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★ Experiments: 10

Objective:- Determination of the Velocity of Ultrasonic waves in a non-electrolytic liquid by Ultrasonic interferometer & also determine the Compressibility of liquid Pad.

Equipments needed:- Ultrasonic trainer kit, liquid cell, mains cord, Co-axial cable.

Procedure:-

1. Connect the mains cord to the trainer.
2. Insert the cell in base & clamp it with help of screw provided on one of its side.
3. Unscrew the knurled cap of cell & lift it away from double walled construction of the cell. In the middle portion of it pour experimental liquid (water) & screw the knurled caps as shown in figure.
4. Note: Make sure the power switch should be 'off' at time of connection.
5. Connect co-axial cable between liquid cell & recievers terminal of the trainer.
6. Switch 'on' the power of trainer.
7. Select the toggle switch of display at frequency 2 MHz.
8. Wait for 2-3 minutes until display shows a constant value of current.
9. Adjust the gain knob for maximum constant value of current.
10. Move micro-meter slowly in either clockwise or anticlockwise direction till current shows minimum

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reading on display.

11. Note the readings of micrometer corresponding to value of current. Now again rotate the micrometer in same direction until second minimum value of current occured.

12. Note the readings of micrometer in the table below.

13. Repeat the same procedure for no of consecutive minimum value of current & tabulate them.

* Observation Table :-

Sr. No.	Current (uA) Min	Micrometer reading N (mm)			Difference between consecutive Max/min $\lambda/2 = N_{n+1} - N_n$
		M.S.R	C.S.R	T.R = M.S.R + (C.S.R * L.C)	
1	25	24	36	24.36	0.88
2	25	23	48	23.48	1.24
3	25	22	24	22.24	

Where,
M.S.R = Main scale reading
C.S.R = Circular scale reading
T.R = Total reading
Mean = $\lambda/2$ = ~~0.88~~ 1.06
Wavelength λ = mm $\Rightarrow$ 2.12 $\times 10^{-3}$ m
Frequency f = 2 MHz
= 2×10^6 Hz

∴ Velocity of Ultrasonic wave :-

$$V = \lambda * f$$
$$= 2.12 \times 10^{-3} \times 2 \times 10^{6}$$
$$= 4.24 \times 10^{3} \text{ m/sec}$$

Compressibility of Liquid (B_{ad}) :-

$$B_{ad} = \frac{1}{\rho V^2} = \frac{1}{997.0479 \times (4.24 \times 10^3)^2}$$

$$= 5.5 \times 10^{-5} \times 10^{-6}$$
$$= 5.5 \times 10^{-11} \text{ m}^2/\text{N}$$

Precautions :-

1. Do not connect liquid cell to trainer without filling experimental liquid.
2. Do not tilt the liquid cell after filling the experimental liquid.
3. Remove experimental liquid from cell after performing experiment.
4. Keep micrometer open at 25mm after use.
5. While cleaning cell care should be taken.
6. Avoid to sudden rise of fall in temp, Circulate liquid to prevent thermal shock to quartz crystal

Result :-

The Velocity of Ultrasonic wave $V = 4.24 \times 10^3$ m/sec
The Compressibility of liquid $B_{ad} = 5.5 \times 10^{-11}$ m²/N

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