

# Physics 2C

Thermodynamics, Fluids, Waves

# Quarter Overview

## Text: Wolfson & Pasachoff

- Thermodynamics:
  - ~3 weeks
  - Chapters 19,20,21,22
- Fluids:
  - ~1 week
  - Chapter 18
- Waves & Optics:
  - ~6 weeks
  - Chapters 16,17,35,36,37,parts of 34

# Lectures

- Mo, We, Fri 4-4:50pm Peter 110
- Thu 5-5:50pm Solis 107
  
- Discussion: We 5-5:50pm Peter 110
- Quiz preparation: Thu 7-8:50pm WLH 2005
  
- Quiz: Roughly once a week. Initially Mondays, later Fridays.

# Course web site

- <http://hepuser.ucsd.edu/twiki2/bin/view/UCSDTier2/Physics2CSpring2013>
- Syllabus, schedule, suggested homework assignments are all available from course web site
- Lecture notes, quiz solutions & grades are also available from web site.

<b>Date</b>	<b>Topics</b>	<b>Chapters in Wolfson/Pasachoff</b>
April 1st April. 3rd April 4th April 5th	Introduction Ideal Gas, Phase Diagrams 1st Law & thermodynamic processes	Chapter 19 Chapter 20 Chapter 20 Chapter 21
April 8th April 10th April 11th April 12th	<b>Quiz 1</b> Cyclic processes Heat engine & refrigerator 2 <sup>nd</sup> law of thermodynamics	<b>Covering Chapters 19,20</b> Chapter 21 Chapter 22 Chapter 22
April 15th April 17th April 18th April 19th	<b>Quiz 2</b> Entropy Hydrostatic equilibrium Fluid Flow	<b>Covering Chapters 19, 20, 21, 22</b> Not in textbook the way I teach it. Chapter 18 Chapter 18
April 22nd April 24th April 25th April 26th	<b>Quiz 3</b> Waves Waves Superposition Principle	<b>Covering Entropy &amp; Chapter 18 part 1</b> Chapter 16 Chapter 16 Chapter 17
April 29th May 1st May 2nd May 3 <sup>rd</sup>	<b>Quiz 4</b> Sound Waves Standing Waves Doppler Effect	<b>Covering Chapter 16 &amp; 18 part 2</b> Chapter 17 Chapter 17 Chapter 35
May 6th May 8th May 9th May 10th	<b>Quiz 5</b> Optics: Reflection & Refraction Total internal reflection & dispersion Mirrors	<b>Covering Chapter 17</b> Chapter 35 Chapter 35 Chapter 36
May 13th May 15th May 16th May 17th	Lenses Optical Instruments Coherence & Interference <b>Quiz 6</b>	<b>Covering Chapter 35</b> Chapter 36 Chapter 37 Chapter 37
May 20th May 22nd May 23rd May 24th	Interferometry Huygens Principle EM waves <b>Quiz 7</b>	Chapter 37 Chapter 37 Chapter 34 <b>Covering Chapter 36 &amp; 37</b>
May 27 <sup>th</sup> May 29th May 30th May 31 <sup>st</sup>	Memorial day – no class EM waves Polarization EM waves	No class Chapter 34 Chapter 34 Chapter 34
June 3rd June 5th June 6 <sup>th</sup> June 7th	<b>Quiz 8</b> Gravitaitonal Waves & stuff like that Final Review Final Review	<b>Covering Chapter 37 &amp; 34</b> Not part of final exam
June 13th	<b>Final Exam!!!</b>	<b>Success</b>

# Homework

- Homework is optional
- It is meant for you as a study guide for the weekly quizzes.
- It's already linked in at course web site:
- <http://hepuser.ucsd.edu/twiki2/bin/view/UCSDTier2/Physics2CSpring2013>

# Grades

- 8 Quizzes
  - Best 7 of which count for 70% of total grade.
- Final exam
  - 3 hours for 2 quizzes worth of work
  - Counts for 30% of grade.

# Absolute Grading Scale

Note: There are no D's

**A+ >85%**

**A 80%**

**A- 75%**

**B+ 70%**

**B 65%**

**B- 60%**

**C+ 55%**

**C 50%**

**F <50%**

Average grade is usually in the range 65-70



# Let's start with physics

- Chapter 19:
  - Thermodynamics vs statistical mechanics
  - 0th law of thermodynamics
  - Measuring temperature:
    - Kelvin Scale
    - Celsius Scale
    - Fahrenheit Scale
  - Heat Capacity & Specific heat
  - Heat transfer

# Thermodynamics versus statistical mechanics

- Thermodynamics:
  - describes macroscopic state
- Statistical mechanics:
  - describes microscopic state

# 0th law

- Thermodynamic Equilibrium is transitive.
- $A = B$  .and.  $B=C$   $\Rightarrow$   $A=C$
- This allows us to measure temperature!

# Measuring Temperature

- Choose a macroscopic phenomenon that varies with temperature:
  - E.g. expansion of gas
- Choose calibration points:
  - E.g. phase transitions of water
  - 0 degree Celsius = water/ice @ 1atm
  - 100 degree Celsius = steam/water @ 1atm
- Bring thermometer in contact with
  - substance to be measured
  - Known substance

=> Use 0th law to define T.

# Better way to define calibration scale

- Kelvin Scale
  - Take 2 points that are better defined:
    - Zero pressure @ constant volume of ideal gas
    - Triple point of water
- We'll talk more about this next class

# Heat = Energy

- To increase the temperature of a macroscopic system requires energy.
- The proportionality constant is called “heat capacity,  $C$ ”

$$dQ = C dT$$

- Heat capacity,  $c$ , per unit mass:

$$dQ = m c dT$$

# What is heat?

- Heat = ***energy transferred*** between objects as a result of a ***temperature difference***.

# What is temperature?

- temperature = Measure of ***average “internal energy”*** of a many body system.

# Heat Transfer

- Conduction: for things that “touch”
- Convection: for things that “flow”
- Radiation: for things that “radiate”



Why do high quality thermos  
have mirroring inside  
surfaces?

- (a) To minimize thermal convection.
- (b) To minimize thermal conduction.
- (c) To minimize thermal radiation.