-4}	------------	------------	------------	1.445	1.589	5.593	1.133×10^{10}
0.01	1/1	2800	3.704×10^{-12}	7.917×10^{-8}	6.666×10^{-3}	3.333×10^{-3}	9.702×10^{-9}	3.184×10^{-8}	8.632×10^{-15}	7.709×10^{-8}	6.224×10^{-9}	2.041×10^{-7}	1.034×10^{-7}	8.938×10^{6}
	1/1.10		3.489×10^{-5}	2.258×10^{-4}	6.196	3.196	2.916×10^{-5}	9.443×10^{-12}	------------	------------	1.885×10^{-12}	1.999	3.174×10^{-4}	4.852×10^{8}
	1/1.20		1.143×10^{-4}	3.831	5.807	3.069	5.172	4.791	------------	------------	9.760×10^{-13}	1.958	5.745	6.461
	1/1.40		3.310	5.820	5.184	2.840	8.466	2.418	------------	------------	5.120	1.884	9.777	8.266
	1/1.60		5.732	6.939	4.697	2.641	1.074×10^{-4}	------------	------------	------------	3.525	1.817	1.286×10^{-3}	9.311
	1/2.00		1.047×10^{-3}	7.930	3.970	2.313	1.359	------------	------------	------------	2.204	1.700	1.739	1.047×10^{9}
	1/4.00		2.657×10^{-3}	7.220	2.270	1.411	1.691	------------	------------	------------	7.913×10^{-14}	1.328	2.770	1.167×10^{9}
0.01	1/4.00	2400	3.864×10^{-3}	2.700×10^{-3}	9.936×10^{-4}	1.787×10^{-3}	1.192×10^{-4}	------------	------------	------------	$< 1.0 \times 10^{-16}$	4.765×10^{-9}	5.345×10^{-4}	3.960×10^{7}

TABLE III.- ADIABATIC FLAME TEMPERATURES AND ELECTRON CONCENTRATIONS FOR VARIOUS CYANOGEN-OXYGEN MOLE RATIOS AND COMBUSTION PRESSURES AS DETERMINED BY GRAPHICAL METHODS

C_2N_2/O_2 mole ratio	O_2, percent by volume	P = 1 atm		P = 4 atm	
		T_f, °K	N_e, cm^{-3}	T_f, °K	N_e, cm^{-3}
1/0.90	47.4	4202	9.80×10^{11}	4260	1.83×10^{12}
1/0.95	48.7	4593	3.82×10^{12}	4624	7.30×10^{12}
1/1.0	50.0	4848	7.35×10^{12}	4955	1.95×10^{13}
1/1.05	51.2	4757	1.02×10^{13}	4835	3.25×10^{13}
1/1.1	52.4	4554	9.10×10^{12}	4631	2.90×10^{13}
1/1.2	54.5	4167	4.70×10^{12}	4311	1.80×10^{13}
1/1.4	58.3	3809	1.98×10^{12}	3993	8.80×10^{12}
1/1.6	61.5	3636	1.17×10^{12}	3870	6.40×10^{12}
1/2.0	66.7	3490	7.10×10^{11}	3710	3.80×10^{12}
1/4.0	80.0	3159	1.38×10^{11}	3340	7.70×10^{11}

C_2N_2/O_2 mole ratio	O_2, percent by volume	P = 10 atm		P = 40 atm	
		T_f, °K	N_e, cm^{-3}	T_f, °K	N_e, cm^{-3}
1/0.90	47.4	4292	2.53×10^{12}	4329	3.30×10^{12}
1/0.95	48.7	4664	1.07×10^{13}	4712	1.67×10^{13}
1/1.0	50.0	5016	3.75×10^{13}	5086	9.50×10^{13}
1/1.05	51.2	4878	6.85×10^{13}	4954	2.00×10^{14}
1/1.1	52.4	4692	6.35×10^{13}	4801	1.95×10^{14}
1/1.2	54.5	4410	4.22×10^{13}	4607	1.60×10^{14}
1/1.4	58.3	4158	2.55×10^{13}	4387	1.10×10^{14}
1/1.6	61.5	4013	1.80×10^{13}	4275	8.60×10^{13}
1/2.0	66.7	3892	1.30×10^{13}	4122	5.80×10^{13}
1/4.0	80.0	3480	2.50×10^{12}	3665	1.10×10^{13}

TABLE III.- ADIABATIC FLAME TEMPERATURES AND ELECTRON CONCENTRATIONS FOR VARIOUS CYANOGEN-OXYGEN MOLE RATIOS AND COMBUSTION PRESSURES AS DETERMINED BY GRAPHICAL METHODS - Concluded

	P = 100 atm			P = 0.1 atm	
C_2N_2/O_2 mole ratio	O_2, percent by volume	T_f, $^{\circ}K$	N_e, cm^{-3}	T_f, $^{\circ}K$	N_e, cm^{-3}
1/0.90	47.4	4330	3.20×10^{12}	4086	2.42×10^{11}
1/0.95	48.7	4734	1.87×10^{13}	4408	7.60×10^{11}
1/1.0	50.0	5119	1.60×10^{14}	4605	1.07×10^{12}
1/1.05	51.2	5012	3.90×10^{14}	4556	1.32×10^{12}
1/1.1	52.4	4896	4.08×10^{14}	4433	1.30×10^{12}
1/1.2	54.5	4740	3.65×10^{14}	4042	6.50×10^{11}
1/1.4	58.3	4564	2.82×10^{14}	3508	1.43×10^{11}
1/1.6	61.5	4447	2.27×10^{14}	3330	7.60×10^{10}
1/2.0	66.7	4291	1.55×10^{14}	3160	3.60×10^{10}
1/4.0	80.0	3795	2.87×10^{13}	2888	7.80×10^{9}

	P = 0.01 atm		
C_2N_2/O_2 mole ratio	O_2, percent by volume	T_f, $^{\circ}K$	N_e, cm^{-3}
1/0.90	47.4	------	-----------
1/0.95	48.7	4198	1.20×10^{11}
1/1.0	50.0	4370	1.63×10^{11}
1/1.05	51.2	4344	1.63×10^{11}
1/1.1	52.4	4262	1.60×10^{11}
1/1.2	54.5	3950	8.90×10^{10}
1/1.4	58.3	3259	1.07×10^{10}
1/1.6	61.5	3067	4.50×10^{9}
1/2.0	66.7	2896	2.02×10^{9}
1/4.0	80.0	2638	3.40×10^{8}

TABLE IV.- CONCENTRATION OF NEUTRAL SPECIES FOUND IN CYANOGEN-OXYGEN FLAME

P, atm	C_2N_2/O_2 mole ratio	Mole fraction of flame species										
		O_2	CO_2	CO	N_2	NO	CN	C_2N_2	C_2	C	N	O
100	1/0.95	3.70×10^{-9}	2.18×10^{-5}	6.42×10^{-1}	3.26×10^{-1}	1.43×10^{-5}	2.28×10^{-2}	1.36×10^{-4}	2.51×10^{-3}	5.18×10^{-3}	2.52×10^{-3}	2.88×10^{-5}
10		3.90×10^{-9}	7.70×10^{-6}	6.40×10^{-1}	3.27×10^{-1}	1.40×10^{-5}	1.77×10^{-2}	9.80×10^{-6}	1.92×10^{-3}	1.12×10^{-2}	2.55×10^{-3}	8.30×10^{-5}
1		-----------	4.10×10^{-6}	6.34×10^{-1}	3.27×10^{-1}	1.73×10^{-5}	1.10×10^{-2}	4.35×10^{-7}	1.00×10^{-3}	1.97×10^{-2}	6.70×10^{-3}	3.08×10^{-4}
0.1		-----------	1.30×10^{-6}	6.30×10^{-1}	3.21×10^{-1}	1.50×10^{-5}	6.10×10^{-3}	2.20×10^{-8}	6.85×10^{-4}	2.65×10^{-2}	1.22×10^{-2}	6.80×10^{-4}
0.01		-----------	5.35×10^{-7}	6.28×10^{-1}	3.17×10^{-1}	1.17×10^{-5}	3.18×10^{-3}	1.06×10^{-9}	4.63×10^{-4}	2.95×10^{-2}	2.00×10^{-2}	1.37×10^{-3}
100	1/0.90	-----------	7.97×10^{-6}	6.20×10^{-1}	3.30×10^{-1}	2.42×10^{-6}	2.78×10^{-2}	5.37×10^{-4}	1.85×10^{-2}	3.20×10^{-3}	3.08×10^{-4}	3.21×10^{-6}
10		-----------	2.55×10^{-6}	6.17×10^{-1}	3.30×10^{-1}	2.25×10^{-6}	2.41×10^{-2}	4.67×10^{-5}	1.80×10^{-2}	8.60×10^{-3}	8.80×10^{-4}	9.00×10^{-6}
1		-----------	1.11×10^{-6}	6.13×10^{-1}	3.31×10^{-1}	2.00×10^{-6}	1.83×10^{-2}	3.50×10^{-6}	1.50×10^{-2}	1.77×10^{-2}	2.08×10^{-3}	2.20×10^{-5}
0.1		-----------	3.40×10^{-7}	6.08×10^{-1}	3.30×10^{-1}	1.80×10^{-6}	1.17×10^{-2}	2.35×10^{-7}	1.12×10^{-2}	2.90×10^{-2}	4.40×10^{-3}	5.65×10^{-5}
100	1/1.0	4.70×10^{-6}	4.75×10^{-4}	6.62×10^{-1}	3.30×10^{-1}	6.20×10^{-4}	2.10×10^{-3}	4.70×10^{-7}	5.00×10^{-6}	7.50×10^{-4}	2.50×10^{-3}	1.70×10^{-3}
10		2.57×10^{-6}	1.27×10^{-4}	6.59×10^{-1}	3.26×10^{-1}	4.40×10^{-4}	2.04×10^{-3}	5.70×10^{-8}	7.03×10^{-6}	2.10×10^{-3}	6.20×10^{-3}	3.55×10^{-3}
1		1.18×10^{-6}	3.40×10^{-5}	6.54×10^{-1}	3.21×10^{-1}	2.75×10^{-4}	1.80×10^{-3}	6.40×10^{-9}	1.01×10^{-5}	4.70×10^{-3}	1.31×10^{-2}	6.20×10^{-3}
0.1		4.75×10^{-7}	9.41×10^{-6}	6.43×10^{-1}	3.13×10^{-1}	1.53×10^{-4}	1.30×10^{-3}	5.85×10^{-10}	1.38×10^{-5}	7.90×10^{-3}	2.15×10^{-2}	8.90×10^{-3}
0.01		1.91×10^{-7}	2.69×10^{-6}	6.33×10^{-1}	3.09×10^{-1}	8.60×10^{-5}	8.60×10^{-4}	5.03×10^{-11}	1.72×10^{-5}	1.12×10^{-2}	3.38×10^{-2}	1.23×10^{-2}
100	1/1.05	6.50×10^{-4}	6.40×10^{-3}	6.46×10^{-1}	3.21×10^{-1}	6.80×10^{-3}	1.20×10^{-4}	-----------	2.62×10^{-8}	3.83×10^{-5}	1.95×10^{-3}	1.82×10^{-2}
10		2.05×10^{-4}	1.35×10^{-3}	6.44×10^{-1}	3.18×10^{-1}	3.68×10^{-3}	1.48×10^{-4}	-----------	6.20×10^{-8}	1.24×10^{-4}	4.47×10^{-3}	2.71×10^{-2}
1		3.80×10^{-5}	2.11×10^{-4}	6.41×10^{-1}	3.15×10^{-1}	1.47×10^{-3}	2.32×10^{-4}	-----------	-----------	5.40×10^{-4}	1.02×10^{-2}	3.10×10^{-2}
0.1		8.10×10^{-6}	3.80×10^{-5}	6.33×10^{-1}	3.08×10^{-1}	6.05×10^{-4}	2.62×10^{-4}	-----------	-----------	1.55×10^{-3}	1.88×10^{-2}	3.33×10^{-2}
0.01		1.71×10^{-6}	8.45×10^{-6}	6.20×10^{-1}	3.05×10^{-1}	2.30×10^{-4}	2.72×10^{-4}	-----------	-----------	3.50×10^{-3}	3.05×10^{-2}	3.60×10^{-2}
100	1/1.1	2.63×10^{-3}	1.43×10^{-2}	6.24×10^{-1}	3.12×10^{-1}	1.29×10^{-2}	4.15×10^{-5}	-----------	4.80×10^{-9}	1.16×10^{-5}	1.47×10^{-3}	3.11×10^{-2}
10		1.14×10^{-3}	3.90×10^{-3}	6.25×10^{-1}	3.10×10^{-1}	7.70×10^{-3}	3.45×10^{-5}	-----------	-----------	2.30×10^{-5}	2.71×10^{-3}	4.88×10^{-2}
1		2.38×10^{-4}	7.00×10^{-4}	6.24×10^{-1}	3.07×10^{-1}	3.31×10^{-3}	4.60×10^{-5}	-----------	-----------	7.90×10^{-5}	5.75×10^{-3}	5.85×10^{-2}
0.1		3.80×10^{-5}	1.06×10^{-4}	6.20×10^{-1}	3.02×10^{-1}	1.24×10^{-3}	7.20×10^{-5}	-----------	-----------	3.50×10^{-4}	1.28×10^{-2}	6.13×10^{-2}
0.01		7.15×10^{-6}	1.92×10^{-5}	6.12×10^{-1}	2.95×10^{-1}	4.80×10^{-4}	9.50×10^{-5}	-----------	-----------	1.00×10^{-3}	2.38×10^{-2}	6.27×10^{-2}
100	1/1.2	9.90×10^{-3}	3.22×10^{-2}	5.85×10^{-1}	2.98×10^{-1}	2.27×10^{-2}	1.25×10^{-5}	-----------	-----------	2.90×10^{-6}	9.45×10^{-4}	4.92×10^{-2}
10		6.70×10^{-3}	1.40×10^{-2}	5.90×10^{-1}	2.94×10^{-1}	1.60×10^{-2}	5.00×10^{-6}	-----------	-----------	2.30×10^{-6}	1.20×10^{-3}	7.75×10^{-2}
1		2.50×10^{-3}	4.02×10^{-3}	5.90×10^{-1}	2.92×10^{-1}	8.63×10^{-3}	3.17×10^{-6}	-----------	-----------	3.00×10^{-6}	1.70×10^{-3}	1.00×10^{-1}
0.1		4.85×10^{-4}	7.60×10^{-4}	5.88×10^{-1}	2.90×10^{-1}	3.50×10^{-3}	4.20×10^{-6}	-----------	-----------	9.60×10^{-6}	3.52×10^{-3}	1.12×10^{-1}
0.01		7.30×10^{-5}	1.05×10^{-4}	5.86×10^{-1}	2.88×10^{-1}	1.27×10^{-3}	7.60×10^{-6}	-----------	-----------	4.60×10^{-5}	8.20×10^{-3}	1.15×10^{-1}
100	1/1.4	3.15×10^{-2}	6.70×10^{-2}	5.20×10^{-1}	2.77×10^{-1}	3.62×10^{-2}	3.30×10^{-6}	-----------	-----------	6.25×10^{-7}	5.55×10^{-4}	6.80×10^{-2}
10		2.78×10^{-2}	3.90×10^{-2}	5.28×10^{-1}	2.70×10^{-1}	2.67×10^{-2}	5.00×10^{-7}	-----------	-----------	2.40×10^{-7}	5.00×10^{-4}	1.08×10^{-1}
1		1.92×10^{-2}	2.11×10^{-2}	5.30×10^{-1}	2.67×10^{-1}	1.77×10^{-2}	2.10×10^{-7}	-----------	-----------	1.00×10^{-7}	4.40×10^{-4}	1.40×10^{-1}
0.1		1.15×10^{-2}	1.07×10^{-2}	5.29×10^{-1}	2.66×10^{-1}	1.05×10^{-2}	5.35×10^{-8}	-----------	-----------	3.90×10^{-8}	3.80×10^{-4}	1.70×10^{-1}
0.01		6.00×10^{-3}	4.80×10^{-3}	5.28×10^{-1}	2.64×10^{-1}	6.00×10^{-3}	1.75×10^{-8}	-----------	-----------	2.00×10^{-8}	3.41×10^{-4}	1.90×10^{-1}
100	1/1.6	5.88×10^{-2}	9.60×10^{-2}	4.63×10^{-1}	2.57×10^{-1}	4.50×10^{-2}	1.38×10^{-6}	-----------	-----------	2.20×10^{-7}	3.90×10^{-4}	7.62×10^{-2}
10		5.60×10^{-2}	6.65×10^{-2}	4.75×10^{-1}	2.54×10^{-1}	3.40×10^{-2}	2.70×10^{-7}	-----------	-----------	6.20×10^{-8}	2.95×10^{-4}	1.24×10^{-1}
1		4.75×10^{-2}	4.50×10^{-2}	4.80×10^{-1}	2.51×10^{-1}	2.34×10^{-2}	4.70×10^{-8}	-----------	-----------	1.50×10^{-8}	2.05×10^{-4}	1.51×10^{-1}
0.1		3.67×10^{-2}	2.92×10^{-2}	4.80×10^{-1}	2.49×10^{-1}	1.50×10^{-2}	$< 10^{-8}$	-----------	-----------	4.20×10^{-9}	1.45×10^{-4}	1.82×10^{-1}
0.01		2.42×10^{-2}	1.70×10^{-2}	4.77×10^{-1}	2.47×10^{-1}	9.40×10^{-3}	-----------	-----------	-----------	1.25×10^{-9}	1.06×10^{-4}	2.10×10^{-1}
100	1/2.0	1.14×10^{-1}	1.40×10^{-1}	3.73×10^{-1}	2.28×10^{-1}	5.48×10^{-2}	4.15×10^{-7}	-----------	-----------	5.50×10^{-8}	2.25×10^{-4}	8.60×10^{-2}
10		1.10×10^{-1}	9.90×10^{-2}	3.91×10^{-1}	2.24×10^{-1}	4.15×10^{-2}	8.20×10^{-8}	-----------	-----------	1.60×10^{-8}	1.45×10^{-4}	1.27×10^{-1}
1		1.05×10^{-1}	8.30×10^{-2}	3.95×10^{-1}	2.26×10^{-1}	2.88×10^{-2}	1.20×10^{-8}	-----------	-----------	2.80×10^{-9}	1.00×10^{-4}	1.58×10^{-1}
0.1		9.65×10^{-2}	6.55×10^{-2}	4.01×10^{-1}	2.27×10^{-1}	2.00×10^{-2}	-----------	-----------	-----------	4.35×10^{-10}	5.40×10^{-5}	1.83×10^{-1}
0.01		8.05×10^{-2}	5.00×10^{-2}	4.05×10^{-1}	2.22×10^{-1}	1.28×10^{-2}	-----------	-----------	-----------	8.00×10^{-11}	3.40×10^{-5}	2.10×10^{-1}
100	1/4.0	3.66×10^{-1}	2.28×10^{-1}	1.30×10^{-1}	1.52×10^{-1}	6.15×10^{-2}	8.00×10^{-9}	-----------	-----------	5.00×10^{-10}	3.08×10^{-5}	5.80×10^{-2}
10		3.61×10^{-1}	1.93×10^{-1}	1.60×10^{-1}	1.52×10^{-1}	4.38×10^{-2}	2.20×10^{-9}	-----------	-----------	1.60×10^{-10}	2.50×10^{-5}	9.00×10^{-2}
1		3.58×10^{-1}	1.68×10^{-1}	1.76×10^{-1}	1.54×10^{-1}	3.16×10^{-2}	-----------	-----------	-----------	3.15×10^{-11}	1.50×10^{-5}	1.13×10^{-1}
0.1		3.45×10^{-1}	1.48×10^{-1}	1.79×10^{-1}	1.57×10^{-1}	2.20×10^{-2}	-----------	-----------	-----------	4.80×10^{-12}	7.80×10^{-6}	1.40×10^{-1}
0.01		3.25×10^{-1}	1.40×10^{-1}	1.80×10^{-1}	1.57×10^{-1}	1.57×10^{-2}	-----------	-----------	-----------	$< 10^{-12}$	3.85×10^{-6}	1.60×10^{-1}

Type of equation	Gaseous molecules								Gaseous atoms				
	x_{O_2}	x_{CO_2}	x_{CO}	x_{N_2}	x_{NO}	x_{CN}	$x_{C_2N_2}$	x_{C_2}	x_C	x_N	x_O	x_A	Constant
Gaseous equilibria	1	0	0	0	0	0	0	0	0	0	-2	0	$-\delta_1$
	0	1	0	0	0	0	0	0	-1	0	-2	0	$-\delta_2$
	0	0	1	0	0	0	0	0	-1	0	-1	0	$-\delta_3$
	0	0	0	1	0	0	0	0	0	-2	0	0	$-\delta_4$
	0	0	0	0	1	0	0	0	0	-1	-1	0	$-\delta_5$
	0	0	0	0	0	1	0	0	-1	-1	0	0	$-\delta_6$
	0	0	0	0	0	0	1	0	-2	-2	0	0	$-\delta_7$
	0	0	0	0	0	0	0	1	-2	0	0	0	$-\delta_8$
Mass balance	0	$1p_{CO_2}$	$1p_{CO}$	0	0	$1p_{CN}$	$2p_{C_2N_2}$	$2p_{C_2}$	p_C	0	0	$-\sum a_i\ p_i$	$Aa \log_e \frac{2}{a}$
	0	0	0	$2p_{N_2}$	$1p_{NO}$	$1p_{CN}$	$2p_{C_2N_2}$	0	0	p_N	0	$-\sum b_i\ p_i$	$Ab \log_e \frac{2}{b}$
	$2p_{O_2}$	$2p_{CO_2}$	$1p_{CO}$	0	$1p_{NO}$	0	0	0	0	0	p_O	$-\sum c_i\ p_i$	$Ac \log_e \frac{2}{c}$
Pressure	p_{O_2}	p_{CO_2}	p_{CO}	p_{N_2}	p_{NO}	p_{CN}	$p_{C_2N_2}$	p_{C_2}	p_C	p_N	p_O	0	$P \log_e \frac{1}{P}$

Figure 1.- General matrix of correction equations for combustion of 1 mole of C_2N_2 with 1 mole of O_2 at 1 atmosphere of pressure and an arbitrarily assigned temperature. (See ref. 14.)

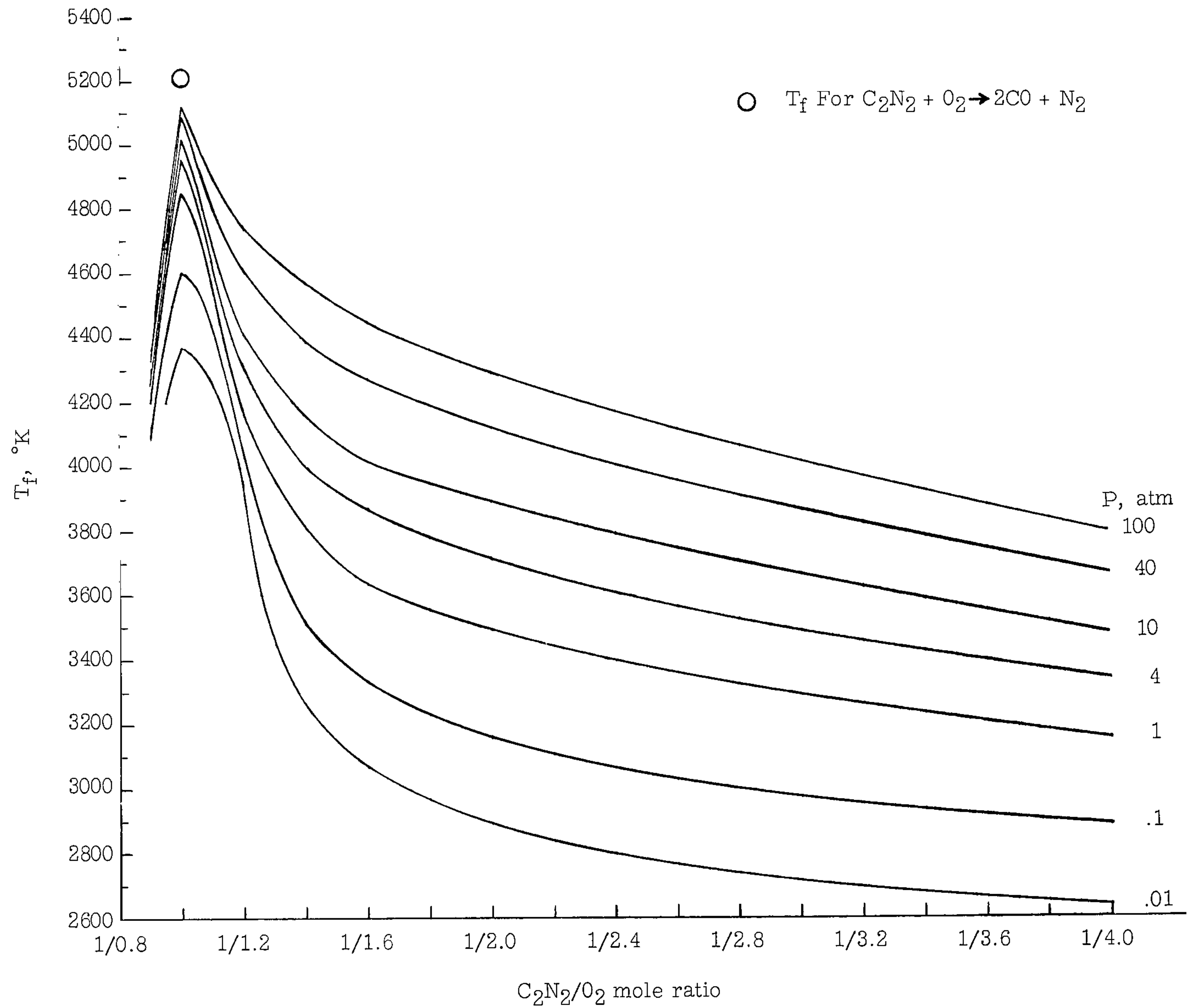


Figure 2.- Values of flame temperature as a function of initial reactant mixture of C_2N_2/O_2 for various equilibrium pressures.

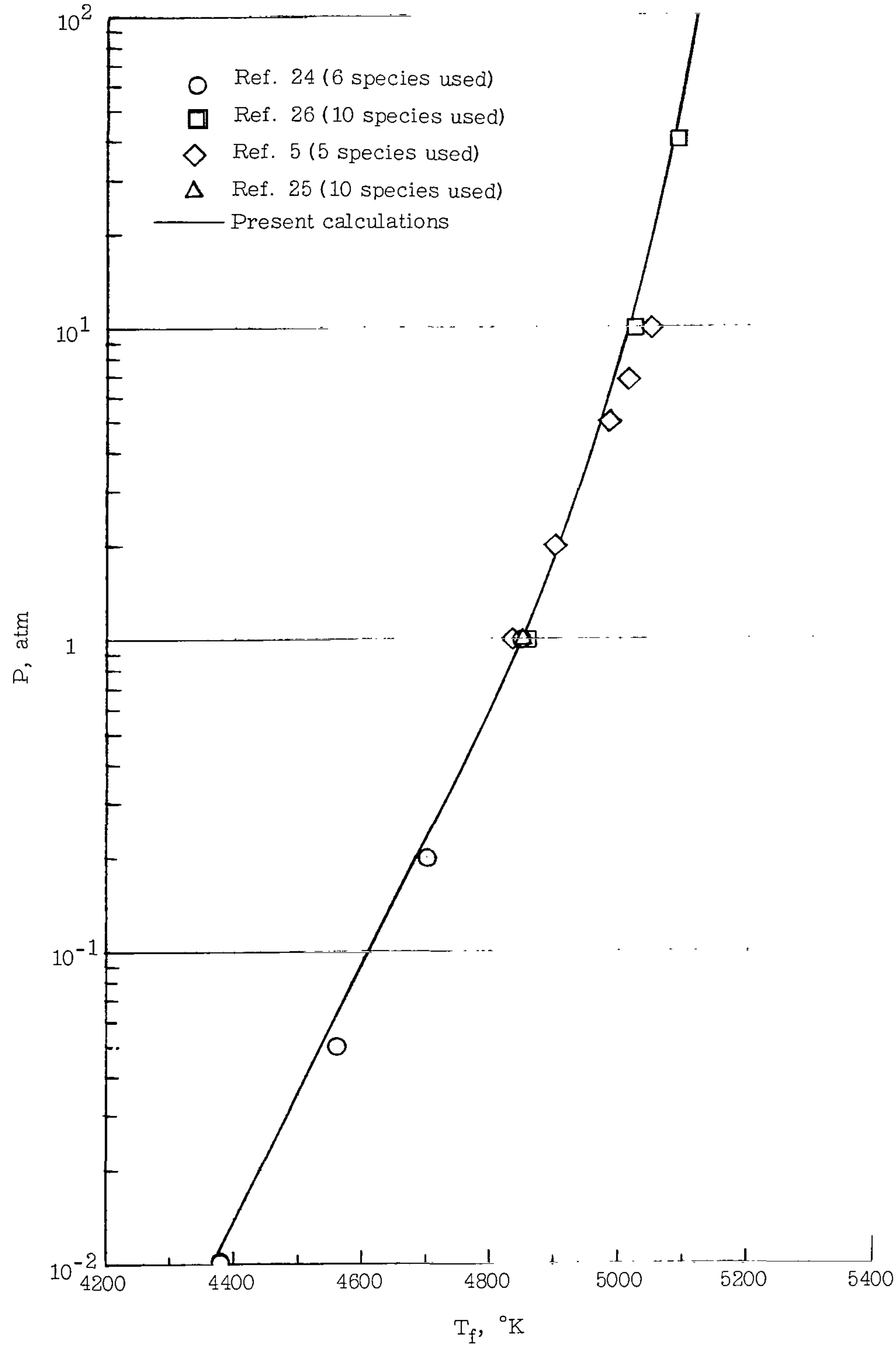


Figure 3.- Flame temperature as a function of pressure for C_2N_2/O_2 mole ratio of 1/1.

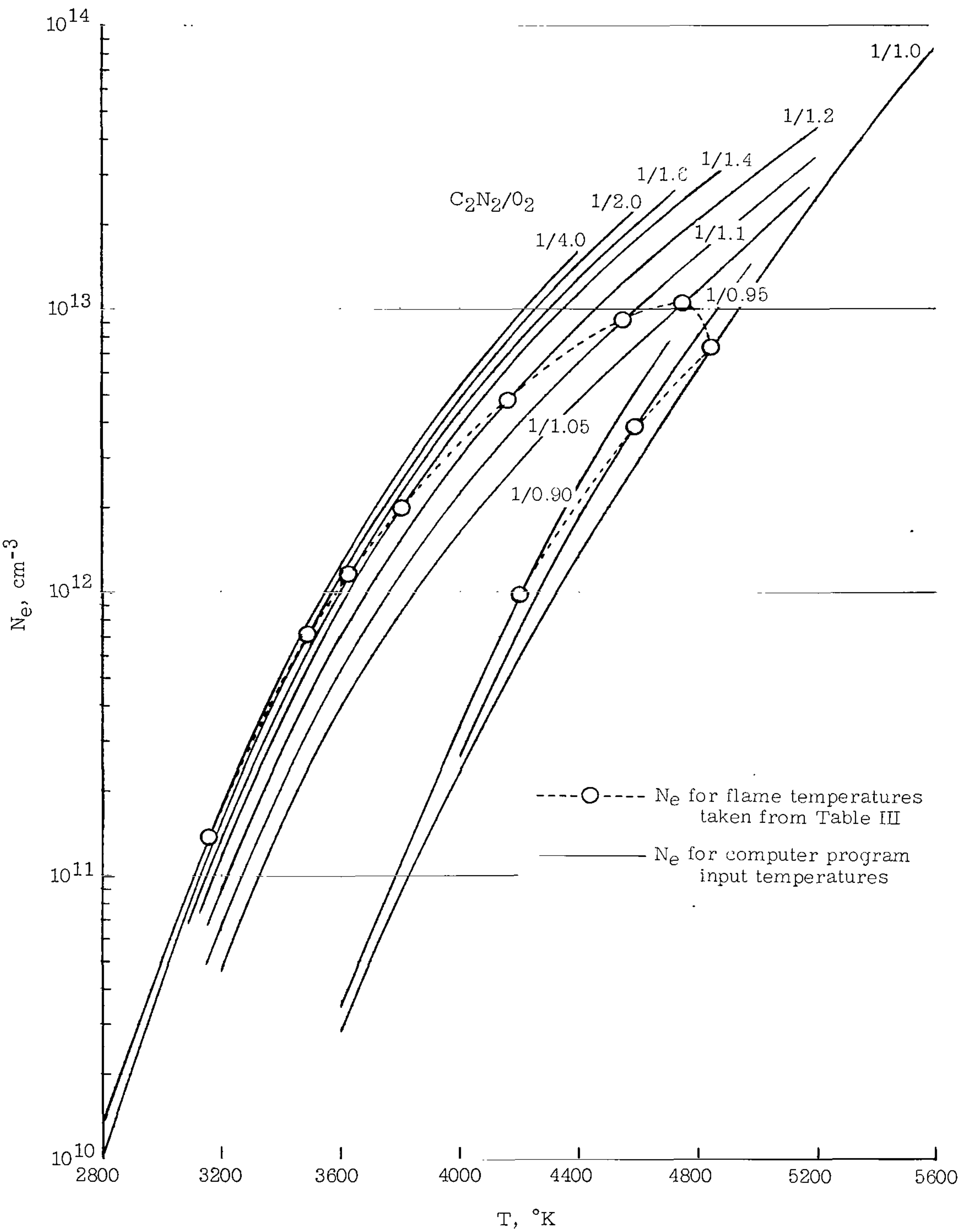


Figure 4.- Electron concentration as a function of temperature for various reactant mixtures of C_2N_2/O_2 at P = 1 atm.

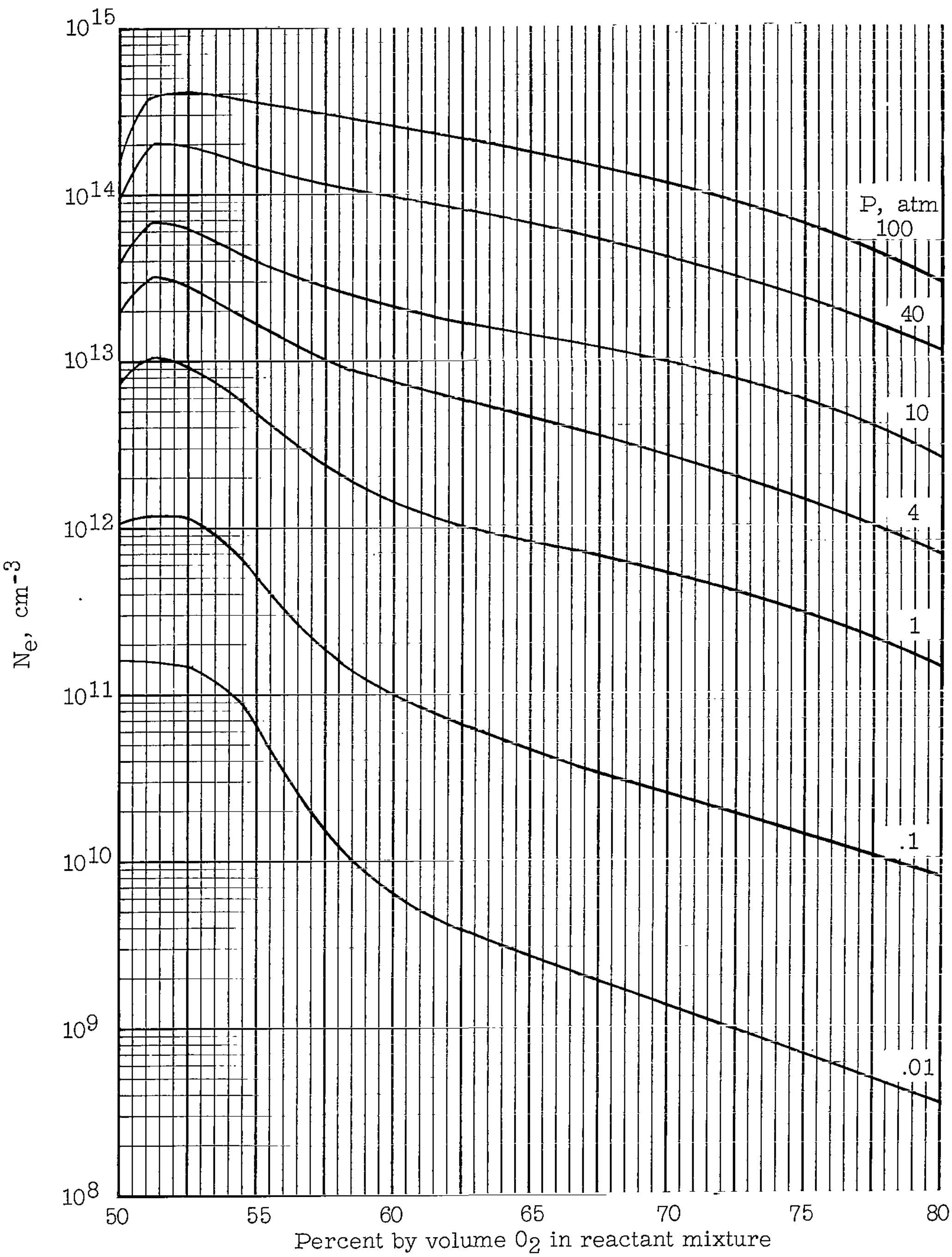


Figure 5.- Electron concentration as a function of O_2 concentration in initial reactant mixture for various pressures.

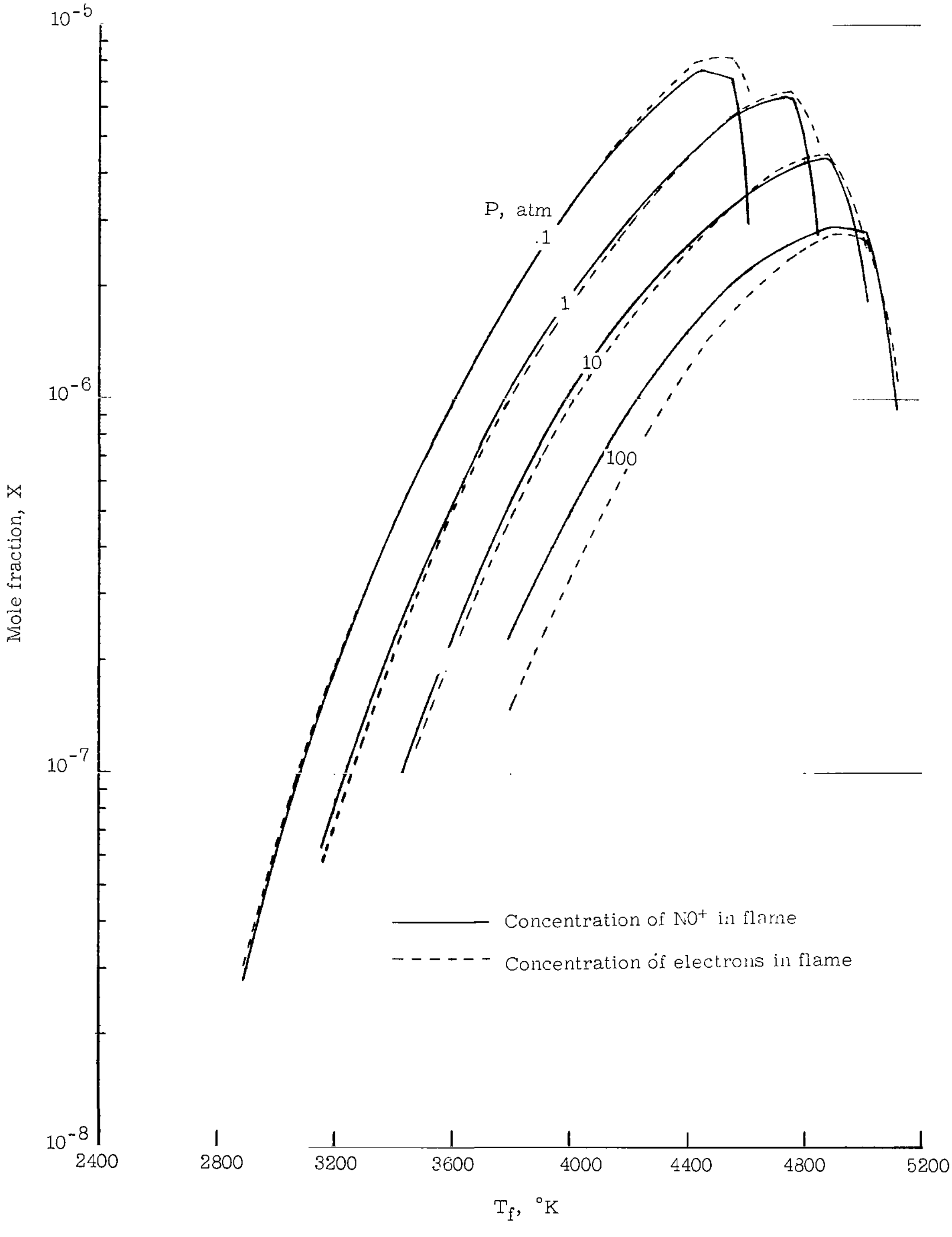


Figure 6.- Mole fraction of NO^+ and electrons as a function of flame temperature for various pressures.

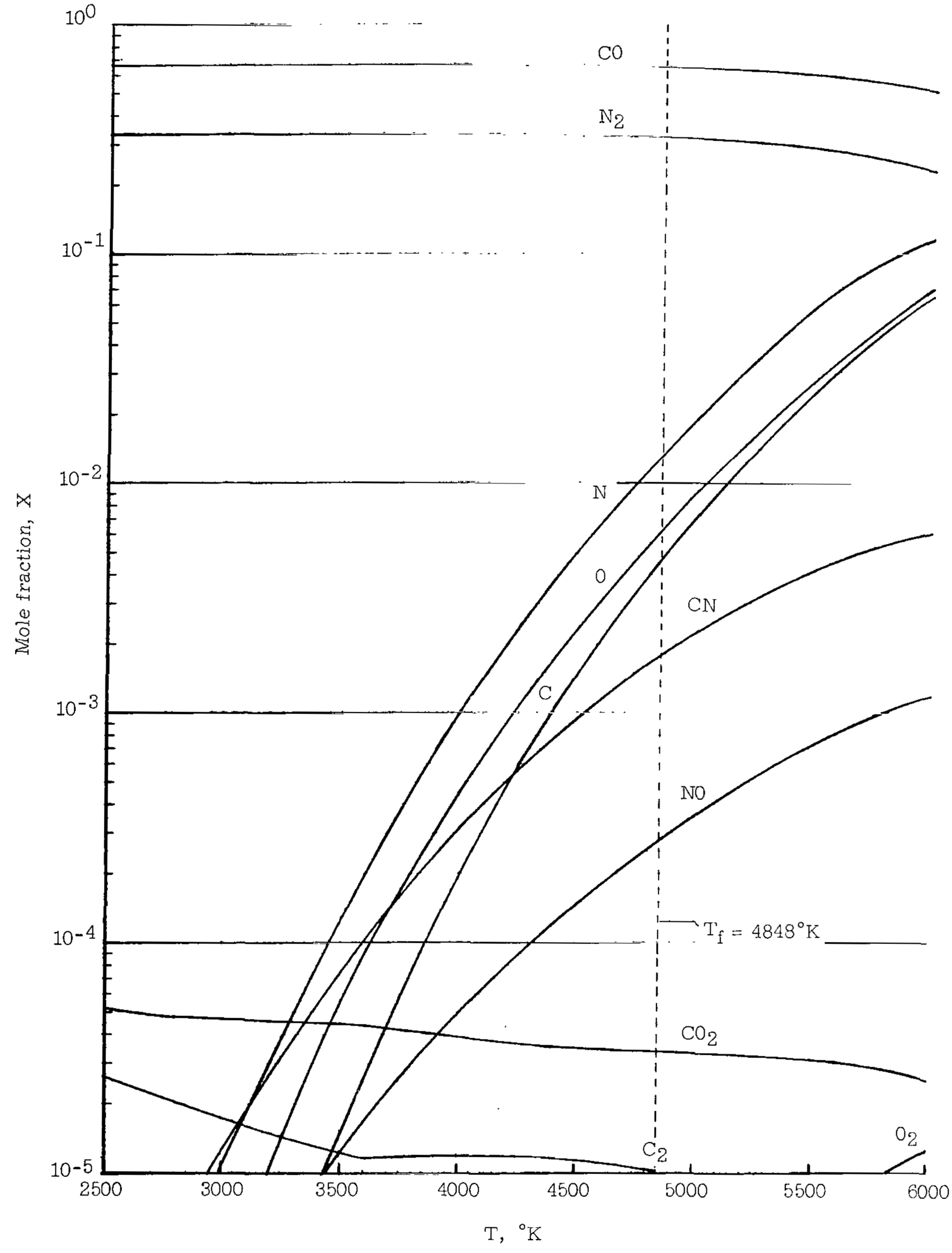
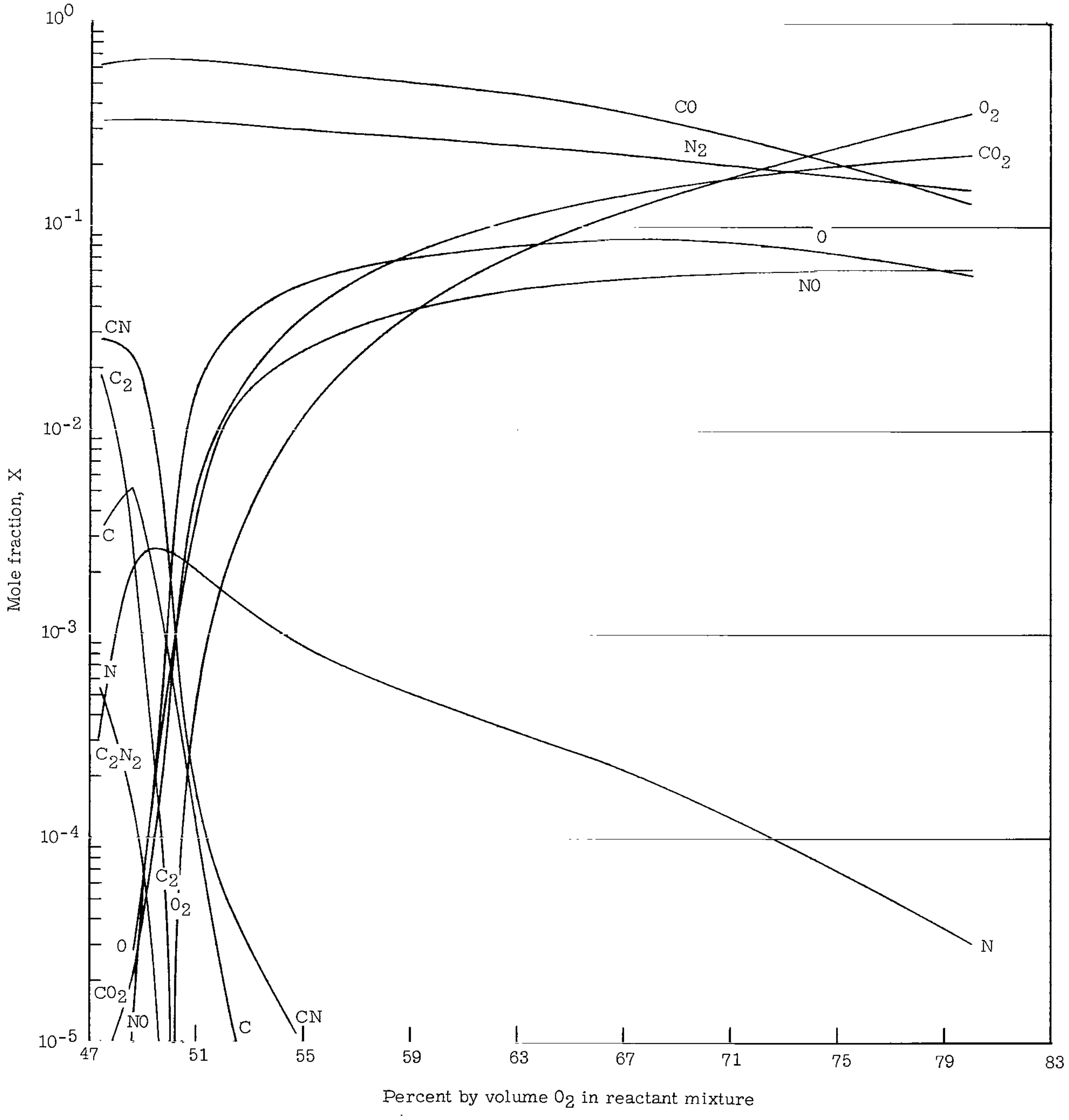
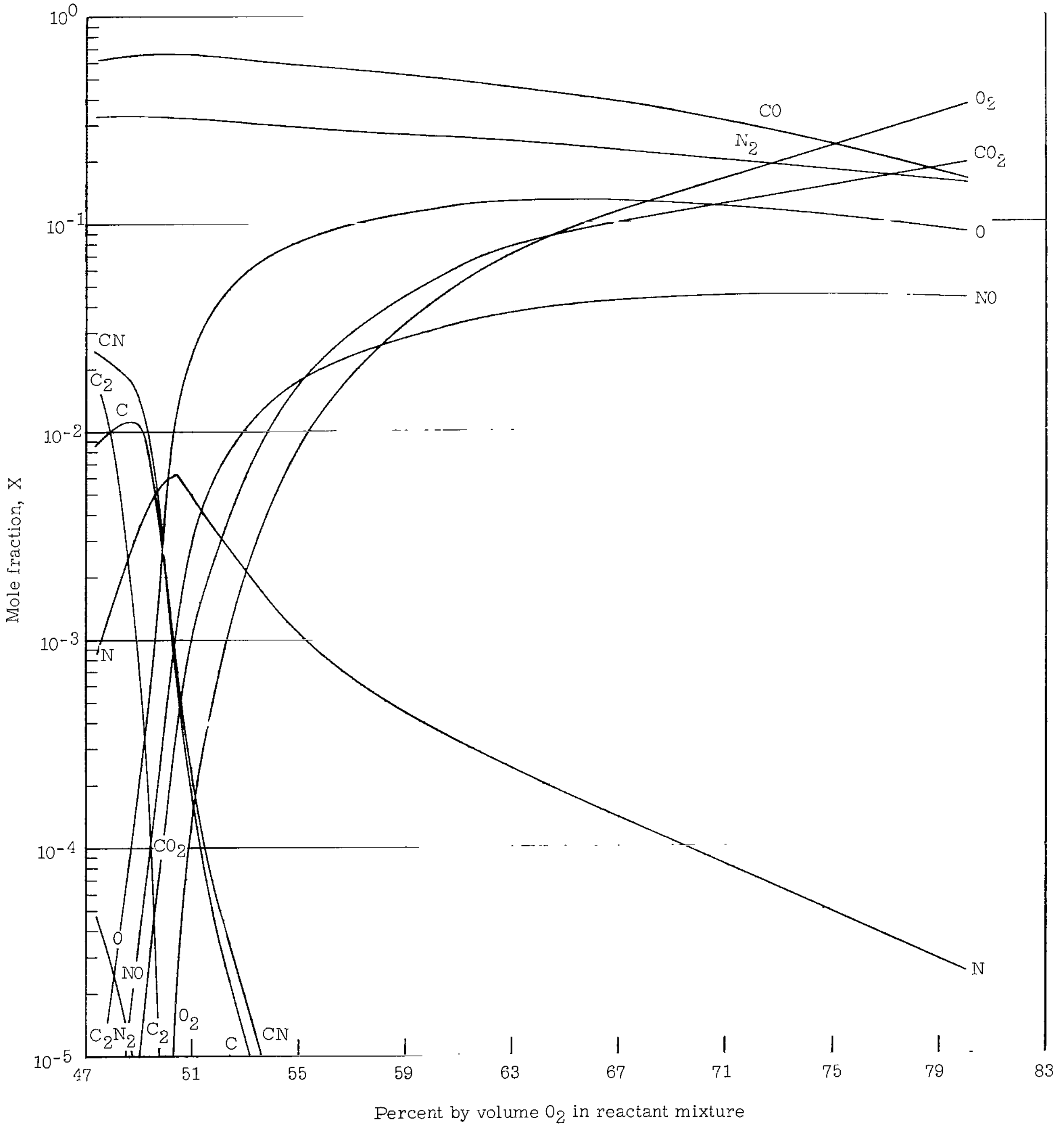


Figure 7.- Mole fraction of neutral species as a function of equilibrium temperature for C_2N_2/O_2 mole ratio of 1/1.0 and P = 1 atm. (The adiabatic flame temperature gives p_i value for given initial conditions by intersecting the concentration curves.)



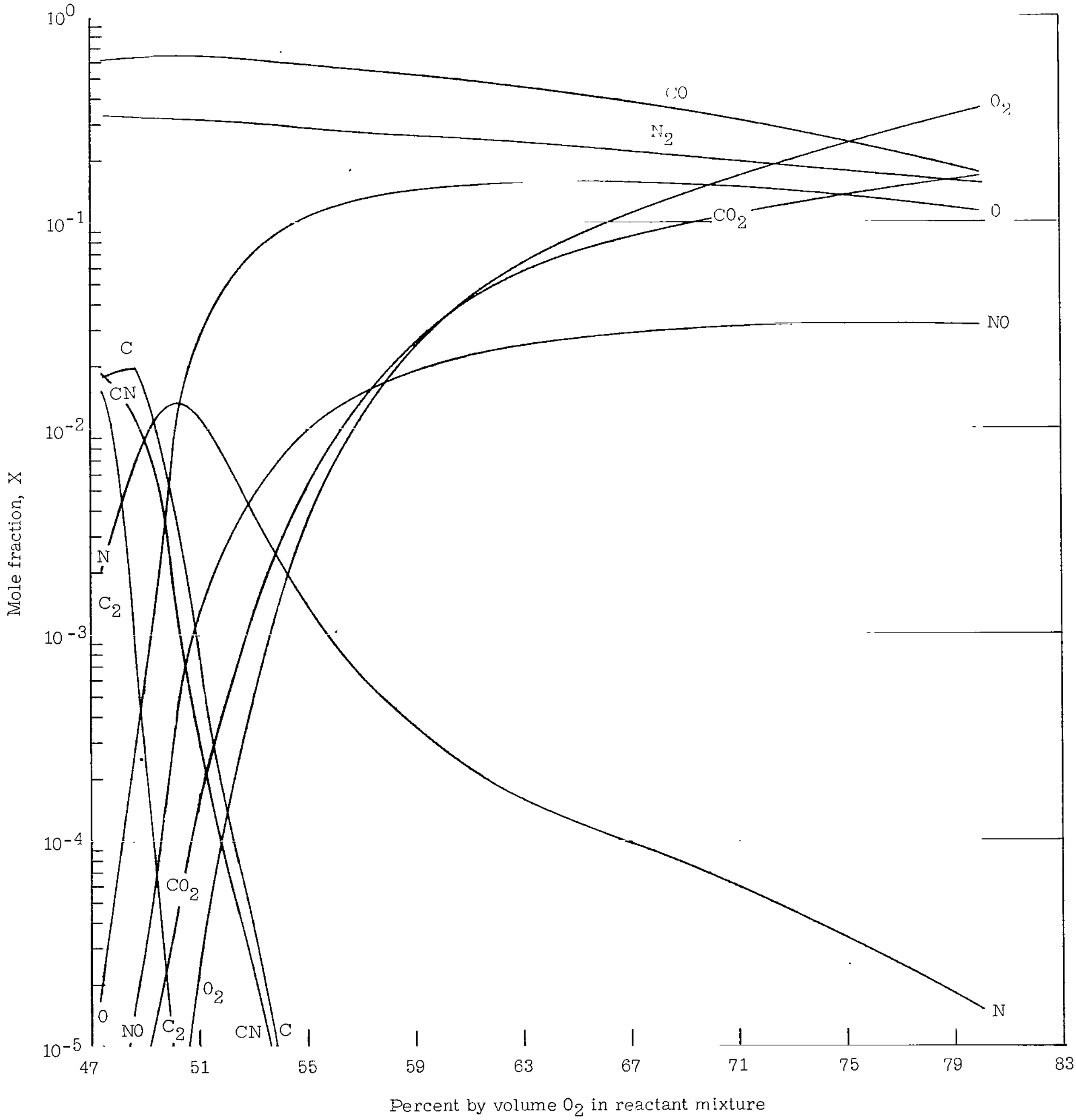
(a) P = 100 atm.

Figure 8.- Mole fraction of neutral species as a function of percent by volume O_2 in reactant mixture.



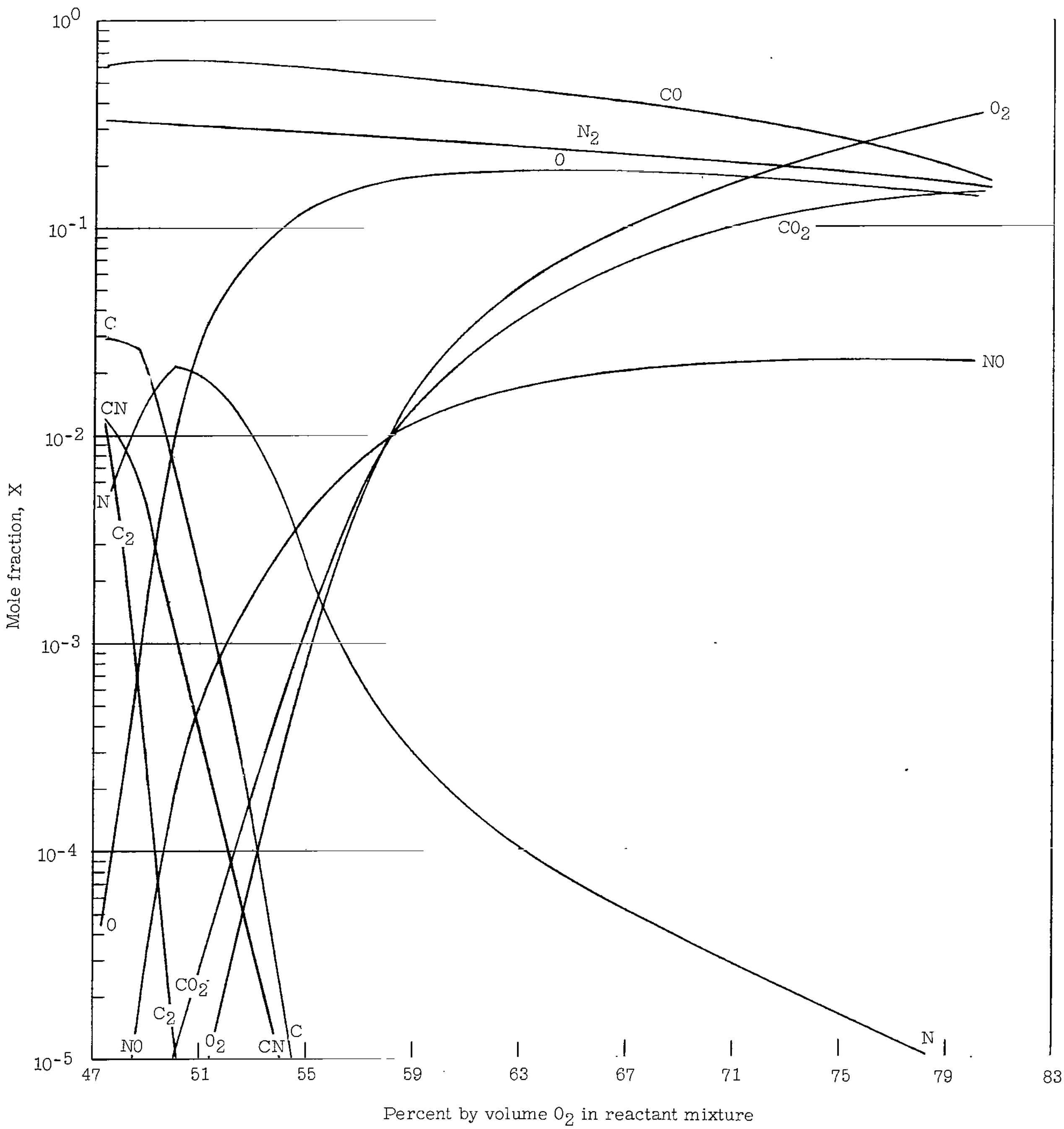
(b) P = 10 atm.

Figure 8.- Continued.



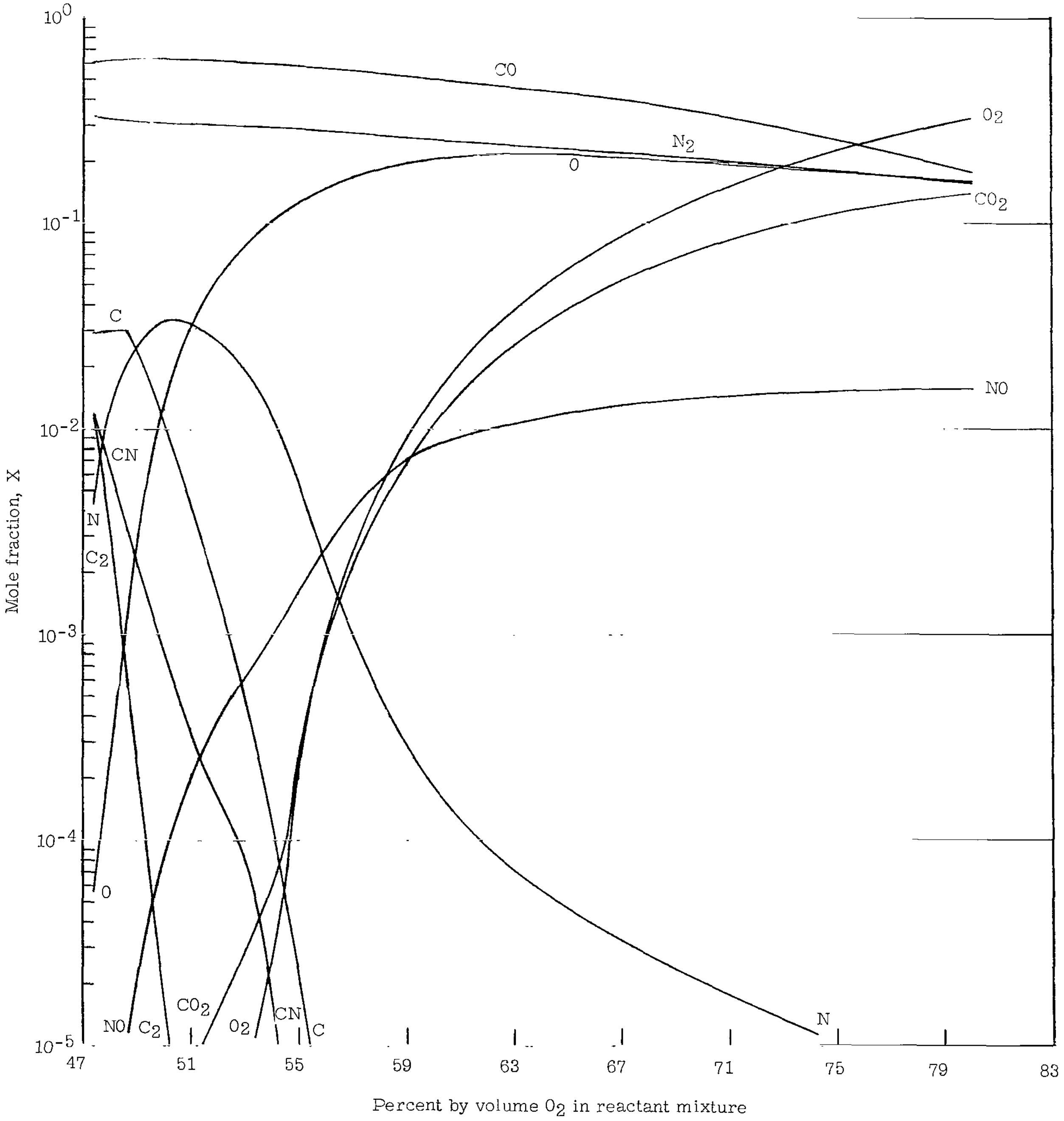
(c) P = 1 atm.

Figure 8.- Continued.



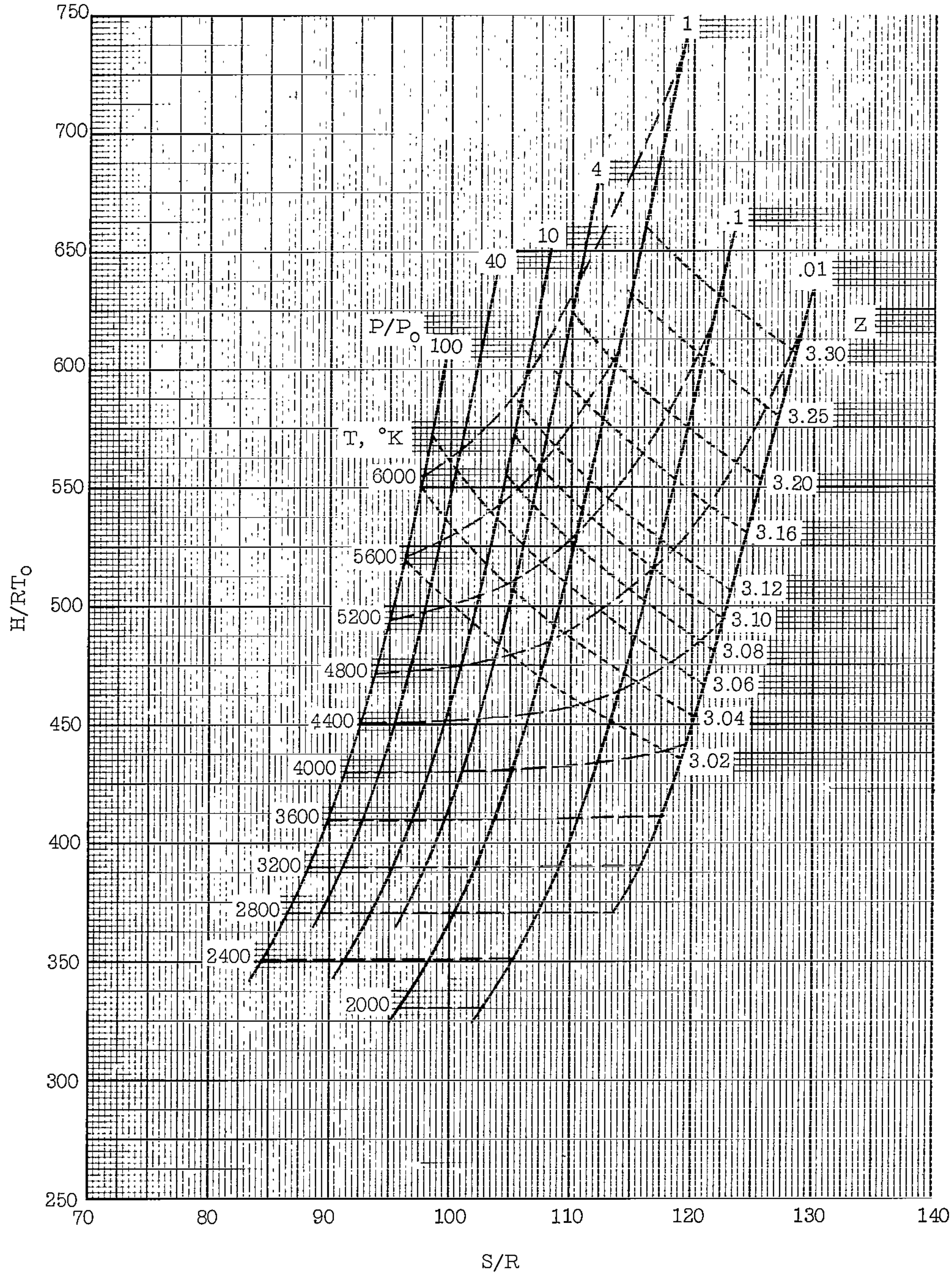
(d) P = 0.1 atm.

Figure 8.- Continued.



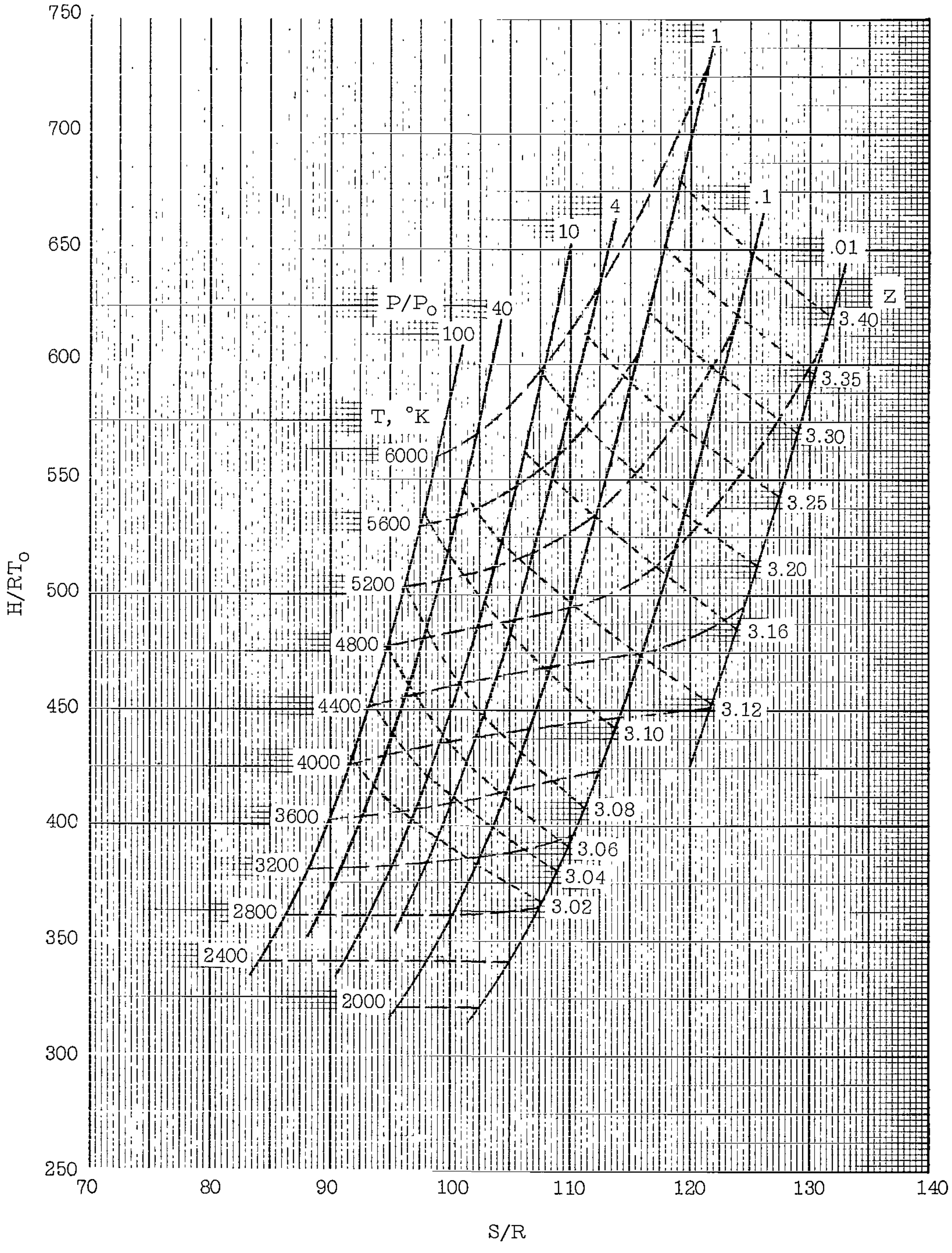
(e) P = 0.01 atm.

Figure 8.- Concluded.



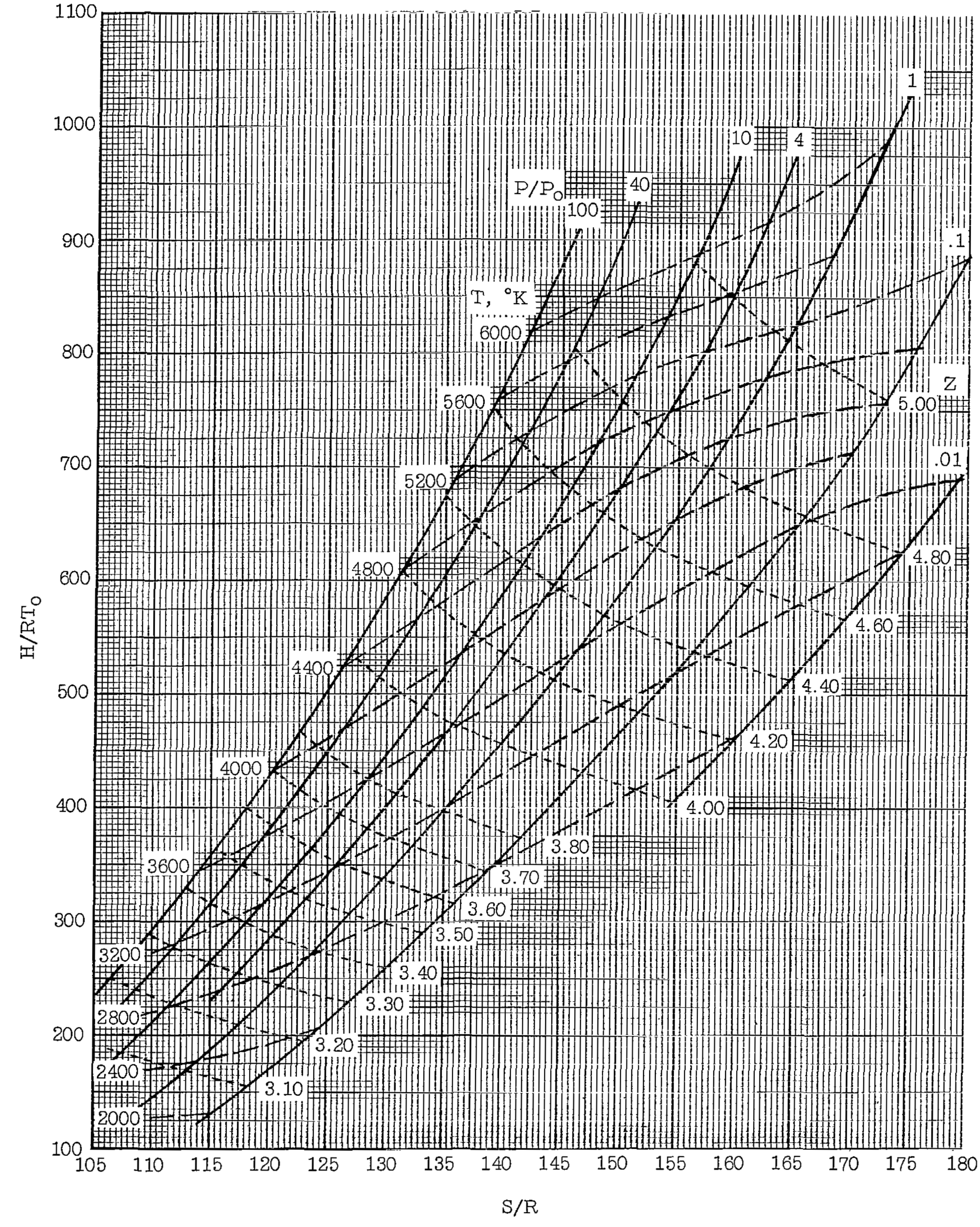
(a) $C_2N_2/O_2 = 1/1.0$.

Figure 9.- Mollier chart for C_2N_2/O_2 combustion products. Charts are based on mole of input $\left(C_2N_2 + mO_2\right)$. $T_o = 273.2^{\circ}$ K; $P_o = 1$ atm.



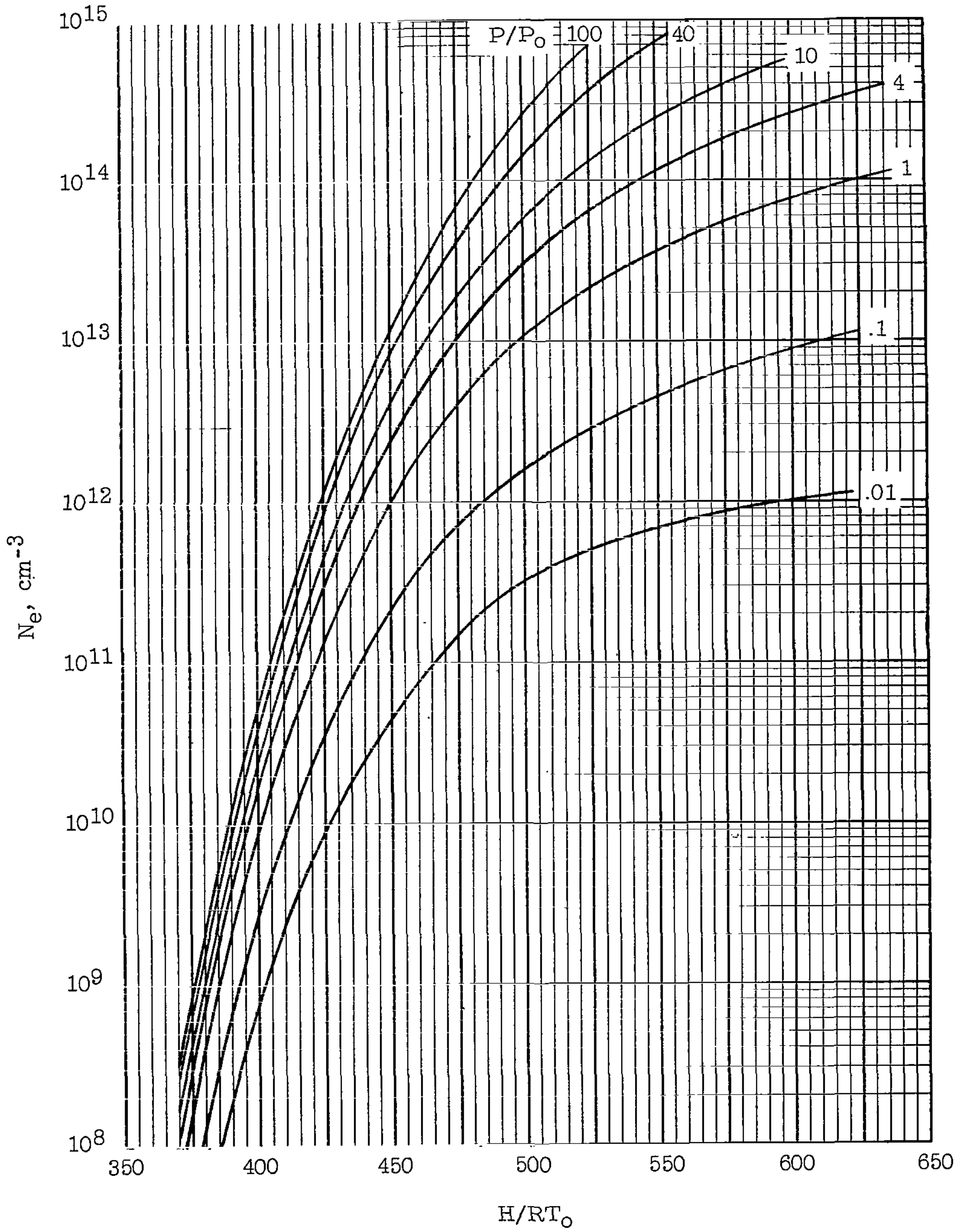
(b) $C_2N_2/O_2 = 1/1.05$.

Figure 9.- Continued.



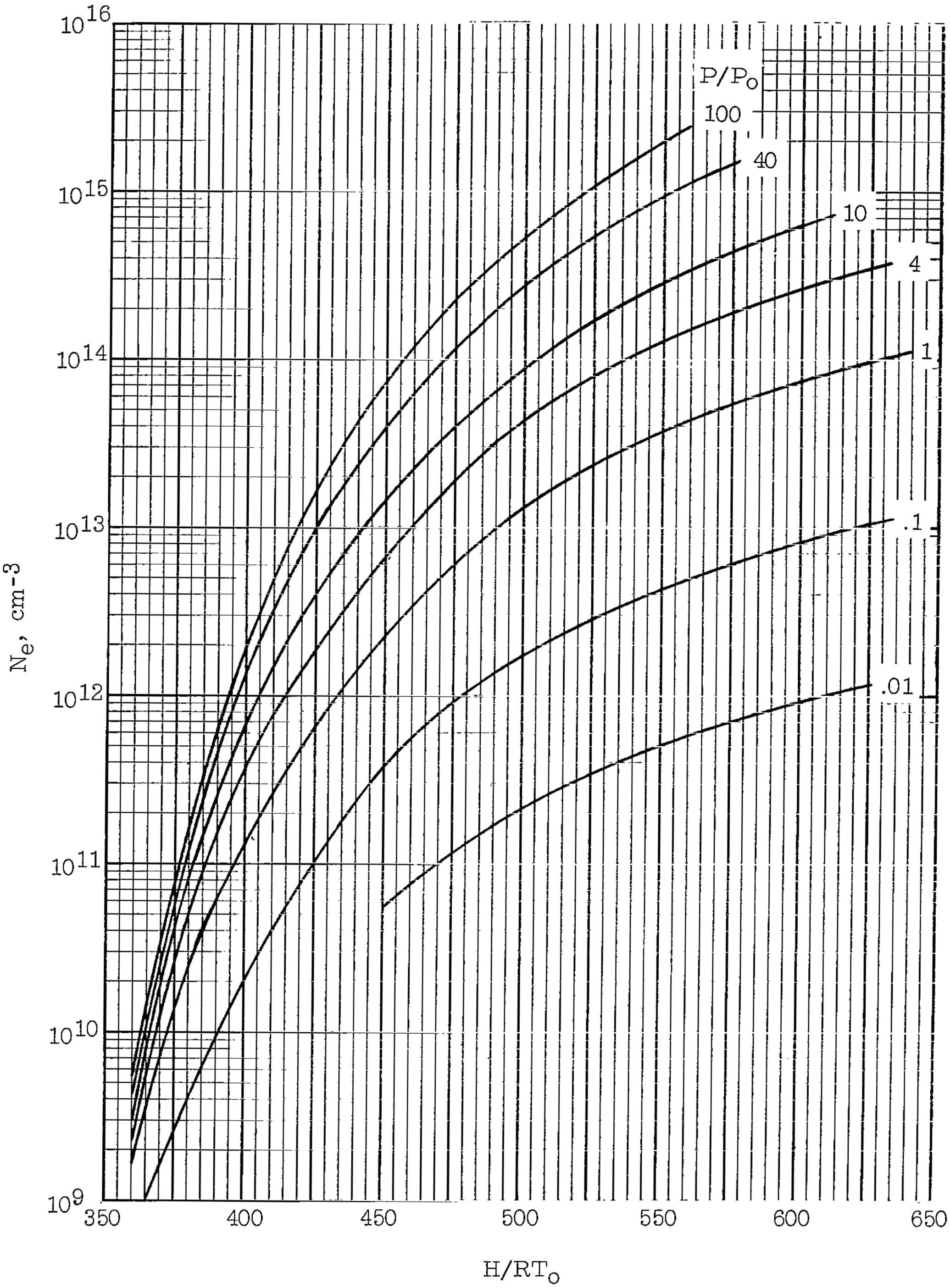
(c) $C_2N_2/O_2 = 1/2.0$.

Figure 9.- Concluded.



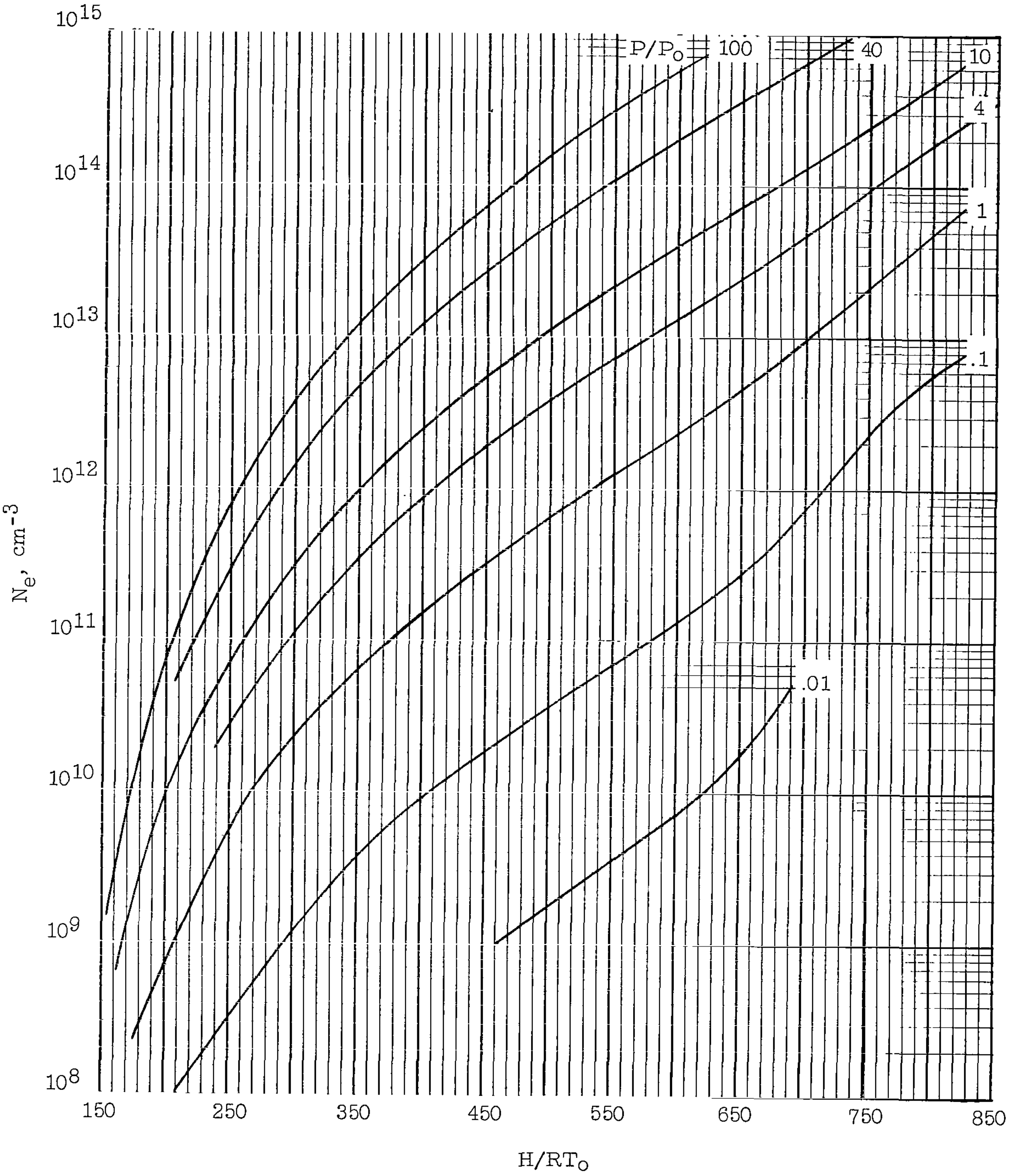
(a) $C_2N_2/O_2 = 1/1$.

Figure 10.- Electron concentration as a function of H/RT_o for various pressures. $T_o = 273.2^{\circ}$ K; $P_o = 1$ atm.



(b) $C_2N_2/O_2 = 1/1.05$.

Figure 10.- Continued.



(c) $C_2N_2/O_2 = 1/2$.

Figure 10.- Concluded.

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"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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