PHYSICS 108

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- Thermal Physics
  - Deconstructing Temperature
  - Statistical Mechanics
    - Randomness
    - Conservation
    - Counting all the Accessible States
    - Entropy is Simple!

SYLLABUS

See

http://musr.physics.ubc.ca/~jess/p108/syll/2005/

MARKING:

ITEM	MARKS
Best 8 Assignments	20
Best Midterm Exam	30
Final Exam	50
TOTAL	100

TA: Shirin Hadizadeh <shirin@physics.ubc.ca>

Tentative Schedule of Topics

See

http://musr.physics.ubc.ca/~jess/p108/outl/2005/

Homework:

At the beginning of class every Wednesday, pick up any marked assignments & the new assignment and turn in your finished assignment. Solutions will be handed out at the end of class, so assignments must not be late.

The **best 8 out of 12** will be used in your final mark.

Physics 108 WEBSITES

You should automatically be registered in the

`phys_108` ***WebCT*** course, where you will find the ***weekly quiz***

which counts for ***20%*** of each week's ***Assignment*** mark.

Most actual ***CONTENT*** is found on

`http://musr.physics.ubc.ca/~jess/p108/`

where you will find links to the syllabus, outline, WebCT site, lecture summaries, assignments & solutions, old exams, the Skeptic's Guide to Physics, the HyperTextBook, class photos, the people database, surveys and the Conflict Scheduler. . . .

Physics 108 Links

Log In and indicate your SCHEDULE CONFLICTS.

Syllabus

WebCT site (password access)

Tentative *Course Outline* for Spring 2005

Lecture Archives

Assignments & Solutions

Old Exams

Physics 108 *People Database*

Surveys and Feedback

The Skeptic's Guide to Physics

First Year Science *HyperTextBook*

Physics 108 *Photo Album*

http://musr.physics.ubc.ca/~jess/p108/

Tutorial Conflicts?

Our TA can't come to two out of the three Tutorials. It is unlikely that the Tutorials can be moved, but it's worth a try. It will also be useful to know if there are any "empty slots" in most people's schedules. So please

go to **http://musr.physics.ubc.ca/~jess/p108/peo/**

and register yourself using "*Enter your profile*" to get an ID. Then go back to the main page and "*indicate your SCHEDULE CONFLICTS*" for the "typical week" of 10-14 Jan 2005 so we can see if there are any better Tutorial times than 4-5pm Mon, 12-1pm Tue & 3-4pm Tue.

Physics 108 Links

Log In and indicate your SCHEDULE CONFLICTS.

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Syllabus

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Physics 108 People Database

1: register yourself

Surveys and Feedback

The Skeptic's Guide to Physics

First Year Science HyperTextBook

Physics 108 Photo Album

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Select Schedule

DEPT	Course #		Year		Month	Day		Month	Day
PHYS	108	in	2005	from	01	10	to	01	14

DISPLAY/ENTER CONFLICTS

NOTE: You must be *logged in* for this to work!

Last modified: Fri Oct 29 14:20:06 PDT 2004

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Schedule Conflicts

Dept: PHYS **Course #** 108 **from** 2005-01-10 **to** 2005-01-14

	Hour →		06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
course	**↓ Date**																
PHYS *108*	Mon 10 Jan 2005								50								
PHYS *108*	Tue 11 Jan 2005												1	1	1	1	1
PHYS *108*	Wed 12 Jan 2005								50								
PHYS *108*	Thu 13 Jan 2005												1	1	1	1	1
PHYS *108*	Fri 14 Jan 2005								50								

Click *checkboxes* by hours & dates for which you have *CONFLICTS*, then SUBMIT.

Don't hit **Reload**! It will resubmit the same data over again and corrupt the database.

THERMAL PHYSICS

Read the handout! It contains everything I am going to say about **Statistical Mechanics**, which will probably not resemble anything you have heard before and is very different from your textbook's more traditional approach to Thermodynamics.

First let's **deconstruct temperature**. What **is** "temperature"?
I want a definition, not a description of its properties or effects, although it may be useful to make a list of those, too.

ENTROPY

What is "**entropy**"? If we have a hard time defining temperature, then this mysterious thermodynamic function must be even worse, right? Not so! Entropy is actually very simple to understand, once we establish the proper perspective on Statistical Mechanics. This requires an old idea and a new one:

OLD IDEA: **Energy is Conserved** in a closed system.

NEW IDEA: **Every possible** fully specified microstate of a closed system is *a priori* **equally likely**. This is known as the "fundamental assumption of statistical mechanics" and it contains some tricky terminology (not to mention an implausible-sounding hypothesis).

Suppose we have a total energy U contained in some system $\mathcal{S}$. Usually $\mathcal{S}$ will contain a lot of microscopic components, each of which can hold varying fractions of U, subject only to the ***constraint*** that all those fractions have to add up to 100% of U because energy is conserved.

We define the "multiplicity" Ω of the ensemble of {all accessible microstates of the system $\mathcal{S}$} to be simply the **number** of all such possible states. For macroscopic systems this gets to be a really, really **big** number, so we take its natural logarithm to get something a little more manageable.

And that's Entropy, man. $\sigma = \log \Omega$