10/19/2005. **Due:** Wednesday, Oct. 26, 2005 (in class).

# Physics 501: Classical Mechanics

*Read:* **LL** 25-26, 31-36;

Problems with stars are not for credit and will NOT be graded.

## Homework 6

### Exercise 1

Estimate quality factors of a church bell and of a simple children's toy bell.

### Exercise 2

Calculate the inertia tensor of a molecule consisting of 12 identical atoms of the mass $m$ each forming an icosahedron (the radial size of the icosahedron is $R$).

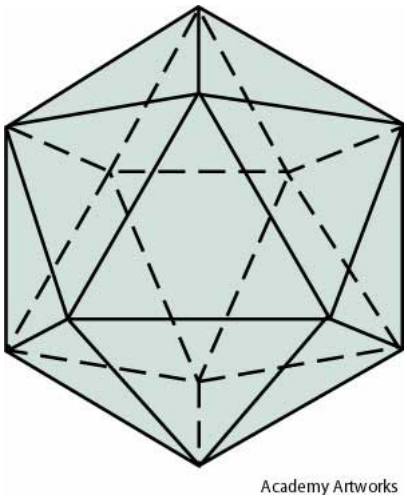


Figure 1: To Exercise 2.

### Exercise 3

A solid homogeneous cube occupies the region of space given in some reference frame by $0 \leq x, y, z \leq a$. Calculate the inertia tensor of the cube in this reference frame.

## Exercise 4

A solid homogeneous ball of the radius $R$ has a spherical cavity of the radius $r$ with the center at the distance $a$ from the center of the ball. Choose a convenient reference frame and calculate the inertia tensor of this body.

## Exercise 5

A neutron star of the mass $M = 3 \times 10^{30}$kg and radius $R = 10$km rotates with the frequency $f = 100$Hz. The star (pulsar) has a magnetic moment and radiates electromagnetic energy with power $P = 3.8 \times 10^{32}$W. Find the rate with which it slows down its rotation. For example, you can find the relative change of the frequency of rotation for the period $\Delta f/f$.

## Exercise 6 (JS 8.3)

Calculate the rotation matrix $R(\theta)$ that results from a rotation of $\theta$ about the 3 axis followed by another of $\theta$ about the 2 axis. Now calculate the result of applying them in the opposite order. Note the difference. Specialize to $\theta = \pi/2$. Find the axes and angles of the resulting $\pi/2$ rotations.