EXPERIMENTAL EXAMINATION A

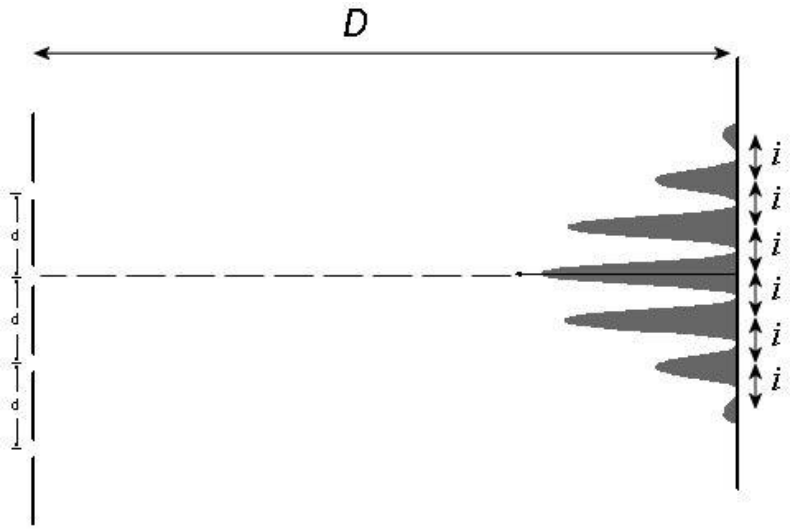
AIM: Determine the thread spacing in a fabric sample.

EQUIPMENT:

- Diffraction grating of spatial period d = (0.070 ± 0.001) mm.
- Laser.
- Two paper clips.
- Ruler.
- Card.
- Measuring tape.
- Fabric sample.
- Adhesive tape.

THEORETICAL BASIS.

A diffraction grating consists of many equally spaced slits separated by d. Normally incident coherent monochromatic light of wavelength λ produces an interference pattern of alternating intensity maxima and minima, as shown.



The separation between consecutive maxima (or minima) is

$$i \approx \lambda \frac{D}{d},$$

where D is the distance between the grating and screen. The preceding approximation requires $D \gg d$ and $D \gg i$.

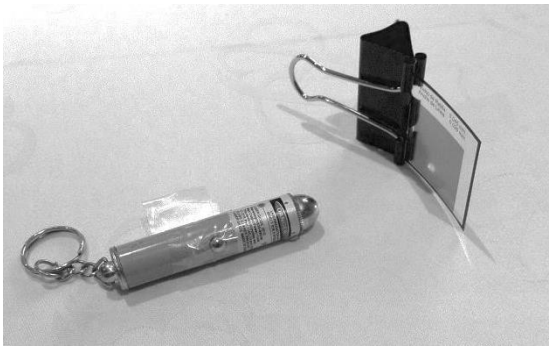
QUESTIONS:

1. Determine the laser wavelength and its uncertainty. (4 points)
2. Determine the fabric thread spacing d and its uncertainty. (3 points)
3. Describe in detail the method used in each case. (3 points)

NOTES:

- **DO NOT LOOK DIRECTLY INTO THE LASER BEAM; IT CAN DAMAGE YOUR EYES.**

- Tape the laser to the table in your setup.
- Another piece of tape can hold the switch down.
- Switch off the laser when not measuring, to avoid exhausting the battery.
- The card may be used as a screen.



XVIII OLIMPIADA IBEROAMERICANA DE FÍSICA
SANTO DOMINGO 2013-REP. DOM.

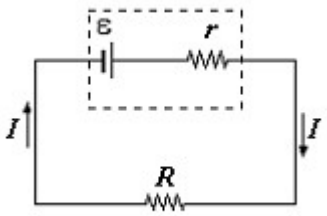
EXPERIMENTAL EXAMINATION B

CHARACTERISING A VOLTAGE SOURCE.

EQUIPMENT.

- 15 different resistors.
- Voltage source with unknown characteristics.
- Connecting wires.
- Digital multimeter.

THEORETICAL BASIS.



A real voltage source can be modelled as ideal emf ε and internal resistance r. Connecting load resistance R across its terminals gives current I. Kirchhoff's loop law gives:

$$\varepsilon - I(r+R) = 0$$

Electrical power dissipated in a resistor is:

$$P = V^2 / R$$

EXPERIMENTAL PROCEDURE

Part 1: Measure resistances *R* and their potential differences *V* to determine experimentally the source emf and internal resistance, with uncertainties. (6 points)

Part 2: Determine experimentally the external resistance for maximum power delivered by the source. Estimate its uncertainty. (4 points)

NOTE: Use the multimeter only as a DC voltmeter or ohmmeter.

