Physical Experiment I

The Oscilloscope

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Overall

Score

Abstract (About 100 words, 10 points)

In this experiment, we use oscilloscope to exam varying signal voltages, such voltages are usually as a two-dimensional plot of one or more signals as a functional at a time. By using the results which we observed, we can analyze some properties of wave. For instance, amplitude, frequency, rise time, time interval and so on. After finishing this experiment, I find that I understand more about how the oscilloscope work and when we use it to do some experiment. This experiment ask us to test what kind of signals we input to get the final graphs that we see from the experiment data sheet.

Score

Calculations and Results (Calculations, data tables and figures; Use about 100 words to describe your results, 20 points)

(1) Show the sample calculation of peak-to-peak voltage of the sine wave.

Assume that we read the result from the oscilloscope. We get the Y divisions, H (cm) which is the distance between the peak of two cycles and read the result of vertical sensitivity, V in cm.

$$\mathrm{H}\times\mathrm{V} = 2\mathrm{cm}\times\frac{1\mathrm{V}}{\mathrm{cm}} = 2\mathrm{V}(2 \text{ and } 1 \text{ is the number which is assumed by me})$$

(2) Show the sample calculation of the period of the sine wave.

Assume that the length, L, of a complete cycle for the sine wave in X division is 5cm, and the horizontal sensitivity, t which is 4ms/cm. Then the period of the sine wave is calculated by the following equation, which is:

$$\mathrm{L}\times\mathrm{t} = 5\mathrm{cm}\times 3\mathrm{ms/cm} = 15\mathrm{ms}(5 \text{ and } 3 \text{ is the number which is assumed by me})$$

(3) Show the sample calculation of the unknown frequency f_x in Data Table 3.3-2.

If we want to get the first Lissajous Pattern, where $\frac{N_x}{N_y} = \frac{f_x}{f_y} = 1$

Then according to the formula:

$$f_x = f_y = 50Hz$$

Score

Answers to Questions (10 points)

(1) What, exactly, is the trigging function doing that makes an AC wave form appear to stand still?

This function, Triggering control, means that we apply two sine waves with the same integral rate, which are added to the horizontal X deflection and the vertical Y deflection, respectively. It means that, if two sine waves have the same integral frequency ratio and are connected to CH1 and CH2, respectively, we can get a stable closed pattern on the screen by using X-Y mode. Such closed curve are Lissajous patterns.

(2) Is the input frequency of a signal that covers 4.2 diversions when the horizontal sweep rate is set to a 4 ms?

As we can see, there are totally ten divisions on the horizontal line. Hence in this case, the horizontal sensitivity (t) is 4/10=0.4 (ms). So the period of the signal is

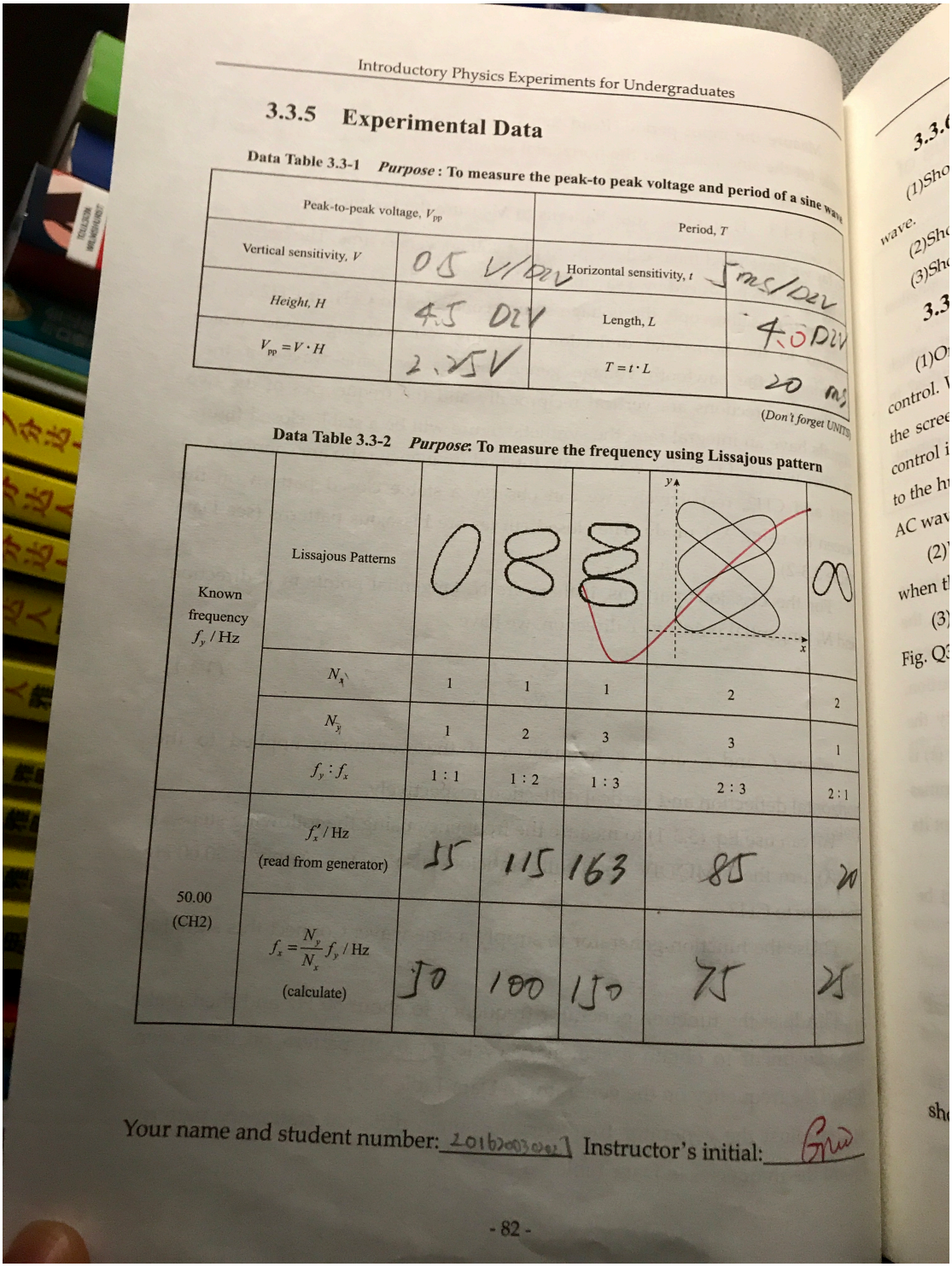
$$T = L \times t = 4.2 \times 0.4 = 1.68ms \Rightarrow f = \frac{1}{T} = 0.6Hz$$

(3) What controls on the oscilloscope need to be adjusted in order to show fewer cycles with a greater height of this signal on the screen?

If we adjust the display knobs, we can change both of the horizontal sensitivity(smaller) and the vertical sensitivity (smaller), thus there will be fewer completed periods presented in the screen, and the height will be greater.

Appendix

(Scanned data sheets)



Introductory Physics Experiments for Undergraduates

3.3.5 Experimental Data

Data Table 3.3-1 ***Purpose*: To measure the peak-to peak voltage and period of a sine wave**

Peak-to-peak voltage, V_{pp}		Period, T	
Vertical sensitivity, V	0.5 V/DIV	Horizontal sensitivity, t	5ms/DIV
Height, H	4.5 DIV	Length, L	4.0DIV
$V_{pp} = V \cdot H$	2.25V	$T = t \cdot L$	20 ms

(Don't forget UNITS)

Data Table 3.3-2 ***Purpose*: To measure the frequency using Lissajous pattern**

Known frequency f_y / Hz	Lissajous Patterns	0	8	8		∞
	N_x	1	1	1	2	2
	N_y	1	2	3	3	1
	$f_y : f_x$	1 : 1	1 : 2	1 : 3	2 : 3	2 : 1
50.00 (CH2)	f_x' / Hz (read from generator)	55	115	163	85	20
	$f_x = \frac{N_y}{N_x} f_y$ / Hz (calculate)	50	100	150	75	25

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