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QUANTITIES AND UNITS OF HEAT

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BUREAU OF CEYLON STANDARDS

QUANTITIES AND UNITS OF HEAT

C. S. 84 — Part IV: 1969

Gr.5

BUREAU OF CEYLON STANDARDS
53, DHARMAPALA MAWATHA
COLOMBO 3.

Ceylon Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

BUREAU OF CEYLON STANDARDS
53, DHARMAPALA MAWATHA
COLOMBO 3.

Telephone: 26051, 26054, 26055

Telegrams: "PRAMIKA"

FOREWORD

This Ceylon Standard, containing a table of Quantities and Units of Heat, is part of a series of Ceylon Standards dealing with quantities and units in various fields of science and technology. It was adopted as a Ceylon Standard by the Council of the Bureau of Ceylon Standards on 6th December, 1969.

The other parts of the series are:-

C.S.84 : Part I : 1969 - Basic quantities and units of the SI and quantities and units of space and time.

C.S.84 : Part II : 1969 - Quantities and units of periodic and related phenomena.

C.S.84 : Part III : 1969 - Quantities and units of mechanics.

C.S.84 : Part V : 1969 - Quantities and units of electricity and magnetism.

C.S.84 : Part VII : 1969 - Quantities and units of acoustics.

C.S.84 : Part XI : 1971 - Mathematical signs and symbols for use in physical sciences and technology.

This standard is based on ISO Recommendation R 31 - Part IV : 1960 - Quantities and Units of Heat.

4. Heat

Quantities

Item No.	Quantity	Symbol	Definition [1]	Remarks
4-1.1	thermodynamic temperature absolute temperature	T, Θ	The thermodynamic temperature is defined according to the principles of themodynamics	
4-2.1	customary temperature	t, ϑ, θ,	$t = T - T_0$ where t and T are the customary and absolute (thermodynamic) temperatures, of the same system and T_0 is fixed by convention.	

1) The statements in this column are given merely for identification and they are not intended to be complete definitions.

Item No.	Name of unit and in certain cases abbreviation for this unit	International symbolic abbreviation for unit	Definition	Conversion factors	Remarks
4-1.	**kelvin**	K	The kelvin is the unit of thermodynamic temperature as defined by the Conference Generale des Poids et Mesures (See C. S. 84: Part I)		
4-2.a	degree Celsius	°C	The Celsius temperature t of a system is given by expressing in $t = T - T_0$ the absolute (thermodynamic) temperature T in kelvins and putting $T_0 = 273.15$ K		**The "International Temperature Scale of 1948"** For purposes of practical measurements the Conference Generale des Poids et Mesures has adopted a temperature scale based on a number of fixed points (that can be reproduced with high accuracy) and on certain procedures for interpolation. This scale is called the International Temperature Scale of 1948. Temperatures on it indicated by t_{int} °C(Int. 1948).

4. Heat

Quantities

Item No.	Quantity	Symbol	Definition[1)]	Remarks
4-3.1	linear expansion coefficient	α, λ	$\alpha = \frac{1}{l}\frac{dl}{dT}$	These quantities are not completely defined unless the type of change is specified.
4-3.2	cubic expansion coefficient	α, β, γ	$\gamma = \frac{1}{V}\frac{dV}{dt}$	
4-3.3	pressure coefficient	β	$\beta = \frac{1}{p}\frac{dp}{dT}$	The quantity, pressure coefficient as here defined is used only for gases.
4-4.1	heat, quantity of heat	Q		

1) *See footnote on Page 6.*

Item No.	Name of unit and in certain cases abbreviation for this unit	International symbolic abbreviation for unit	Definition	Conversion factors	Remarks
4-2.b	degree Fahrenheit reciprocal Kelvin	°F 1/K	5/9 degree Celsius	If t_C °C, t_F °F and T_K K relate to one and the same physical state then the numerical values t_C, t_F and t_K connected by: $t_C = \frac{5}{9}(t_F - 32)$ $= T_K - 273.15$	The Comite International des poids et Mesures has adopted an international Kelvin temperature scale, indication T_{int} K (Int 1948). This is defined by $T_{int} = t_{int} + 273.15$
4-3.a	reciprocal degree. deg^{-1}				
4-3.b	reciprocal Fahrenheit degree. $degF^{-1}$				
4-4	joule	J			For other units see 3-22.b...m*)

4. Heat

Quantities

Item No	Quantity	Symbol	Definition [1]	Remarks
4-5.1	heat flow rate	Φ, (q)	Heat crossing a surface divided by time	
4-6.1	density of heat flow rate	q, (ϕ)	Heat flow rate divided by area.	
4-7.1	thermal conductivity	λ, (k)	Density of heat flow rate divided by temperature gradient	

[1]) *See footnote on Page 6.*

4. Heat

Units

Item No.	Name of unit and in certain cases abbreviation for this name	International symbolic abbreviation for unit	Definition	Conversion factors	Remarks
4-5.	watt	W			For other units see 3-23.b .....i*
4-6.	watt per square metre	W/m^2			
4-7.a	watt per metre kelvin	W/m K			
4-7.b	I. T. calorie per second centimetre degree Celsius cal_{IT}/(s cm. degC)			1 cal_{IT}/(s cm deg C) = 418.68 W/(m degC) (exactly)	
4-7.c	British thermal unit per second foot Fahrenheit degree, Btu/(s ft degF)			1 Btu/ (s ft degF) = 6230.64 W/ (m deg*C*)	
4-8.a	watt per square metre Kelvin	W/m^2 K			
4-8.b	I. T. calorie per second square centimetre degree Celisus cal_{IT}/(s cm^2 *deg C*)			1 cal_{IT} / (s cm^2 degC) = 4.1868×10^4 $W/(m^2$ deg C) (exactly)	
4-8.c	British thermal unit per second square foot Fathrenheit degree Btu/ (s ft^2 degF)			1 Btu/ (s. ft^2 degF) = 20 441.7W/ (m^2 deg C)	

Quantities

Item No.	Quantity	Symbol	Definition[1])	Remarks
4-9.1	thermal diffusivity	a, (α, κ) K)	$a = \frac{\lambda}{\rho c_p}$ (λ = thermal conductivity, ρ = density, c_p = specific heat capacity at constant pressure)	
4-10.1	heat capacity	C	When the temperature of a system is increased by dT as a result of the addition of a small quantity of heat dQ, the quantity dQ/dT is the heat capacity	This quantity is not completely defined unless the type of change is specified.
4-11.1	specific heat capacity	c	Heat capacity divided by mass	The quantities expressed in terms of units involving the mole are to be found in the section dealing with chemistry.
4-11.2	specific heat capacity at constant pressure	c_p		
4-11.3	specific heat capacity at constant volume	c_v		
4-12.1	ratio of the specific heat capacities	γ, $\varkappa$) (K	$\gamma = c_p/c_v$	This quantity is dimensionless.

1) *See footnote on Page 6.*

Item No.	Name of unit and in certain cases abbreviation for this name	International symbolic abbreviation for unit	Definition	Conversion factors	Remarks
4-9.a	square metre per second	m^2/s			
4-9.b	square foot per second	ft^2/s		1 $ft^2/s = 0.092\,903\,0\ m^2/s$	
4-10.	joule per kelvin	J/K			
4-11.a	joule per kilogramme kelvin J/kg K.	J/kg K			
4-11.b	I. T. calorie per gramme degree Celcius, cal_{IT} /g deg C			1 cal_{IT}/ (g degC)=4186.8 J/(kg degC) (exactly)	
4-11.c	British thermal unit per pound Fahrenheit degree, Btu/lb deg F			1 Btu/(lb degF) = 4186.8 J/kg deg C (exactly)	

Quantities

Item No.	Quantity	Symbol	Definition[1])	Remarks
4-13.1	entropy	S	When a small quantity of heat dQ is received by a system the thermodynmic temperature of which is T, the entropy of the system is increased by dQ/T, provided that no irreversible change take place in the system.	
4-14.1	specific entropy	s	entropy divided by mass.	See remark 4-11.1...3
4-15.1	internal energy	U, (E)		
4-15.2	enthalpy	H (I),	$H=U+pV$	
4-15.3	free energy	F	$F=U-TS$	The free energy here defined is that defined by Helmholtz.
4-15.4	Gibbs function	G	$G=U+pV-TS$	$G=H-TS$ In French: enthalpie libre

1) *See footnote on page 6.*

Item No.	Name of unit and in certain cases abbreviation for this name	International. symbolic abbreviation for unit	Definition	Conversion factors	Remarks
4-13.	Joule per kelvin	J/K			
4-14.a	Joule per kilogramme kelvin	J/ kg K			
4-14.b	I. T. calorie per gramme kelvin	cal_{IT} / g K		1 cal_{IT} /g K = 4186.8 J/ kg K (exactly)	
4-14.c	British thermal unit per pound degree Fahrenheit	Btu/lb deg F		1 Btu/lb deg F = 4186.8 J/ kg K (exactly)	
4-15.	Joule	J			

4. Heat

Quantities

Item No.	Quantity	Symbol	Definition [1]	Remarks
4-16.1	specific internal energy	u, (e)	Internal energy divided by mass	See remark 4-11.1...3
4-16.2	specific enthalpy	h (i)	Enthalpy divided by mass.	
4-16.3	specific free energy	f	Free energy divided by mass	
416.4	specific Gibbs function	g	Gibbs function divided by mass	In French: enthalpie libre massique
4-17.1	latent heat	L	Quantity of heat absorbed or released in an isothermal transformation of phase.	This quantity is not completely defined unless a sign convention is specified.
4-18.1	specific latent heat	l	Magnitude of latent heat divided by mass.	See remark 4-11.1...3

1) *See Footnote on Page 6.*

4. Heat

Item No.	Name of unit and in certain cases abbreviation for this name	International symbolic abbreviation for unit	Definition	Conversion factors	Remarks
4-16.a	Joule per kilogramme	J/kg			
4-16.b	I. T. calorie per gramme	cal_{IT} /g		1 cal_{IT} /g = 4186.8 J/kg (exactly)	
4-16.c	British thermal unit per pound	Btu/lb		1 Btu/lb = 2326 J/kg (exactly)	
4-17.	Joule	J			
4-18.	Joule per kilorgamme	J/kg			

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BUREAU OF CEYLON STANDARDS

The Bureau of Ceylon Standards (BCS) is the national standards organisation of Ceylon and was established by the Hon. Minister of Industries and Fisheries, as provided for by the Bureau of Ceylon Standards Act, No. 38 of 1964.

The principal objects of the Bureau as set out in the Act are to promote standards in industry and commerce, prepare national standard Specifications and Codes of Practice and operate a Standardisation Marks Scheme and provide testing facilities, as the need arises.

The Bureau is financed by Government grants and the sale of its publications. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The detailed preparation of Standard Specifications is done by Drafting Committees composed of experts in each particular field assisted by permanent officers of the Bureau. These Committees are appointed by Divisional Committees, which are appointed by the Council. All members of the Drafting and Divisional Committees render their services in an honorary capacity. In preparing the Standard Specifications the Bureau endeavours to ensure adequate representation of all view points.

In the international field the Bureau represents Ceylon in the International Organisation for Standardisation (ISO) and will participate in such fields of Standardisation as are of special interest to Ceylon.