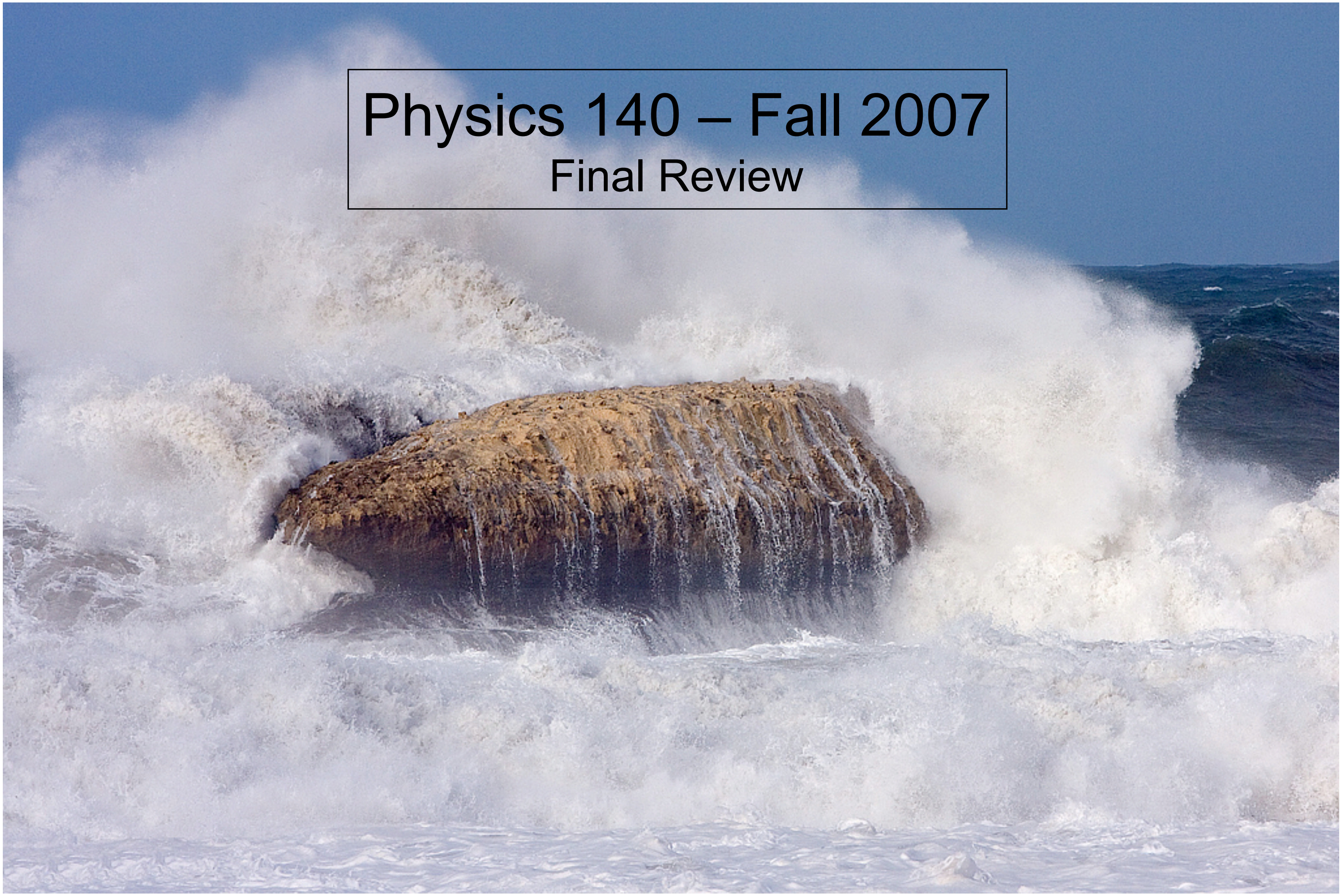
open.michigan


Physics 140 – Fall 2007
Final Review

Final Grade determination

Letter grades will be based on your overall score S, defined as a weighted sum (normalized to a 0-100 scale):

$$S = 0.20*H + 0.10*D + 0.05*L + 0.15*(Mid1+Mid2+Mid3) + 0.20*Final$$

where each capitalized entry is a normalized score:

$$X = 100 \left[\Sigma (\text{your score})_i \; / \; \Sigma (\text{maximum score})_i \right]$$

For discussion (D) and lecture (L), the scores are computed *after dropping your lowest four scores* of the term.

Bad logic -
What equation do I use?

Good logic -
What information do I know?
What information am I being asked to find?
What key ideas/conceptual tools do I apply?
What equations express these ideas?

When I hang this slinky by one end and then drop it, what will happen?

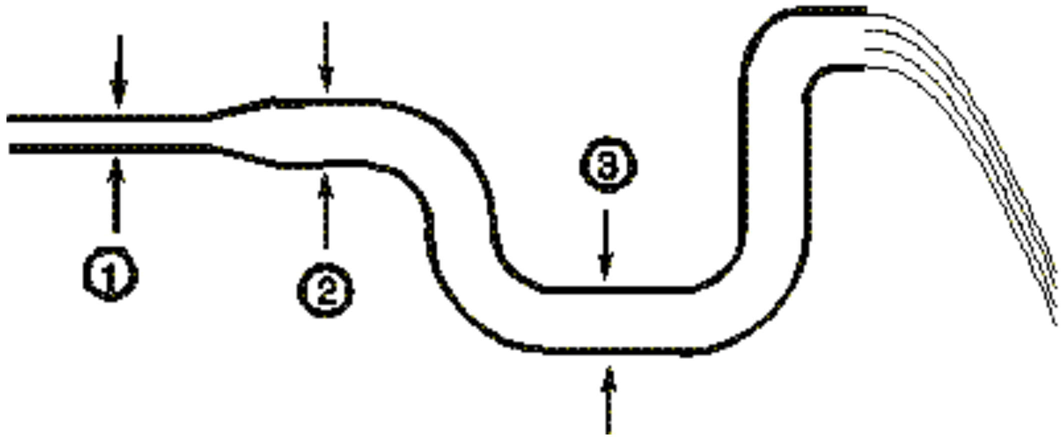
1) The bottom end of the slinky will immediately start falling at the same rate as the top.
2) The bottom end of the slinky will rise up, and the two ends will meet in the middle. Then the whole thing will fall to the floor.
3) The bottom end of the slinky will hang suspended momentarily, then start falling.

A 1 kg mass is placed on a spring, pulled back a distance of 10 cm, and set into simple harmonic motion. If instead a 2 kg mass is used on the same spring with the same initial amplitude, what is the total energy of this oscillating system compared to the original?

1) 4 times as large
2) 2 times as large
3) the same
4) half as large
5) one fourth as large

You place a large beaker of water on a laboratory scale and record its weight. You then add a toy boat filled with pebbles, of overall mass m, to the beaker. What happens to the reading on the scale?

1) It always increases by an amount greater than mg.
2) It increases by an amount mg if the boat sinks, by less than mg if it floats.
3) It increases by an amount mg if the boat floats, by less than mg if it sinks.
4) It always increases by an amount mg.
5) It always increases by an amount less than mg.



An ideal fluid flows in a tube whose radius and vertical location vary in the manner shown above. Rank the locations according to the fluid pressure in the tube, lowest to highest.

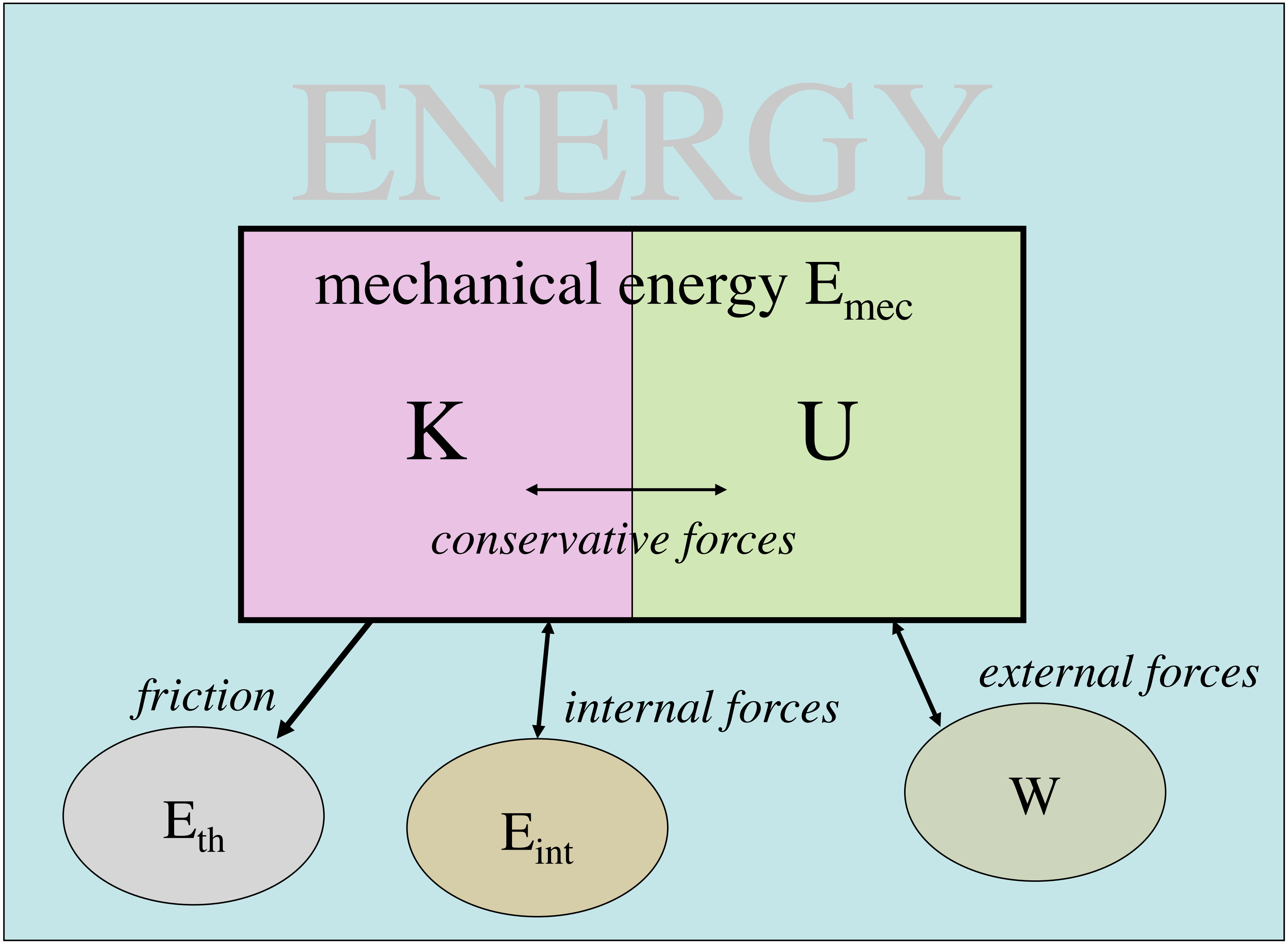
1) 3, 2, 1

2) 3, 1, 2

→ 3) 1, 2, 3

4) 3, 1=2

5) 1=3, 2


ENERGY
mechanical energy E_{mec}
K
U
conservative forces
friction
internal forces
external forces
E_{th}
E_{int}
W

Some tips for solving Newton's second law problems:

1. Think! Define the system (or set of systems).

- draw a cartoon and define your coordinate system(s).
- identify all the forces that are acting

2. FBD. Draw a free-body diagram(s) for the system(s).

- imagine a bubble enclosing the system
- "shrink it to a dot"
- draw vector forces in the chosen coordinate system.
- apply Newton's 3rd law, if needed, at interfaces.

3. NSL. Apply $\Sigma \boldsymbol{F} = m\,\boldsymbol{a}$

- in *static* situations, $\Sigma \boldsymbol{F} = 0$.
- in *dynamic* situations involving multiple objects, find the links between the objects (e.g., same acceleration)

Comparison of linear and rotational motion

Quantity	**Linear Motion**	**Rotational Motion**
displacement	$\boldsymbol{x}$	θ
velocity	$\boldsymbol{v}$	ω
acceleration	$\boldsymbol{a}$	α
inertia	m	$I \sim (\text{constant})mr^2$
kinetic energy	$K_{trans} = 1/2\ mv^2$	$K_{rot} = 1/2\ I\omega^2$
momentum	$\boldsymbol{p} = m\boldsymbol{v}$	$\boldsymbol{L} = I\omega$
2nd Law (dynamics)	$\Sigma\ \boldsymbol{F} = \mathrm{d}\boldsymbol{p}/\mathrm{d}t$	$\Sigma\ \tau = \mathrm{d}L/\mathrm{d}t$
work	$W = F_{\parallel}\ \Delta x$	$W = \tau\ \Delta\theta$
conservation law	$\Delta\boldsymbol{p} = 0$ if $\Sigma\boldsymbol{F}_{ext}=0$	$\Delta\boldsymbol{L} = 0$ if $\Sigma\tau_{ext}=0$
impulse	$\boldsymbol{F}\Delta t = \Delta\boldsymbol{p}$	$\tau\ \Delta t = \Delta\boldsymbol{L}$

Two objects, P and Q, have the same linear momentum. Q will have a larger kinetic energy than P if …

1) Q is more massive than P.
2) Q’s speed is the same as P’s.
3) Q is the same mass as P.
4) Q’s speed is lower than P’s.
5) Q is less massive than P.

Albert says…

Source: The Scientific Monthly (1921)

Channel me on the final exam!

Thanks for your efforts and attention this term.

And remember…

Physics is always with you!