FARADAY'S LAW

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QUESTION

TO UNDERSTAND DEPENDENCE OF AMPLITUDE OF THE GENERATED CURRENT, TO THE VELOCITY OF THE MAGNET THAT PASSES THROUGH THE COIL AND NUMBER OF TURNS OF THE COIL

HYPOTHESIS

ACCORDING FARADAY'S LAW THE NUMBER OF TURNS OF THE COILS WILL BE DIRECTLY PROPORTIONAL TO THE EMF INDUCED IN THE COIL.

SO, IN OUR EXPERIMENT, INCREASING THE NUMBER OF COILS WILL INCREASE THE INDUCED EMF IN THE COIL WHILE VARYING THE VELOCITY OF THE MAGNET WILL NOT CHANGE THE INDUCED EMF FOR THE SAME NUMBER OF COILS.

PROJECT OVERVIEW

TWO EXPERIMENTS WILL BE PERFORMED
-IN THE FIRST EXPERIMENT WILL BE VARIED THE VELOCITY FOR SAME NUMBER OF COILS
-THE INDUCED CURRENT WILL BE RECORDED FROM THE AMMETER READINGS
-THE INDUCED CURRENT WILL BE PLOTTED AGAINST THE VELOCITY OF THE MAGNET TO SHOW THAT VELOCITY DOES NOT AFFECT THE CURRENT
-IN THE SECOND EXPERIMENT THE NUMBER OF COILS WILL BE VARIED FOR THE SAME VELOCITY OF MAGNET
- THE INDUCED CURRENT WILL BE RECORDED FROM THE AMMETER READINGS
-THE INDUCED CURRENT WILL BE PLOTTED AGAINST THE NUMBER OF TURNS OF COIL TO SHOW THAT THE RELATION IS LINEAR
-BOTH EXPERIMENTS WILL BE REPEATED FOR DIFFERENT VELOCITY AND NUMBER OF COILS RESPECTIVELY

Formula 1: $\varepsilon = -N\Delta\Phi\Delta t$

Formula 2: $\varepsilon = IR$

VARIABLES

CONTROLLED:
 NO. OF TURNS OF COIL (EXP 1), APPROACH VELOCITY (EXP 2)
INDEPENDENT VARIABLES:
 APPROACH VELOCITY (EXP 1), NO. OF TURNS OF COIL (EXP 2)
DEPENDENT VARIABLES:
 INDUCED EMF/ CURRENT

MATERIALS

COPPER WIRE
CYLINDRICAL SHELL (FOR MAKING THE COIL)
ANALOGUE AMMETER
MAGNET
METAL ROD (TO CONNECT THE MAGNET)

PROCEDURE

CONNECT THE MAGNET TO THE METAL ROD

SET THE ANALOGUE AMMETER TO (μ100A) BECAUSE THE INDUCED EMF WOULD BE VERY LOW.

ROLL THE COPPER WIRE AROUND THE CYLINDRICAL SHELL TO MAKE A COIL.

SCRATCH THE ENDS OF THE COIL, AND CONNECT THE AMMETER AT THOSE TERMINALS

MOVE THE MAGNET ATTACHED TO THE METAL ROD IN AND OUT OF THE CYLINDRICAL SHELL THIS WOULD PRODUCE INDUCED EMF IN THE COIL.

RECORD THE INDUCED CURRENT IN A TABLE BY VARYING THE APPROACH VELOCITY OF MAGNET

REPEAT WITH CONSTANT VELOCITY BUT VARYING NUMBER OF TURNS
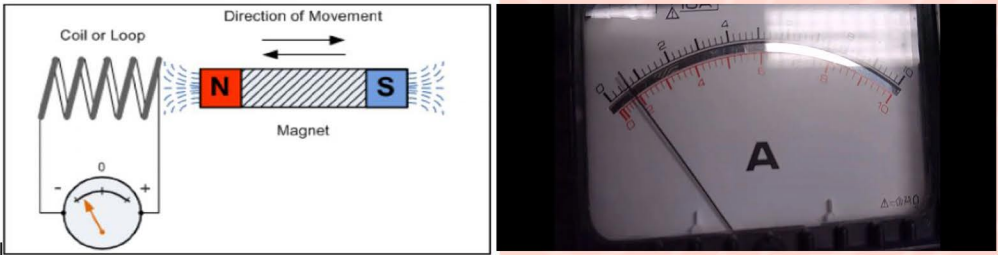
DATA/ OBSERVATIONS

EXPERIMENT 1: VARYING VELOCITY

IThe Table for Experiment 1 (varying approach velocity of magnet with constant number of turns) is as below:

Number of turns (N)	Approach velocity of Magnet	Ammeter Reading (μA)
400	Very Slow	100
400	Slow	100
400	Moderate	100
400	Fast	100
400	Very Fast	100

As shown in the graph, the current induced does not vary upon changing the approach velocity so constant trend is produced.

EXPERIMENT 2: VARYING NUMBER OF TURNS (N)

The Table for Experiment 2 (varying number of turns with constant velocity ie: moderate) is as below:

Number of Turns (N)	Ammeter Reading (A)
400	100
600	150
800	210
1000	260
1200	300
1400	340
1600	390

The Table shows that the current induced increases linearly when the number of turns of coil are increased. The average error observed is: 3.2% for the values

GRAPHS
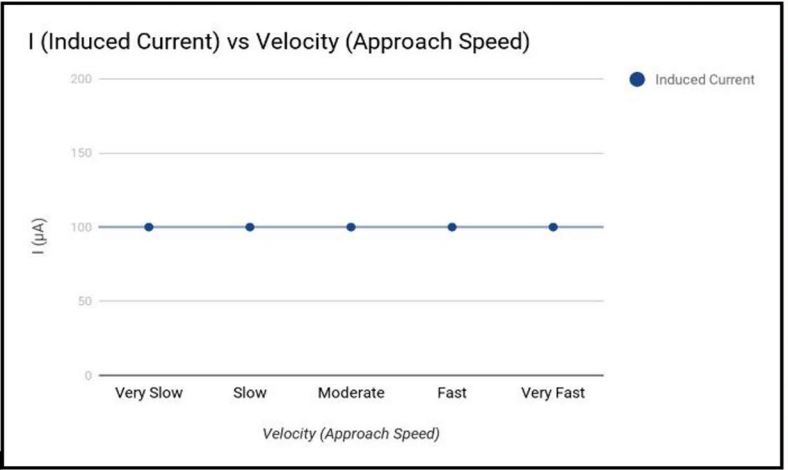
FROM THE ABOVE PLOTS IT IS EVIDENT THAT THERE IS NO LIABLE RELATION BETWEEN THE APPROACH VELOCITY OF THE MAGNET AND THE CURRENT INDUCED AND HENCE A CONSTANT GRAPH IS PRODUCED.
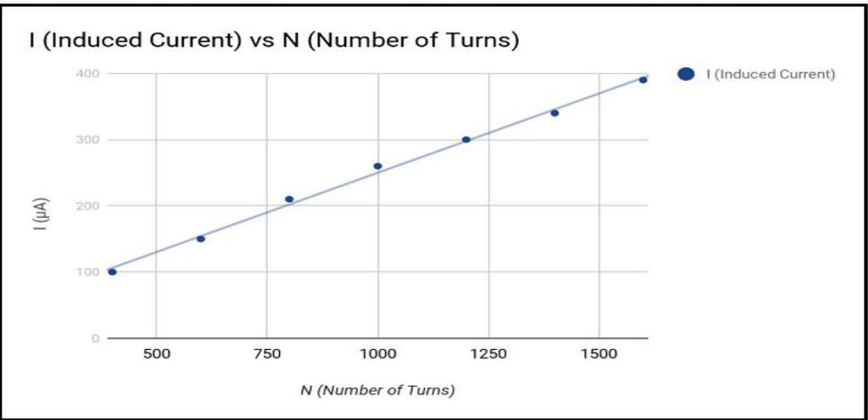
FROM PLOT 2, IT IS SHOWN THAT THE CURRENT INDUCED (I) IN THE COIL IS LINEARLY DEPENDENT ON THE NUMBER OF TURNS OF COIL (N) (AS MANIFESTED IN THE FARADAYS LAW EQUATION).

SO, THE CURRENT INDUCED IN THE COIL INCREASES WITH INCREASING NUMBER OF TURNS ON THE COIL

CONCLUSION

SINCE WE CAN SEE THAT THE FARADAY'S LAW STATES THAT THE EMF INDUCED IS DEPENDANT UPON THE RATE OF CHANGE OF MAGNETIC FLUX AND THE NUMBER OF TURNS IN THE COIL, IT WILL BE PRODUCED GREATER CURRENT UPON GREATER NUMBER OF COILS, HENCE THE RELATION BETWEEN THEM IS LINEAR. ALSO, IT WAS OBSERVED THAT THE CURRENT INDUCED IS NOT DEPENDENT ON THE APPROACH VELOCITY OF THE MAGNET AND HENCE, THE GRAPH IS A CONSTANT LINE IN PLOT OF EXPERIMENT 1.

TO ACCOUNT FOR THE ERRORS IN READINGS AND OUTLYING POINTS IN THE PLOTS, THE MANY POSSIBLE ERRORS MAY INCLUDE: INABILITY TO KEEP THE VELOCITY OF APPROACH CONSTANT IN EXPERIMENT 1, CHANCE OF INACCURACIES IN THE ANALOG AMMETER USED, EFFECTS OF EXTERNAL MAGNETIC INTERFERENCE, THE UNSTABLE CONNECTION BETWEEN THE WIRE AND THE AMMETER TERMINALS.

REFERENCES

HTTP://DEMOWEB.PHYSICS.UCLA.EDU/CONTENT/EXPERIMENT-1-MAGNETIC-FIELDS-C OILS-AND-FARADAYS-LAW (USED TO IDENTIFY THE APPARATUS AND ARRANGEMENT)

HTTPS://BYJUS.COM/PHYSICS/FARADAYS-LAW/ (USED TO FIND RELEVANT FORMULAS AND LAWS IN THE EXPERIMENT)

GIANCOLI, 6TH EDITION, PHYSICS FOR SCIENTISTS AND ENGINEERS WITH MODERN PHYSICS, PERSON. (USED FOR DEFINITION OF FARADAY'S LAW AND CONSULTATION IN EXPECTED RESULTS AND PLOTTING OF DATA)