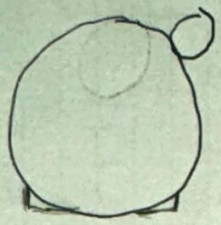
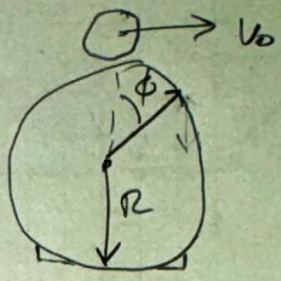
a)

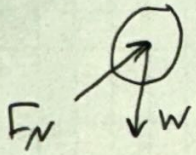
i)



About 60°



ii)



iii) To remain on the cylinder, the normal force must be nonzero

b) $PE_0(\phi = 0) = mgh = 2mgr$

c) $KE_0(\phi = 0) = \frac{1}{2}mv_0^2$

d) $\Delta KE = -\Delta PE \rightarrow -\Delta PE = PE_0 - PE(\phi)$

$-\Delta PE = 2mgr - mgr(1+\cos\phi) = mgr(1-\cos\phi)$

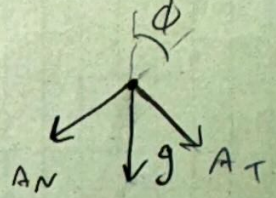
$KE_f = KE_0 + mgr(1-\cos\phi) = \frac{1}{2}mv_0^2 + mgr(1-\cos\phi)$

e) Corbis 625 $\rightarrow a_n = \frac{v^2}{\rho}$ $\quad \rho = r$

$\frac{1}{2}mv_f^2 = \frac{1}{2}mv_0^2 + mgr(1-\cos\phi)$

$v_f^2 = v_0^2 + 2gr(1-\cos\phi)$

$a_n = \frac{1}{r}\left(v_0^2 + 2gr(1-\cos\phi)\right)$



$a_n = g\cos\phi \rightarrow gr\cos\phi = v_0^2 + 2gr(1-\cos\phi)$