

NAME: _____

Quiz #6a:
Phys270

1. [10 pts] You have been asked to build a telescope from a 5.0x magnifying lens and a 30.0x magnifying lens.

a. [3 pts] What is the maximum magnification you can achieve?

$$M = \frac{25 \text{ cm}}{f} \quad \left. \begin{array}{l} f_{5.0x} = 5.0 \text{ cm} \\ f_{30.0x} \approx 0.83 \text{ cm} \end{array} \right\} \begin{array}{l} \text{Magnification of telescope} \\ = f_{\text{obj}} / f_{\text{eye}} = \frac{5.0}{0.83} \\ = 6 \end{array}$$

or, $f = 25 \text{ cm} / M$

- b. [4 pts] Which lens should be used as the objective? Make sure to explain your reasoning.

$|M| = f_{\text{obj}} / f_{\text{eye}}$ and we want $|M| > 1$ so that far away objects appear larger and are well separated. Hence, $f_{\text{obj}} > f_{\text{eye}}$.
Hence one should be using the 5.0x lens as the objective.

- c. [3 pts] What will be the length of your telescope?

The basic layout of the telescope (right)
We see that the length $\approx f_{\text{obj}} + f_{\text{eye}}$

$$\begin{aligned} &= 5.0 \text{ cm} + 0.83 \text{ cm} \\ &= 5.83 \text{ cm} \end{aligned}$$

