



Welcome to PHYS102H
General Physics II
Honors

Spring 2024

About the instructor

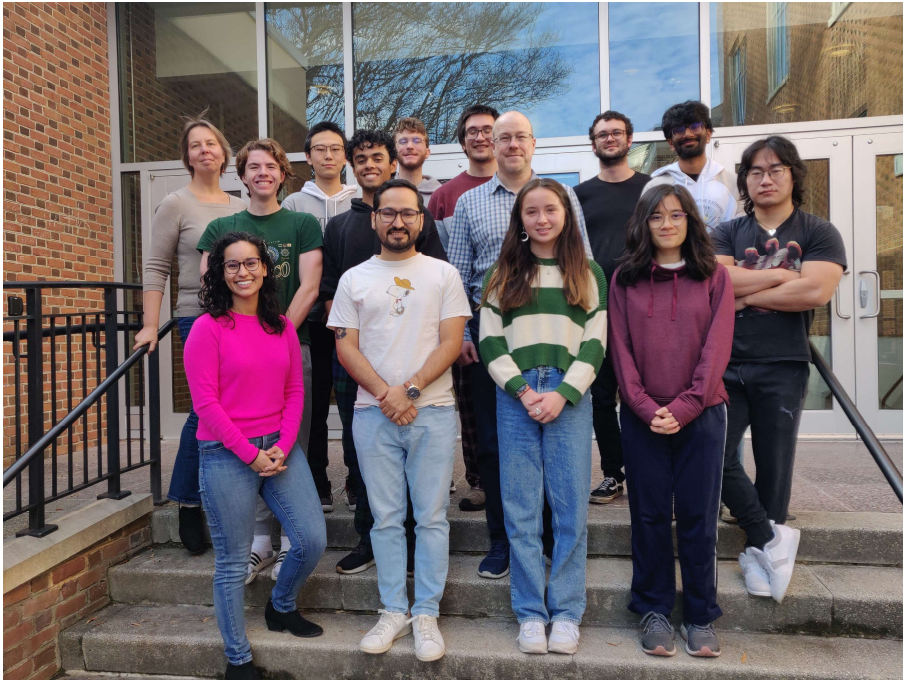
Lectures: Irina Novikova

Office: Small 251	E-mail: ixnovi[at]wm.edu
Office hours: Thursday, Friday after class or by appointment	
Web-site: http://physics.wm.edu/~inovikova/phys102H/phys102H.htm	

My research areas: quantum optics, atomic physics,
experimental quantum information

Research lab – Small 065

Quantum Optics group



- **Atom-based metrology (atomic clock, magnetometers)**
- **Generation of non-classical light (squeezing)**
- **Quantum noise-based imaging with (almost) no photons**
- **New: non-invasive detection of charge particles and plasmas**

**William&Mary Quantum
Optics Group,
Founded in 2006
PIs: Irina Novikova and
Eugeniy Mikhailov**

<http://physics.wm.edu/~inovikova/webpage/>



Components of the course

- Lectures (MWF)
- “Problem sessions” (usually Thursday)

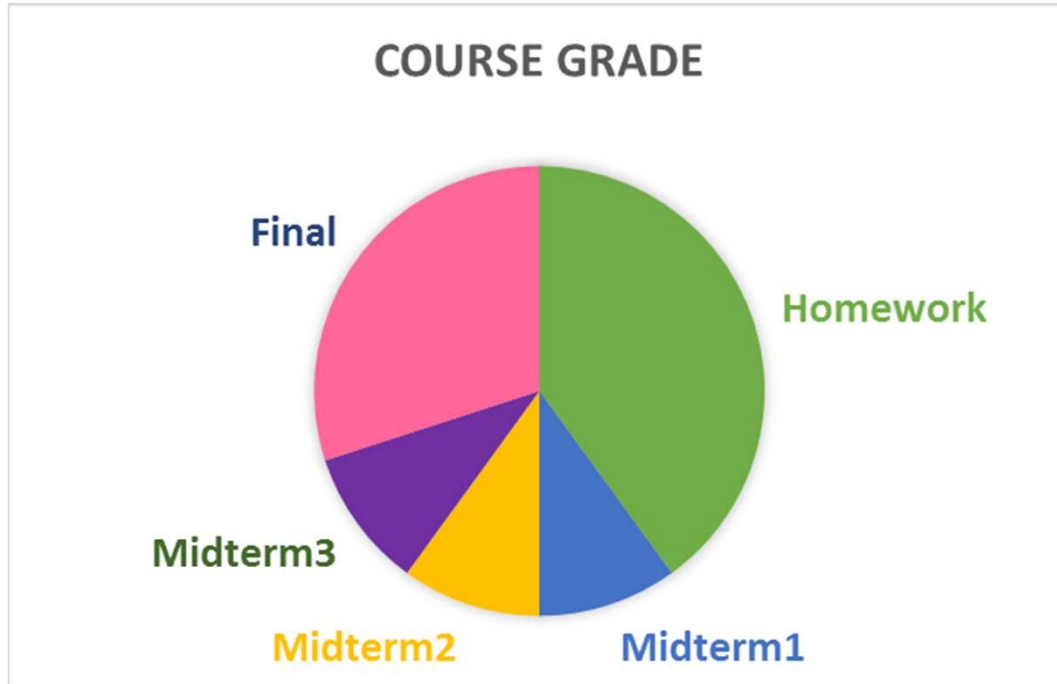
Labs are a separate course

Available help:

Office hours (Th4.30-5.30pm, F12-1pm)

Free SPS help sessions (Thursdays 6-8pm,
Small122)

Grade for the course



Homework	40%
Midterm tests	10% each
Final exam	30%

Letter grades will be assigned according to the following approximate grading scale:

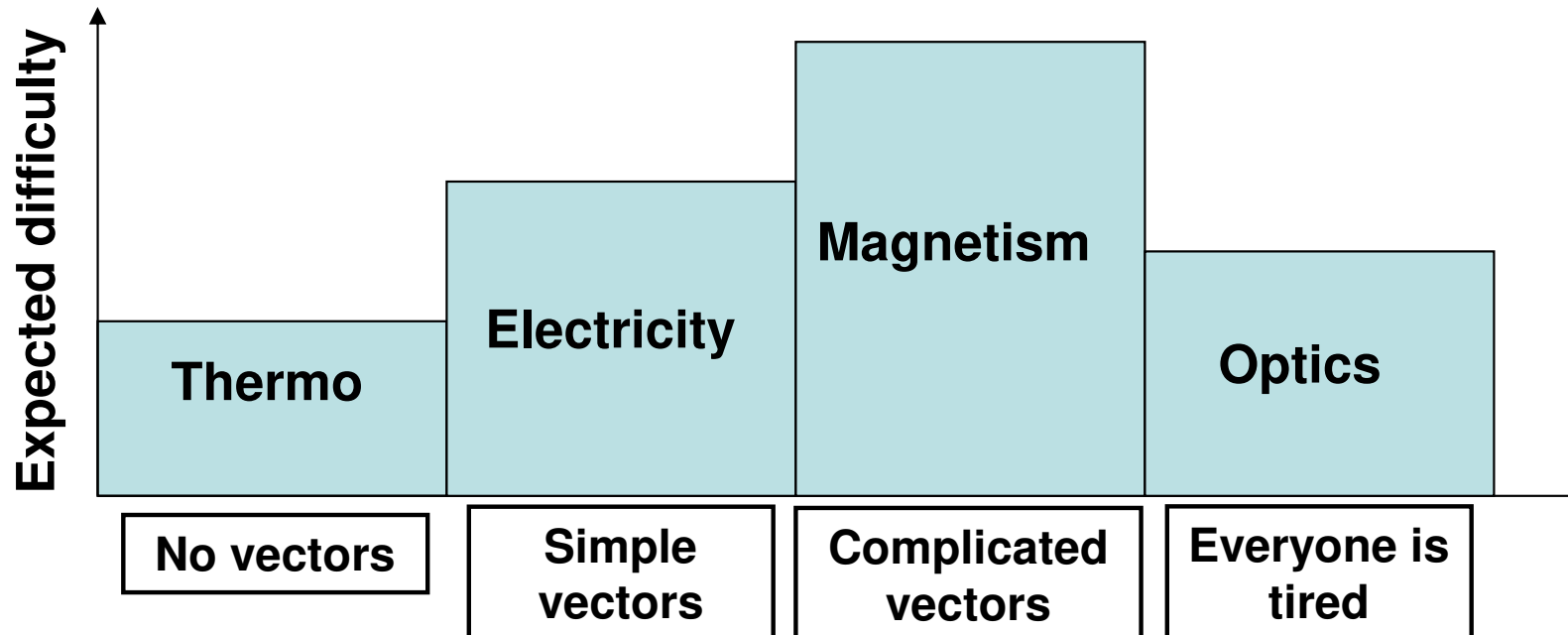
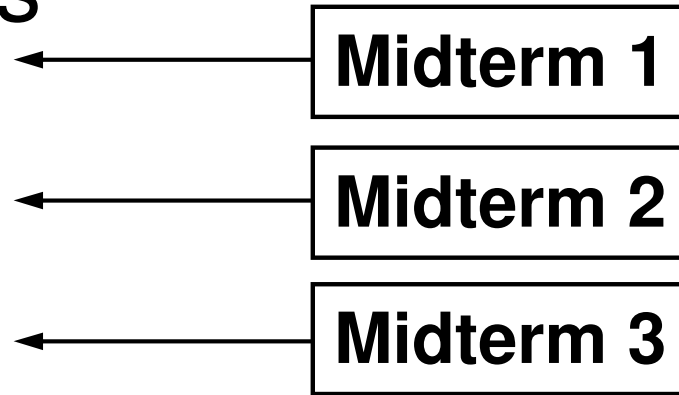
A: 90-100% B: 80-89%

C: 70-79% D: 60-69%

F: below 60%

Main topics

- Thermodynamics
- Electricity
- Magnetism
- Optics



And now let's start....



THERMODYNAMICS

Physics of heat, work and temperature

What is temperature?

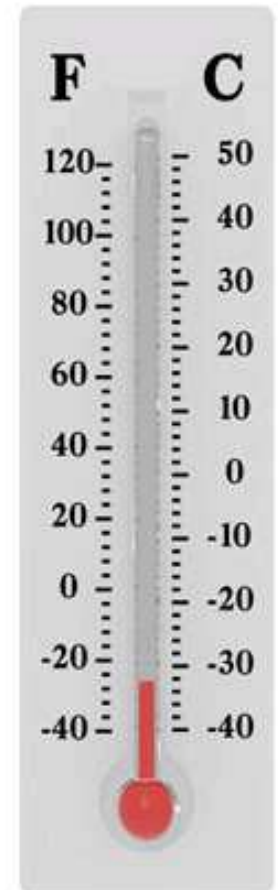
- *Merriam-Webster dictionary*: degree of hotness or coldness measured on a definite scale

What is temperature?

- *Merriam-Webster dictionary*: degree of hotness or coldness measured on a definite scale
- *Britannica*: measure of hotness or coldness expressed in terms of any of several arbitrary scales and indicating the direction in which heat energy will spontaneously flow—i.e., from a hotter body (one at a higher temperature) to a colder body (one at a lower temperature).

Temperature (degree of hotness or coldness measured on a definite scale)

- Fahrenheit scale (F)
- Celsius scale (C)



Temperature (degree of hotness or coldness measured on a definite scale)

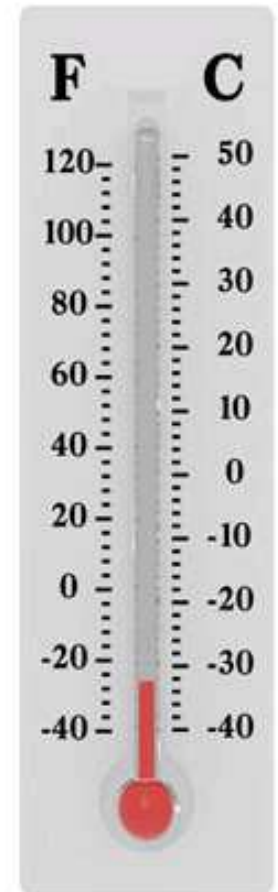
- Fahrenheit scale (F)
- Celsius scale (C)

Both Fahrenheit and Celsius scales are linked to boiling and freezing temperatures of water

- Water freezes at 0°C and 32°F
- Water boils at 100°C and 212°F

$$T[^\circ\text{F}] = (T[^\circ\text{C}] \times 9/5) + 32$$

$$T[^\circ\text{C}] = (T[^\circ\text{F}] - 32) \times 5/9$$

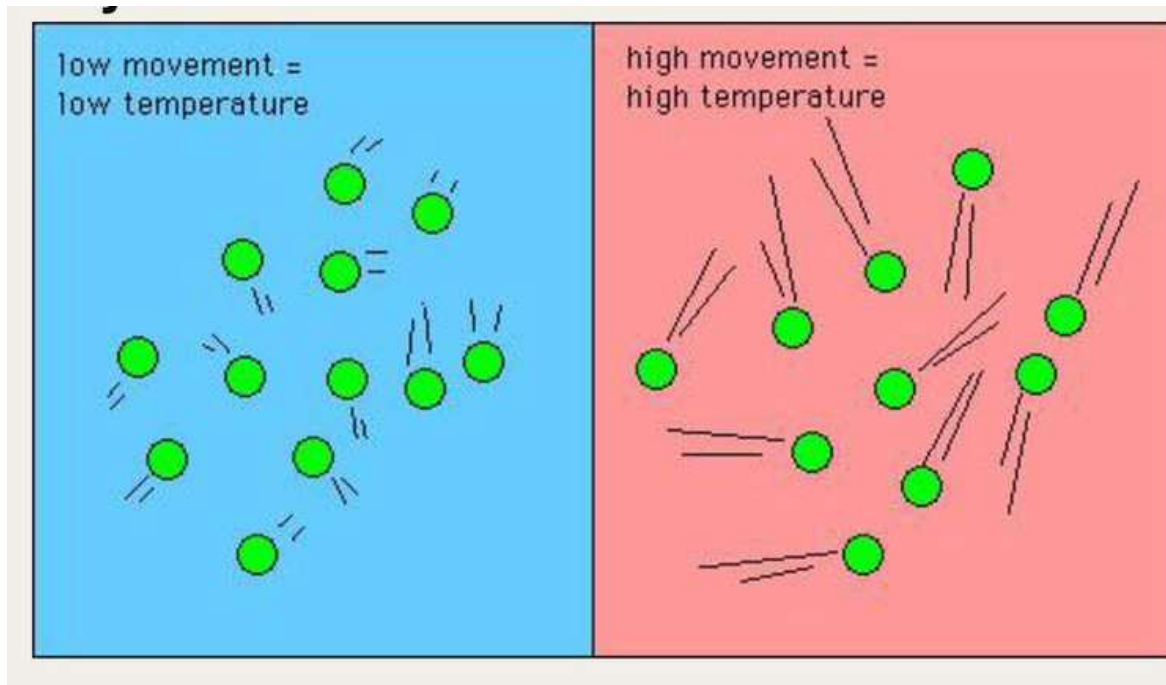


What is temperature?

- *Wikipedia*: Temperature is a physical quantity that quantitatively expresses the attribute of hotness or coldness. Temperature is measured with a thermometer. It reflects the kinetic energy of the vibrating and colliding atoms making up a substance.

What is temperature?

- *Scientific definition:* Temperature is a measure of the average kinetic energy of the atoms or molecules in the system.



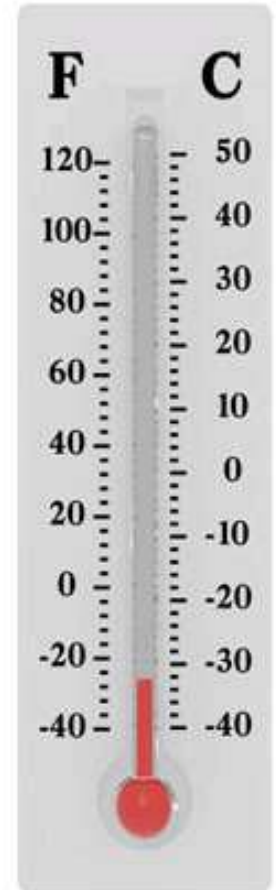
- Thermal motion is usually chaotic/random.

Temperature scales

- Fahrenheit scale (F)
- Celsius scale (C)
- Kelvin scale (K)

0K represents absolute zero where all the motion ceases.

$$1\text{K} = 1^{\circ}\text{C}$$



What is temperature?

Zeroth Law of Thermodynamics

- The zeroth law of thermodynamics states that if two bodies are each in thermal equilibrium with some third body, then they are also in equilibrium with each other.