I. Find the wavelength:

Use the two or more thin slits of known spacing to determine the wavelength of the laser light, and compare it to the known wavelength. The lab TA knows the wavelength. This comparison will give you some idea of the experimental uncertainty for the next experiment.

II. Testing experiment:

The goal of this experiment is to test whether or not the relationship between the separation of two slits, their distance to the screen and the interference pattern on the screen is applicable to a given system of slits. You have a laser, various types of wide double-slits (ask your TA if you don't know which objects on the plate are the double slits), and a ruler. You do not need to follow the full testing rubric for the following experiment. Simply give careful responses to each of the bullet points below.

a. Choose one double-slit and set up the laser such that you obtain an interference pattern on the screen. Think what observations you should record in order to make predictions in parts b and c. Record this information in an appropriate format.
b. Use your knowledge about double slit interference to predict qualitatively what will happen to the pattern if the screen is farther or closer. Choose distances for the screen that are farther and closer, and record your predictions. Then perform the experiments and record your observations. Decide if the experimental outcomes supported your predictions.
c. Use your knowledge about double-slit interference to predict qualitatively what will happen to the pattern if the separation between the slits is different. Choose a system of slits with a different separation, and record your prediction. Then perform the experiment and record your observations. Compare your prediction and the experimental outcome.
d. For part c, what aspect of the pattern changed when you changed the slit separation? What aspect of the pattern stayed the same? Explain.

III. Application experiment:

Design two independent experiments to determine the thickness of a strand of your hair. One of the methods must involve ideas about single-slit diffraction. You have a laser which emits light of a known wavelength, rulers, a holder for the strand of hair, and a micrometer.

Any lettered section can be graded. Items which include a letter and a number in parentheses refer to a rubric ability. For example, (A3) refers to the application experiment rubric ability 3. Items without such designation are given as additional guidance.

Include in your report the following:

a. (A1) Identify the problem to be solved.
b. (A2) Design two reliable experiments that solve the problem.
c. Draw a sketch of your experimental designs.
d. Draw appropriate physical representations for each experiment.
e. (A7) Choose a productive mathematical procedure for solving the problem. Use the physical representation to devise the mathematical procedure to solve the problem for each experimental set-up.
f. (A3) Discuss how you will use the available equipment to make the measurements.
g. (A8) Identify the assumptions made in using the mathematical procedure.
h. (A9) Determine specifically the way in which assumptions might affect the results.
i. What are the possible sources of experimental uncertainty? How could you minimize them?
Perform the experiments.

j. Record the outcome of your experiments.
k. (A4) Make a judgment about the results of your experiments.
l. (A5) Evaluate your results by comparing the two independent methods. Use your uncertainty to make and explicit comparison of the two values you obtained.
m. What are possible reasons for the difference?
n. Which experiment was more accurate and why?
o. (A6) Identify the shortcomings in the experiments and suggest specific improvements.