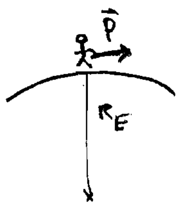
Physics 100 HW 5 (Due 2/14/07) Name S. Olsen

1. (For this question, use the center of the Earth, which is 6.4×10^6 m $= R_E$ straight down, as the pivot point.) Suppose you start from rest and then run due east at a speed of 3 m/s.



a) What is your angular momentum?

ang-mom $= m v R_E = 80\text{kg} \cdot 3\text{m/s} \cdot 6.4\times10^6\text{m} = 1.5\times10^9 \text{ kg m}^2/\text{s}$

b) Angular momentum is conserved. What compensates for your change in angular momentum? The Earth rotates in the opposite direction with equal (but opposite) angular momentum

2. A pendulum oscillates back and forth with a frequency of 0.3 Hz. How long does it take it to make 50 full swings?

T = period = time for 1 cycle $= \frac{1}{f} = \frac{1}{0.3\text{ Hz}} = 3.3\text{ s}$

Time for 50 swings $= 50T = 50 \times 3.3\text{ s} = 165\text{ s}$

3. An object oscillates with a motion that is indicated in the graph. What is the

a) Amplitude,

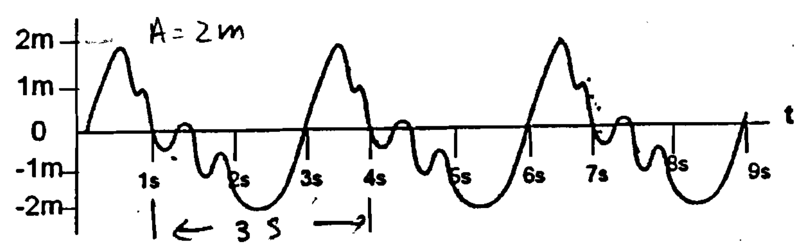
$A = 2\text{m}$

b) Period, and

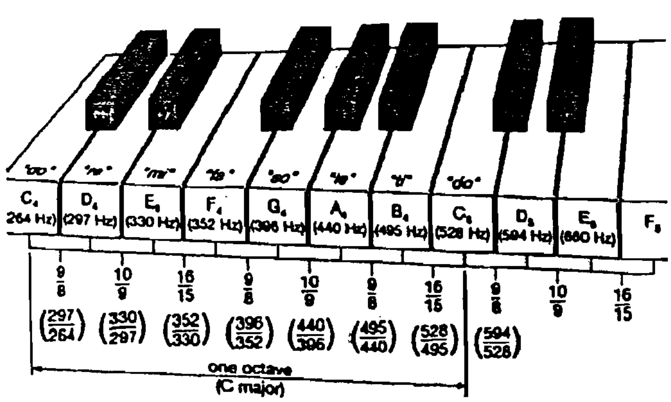
$T = 3\text{s}$

c) Frequency of this oscillation?

$f = \frac{1}{T} = \frac{1}{3\text{s}} = 0.33\text{ Hz}$

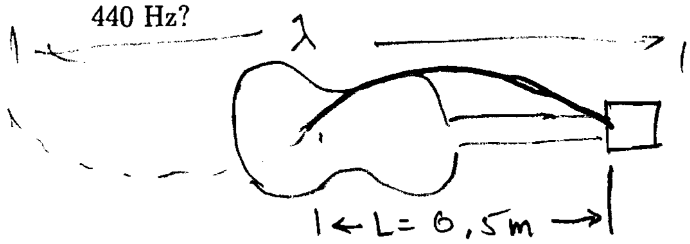


4. The frequency for some of the musical scale starting at middle C are indicated in the accompanying figure. Using a speed of sound in air of 340 m/s, compute the the wavelengths of the sound notes for the eight notes (do-re-mi-fa-so-la-ti-do).



note	f (Hz)	$\lambda = v/f$
C	264	1.3 m
D	297	1.1 m
E	330	1.0 m
F	352	0.97 m
G	396	0.86 m
A	440	0.77 m
B	495	0.69 m
C	528	0.64 m

5. What is the velocity of waves in a 0.5 m long ukulele string that has a fundamental tone of 440 Hz?



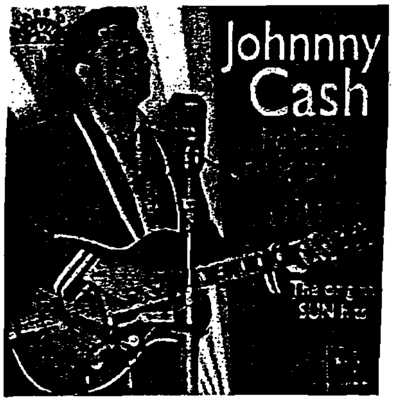
$\lambda = 2L = 2 \times 0.5\,\text{m} = 1.0\,\text{m}$

$v = f\lambda = 440\,\text{Hz} \cdot 1\,\text{m}$

$= 440\,\text{m/s}$

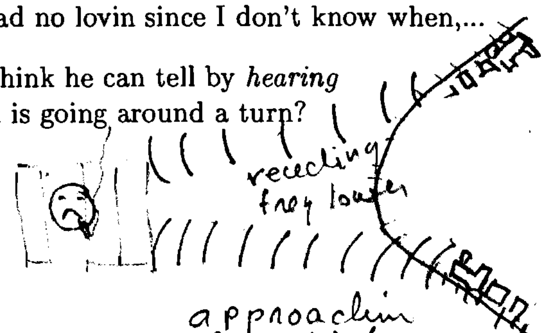
6. In the late-great Johnny Cash's famous song *Folsom Prison Blues*, he sings:

> I *hear* that train a comin, a rollin roun da bend,
> I ain't had no lovin since I don't know when,...



How do you think he can tell by *hearing* that the train is going around a turn?

Doppler effect



7. When you run, you bend your arms sharply at the elbows; it is awkward to run with your arms fully extended, as they usually are when you walking. Why the difference?

Natural freq of extended arms approximately matches the frequency that you take steps. When you run, this frequency increases. By shortening your arms, you make the natural freq of your arms higher.

8. Make a pendulum by hanging a weight from a string that is about 1 meter long.

   a) What is its frequency?

   f= 0.5 m

   b) You can make the frequency higher by shortening the string. At what length is the frequency twice as high?

   L=0.25m

   c) What happens to the frequency if you increase the weight?

   stays the same