Consider the setup shown. Incident beam with intensity $I_0$ is unpolarized. Assume #1 transmission axis is along the $x$-axis and #2 is $30^\circ$ with respect to $y$-axis.

Find the intensity $I_1$ and $I_2$.

A) $I_1 = \frac{I_0}{2}$ and $I_2 = \frac{I_1}{4}$.
B) $I_1 = \frac{3I_0}{4}$ and $I_2 = \frac{I_1}{4}$.
C) $I_1 = \frac{I_0}{2}$ and $I_2 = \frac{3I_1}{4}$.
D) $I_1 = \frac{3I_0}{4}$ and $I_2 = \frac{3I_1}{4}$.

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Polarized light $I = I_0 \cos^2 \alpha$.

Unpolarized light $I = \frac{I_0}{2}$

Since the incident light is unpolarized, $I_1 = \frac{I_0}{2}$.

When the intermediate ray passes through the second polarizer,

$$I_2 = I_1 \cos^2 60^\circ = \frac{I_1}{4}.$$  

Answer A.