

# physics practical report

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Part IB Physics Report

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## Abstract

Abstract Guidance:

1. This is NOT an introduction. It is a summary of the entire report. 2. Structure:
    - State the question/open problem (1-2 sentences).
    - Briefly describe what was done and how (method).
    - Present the MAIN results, including specific numerical values (e.g., power dissipated, permeability) and uncertainties.
    - Conclude with the implication of the results.
  3. Constraints:
    - No bullet points.
    - No tables or graphics.
    - No references usually.
- Paragraphs should not be single sentences.

## 1 Introduction

Introduction Guidance:

1. Context Motivation: - Why is this experiment interesting? (e.g., understanding magnetic properties of materials).
- Explain the physics FIRST, then the technical details.
2. Audience: - Write for another IB Physics student who has NOT seen the manual.
3. Content: - Briefly introduce hysteresis and ferromagnetic materials.
- State the aims: Investigate B-H curves, measure energy loss, check saturation behavior.

## 2 Theory

Theory Guidance:

1. Key Equations: - Solenoid field:  $H = I * n_p / L_p$  (Eq 6.1) - Measurement of I via  $V_x : V_x = I * R_p$  (Eq 6.2) - Induced EMF:  $E_s = n_s * d(\phi) / dt$  (Eq 6.3) - Integrator output:  $V_y$  proportional to  $B$  (Eq 6.5) - Flux in sample:  $\phi$  approx  $B_{sample} * A_{sample}$  (Eq 6.6)
2. Concepts: - Explain Hysteresis: Directional dependence, energy loss per cycle = Area of loop (integral H dB).
- Saturation: Explain that  $\mu_r$  approaches 1 at saturation.
3. Conventions: - Variables in italic (e.g.,  $B$ ,  $H$ ), Units not in italic (e.g.,  $T$ ,  $A/m$ ).
- Define all symbols before use.

## 3 Experimental Setup

Experimental Setup Guidance:

1. General: - Do NOT rewrite the lab manual step-by-step.
- Focus on what is relevant for the reader to understand the results.
2. Apparatus: - Include a schematic diagram of the setup (Solenoid, Secondary coil, Integrator, Oscilloscope).
- Describe the integrator circuit (R and C values) and why it's used.
- Mention the calibration step using the air core (linear B-H).
3. Samples: - List the materials tested: Mild steel, Transformer iron, Cu/Ni alloy.
- Mention the temperature variation setup for Cu/Ni.

## 4 Results

Results Guidance:

1. Graphs (Crucial): - Plot Hysteresis loops ( $B$  vs  $H$ ) for Mild Steel and Transformer Iron. - Plot loops for Cu/Ni above and below 40 deg C. - Ensure axes are labeled (Quantity / Unit). - Include ERROR BARS on graphs. - Use solid data markers. 2. Quantitative Results: - Calculate and report Power dissipated per unit volume ( $P / V$ ): Area of loop). - Report Relative Permeability ( $\mu_r$ ): Max, Min, and Range. - Compare values for different materials. 3. Presentation: - Figures must have detailed captions describing the features. - Refer to every figure in the text.

## 5 Discussion

Discussion Guidance:

1. Interpretation: - Do the results match theoretical expectations? (e.g., Does  $\mu_r$  approach 1 at saturation?) - Discuss the shape of the loops. 2. Comparison: - Compare your results with literature values (cite references). - Compare the materials (Steel vs Iron vs Cu/Ni). 3. Uncertainties: - Critical evaluation of Systematic and Random errors. - Discuss the limitations of the apparatus (e.g., temperature measurement accuracy for Cu/Ni). - How do uncertainties affect your conclusions?

## 6 Conclusion

Conclusion Guidance:

1. Summary: - Summarize the main findings (Power dissipated,  $\mu_r$  values). - State whether the aims were achieved. 2. Final Remarks: - Comment on the validity of the method. - No new information should be introduced here. - No bullet points.