Experiment Name / No.: — 04

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Aim:-

To determine the refractive index of water by using Travelling microscope.

Apparatus required :-

(i) Travelling microscope
(ii) Beaker
(iii) Pin
(iv) Water
(v) Chalk powder

Theory :-

Least Count :-

The smallest measurment of any given apparatus, instrument or any things is called least count.

∴ Least Count = 1 div of M.S.R − 1 div. of V.S.R

where,

M.S.R = main scale reading
V.S.R = Vernier scale reading

Now,

20 small div of M.S.R = 1 cm

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$\therefore$ 1 small div of M.S.R $= \frac{1}{20}$ cm

Similasly,

$\therefore$ 50 div of V.S.R = 49 div of M.S.R

1 div of V.S.R $= \frac{49}{50}$ div of M.S.R

$= \frac{49}{50} \times \frac{1}{20}$ cm

$= \frac{49}{1000}$ cm

Now,

L.C = 1 M.S.R − 1 V.S.R

$= \left(\frac{1}{20} - \frac{49}{1000}\right)$ cm

$= \left(\frac{50-49}{1000}\right)$ cm $= \frac{1}{1000}$ cm $= 0.001$ cm

We know that

Refractive index($\mu$) $= \frac{\text{Real depth}}{\text{apparent depth}}$

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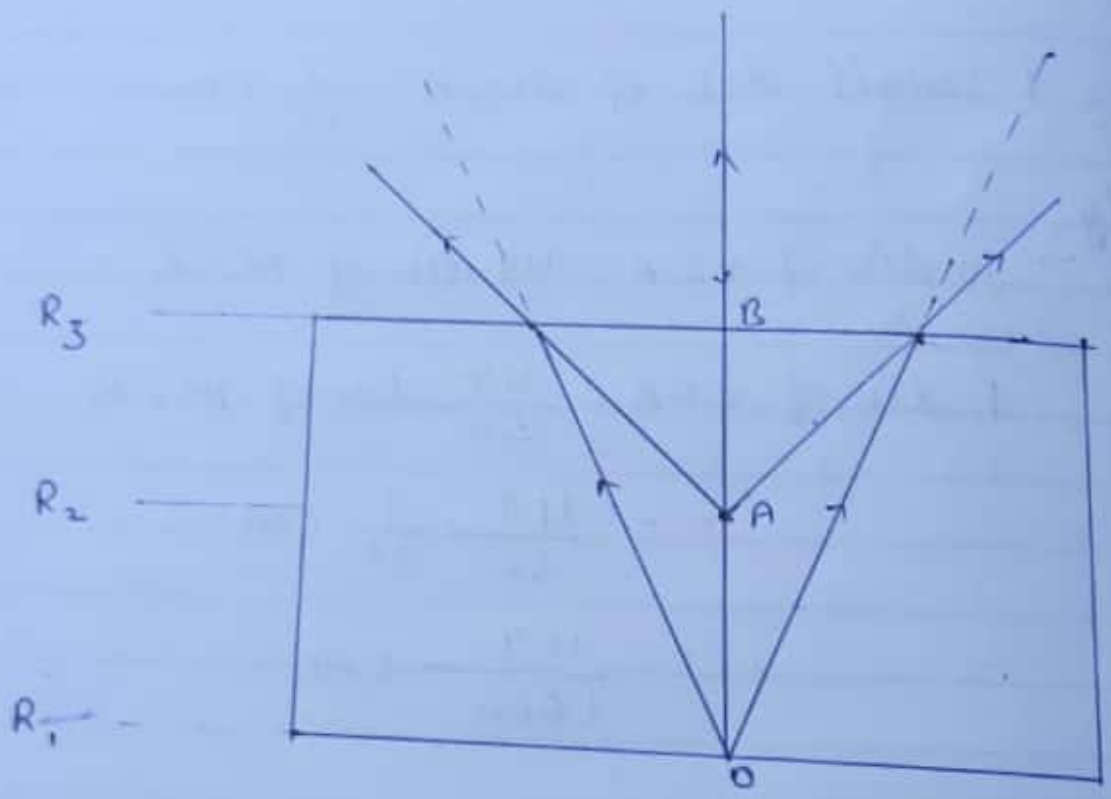

Real depth = $R_3 - R_1$

apparent depth = $R_3 - R_2$

$$\mu = \frac{R_3 - R_1}{R_3 - R_2} \quad \text{---} \quad (A)$$

Observation Table :-

| S.No. | object focused on | obs. no | M.S.R (in cm) 'A' | V.S.R (in div.) | V.S.R × L.C (in cm) 'B' | A + B | Mean |
|---|---|---|---|---|---|---|---|
| | Pin + Beaker | (i) | 1.5 | 21 | 0.021 | 1.521 | |
| 1.) | without | (ii) | 1.5 | 22 | 0.022 | 1.522 | $R_1 = 1.522$ |
| | water ($R_1$) | (iii) | 1.5 | 23 | 0.023 | 1.523 | |
| | | | | | | | |
| | Pin + Beaker | (i) | 2.0 | 25 | 0.025 | 2.025 | |
| 2.) | with water | (ii) | 2.0 | 26 | 0.026 | 2.026 | $R_2 = 2.026$ |
| | ($R_2$) | (iii) | 2.0 | 27 | 0.027 | 2.027 | |
| | | | | | | | |
| | Pin + beaker | (i) | 3.5 | 30 | 0.030 | 3.530 | |
| 3.) | with water + | (ii) | 3.5 | 31 | 0.031 | 3.531 | $R_3 = 3.531$ |
| | Chalk powder | (iii) | 3.5 | 32 | 0.032 | 3.532 | |

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Calculation :-

$R_1 = 1.522$

$R_2 = 2.026$

$R_3 = 3.531$

$\therefore \mu = \frac{R_3 - R_1}{R_3 - R_2} = \frac{3.531 - 1.522}{3.531 - 2.026}$

$= \frac{2.009}{1.505} = 1.33$

As we know that

Real value (Refsacture index) of water = 1.33

Experiment value of water = 1.33

$\therefore$ percentage of Error = $\frac{\text{Real value} - \text{Exp. value}}{\text{Real value}} \times 100$

$= \frac{1.33 - 1.33}{1.33} \times 100$

$= \frac{0}{1.33} \times 100$

% of Error = 0 %

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