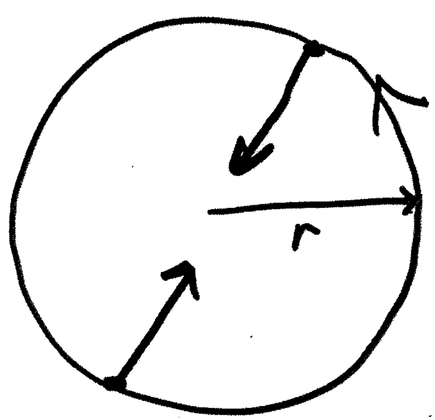
Read 5.3

Group tomorrow

office hours 1:30 - 2:30

Review

Uniform circular motion
motion in a circle with constant speed (V)



$$a_c = \frac{V^2}{r}$$

always toward center of circle

$$F_{net} = m a_c = \frac{mV^2}{r}$$

Sum of all forces in radial direction

Interactive Question

(E)

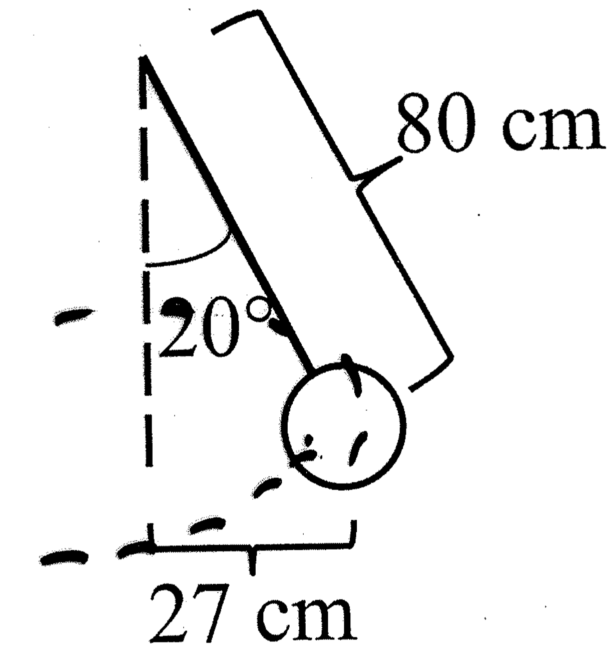
A boy is whirling a stone around his head by means of a string. Assume the string is exactly horizontal. The string makes one revolution every second and the tension in the string is T. The boy then doubles the speed of the stone, keeping the radius of the circle unchanged so that the string makes two complete revolutions every second. What happens to the tension in the string? (You can neglect the effects of gravity).

A) It remains unchanged
B) It is reduced to half of its original value.
C) It is increased to twice its original value.
D) It is reduced to one-fourth of its original value.
E) It is increased to four times its original value.

<u>Problem:</u> You tie a ball to a 0.80 m long string and rotate the ball in a horizontal circle that makes an angle of 20° with the vertical direction. The distance from the ball to the "center of the circle" is 27 cm and the ball takes 1.7 seconds to complete one circle.

(a) What is the centripetal acceleration?

(b) Why is the string at an angle?



a) want a_c

Given $r = 27m = .27m$

1.7 seconds to complete a revolution

$T = 1.7s$

$v = \frac{d}{t}$ $\quad$ $2\pi r$

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

$v = \frac{2\pi r}{T}$

$v = \frac{2\pi(.27m)}{1.7s} = .997m/s$

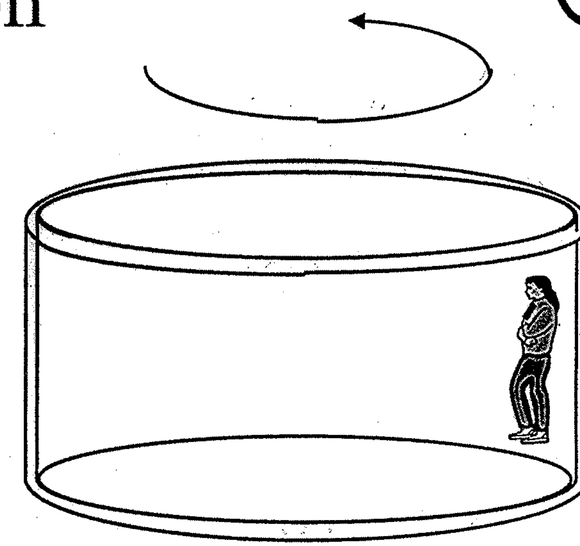
$a_c = \frac{v^2}{r} = \frac{(.997m/s)^2}{.27m}$

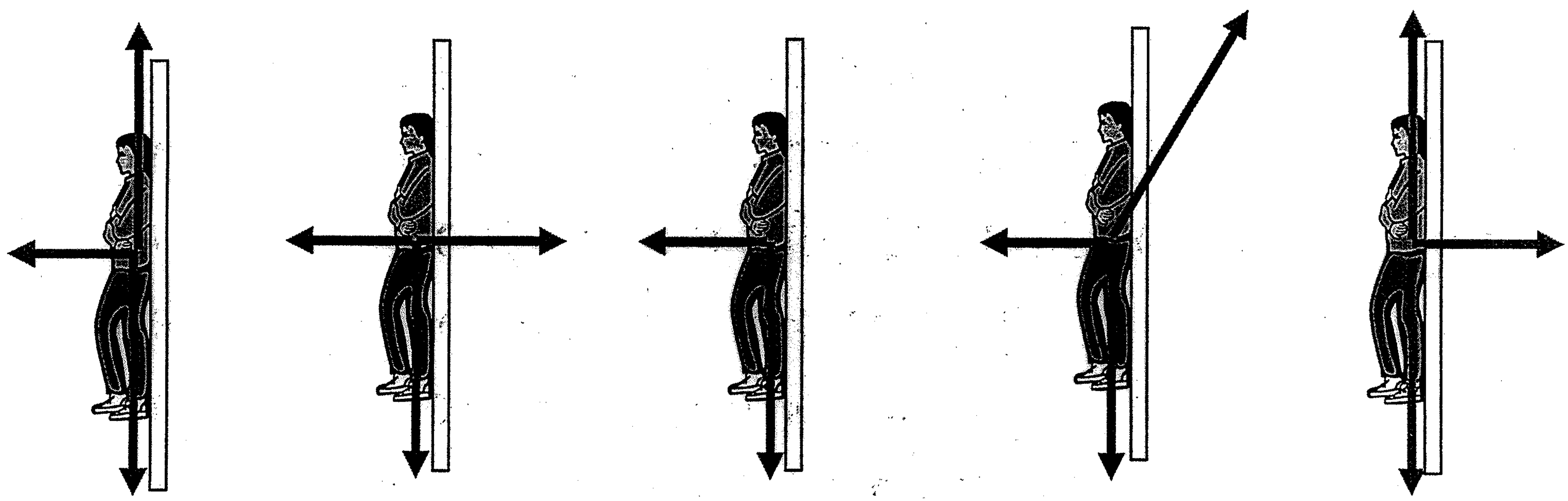
$a_c = 3.7m/s^2$

Interactive Question

A

A rider in an amusement park ride, the "barrel of fun" finds herself stuck with her back to the wall. Which diagram correctly shows the forces acting on her?

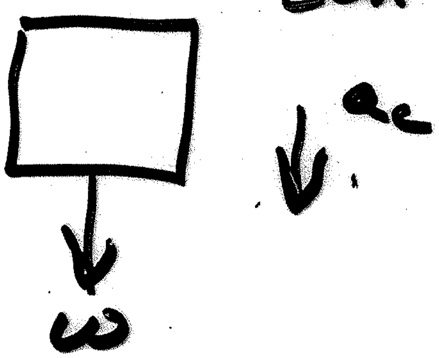




A) B) C) D) E)

<u>Problem:</u> What is the minimum velocity you can spin a can filled with water attached to a 1.0 m long string in a vertical direction without the water falling out?

can at top — Normal force = 0 N



$F_{net} = ma_c$

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

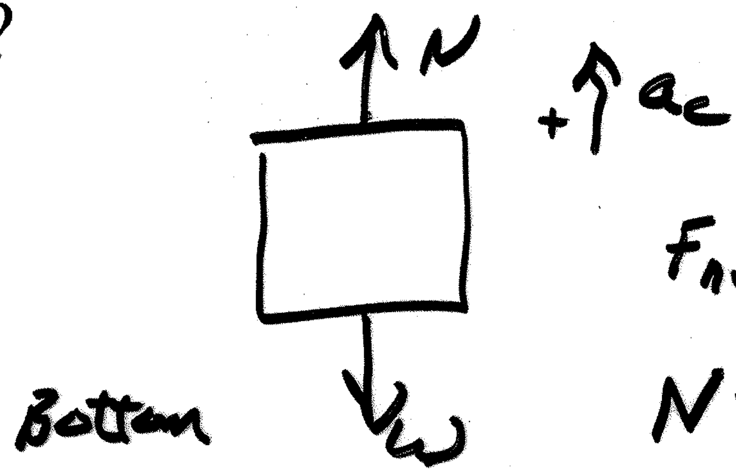
$mg = \frac{mv^2}{r}$

$v^2 = gr$

$v = \sqrt{gr} = \sqrt{(9.8\,m/s^2)(1\,m)}$

$v = 3.13\,m/s$

<u>Problem:</u> If you are spinning a can as in the previous problem, what is the normal force at the bottom of the circle?



$$F_{net} = ma_c = \frac{mv^2}{r}$$

$$N - W = \frac{mv^2}{r}$$

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

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