# 2021Q20 (ANGULAR VELOCITY, WIND SPEED)

The process of designing a wind turbine project begins with a site wind resource assessment. This assessment reveals crucial information about wind speed and wind direction at the project location. One of the many tools used in measuring wind speed is called a cup anemometer. A cup anemometer usually features three or four hemispherical cups attached to horizontal arms extending out from a vertical spinning shaft. As the wind blows, it gets caught in the cups and the anemometer starts spinning. The faster the wind blows, the faster the cups spin. Knowing how many rotations the cups make in a given time period can help us figure out the rotational frequency of the anemometer. The rotational frequency can in turn allow us to calculate the wind speed. The equation for rotational frequency is expressed as:

*Rotational Frequency (rev/sec) = No. of Rotations / Time (seconds)*

*The image below shows some of the instruments we have on top of a meteorological pole at the North Findlay Wind Campus. If you look closely, you can see a sonic anemometer (red box) at the top of the tower and two cup anemometers (blue box) placed slightly lower.*

**Level 1:** A cup anemometer has a rotational frequency of 30 rev/sec. How long, in seconds, does it take the anemometer to complete 250 rotations?

**Level 2:** Calculate the wind speed in m/s as measured by a cup anemometer, given that it has a rotational frequency of 20 rev/sec and the anemometer radius is 30 cm. Based on the calculated wind speed, should a wind turbine be operating if it normally operates when the wind speed is between 3 m/s and 22 m/s?