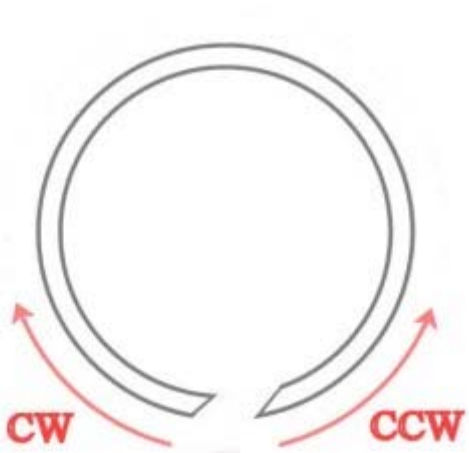
Answer #321

The answers are (a): the top must be spinning clockwise as viewed from above (arrow to the left in the sketch at the left below); (a) and (b): the sound will be heard at the beginning of the spin and continuing through the middle of the spin; and (c) the sound will be a single-frequency "humming" sound. You can hear the sound by clicking your mouse on the photograph at the left below.



When the sharp "knife edge" on the right side of the hole in the photograph cuts through the air, it creates vortexes that shed alternately to the outside and then the inside of the edge, creating "edge tones." When the angular velocity of the top is in the correct range, these vortices are shed with a frequency component at the resonant frequency of the cavity in the top, acting as a *Helmholtz* or volume resonator. This creates a beautiful humming sound, so this type of top is typically known as a *humming top*. Click on the photograph at the right to hear the tone produced by blowing into the knife edge as you would play a flute or recorder.

Note that this can only happen when the edge is moving *into* the air and thus producing edge tones. Click here to hear the sound from the top when it spins in the wrong direction.

Finally, when the angular speed of the top becomes small, as it prepares to topple, the rate at which vortices are produced falls below the resonant frequency of the cavity, so the humming is no longer created.

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For questions and comments regarding the *Question of the Week* contact

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