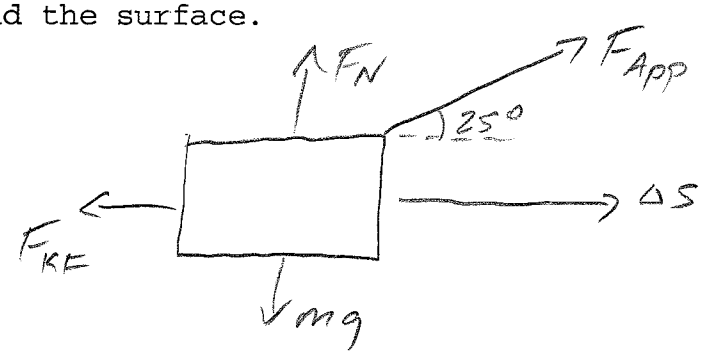
Physics 10154 - Exam #5B

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 15-kg block is pulled at a constant speed of 1.5 m/s across a rough surface by an applied force of magnitude 64 Newtons at an angle of 25° above the horizontal. Use the Work-Energy theorem to determine the coefficient of kinetic friction between the block and the surface.



$\Sigma F_\perp = F_N + F_{App}\sin 25 - mg = 0$

$F_N = mg - F_{App}\sin 25$

$= (15)(9.8) - (64)\sin 25$

$= 120\ N$

$W_N = 0$

$W_{grav} = 0$

$W_{App} = F_{App}\,\Delta s \cos 25$

$= (64)\,\Delta s \cos 25^\circ = 58\,\Delta s$

$W_{KF} = -\mu_k F_N \Delta s$

$= -120\,\mu_k \Delta s$

constant speed

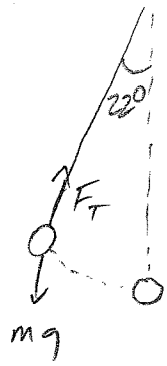
$\Rightarrow K_f = K_i$

$0 + 0 + 58\,\Delta s - 120\,\mu_k \Delta s = 0$

$58 = 120\,\mu_k$

$\boxed{\mu_k = 0.48}$

2. A marble is attached to a 4.2 meter string angled 22° from the vertical to create a simple pendulum. The marble is given an initial speed of 2.4 m/s. What is the speed of the marble when it reaches its lowest point on the pendulum?



$\Delta y = L - L\cos 22° = 0.306\,m$

$$W_T + W_{grav} = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

$$0 + mg\Delta y = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

$$(2)(9.8)(.306) = v^2 - (2.4)^2$$

$$v^2 = 5.9976 + 5.76$$

$$\boxed{v = 3.4\ m/s}$$