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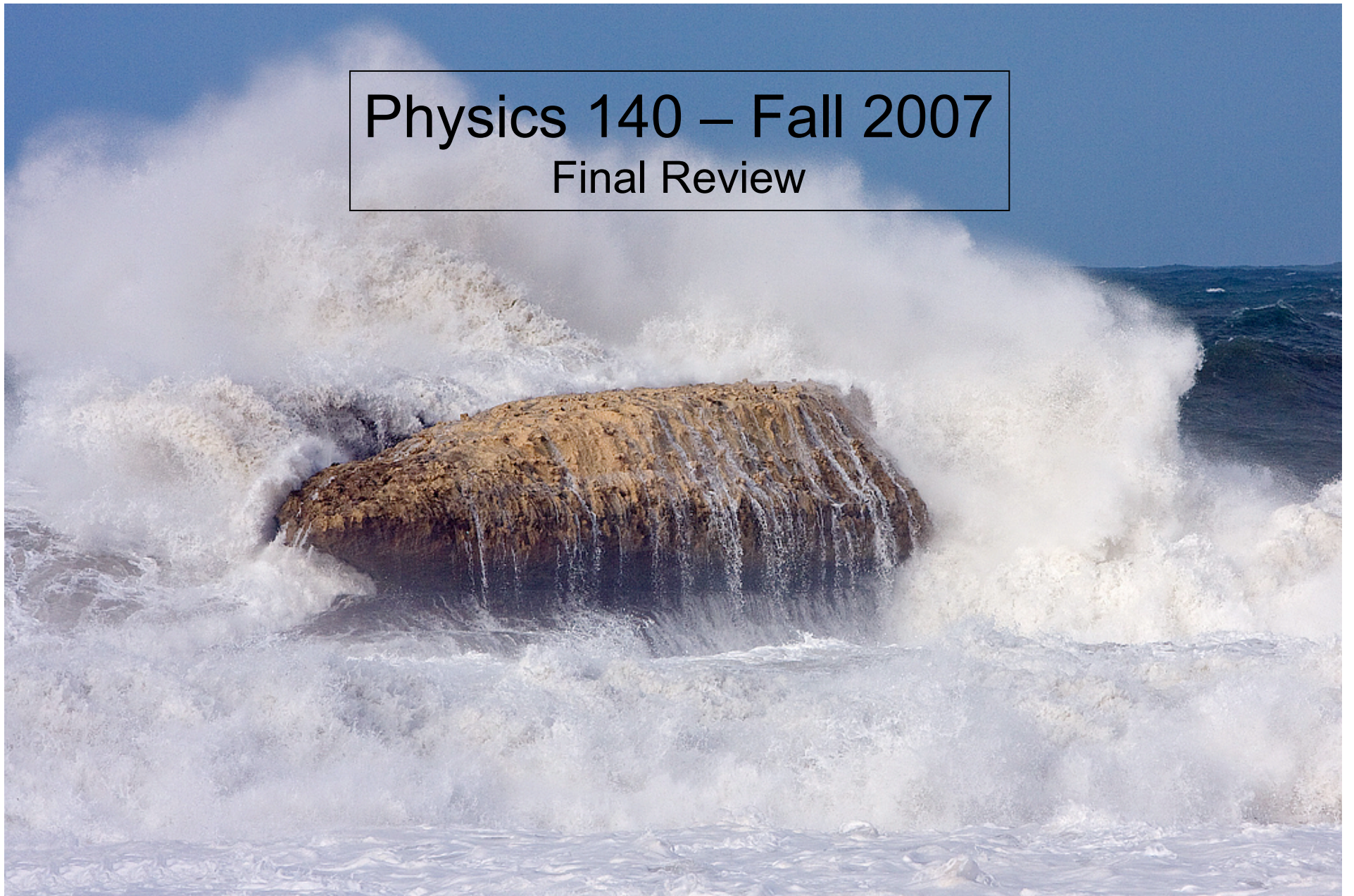
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Physics 140 – Fall 2007

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:

$$X = 100 [\sum (\text{your score})_i / \sum (\text{maximum score})_i]$$

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?

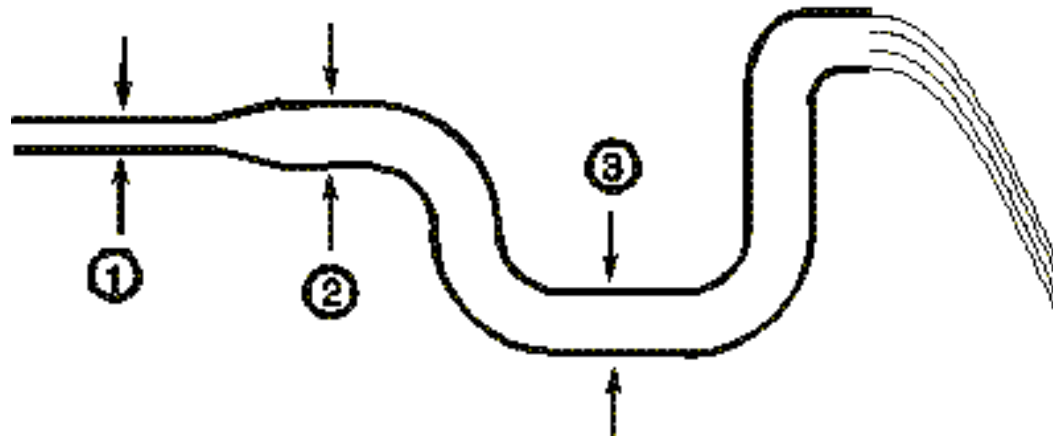
- 1) The bottom end of the slinky will immediately start falling at the same rate as the top.
- 2) The bottom end of the slinky will rise up, and the two ends will meet in the middle. Then the whole thing will fall to the floor.
-  3) The bottom end of the slinky will hang suspended momentarily, then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

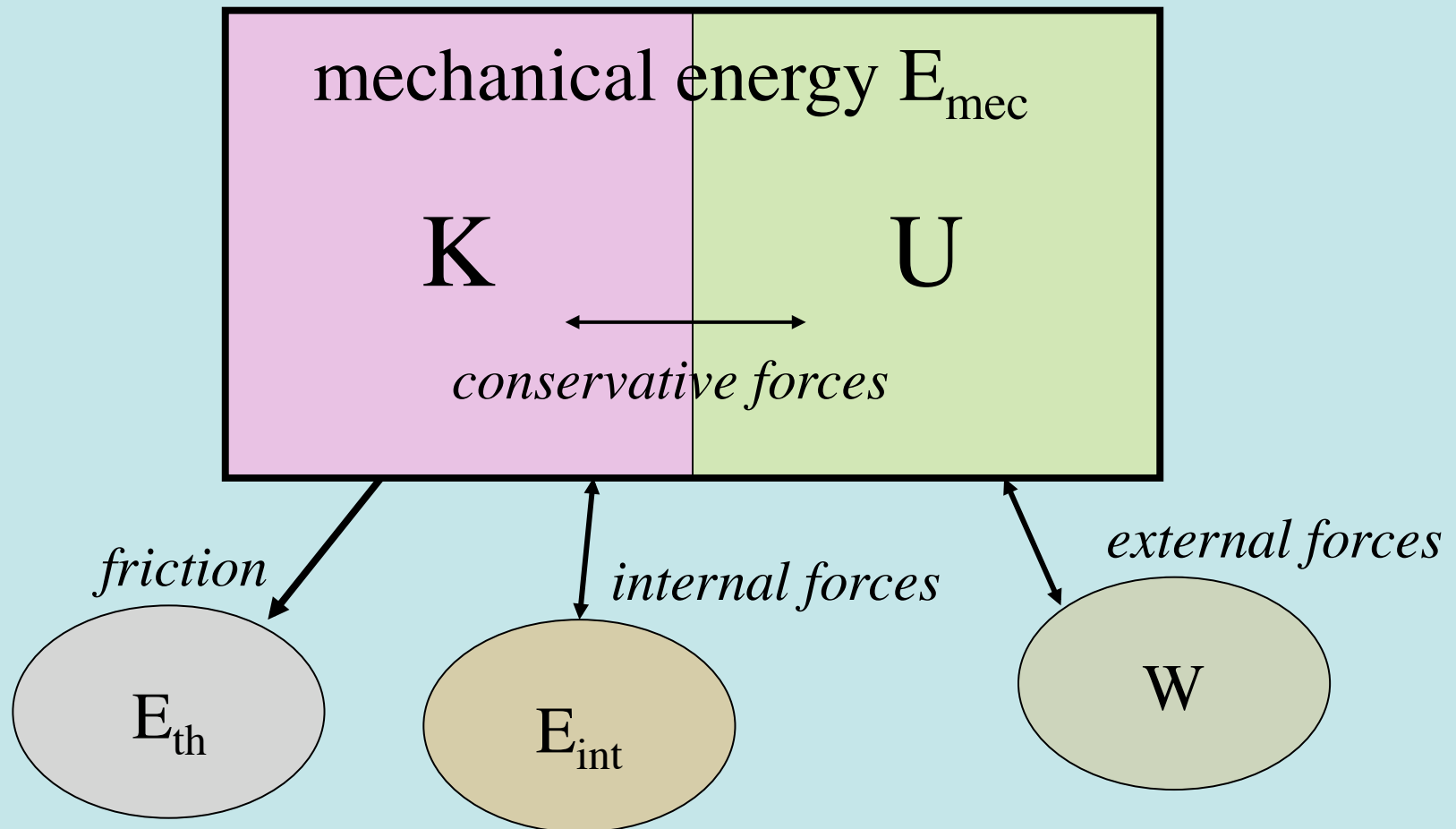
- 1) It always increases by an amount greater than mg .
- 2) It increases by an amount mg if the boat sinks, by less than mg if it floats.
- 3) It increases by an amount mg if the boat floats, by less than mg if it sinks.
-  4) It always increases by an amount mg .
- 5) It always increases by an amount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



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

Comparison of linear and rotational motion

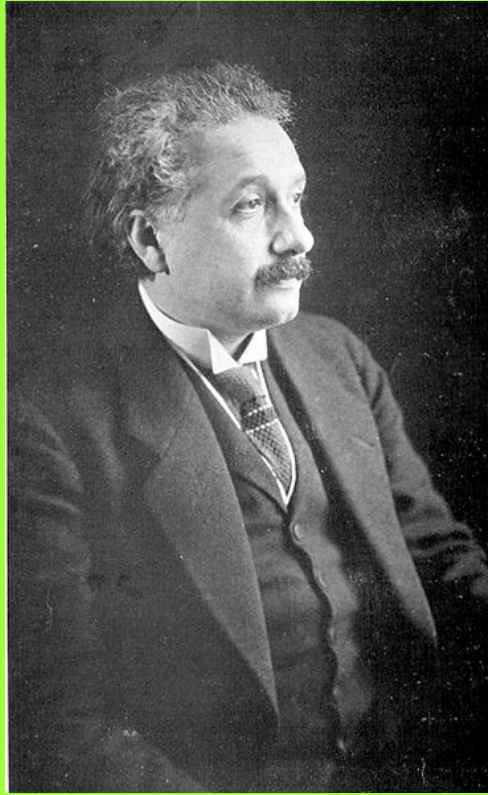
Quantity	Linear Motion	Rotational Motion
displacement	x	θ
velocity	v	ω
acceleration	a	α
inertia	m	$I \sim (\text{constant})mr^2$
kinetic energy	$K_{\text{trans}} = 1/2 mv^2$	$K_{\text{rot}} = 1/2 I\omega^2$
momentum	$p = mv$	$L = I\omega$
2 nd Law (dynamics)	$\Sigma F = dp/dt$	$\Sigma \tau = dL/dt$
work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

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!