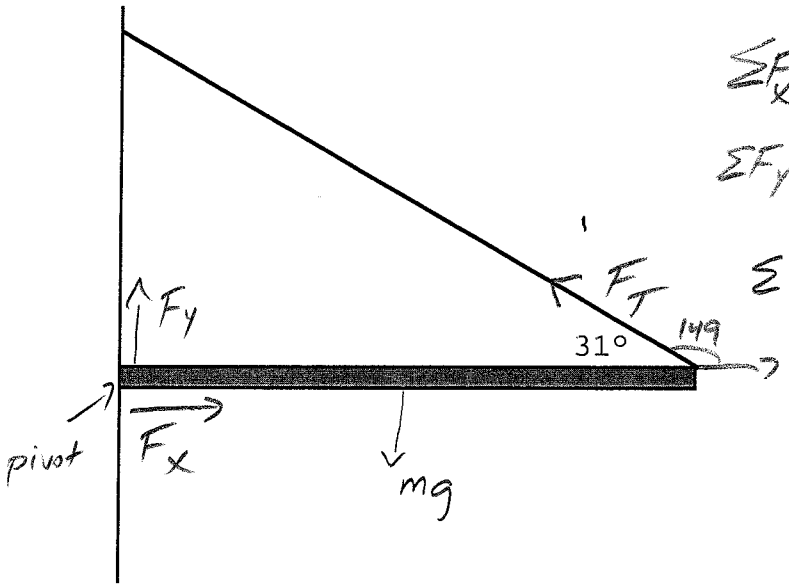
Physics 10154 - Exam #8A

Each problem is worth 50 points. Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. A uniform 45-kg beam of unknown length is attached to a wall and supported in part by a rope attached to the far end. Find the tension in the rope and the horizontal and vertical components of the reaction force of the wall on the beam.



$$\Sigma F_x = F_x - F_T \cos 31 = 0$$

$$\Sigma F_y = F_y - mg + F_T \sin 31 = 0$$

$$\Sigma \tau = \tau_{grav} + \tau_T = 0$$

$$-\frac{\ell}{2}(mg)\sin 90° + \ell F_T \sin 149° = 0$$

ℓ cancels, so $-\frac{1}{2}(45)(9.8) + F_T \sin 149° = 0$

$$F_T = \frac{220.5}{\sin 149°} = \boxed{430\ N}$$

$$F_x = F_T \cos 31 = \boxed{370\ N}$$

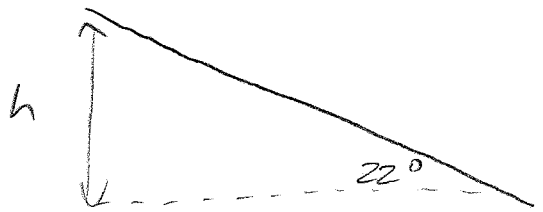
$$F_y = mg - F_T \sin 31$$

$$= (45)(9.8) - (428)\sin 31 = \boxed{220\ N}$$

2. Starting from rest, a thin ring of radius 12 cm rolls down a 2.5 meter ramp angled 22° above the horizontal.

a) What is the final angular speed of the ring at the base of the ramp?

b) What fraction of the ring's kinetic energy is rotational?



$h = 2.5 \sin 22^\circ$

$= 0.9365$

a) $W_{grav} = \Delta K$

$mgh = (1+1)\frac{1}{2}mv^2$

$v = \sqrt{gh} = 3.0\ m/s$

$\omega = \frac{v}{r} = \frac{3.0}{0.12} = \boxed{25\ rad/s}$

b) $K_r = \frac{1}{2} I \omega^2$

$= \frac{1}{2}(mR^2)\omega^2 = \frac{1}{2}mv^2$

K_T also $= \frac{1}{2}mv^2$, so $\boxed{50.\%}$