To Determine Volume of an Irregular Lamina Using Screw Gauge

Aim
To determine volume of an irregular lamina using screw gauge.

Apparatus
Screw gauge, an irregular lamina (it must be of uniform thickness), a centimetre graph paper, a pencil.

Theory
Same as in Experiment 2B.

Procedure

1. Step 1 to 9 as in Experiment 2B for the thickness of the lamina.
2. Put the lamina on a clean centimetre graph paper and mark its boundary by a sharp pointed pencil.
3. Find area of the lamina by counting small squares enclosed on graph paper by the boundary of lamina. Take half or more than half square as full and leave if less than half.

Observations
For thickness
Same as in Experiment 2B.
For area.
Number of small squares enclosed by the boundary = n

Calculations
For thickness.
Same as in Experiment 2B.
For area. Area = n mm^2 For volume.
Volume = area x thickness V = A x t = nt mm^3.

Result
The volume of the given lamina is nt mm^3

Precaution
Same as in Experiment 2B.

Sources of error
Same as in Experiment 2B.

Viva Voce

Question.1. Why is the screw used in screw gauge called a micrometre screw?
Answer. It is so called because it can measure distance correct up to a micrometre (10^{-6} metre).

Question.2. Why is a screw gauge so named?
Answer. Diameters of wires are governed by some standard numbers called standard wire gauge. As the instrument measures these diameters, it is named'screw gauge.

Question.3. What is the principle of a screw gauge?
Answer. The principle is that when an ideal screw moves in a fixed nut, the translatory motion of the screw is proportional to the rotation given to the screw.

Question.4. What are the various types of motions possessed by a screw?
Answer. The screw has two types of motions : (i) axis has linear motion, (ii) surface has circular motion.

Question.5. What is a ratchet? Explain its utility.
Answer. Ratchet is an arrangement inside the milled head (R) at the end of the screw. It prevents the screw from undue pressure.

Question.6. Define pitch of the screw gauge.
Answer. The pitch is the distance moved by the screw in one complete rotation. It is equal to the distance (measured along the axis) between the consecutive threads of the screw.

Question.7. What is least count of a screw gauge?
Answer. It is the distance moved by the screw when it is rotated by one circular scale division. It is given by

$$\text{Least count} = \frac{\text{Pitch}}{\text{No. of divisions on the circular scale}}$$

Question.8. What is the least count of commonly used screw gauge ?
Answer. It is 0.001 cm.

Question.9. What is zero error of screw gauge ?
Answer. When faces A and B of screw gauge come in contact and zero of circular scale does not come on reference line, the screw gauge has an error. This error is called zero error.

Question.10. When is the zero error positive and when is it negative in a screw gauge ?
Answer. When faces A and B of screw gauge come in contact and zero of circular scale does not cross the reference line, zero error is positive. If the zero crosses the reference line, zero error is negative.

Question.11. What are the reasons for a zero error ?
Answer. The reasons for zero error are :
(i) Wear and tear of the screw (ii) The defect in manufacturing.

Question.12. Of what metal is the screw made and why ?
Answer. The screw is made of gun metal to avoid wear and tear after long use.

Question.13. What is back-lash error?
Answer. Due to wear and tear, the screw becomes loose in the nut and may not move forward when turned in the nut. Error due to this is called a back-lash error.

Question.14. How can the back-lash error be avoided ?
Answer. It can be avoided by exerting a slight lateral pressure on the screw and by turning it always in the same direction.

Question.15. Can back-lash error be avoided completely ?
Answer. No.

Question.16. How can you find thickness of a paper by a screw gauge ?
Answer. We find thickness of 50 sheets of paper. Then calculate thickness of one sheet.

Question.17. Why do you measure the diameter of the wire in two perpendicular directions ?
Answer. It is done to eliminate error due to non-uniformity of thickness.

Question.18. Two screw gauges have equal number of divisions in circular scale. A has pitch 1 mm and B has pitch 0.5 mm. Which is more accurate and why ?
Answer. The screw gauge B is more accurate because its least count will be half of that of the A.