

CONTENTS.

CHAPTER I.

GENERAL NOTIONS. THE PRINCIPLE OF CONSERVATION	
OF EXTENSION-IN-PHASE.	AGI
Hamilton's equations of motion	3-8
Ensemble of systems distributed in phase	
Extension-in-phase, density-in-phase	
Fundamental equation of statistical mechanics	
Condition of statistical equilibrium	
Principle of conservation of density-in-phase	ç
Principle of conservation of extension-in-phase	
Analogy in hydrodynamics	11
	1–18
Dimensions of extension-in-phase	13
Various analytical expressions of the principle	3–15
Coefficient and index of probability of phase	
Principle of conservation of probability of phase	, 18
Dimensions of coefficient of probability of phase	19
CIT A DWDED. AT	
CHAPTER II.	
APPLICATION OF THE PRINCIPLE OF CONSERVATION OF EXTENSION-IN-PHASE TO THE THEORY OF ERRORS.	
Approximate expression for the index of probability of phase . 20 Application of the principle of conservation of probability of phase to the constants of this expression	
CHAPTER III.	
APPLICATION OF THE PRINCIPLE OF CONSERVATION OF EXTENSION-IN-PHASE TO THE INTEGRATION OF THE DIFFERENTIAL EQUATIONS OF MOTION.	



xiv

CONTENTS.

CHAPTER IV.

ON THE DISTRIBUTION-IN-PHASE CALLED CANONICAL, IN WHICH THE INDEX OF PROBABILITY IS A LINEAR FUNCTION OF THE ENERGY.
PAGE
Condition of statistical equilibrium
Other conditions which the coefficient of probability must satisfy . 33
Canonical distribution — Modulus of distribution
$m{\psi}$ must be finite
The modulus of the canonical distribution has properties analogous
to temperature
Distribution in which the index of probability is a linear function of
the energy and of the moments of momentum about three axes. 38, 39
Case in which the forces are linear functions of the displacements,
and the index is a linear function of the separate energies relating
to the normal types of motion
Differential equation relating to average values in a canonical
ensemble
This is identical in form with the fundamental differential equation
of thermodynamics
CHAPTER V.
AVERAGE VALUES IN A CANONICAL ENSEMBLE OF SYSTEMS.
Case of ν material points. Average value of kinetic energy of a single point for a given configuration or for the whole ensemble
$=\frac{3}{2}\Theta$
Average value of total kinetic energy for any given configuration
or for the whole ensemble $= \frac{8}{2} \nu \Theta \dots \dots$
System of n degrees of freedom. Average value of kinetic energy,
for any given configuration or for the whole ensemble $=\frac{n}{2}\Theta$. 48-50
Second proof of the same proposition 50-52
Distribution of canonical ensemble in configuration 52-54
Ensembles canonically distributed in configuration
Ensembles canonically distributed in velocity
CHAPTER VI.
EXTENSION-IN-CONFIGURATION AND EXTENSION-IN- VELOCITY.
Extension-in-configuration and extension-in-velocity are invariants
will



CONTENTS. XV
Dian
Dimensions of these quantities
CHAPTER VII.
FARTHER DISCUSSION OF AVERAGES IN A CANONICAL ENSEMBLE OF SYSTEMS.
Second and third differential equations relating to average values in a canonical ensemble
CHAPTER VIII.
ON CERTAIN IMPORTANT FUNCTIONS OF THE ENERGIES OF A SYSTEM.
Definitions. $V=$ extension-in-phase below a limiting energy (ϵ). $\phi=\log dV/d\epsilon$



xvi

CONTENTS.

CHAPTER IX.

THE FUNCTION φ AND THE CANONICAL DISTRIBUTION.
When $n > 2$, the most probable value of the energy in a canonical
ensemble is determined by $d\phi/d\epsilon = 1/\Theta$
When $n > 2$, the average value of $d\phi / d\epsilon$ in a canonical ensemble
is 1/ Θ
When n is large, the value of ϕ corresponding to $d\phi/d\epsilon = 1/\Theta$
(ϕ_0) is nearly equivalent (except for an additive constant) to
the average index of probability taken negatively $(-\bar{\eta})$ 101-104
Approximate formulae for $\phi_0 + \bar{\eta}$ when n is large 104-106
When n is large, the distribution of a canonical ensemble in energy
follows approximately the law of errors
This is not peculiar to the canonical distribution
Averages in a canonical ensemble
CHAPTER X.
ON A DISTRIBUTION IN PHASE CALLED MICROCANONI- CAL IN WHICH ALL THE SYSTEMS HAVE THE SAME ENERGY.
The microcanonical distribution defined as the limiting distribution obtained by various processes
CITE A TOPPY TO SEE
CHAPTER XI.
MAXIMUM AND MINIMUM PROPERTIES OF VARIOUS DIS- TRIBUTIONS IN PHASE.
Theorems I-VI. Minimum properties of certain distributions . 129-133 Theorem VII. The average index of the whole system compared with the sum of the average indices of the parts



CONTENTS. xvi
Theorem VIII. The average index of the whole ensemble compared with the average indices of parts of the ensemble 135-13 Theorem IX. Effect on the average index of making the distribution-in-phase uniform within any limits
CHAPTER XII.
ON THE MOTION OF SYSTEMS AND ENSEMBLES OF SYSTEMS THROUGH LONG PERIODS OF TIME.
Under what conditions, and with what limitations, may we assume that a system will return in the course of time to its original phase, at least to any required degree of approximation? 139-142 Tendency in an ensemble of isolated systems toward a state of statistical equilibrium
CHAPTER XIII.
EFFECT OF VARIOUS PROCESSES ON AN ENSEMBLE OF SYSTEMS.
Variation of the external coördinates can only cause a decrease in the average index of probability
CHAPTER XIV.
DISCUSSION OF THERMODYNAMIC ANALOGIES.
The finding in rational mechanics an à priori foundation for thermodynamics requires mechanical definitions of temperature and entropy. Conditions which the quantities thus defined must satisfy



xviii	CONTENTS.
	PAGE
The functions of the	e energy $d\epsilon/d\log V$ and $\log V$ as analogues of
temperature and e	entropy
The functions of the	energy $d\epsilon/d\phi$ and ϕ as analogues of tempera-
ture and entropy	
Merits of the differe	ent systems
	at number of degrees of freedom is microcanon-
	in phase, any very small part of it may be re-
garded as canonic	ally distributed
	compared with those of temperature and
	,
••	
	CHAPTER XV.
SYSTEMS COMPOSE	ED OF MOLECULES.
Generic and specific	definitions of a phase
	m with respect to phases generically defined
	o phases specifically defined 189
	etit ensembles
Grand ensemble can	onically distributed
	spect to gain or loss of molecules 194-197
	y quantity in grand ensemble canonically dis-
	n identical in form with fundamental differen-
-	ermodynamics
	mber of any kind of molecules (ν) 201
	$-\bar{\nu})^2$
	es
	of particles in a system is to be treated as
	age index of probability for phases generically
•	ls to entropy