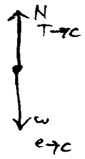
Solution to Practice Test 3, Problem 5

Student solution.



$a = \frac{v^2}{r}$

$F_{net} = ma$

$N_{T\to c} + w_{e\to c} = ma$

$N_{T\to c} + W_{e\to c} = \frac{mv^2}{r}$

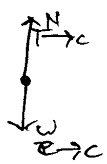
$N_{T\to c} + mg = \frac{mv^2}{r}$

$N_{T\to c} = \frac{mv^2}{r} - mg$

$N_{T\to c} = \frac{(500kg)(20.0\frac{m}{s})^2}{10\ m} - (500kg)(9.8\frac{m}{s^2}) = 15100\ N$

Need to pick a coordinate system and use it consistently. Since the Normal force points up and the Weight force points down, they cannot both be positive. Assuming up is the +y direction, the mg term here should be negative. This will yield a final answer for part A:

$$N_{T\to C} = \frac{mv^2}{r} + mg = 2.5 \text{ x } 10^4 \text{ N}$$



$a = \frac{v^2}{r}$

$F_{net} = ma$

$N_{T\to c} + w_{e\to c} = ma$

$N_{T\to c}^{\nearrow 0} + w_{e\to c} = \frac{mv^2}{r}$ Normal force → 0 at v → max

$mg = \frac{mv^2}{r}$

$\cancel{m}gr = \cancel{m}v^2$

$gr = v^2$

$\sqrt{gr} = v$

$\sqrt{(9.8\frac{m}{s^2})(15.0m)} = v = 12.12\ \frac{m}{s}$

Almost a good solution. Note the use of the free-body diagrams with good labels and the explicit use of Newton's 2nd law. For part b, the solution correctly shows that the Normal force => 0 for the case where the velocity is a maximum.

corrections

- Again the final answer has too many digits.
- The length of the arrows representing the force vectors in the free-body diagram do not reflect the relative magnitudes of the two force vectors.
- The answer for part a is incorrect. There is a sign error in the derivation. The normal force and the weight force cannot both be positive. If up is the +y direction, the weight force is (-).