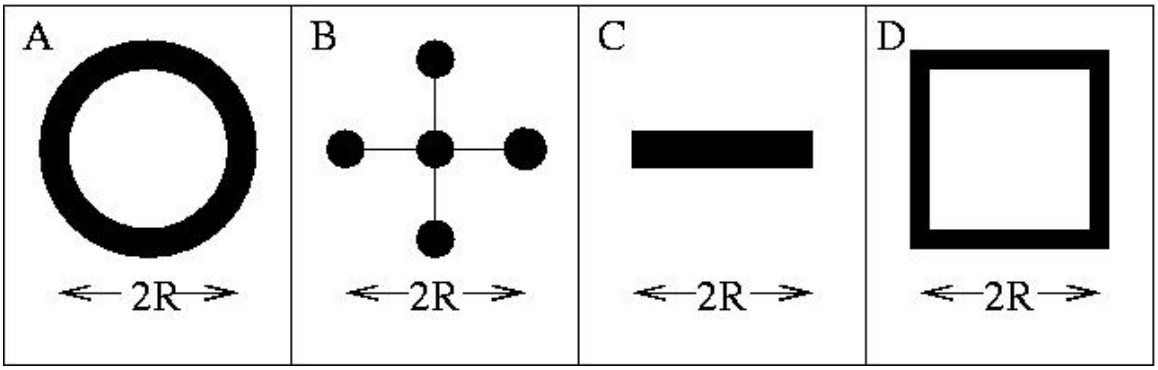
Monday March 6, 2006
In Lecture quiz #6, Physics 131
Name:_____



The four objects above are free to rotate around their centers. They are rigid bodies with various moments of inertia I_A, I_B, I_C, I_D. They all have the same mass M. Circle the correct answers. Only one is correct in each question. You should not worry about the thickness of the bars or ring, or the size of the dots in case B.

1. Which object has the largest moment of inertia (A B C D) ?
2. Which object has the smallest moment of inertia (A B C D) ?
3. Which object has $I = MR^2$ (A B C D) ?

Answers

The most important thing to remember is the formula $I = \Sigma_i M_i R_i^2$ It is easy to see that $I_A = MR^2$, and this means for question 3, the answer is A. For object B, each part has mass M/5, the central one has negligible moment of inertia, so the answer is $I_B = 4MR^2/5$. According to the table 9.2 in the book, the bar in object C has moment $I_C = M(2R)^2/12 = MR^2/3$. This is definitely the smallest of the set as can be seen by the fact that it has lots of mass near the center. So the answer to question 2 is C. The largest moment of inertia is clearly D for the reason that its mass is farthest from the center. To compute the value, notice that it consists of 4 bars, each with moment around its own center equal to $(M/4)R^2/3$, one fourth of I_C. The axis of rotation of each is shifted away from the center by R. By the parallel axis theorem, this means that the moment of inertia of each is $(M/4)[R^2/3 + R^2]$. So the total moment of inertia is $I_D = 4MR^2/3$.