To Measure the Refractive Index of a Liquid

Diagram

**Apparatus**
- Beaker of water
- Plane mirror
- Two pins
- Retort stand
- Metre stick

**Procedure**
1. Drop an “object” pin into the beaker of water so that it sinks to the bottom.
2. Hold a plane mirror so that its back is level with the water. Ensure that it is horizontal.
3. Hold a second “search” pin above the mirror so that its image in the mirror lines up with the image of the pin in the water.
4. Move your head from side to side to check if there is parallax between the two images. Move the search pin until there is no parallax.
5. Measure the distance from the object pin to the water level (real depth) and from the back of the plane mirror to the search pin (apparent depth) using a metre stick.
6. Repeat measurements for different amounts of water in the beaker, ensuring the back of the mirror is always level with the water.

**Results**

**Controlled Variables**
- Refractive index of water.
Results Table

<table>
<thead>
<tr>
<th></th>
<th>6.0</th>
<th>8.0</th>
<th>10.0</th>
<th>12.0</th>
<th>14.0</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Real Depth /cm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apparent Depth /cm</strong></td>
<td>4.6</td>
<td>6.2</td>
<td>7.7</td>
<td>9.1</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td><strong>Refractive index</strong></td>
<td>1.30</td>
<td>1.29</td>
<td>1.30</td>
<td>1.32</td>
<td>1.28</td>
<td>1.30</td>
</tr>
</tbody>
</table>

Graph

Calculations

- Points from graph: (0, 0), (8.0, 10.4)
- \( \text{Refractive index} = \text{slope} = \frac{10.4 - 0}{8.0 - 0} = 1.30 \)

Conclusions

- The refractive index of water was measured to be 1.30 from the graph and from calculations using the refractive index formula for liquids.
Comments

Precautions
- Ensure that the plane mirror is horizontal.
- Measure apparent depth from the back of the mirror.

Sources of Error
- Parallax error associated with measuring the real and apparent depths using the metre stick.
- Small distance measurements will result in large percentage error.

Improvements
- Line up a second search pin with the image of the object pin by holding it outside the beaker and take an average apparent depth with the mirror measurement.
- Use a larger container and place the object pin in the middle to avoid the meniscus causing errors in measurements.