

# The Second Law of Thermodynamics

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**Notes** Abstract: Topics of microscopic reversability, macroscopic invariance, information  
Modern theories are

Consider ball going up and down Velocities appear reversed in time reversal yet acceleration is the same Inconsistency of Newtonian mechanics and electrodynamics —; Special Relativity! :O Non-holonomic constraints?? e.g. bikes???

# 1 Introduction

What is ThERmoDYNAmiCS?

## **2 Statements of the Second Law**

### **2.1 Clausius' and Kelvin's Statements**

Clausius and Kelvin

### **2.2 Carnot's Theorem**

### **2.3 Equivalence of Statements**

### **2.4 Planck's Proposition and Perpetual Motion of the Second Kind**

## **3 Entropy and the Arrow of Time**

It is well known that time has a specific direction; the past is unchangeable and we are left with only memories, whilst the future is not yet determined and we can have no understanding of the future until it arises. This intuitive arrow of time allows us to distinguish whether a video of a burning fire is played in reverse and is our natural interpretation of entropy and the laws of thermodynamics.

Mention time asymmetry of only the 2nd law

### **3.1 Principle of Microscopic Reversability**

### **3.2 Loschmidt's Paradox**

In 1876, Johannn Josef Loschmidt argued that it should not be possible

## **4 Information Theory**

## **5 Uses of the Second Law in the Explanation of Natural Phenomena**

### **5.1 Brownian Motion**

### **5.2 Osmosis**

## **6 Appendix**

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