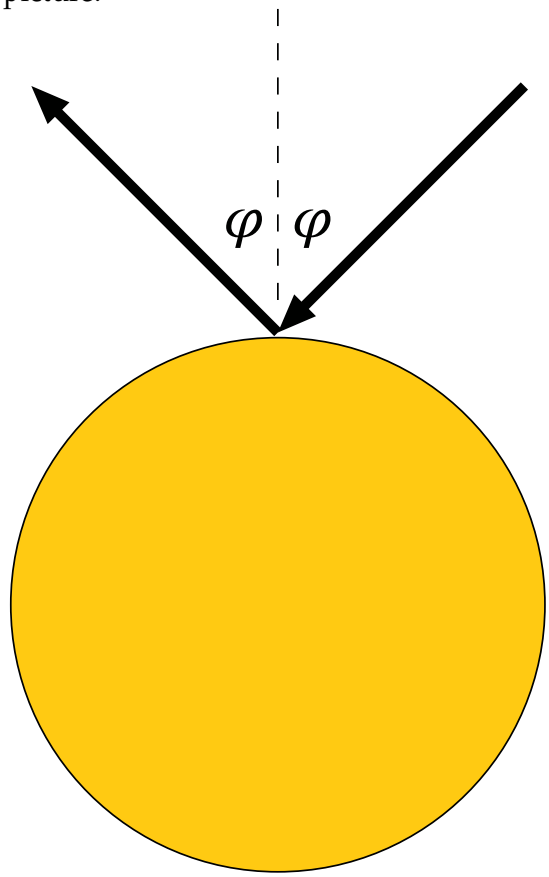
your name(s) KEY

Physics 321 Quiz #9b (20 pts. extra quiz credit) - Friday, November 9 2018

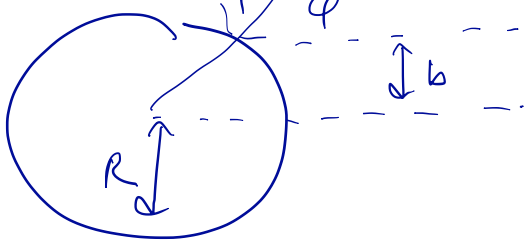
Work in groups of 2 or 3. This is open-book, open-note, open-mouth.
Consider a point particle elastically scattering off a hard spherical ball of radius $\boldsymbol{R}$. For such an elastic scattering, the incoming and outgoing angles, ϕ, relative to the direction pointing to the contact point, are equal. This is illustrated in the picture.



a. (10 pts) For an impact parameter $\boldsymbol{b}$ find the scattering angle $\boldsymbol{\theta_s}$.

b. (10 pts) Find the differential cross section, $\boldsymbol{d\sigma/d\Omega}$, as a function of $\boldsymbol{\theta_s}$.

a)



$$\Theta_s = \pi - 2\varphi$$

$$b = R\sin\varphi = R\sin\left(\frac{\pi}{2} - \frac{\Theta_s}{2}\right) = R\cos(\Theta_s/2)$$

$$\Theta_s = 2\cos^{-1}(b/R)$$

$$d\sigma = 2\pi\, b\, db = 2\pi R^2 \cos(\Theta_s/2)\cdot\tfrac{1}{2}\sin(\Theta_s/2)\, d\Theta_s$$

$$= 2\pi\frac{R^2}{4}\sin\Theta_s\, d\Theta_s = \frac{R^2}{4}d\Omega, \quad \frac{d\sigma}{d\Omega} = R^2/4$$