Phys 131 Chapter 1: Introduction

January 26, 2025

Welcome!

What is Physics?

- A fundamental science, concerned with matter, energy, and fundamental interactions. A strong basis for many other subjects.
- A presumptive science. It attempts to describe everything from the smallest sub-atomic particles to the ultimate fate of the entire universe.
- An experimentally-based science.
  - Not arbitrary proclamations from authority
  - Able to be independently verified (at least in principle). *If it's wrong, it's wrong!*
- A problem-solving discipline. Physicists solve problems. The processes you'll use in this class are similar to those that a wide variety of professionals use.
- *NOT* just a collection of facts and principles, but also the *framework* within which we organize those facts, and the *process* by which we study the physical universe.

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- *Yes:* Underscore the important role of science in understanding the natural world, while appreciating both its applicability and limitations.

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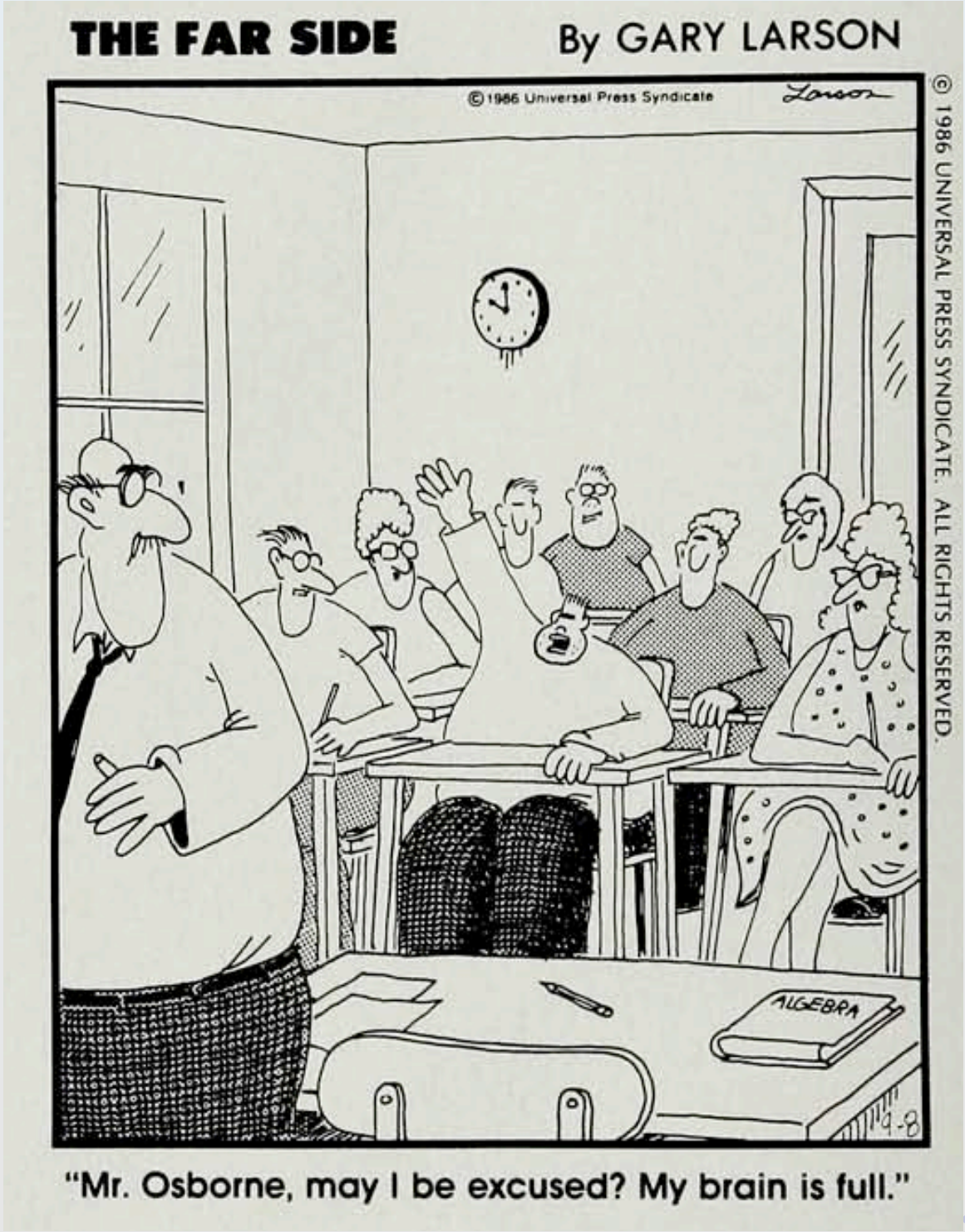
- *Yes:* Underscore the important role of science in understanding the natural world, while appreciating both its applicability and limitations.
- *It's fun!*

How Study Physics?

- *Not* just memorization.


THE FAR SIDE
By GARY LARSON
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Larson
ALGEBRA
9-8
"Mr. Osborne, may I be excused? My brain is full."
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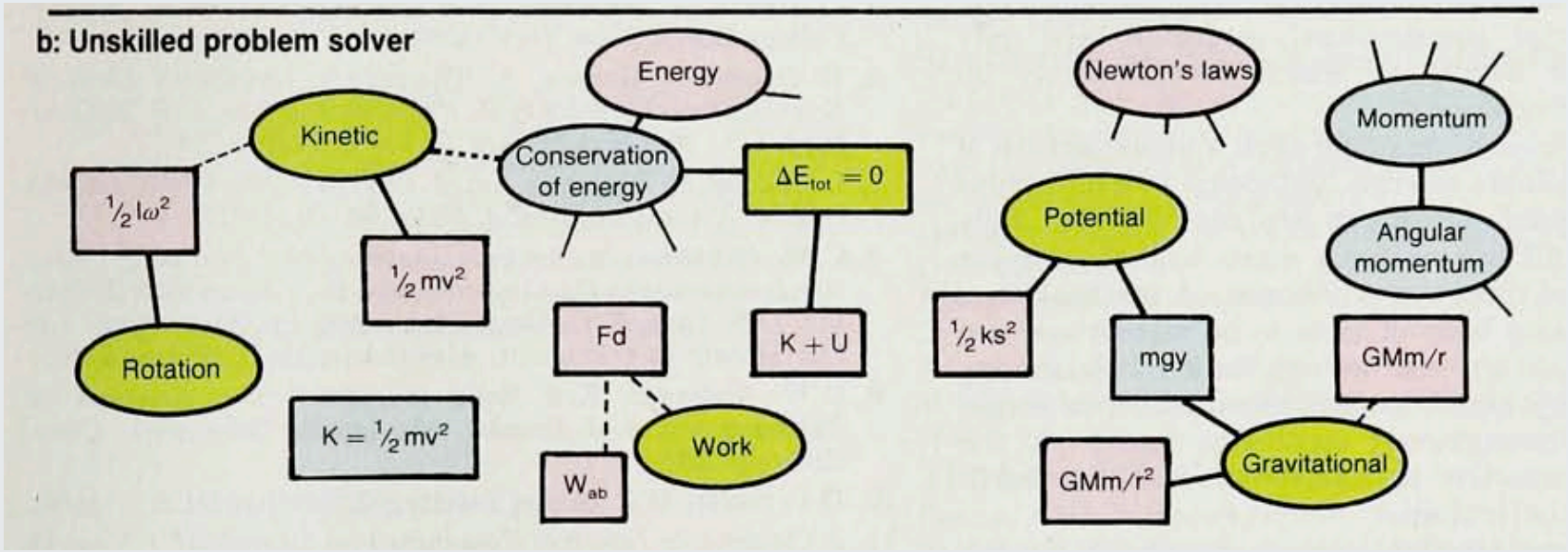
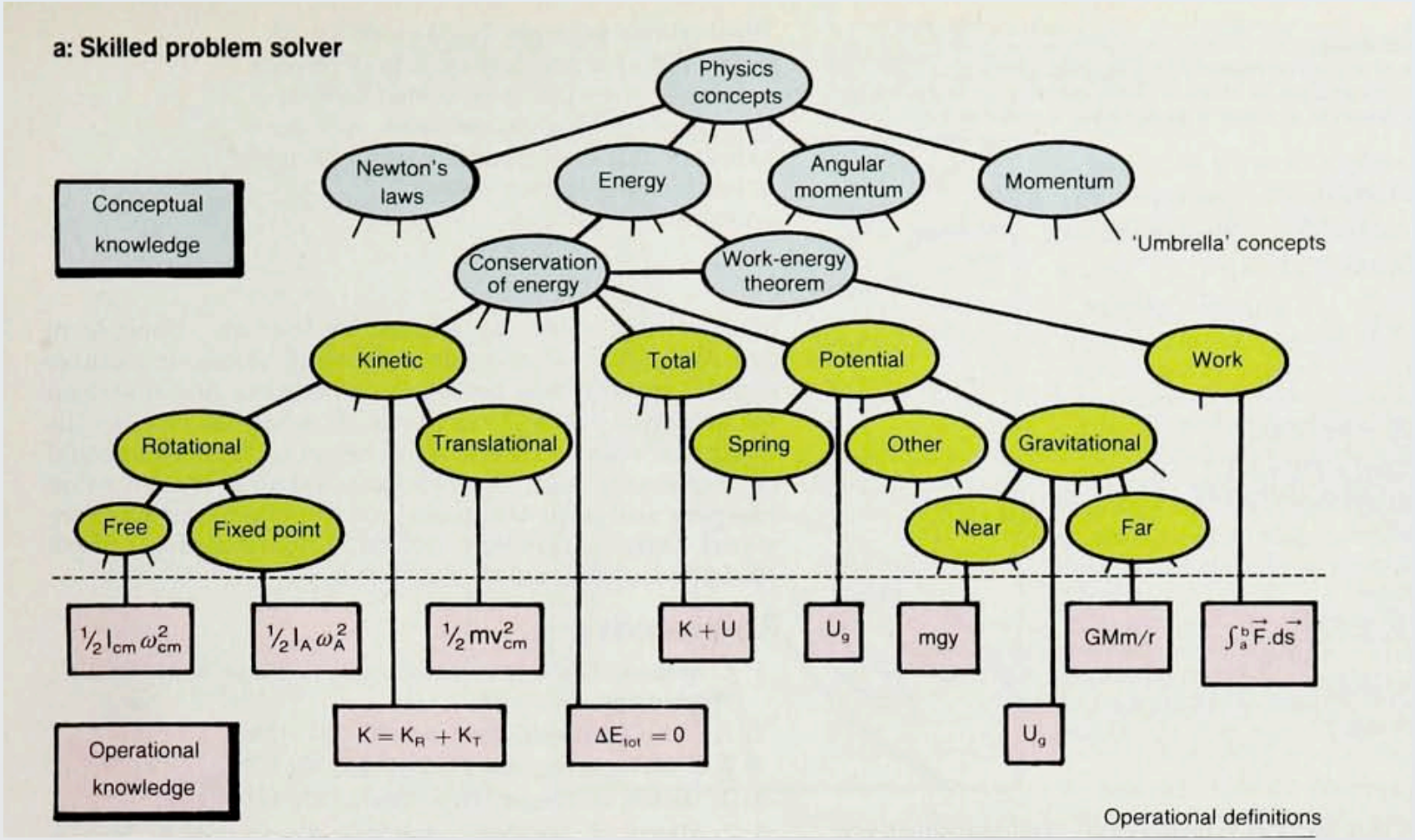
How Study Physics?

- *Not* just memorization
- Developing an organized narrative


b: Unskilled problem solver
Energy
Kinetic
Conservation of energy
$\Delta E_{tot} = 0$
$\frac{1}{2} I\omega^2$
$\frac{1}{2} mv^2$
Rotation
$K = \frac{1}{2} mv^2$
Fd
$K + U$
Work
W_{ab}
Newton's laws
Momentum
Potential
Angular momentum
$\frac{1}{2} ks^2$
mgy
GMm/r
Gravitational
GMm/r^2


a: Skilled problem solver
Physics concepts
Newton's laws
Energy
Angular momentum
Momentum
'Umbrella' concepts
Conceptual knowledge
Conservation of energy
Work-energy theorem
Kinetic
Total
Potential
Work
Rotational
Translational
Spring
Other
Gravitational
Free
Fixed point
Near
Far
$\frac{1}{2} I_{cm} \omega_{cm}^2$
$\frac{1}{2} I_A \omega_A^2$
$\frac{1}{2} mv_{cm}^2$
$K + U$
U_g
mgy
GMm/r
$\int_a^b \vec{F}.d\vec{s}$
$K = K_R + K_T$
$\Delta E_{tot} = 0$
U_g
Operational knowledge
Operational definitions

Ch. 1:1–3

These first 3 sections are worth a quick read.

- Section 1.1: The Nature of Physics
- Section 1.2: Solving Physics Problems
- Section 1.3: Standards and Units.

Ch. 1:4: Using and Converting Units

- Review scientific notation.
- Review unit conversions. We won't do a lot of these, but you should be comfortable using the various metric prefixes.

Ch. 1:5 Uncertainty and Significant Figures

- All measurements have limitations and uncertainty. We can only evaluate a theoretical prediction if we know how certain the measurements are. This is the theme of our first lab.
- Also, it's important to know whether all of our underlying assumptions behind the measurements are valid. This too will be relevant in our first lab.

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- Avoid reckless rounding–don't throw away information.
- Don't give silly or misleading answers with meaningless digits, such as 123.4567890123.
- Final answer: Aim for better than 1% accuracy (*i.e.* about 3 digits, typically.) For intermediate results, keep 4 or 5 digits–or store them in your calculator memory.

Ch. 1:6: Estimates and Orders of Magnitude

This is just a quick discussion. We will encounter such ideas in various contexts throughout the semester. It's worthwhile to read Example 1.4 to get a sense of the sort of problem being considered.

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- Log in to Mastering Physics, using the `Course Materials` link on our Moodle page. This will verify your account works.
- Explore the Study Area in Mastering Physics. There are a number of useful resources for each chapter.
- Lab starts this week with an introductory meeting.