Problem

As a project your team is given the task of designing a space station consisting of four different habitats. Each habitat is an enclosed sphere containing all necessary life support and laboratory facilities. The masses of these habitats are $10 \times 10^5$ kg, $20 \times 10^5$ kg, $30 \times 10^5$ kg, and $40 \times 10^5$ kg. The entire station must spin so that the inhabitants will experience an artificial gravity. Your team has decided to arrange the habitats at corners of a square with 1.0 km sides. The axis of rotation will be perpendicular to the plane of the square and through the center of mass. To help decide if this plan is practical, you calculate how much energy would be necessary to set the space station spinning at 5.0 revolutions per minute. You should also determine the effective gravity in each habitat relative to gravity on the surface of the earth. In your team’s design, the size of each habitat is small compared to the size of the space between the habitats and the structure that holds the habitats together is much less massive than any single habitat.