

PHYS 3345:

OPTICS

Quiz 06: Interferometer

Spring 2008

Answer each of the questions below, showing your work if necessary. Each question is worth 1 point.

Identify each of the labeled parts of the interferometer using the letter for reference.

1. Compensator: **E**
2. Adjustable Mirror: **C**
3. Movable Mirror: **D**
4. Micrometer: **G**
5. Beam Splitter: **B**

6. Which mirror does the micrometer move?

The movable mirror

7. What is the function of the compensator?

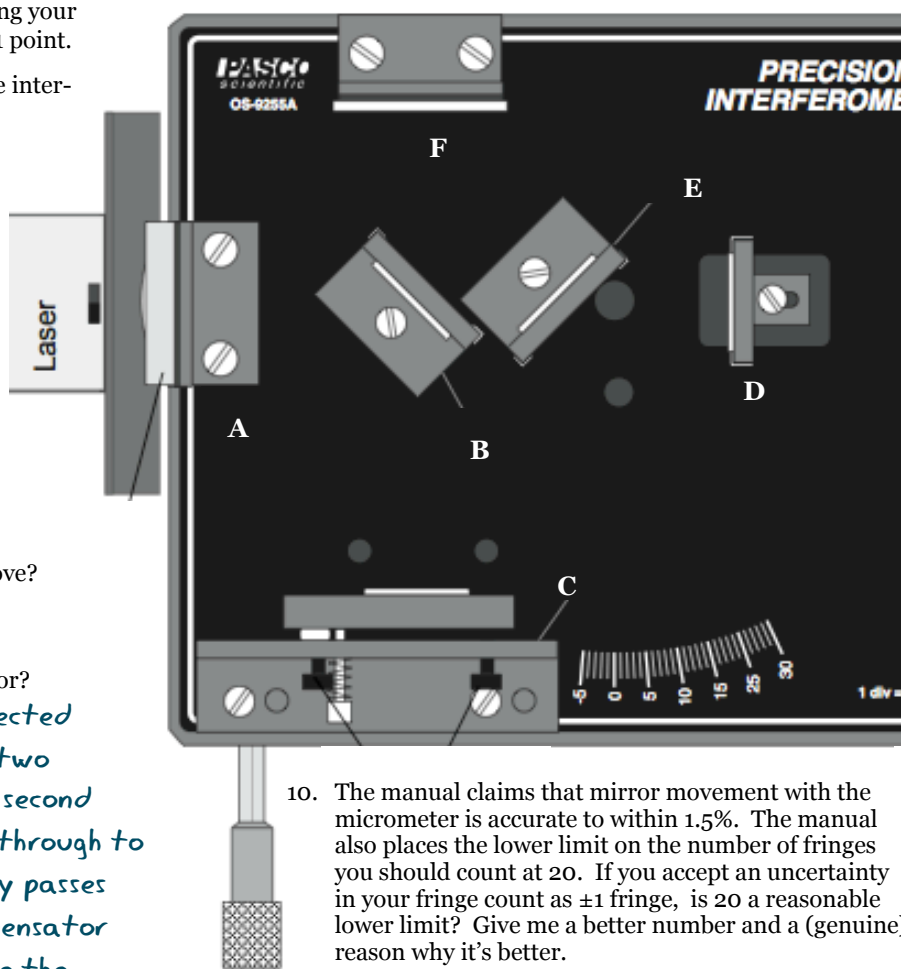
When the beam splits, the reflected part passes through the splitter two extra times: once on reflection, and a second time after bouncing off C and passing through to screen at F. The transmitted beam only passes through the splitter once, so the compensator (same thickness, same angle) makes sure the transmitted beam passes through an equal thickness of glass before it hits the screen.

8. Turning the micrometer knob through one complete revolution moves the mirror how far?

One turn = 25 microns = $25 \times 10^{-6} \text{ m}$

9. What is the technique for minimizing the effect of backlash in your measurements?

Turn the micrometer dial one complete revolution before starting your fringe count, then continue to turn the dial only in that same direction as you count fringes.



10. The manual claims that mirror movement with the micrometer is accurate to within 1.5%. The manual also places the lower limit on the number of fringes you should count at 20. If you accept an uncertainty in your fringe count as ± 1 fringe, is 20 a reasonable lower limit? Give me a better number and a (genuine) reason why it's better.

G

1 fringe out of 20 is a 5% uncertainty.

1 fringe out of 100 would be a 1% uncertainty, but you are more likely to miscount somewhere between 1 and 100 than you are between 1 and 20.

The best method would be to use more fringes, maybe 50 to split the difference between the higher uncertainty and the greater chance of actually making the mistake. To minimize the effects of random error, take more data. Repeat the measurement. Like 10 times. At least. Then have your lab partner do it 10 more times. At least. No kidding.