

Phase and Group Velocity of EM waves

Objective:

To understand the nature of EM waves travelling in a medium with the help of phase and group velocities.

Observation Table.

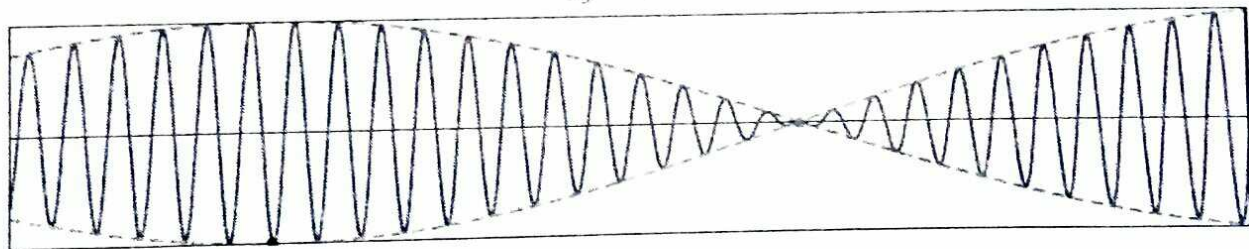
①



$$\Delta \omega = -2.41$$

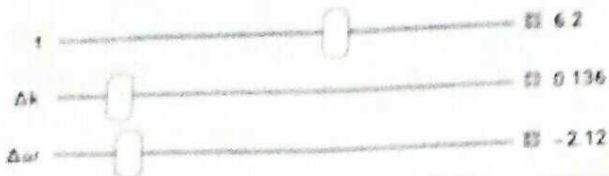
$$\Delta k = 0.123$$

$$v_g = -19.6$$



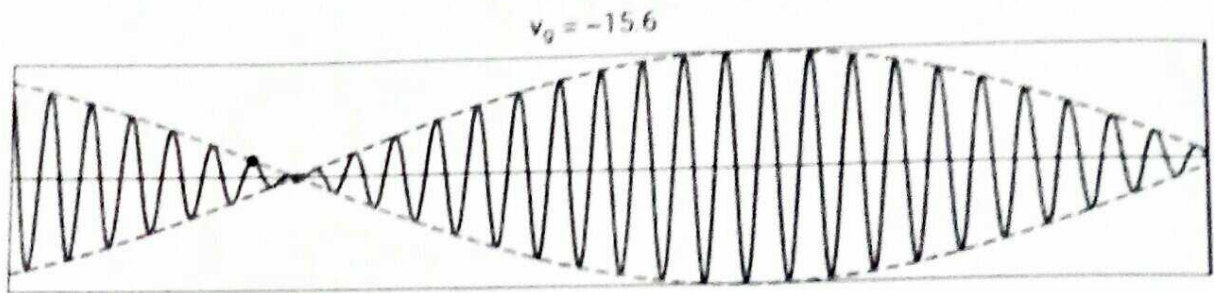
$$v_g = -19.6$$

2



$$\Delta \omega = -2.12$$

$$\Delta k = 0.136$$



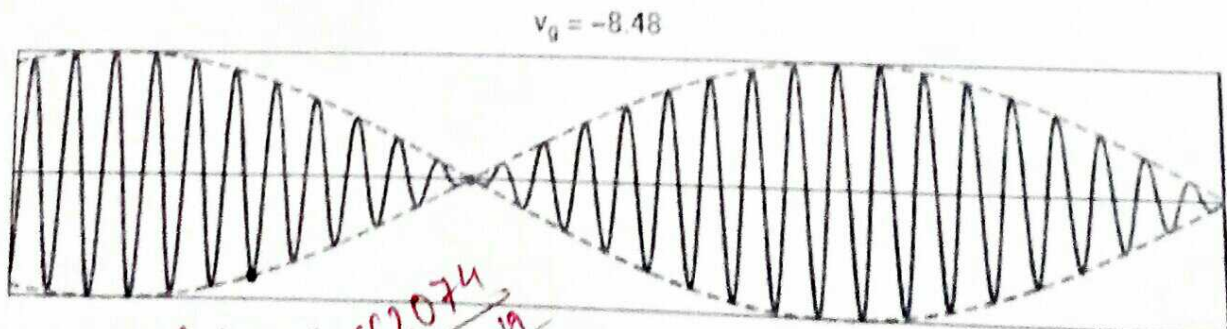
$$v_g = -15.6$$

3



$$\Delta \omega = -1.45$$

$$\Delta k = 0.171$$



Ruby 19BC02074
 0.6 24.19
 $v_g = -8.48$

Expt. No.....

Page No.....

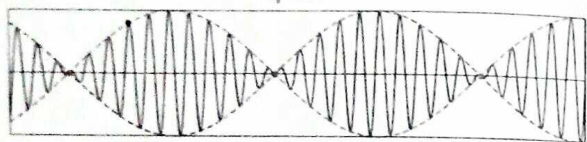
Date.....



$$\Delta \omega = 0.4$$

$$\Delta k = 0.294$$

$$v_g = 1.36$$



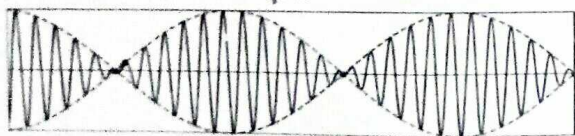
$$v_g = 1.36$$



$$\Delta \omega = 0.49$$

$$\Delta k = 0.2585$$

$$v_g = 1.9$$



$$v_g = 1.9$$

Expt. No.....

Page No.....

Date.....

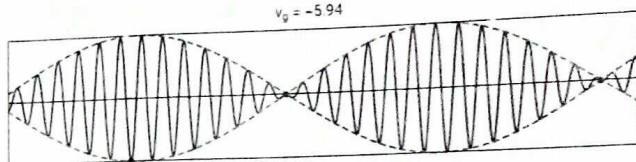
(4)



$$\Delta \omega = -1.29$$

$$\Delta k = 0.217$$

$$v_g = -5.94$$



$$v_g = -5.94$$

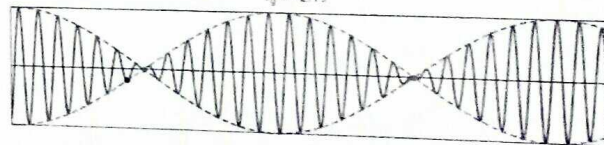
(5)



$$\Delta \omega = -0.5$$

$$\Delta k = 0.2285$$

$$v_g = -2.19$$



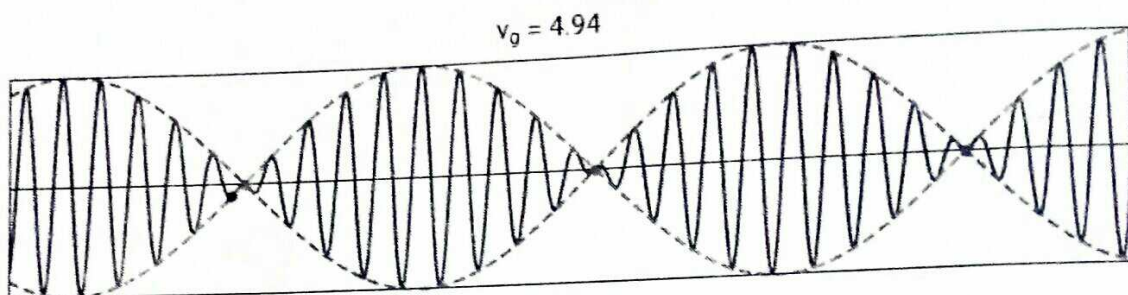
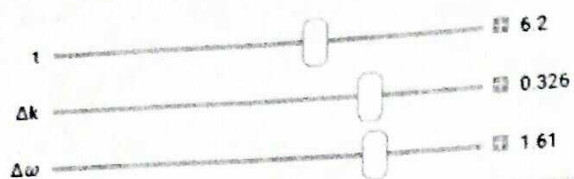
$$v_g = -2.19$$

Expt. No.....

$$\Delta\omega = 1.61$$

$$\Delta k = 0.326$$

8



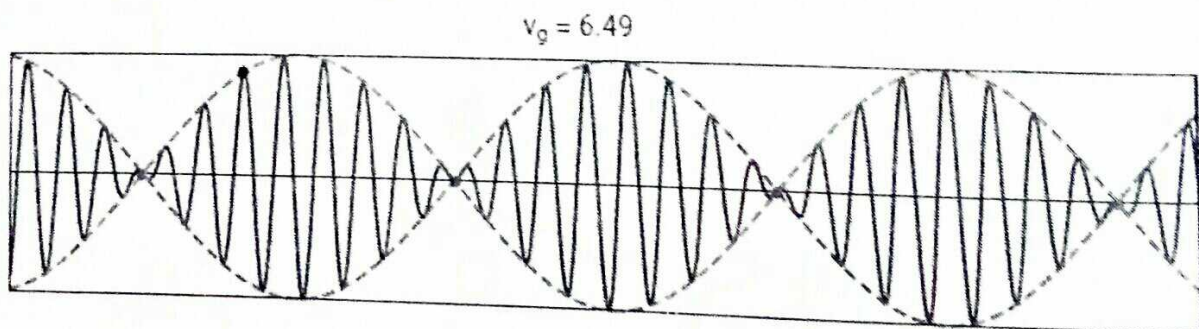
$$v_g = 4.94$$

9



$$\Delta\omega = 2.5$$

$$\Delta k = 0.385$$



$$v_g = 6.49$$

Inference :-

1) Are the wave patterns for various values of $\Delta\omega$ and Δk same? If not why?

→ No the wave patterns are not the same for various values of $\Delta\omega$ and Δk because $v_p \neq v_g$ in a dispersive medium the phase velocities of the components of the envelope causes the wave packet to "spread out" over time. v_g is same in all cases but v_p is different, therefore wave pattern is not constant.

2) Comment on the phase velocity (v_p) of the waves for increased values of $\Delta\omega$ and Δk .

→ There is no change in the value of phase velocity for increased values of $\Delta\omega$ and Δk .

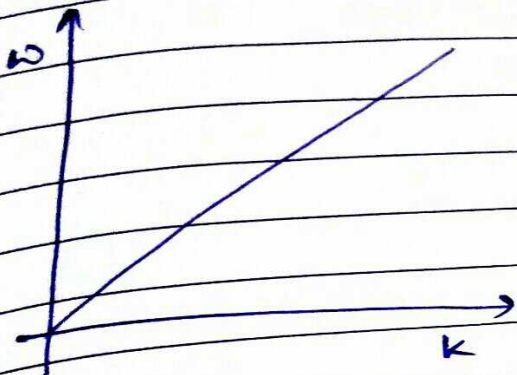
3) when do we see $v_p = v_g$?

→ When the medium is non-dispersive one and there is no change in the refractive index across the medium.

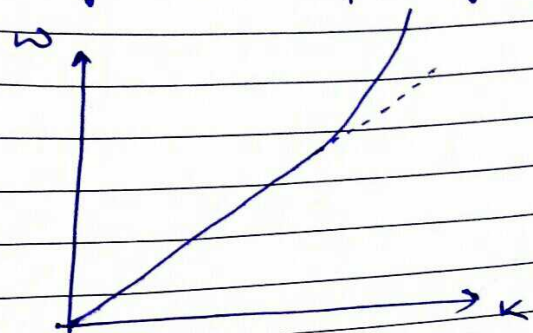
Expt. No.

Page No.

a) Draw a typical dispersion relation curve ($\omega-k$) curve for $v_p = v_g$ and $v_p \neq v_g$ cases



$$v_p = v_g$$



$$v_p \neq v_g$$

7.5
10

Ans by
17131CE2074
24.19