A 20 kg mass is attached to a string that has a breaking strength of 250 N. The mass is whirled in a horizontal circle of radius 100-m. What is the maximum speed at which the object can rotate without breaking the string?

Given:

Mass of object:	$m = 20$ kg
Maximum tension allowed on string:	$T = 250$ N
Radius of circular path:	$r = 100$ m

Determine

Maximum speed allowed to keep object in the circular path: v_{max}

The tension T on the string provides the centripetal force required to keep the object in the circular path. Centripetal force is "mv^2 / r" and acts towards the center of the circular path.

$$T = m(v_{max})^2 /r \text{ ----------------------------(1)}$$

Rearranging (1) & substituting for "T", "r" and "m" in (1):

$$v_{max} = (Tr / m)^{1/2} = (250 \times 100 / 20)^{1/2} = 35.3 \text{ m /s}$$