LIST OF SYMBOLS

a_f	Frozen sound speed	(2.6-43)
A	Streamtube cross-sectional area	(2.6-18)
B_s	$Z_s N_s / N_T$	(2.2-4)
c_i	Moles of species i per gram of mixture	(2.6-21)
c_v	Specific heat at constant volume	(2.6-12)
c_p	Specific heat at constant pressure	(2.6-13)
C	Rate constant in k_d expression	(1.2-6)
e_i	Specific internal energy of species i	(2.6-6)
e_v	Vibrational energy per unit mass	(1.2-1)
$e_v(T)$	Vibrational energy per unit mass at equilibrium at T	(1.2-1)
E_ℓ	Electronic energy of level ℓ	(2.6-5)
E_v	Vibrational energy of level v	(2.2-1)
E_{10}	Vibrational energy involved in the $1 \rightarrow 0$ transition	(2.2-1)
f(s)	Fringe shift at distance s	(3.2-6)
F(y)	Adiabaticity factor	(2.2-11)
g_{ℓ_i}	Electronic degeneracy of level ℓ of species i	(2.6-5)
h_o	Stagnation specific enthalpy	(2.6-20)
h_i	Specific enthalpy of species i	(2.6-11)
h_i^o	Enthalpy of formation per unit mass of species i	(2.6-11)
h_{c_i}	$(\partial h / \partial c_i)_{p,\rho,c_j} \; (i \neq j)$	(2.6-43)
h_ρ	$(\partial h / \partial \rho)_{p,c_i}$	(2.6-43)
k	Boltzmann's constant	(2.2-8)
k_d	Dissociation rate coefficient	(1.2-4)
k_r	Recombination rate coefficient	(1.2-4)
$k_d^{N_2}$	Dissociation rate coefficient with a N_2 third body	(1.2-7)
K(T)	Equilibrium constant	(1.2-5)

K_i	Gladstone-Dale constant of species i	(3.4-1)
L	Morse potential parameter (Å)	(2.2-12)
ℓ	Optical path length	(3.2-6)
m	Morse Oscillator upper level	(2.2-1)
m_i	Mass of species i	(2.6-2)
m'	Mass of element used in Master equation	Sect. 2.4.1
M_f	Frozen Mach number	(2.6-43)
n	Constant in k_d expression	(1.2-6)
N_{TO}	Total original number density of a gas	(2.2-4)
N_A	Number density of species A	(2.2-4)
N_{AV}	Avagadro's number	(2.6-16)
p	Pressure	(2.6-21)
p_i	Partial pressure of species i	(2.6-14)
P(T)	Factor in P(v,T)	(2.2-9)
$P_{v+1,v}$	(v+1)P(v,T), V-T transition probability	(2.2-4)
P_{10}	V-T transition probability for the 1 → 0 transition	(2.2-13)
q	Factor employed to vary Q_{10}^{01}	(2.2-14)
Q_i	Total partition function of species i	(2.6-1)
Q(T)	Factor in Q(i,v,T)	(2.2-9)
$Q_{v+1,v}^{i-1,i}$	(v+1)i Q(i,v,T), V-V transition probability	(2.2-4)
Q_{10}^{01}	V-V transition probability for the 1 → 0 to 0 → 1 transitions	(2.2-14)
$Q_{vib}(T)$	Vibrational partition function	(2.2-8)
r	$[He]/([N_2] + [N])$	Sect.3.4.3.1
R	Universal gas constant	(1.2-2)
R_e	Reynolds number	Sect.3.3.3.1
R_{H_2}	Rotational energy of H_2	(2.4-1)
s	Distance in streamline direction	(2.6-43)
t	Time	(1.2-1)

t_ℓ	Laboratory time	(3.2-8)
t_p	Particle time	(3.2-8)
T	Translational temperature	(1.2-1)
T_v	Vibrational temperature	(1.2-2)
T_{01}	Temperature of the 0 → 1 transition	Sect.2.4.3
u	Velocity	(2.4-3)
V	Volume	(2.6-2)
V_x	ρ_o/ρ_x, Ratio of volume at x to the original volume	(2.2-4)
W	Molecular weight	(1.2-2)
$\tilde{W}$	Reduced molecular weight	(2.2-12)
x	Distance	Sect. 2.4
X_v	Normalised population of vibrational level v	(2.2-4)
$\tilde{X}_v$	Equilibrium value of X_v	(2.2-8)
y'	Distance perpendicular to the axis of symmetry	(2.6-43)
Y	T_{01}	(2.3-5)
Z	Collision frequency	(2.2-13)
α	Atom mass fraction	(2.6-27)
β	Shock angle with respect to the free-stream	(2.6-41)
β_{ir}	$\nu'_{ir} - \nu_{ir}$	(2.6-16)
β_{k+1}		(2.3-7)
δ	Anharmonicity constant	(2.2-1)
ε	ρ_∞/ρ_s	(2.6-22)
ε_i	$E_i - E_o$	(2.4-1)
$\bar{\varepsilon}_u$	$m'u^2/2N_T$ mean kinetic energy of the flow per particle	(2.4-1)
θ	Wedge angle with respect to the free-stream	(2.6-41)
θ'	Molecular property used in transition probabilities	(2.2-12)

θ_d	Characteristic dissociation temperature of molecule	(1.2-6)
θ_R	Characteristic rotational temperature of molecule	(2.6-3)
θ_v	Characteristic vibrational temperature of molecule	(1.2-2)
κ	Shock curvature	(2.6-44)
λ	$\beta-\xi$	(2.6-44)
	OR Wavelength of light	(3.2-6)
μ	Reduced mass	(2.2-13)
ν_{ir}	Stoichiometric coefficients of the reactants i of reaction r	(2.6-15)
ν'_{ir}	Stoichiometric coefficients of the products i of reaction r	(2.6-15)
ξ	Streamline inclination	(2.6-43)
ρ	Density	(2.2-4)
σ	Hard sphere collision diameter	(2.2-13)
τ_v	Relaxation time	Sect. 1.1
τ_{fl}	Flow time	(2.6-34)
τ	Vibrational relaxation time	(1.2-1)
ϕ	τ_v(SHOCK)/τ_v(NOZZLE)	Sect.1.2.1
ϕ_k		(2.3-5)
$\bar{\chi}$	Shock-boundary-layer interaction parameter	Sect.3.3.3.1
ω_i	Relaxation rate	(2.6-25)
[ ]	Concentration, moles per unit volume	(1.2-4)

Subscripts

e	Equilibrium
f	Frozen
i	Species i
v	Vibrational level number
o	Reservoir or Stagnation Conditions
0	Original conditions
∞	Free-stream conditions
s	Conditions behind shock