Welcome to

PHY 215

Spring 2025

section 001

on Tu, We, Th

from 3:00 to 3:50 PM

Agenda:

- syllabus
- textbook
- eBook (for Thermodynamics)
- LON-CAPA

www.loncapa.msu.edu

Grade calculation 1.

Homework: 40%

Midterms: 2x16% = 32%

Final exam: 28%

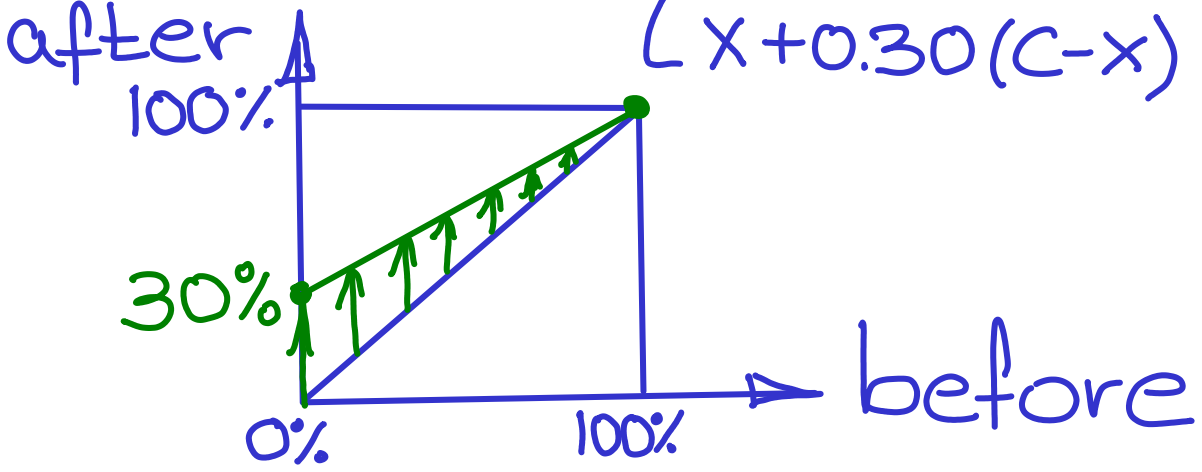
Total: 100%

Correction for midterms:

Exam score: x $(0 \le x \le 50)$

Correction score: c $(0 \le c \le 50)$

Total score: $\begin{cases} x & \text{if } c \le x \\ x + 0.30(c-x) & \text{if } c > x \end{cases}$



Metric base units

SI: Système Internationale

(Gauss: CGS; MKSA → SI)

Quantity	Unit name	Unit symbol
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
temperature	kelvin	K
amount of substance	mol	mol
luminous intensity	candela	cd

Metric prefixes

d	deci	10^{-1}	dk, da	deka	10^{1}
c	centi	10^{-2}	h	hecto	10^{2}
m	milli	10^{-3}	k	kilo	10^{3}
μ	micro	10^{-6}	M	mega	10^{6}
n	nano	10^{-9}	G	giga	10^{9}
p	pico	10^{-12}	T	tera	10^{12}
f	femto	10^{-15}	P	peta	10^{15}
a	atto	10^{-18}	E	exa	10^{18}
z	zepto	10^{-21}	Z	zetta	10^{21}
y	yocto	10^{-24}	Y	yotta	10^{24}

μ: micro sometimes u or mc

(LON-CAPA accepts u)

1 angstrom = 1 Å = 10^{-10} m

1 fermi = 1 fm = 10^{-15} m

James Clerk Maxwell

(1831 - 1879)

In 1865 Maxwell wrote down four equations:

$$\nabla \times \vec{E} = -\dot{\vec{B}}$$
$$\nabla \times \vec{H} = \vec{J} + \dot{\vec{D}}$$
$$\nabla \cdot \vec{D} = \rho$$
$$\nabla \cdot \vec{B} = 0$$

Notes:

- In CGS units these equations are slightly different.
- $\nabla\times$ is curl or rot, $\nabla\cdot$ is div.
- Electromagnetic waves are predicted by these equations and later found that Special Relativity is built into the Maxwell equations.
- This nice, compact format was invented after Maxwell. He wrote them down in a longer format.

Special Relativity is built into the framework of Maxwell equations

The theory of special relativity is deeply connected with Maxwell's equations. Maxwell's equations describe the behavior of electric and magnetic fields and imply that the speed of light is constant in all inertial reference frames.

When Albert Einstein developed the theory of special relativity, one of his key motivations was to resolve the conflict between Newtonian mechanics and Maxwell's electromagnetism. By proposing that the laws of physics are the same for all observers in uniform motion (inertial frames) and that the speed of light is constant, he showed that space and time are not absolute but are relative to the observer.

This led to the famous equations of special relativity that describe how time and space transform between different inertial frames of reference, fundamentally changing our understanding of space and time. So, in a way, you could say that special relativity is built into the framework of Maxwell's equations!