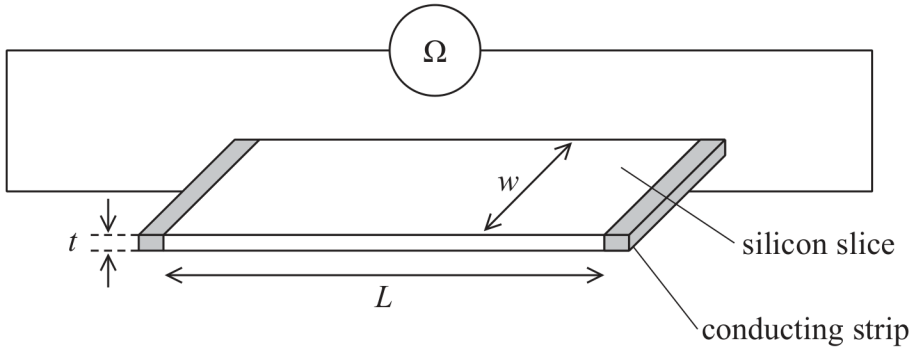
**4** A student investigated the resistance of some thin slices of silicon.

Each silicon slice had
- the same length $L$
- the same thickness $t$
- a different width $w$

Conducting strips were fitted to opposite ends of each silicon slice and connected to an ohmmeter, as shown.

The student measured values of $w$ and corresponding values of resistance $R$.




(a) The table shows the student's measurements.

| $w$ / mm | $R$ / MΩ | |
|---|---|---|
| 14 | 33.6 | |
| 18 | 26.1 | |
| 26 | 17.2 | |
| 37 | 13.3 | |
| 53 | 8.7 | |

The relationship between $R$ and $w$ is

$$R = \frac{\rho L}{wt}$$

where $\rho$ is the resistivity of silicon.

(i) Plot a graph of $R$ on the $y$-axis against $1/w$ on the $x$-axis. Use the additional column of the table for your processed data.

**(6)**

(ii) Determine $t$ using data from the graph.

$\rho = 4.0 \times 10^3\ \Omega\,\text{m}$
$L = 10.0\,\text{cm}$

**(3)**

(b) The student determined a value for $t$. She decided to measure the thickness of several silicon slices stacked together. She measured this thickness using a micrometer.

(i) Explain why this method gives a value for $t$ with low uncertainty.

**(2)**

(ii) The value of $t$ obtained using this method was 0.80 mm with an uncertainty of 2%.

Deduce whether this value is consistent with the value of $t$ obtained from the graph.

**(2)**

**(Total for Question 4 = 13 marks)**