Fall 2000
Sid Rudolph

EXAM 3

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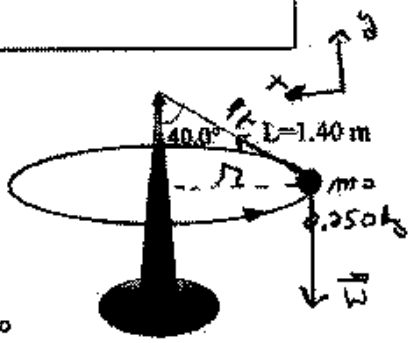
Name:_____ Student ID #:_____

TA (circle one): Beetle Flitcroft McKain Pokrovski

A 0.250 kg ball is tied to a tall pole with a 1.40 rope. The ball is then thrown so it rotates in a horizontal circle, i.e., the plane of the circle is parallel to the ground at constant speed. The rope make an angle of 40.0° with respect to the pole. See figure.



A. 4 PTS On the figure to the right, draw all the actual forces the ball feels.

B. 4 PTS What is the radius of the circular path in which the ball travels?

$r = L \sin 40^\circ = (1.40\,m)\sin 40^\circ$

$\boxed{r = 0.900\,m}$

C. 12 PTS What is the speed of the ball?

SET x AXIS TOWARD CENTER OF CIRCLE
DIVIDE TOP EQ. INTO BOTTOM EQ

$T\cos 40^\circ = mg$

$T\sin 40^\circ = m v^2/r$

$\frac{v^2}{gr} = \tan\theta$

$v = \sqrt{gr\tan 40^\circ} = \sqrt{(9.8\,m/s^2)(0.9\,m)\tan 40^\circ}$

$\boxed{v = 2.72\,m/s}$

D. 6 PTS What is the tension in the rope?

$T = \frac{mg}{\cos 40^\circ} = \frac{(.25\,kg)(9.8\,m/s^2)}{\cos 40^\circ}$

$\boxed{T = 3.20\,N}$

E. 6 PTS How much work is done by the tension the ball feels during one complete rotation of the ball?

SINCE $\vec{T} \perp \vec{v}$ AND EACH TINY DISPLACEMENT OF BALL AROUND CIRCUMFERENCE IS PARALLEL TO $\vec{v}$, IT IS ALSO TRUE $\vec{T} \perp \Delta\vec{r}$ ALL THE WAY AROUND

$W_T = 0$