

英汉双语教材

英汉 English-Chinese

大学物理实验

(第2版)

College Physical Experiment
(2nd edition)

主 编 刘传安
副主编 杜旭日
王卫林
方传代

 天津大学出版社
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修订版前言

本书 2005 年 8 月出版以来,得到了读者的大力支持,许多同行专家提出了宝贵的建议,我们据此对本书进行了修订。

本书共编入实验 61 个,比第一版增加了 11 个实验,其中力、热实验 1 个,电磁学实验 4 个,光学实验 6 个,同时本书增加了设计性实验 14 个,分光计的调节增加了一些附图,订正了发现的错误。

增加的内容由刘传安执笔。

我们感谢读者给予的支持,希望读者继续对本书提出批评和建议。

编者

2007 年 9 月

第一版前言

普通物理实验是理工科学生必修的一门重要基础课程。物理实验的重要性不仅表现在通过实验发现物理定律,而且表现在物理学中的每一次重要突破都与实验密切相关。物理实验在大学教育中的重要性不言而喻。随着改革开放的深入和我国加入 WTO,物理教学的国际交流日趋频繁,迅速培养既懂业务,又精通外语的科技人才是现代教育的当务之急。近年来,各高校大力提倡双语教学,但物理双语教材严重缺乏,特别是适合一般院校使用的物理实验双语教材更难以找到。为了填补这一空白,我们特编写了本书。

鉴于目前地方院校学生的英语水平参差不齐,为了便于学生学习,我们采用英汉对照编排。在误差数据处理方面,按照现代国际科技文献和实验的结果表述要求,我们采用计算结果的标准不确定度,并选择一些有代表性的实验进行了测量举例。全书共编入实验 50 个,其中力学实验 26 个,电磁学实验 16 个,光学实验 8 个。

全书由刘传安策划和统稿。其中:绪论、测量仪器、力学实验和测量举例部分由刘传安执笔;电磁学实验由杜旭日执笔;热学实验由王卫林执笔;光学实验及部分测量举例由方传代执笔。李翔一为本书提供了英文指导。另外,袁新梅参与了绪论的编译及部分测量举例的数据处理;罗小凤进行了图表的绘制和书稿校对;张山彪、吴春晓也对本书的编写提出了很好的意见。参加本书编写讨论的还有张斌、陈亮、褚玉芳、周珺、吴校习等。

本书可供理科、工科、师范院校物理专业选作物理实验双语教材,也可供理工科、专科院校非物理专业和电大、职大选作物理实验(双语)教材。

本书编写过程中参考了杨述武主编的《普通物理实验》和伯克利《大学物理实验》,此外还参考了许多其他大学教材,在此不一一指明,特致谢意。天津大学出版社为本书的编辑出版做了大量工作,深表感谢。

由于水平有限,书中难免有缺点和错误,恳请读者不吝赐教。

编者

2005 年 8 月

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Introduction

1. General Instructions

1.1 Presentation of Experiments

The method adopted for describing the experiments is usually as follows.

Heading: This is a statement (in **heavy type**) of the principle being investigated, or of the determination being made.

Apparatus: This is a list of the apparatus required, omitting such equipment as is commonly to hand such as balances, metre rules, wire, etc.

Theory: This is usually a short section designed to refresh the memory on relevant theory. Occasionally more detail may be given—in cases where a little more help has been found by experience to be needed.

Procedure: Here the actual experimental instructions are given.

Record and Calculation: In this section suggestions are often made as to how the observations should be set out in a notebook. These suggestions are by no means obligatory, and should be discarded if a different presentation is preferred. Any guidance needed in the calculation is also given in this section.

1.2 Instructions Which Apply to All Experiments

Read the experiment heading carefully and

绪论

1. 一般说明

1.1 实验概述

本书采用下述方法叙述实验。

标题:用黑体字交代所要研究的原理或所要做的测定。

仪器装置:是所需要的仪器的目录,天平、米尺、导线等常用仪器和元件一般不列入。

原理:介绍实验原理,一般比较简短,但是,在经验表明需要给实验者较多帮助的地方则比较详细。

实验步骤:对实验给予具体指导。

数据记录与处理:这部分指出在记录本上怎样记录实验数据。不必拘泥于这些提示,读者可以使用其他更好的方法。此外,在这部分还有必要的处理数据方面的指导。

1.2 适用于所有实验的注意事项

仔细阅读实验标题,

be sure that you have grasped precisely what it means. This is a practical book; at times it reminds you of theoretical points, but it does not pretend to deal with them completely. It is assumed that if you are not familiar with the theoretical matter concerning any experiment, you will take the steps necessary to acquire this knowledge before beginning the experiment. Thus, the frequent use of the words "it can be shown" to introduce a formula or expression should be taken as an instruction to find out how it is shown, if this is not already known.

Read right through all that is given about the experiment, so that you have a clear idea of all that you have to do, the precautions you have to take and the kind of record you have to make.

Examine the apparatus to be used, and if you have any doubts about any of it ask for a demonstration.

Carry through the operations in the orders that are given, remembering that this book has not been written for those who blunder from one operation to the next without having understood the whole experiment.

Record all observations in ink in your notebook as you make them.

Put your apparatus away in its proper place when your experiment is finished.

准确理解它的意思。这是一本实践方面的书,书中有的地方提示一些理论要点,但不作系统完整的讨论。如果你不熟悉实验涉及的理论知识,我们设想你在做实验之前会设法去掌握它。因而常用“可以表明”来引出一个公式或表达式。

阅读实验指导全文,对需要做的事情、需要注意的事项及需要做的记录,都能“心中有数”。

检查要用的仪器,如有疑问应请教老师。

按给定的实验步骤进行实验操作。要记住,本书不是为不了解整个实验、只会盲目机械地从一个操作到下一个操作的人写的。

把观察到的一切数据记在笔记本上。

做完实验后,把仪器物品放回原处。

1.3 Your Laboratory Notebook

In your practical notebook, a record of all you do must be kept. The record of each experiment should be started on a fresh page and should normally consist of five main parts:

- ① The heading together with the date;
- ② The observations;
- ③ The calculation;
- ④ The account of the method, accompanied wherever appropriate by a diagram. In the case of electrical experiments a circuit diagram is essential;
- ⑤ The statement of result, including the standard uncertainty.

We will consider these five sections in turn.

① The heading should be a concise statement of the aim of the experiment, with perhaps a phrase indicating the method to be used. The date is an important part of the heading.

② The observations should be recorded in ink in your notebook immediately after they are made. This point cannot be overemphasized. The use of loose pieces of paper, and of pencil, is strongly condemned for the following reasons.

(a) It is a waste of time, as all your observations must be presented in the final record.

(b) It is slovenly, and may lead to confusion.

1.3 实验记录本

必须在记录本里记录你所做的一切。每个实验的记录都应从新的一页开始。它应包括5个主要部分:

- ① 实验标题和日期;
- ② 观测数据;
- ③ 计算;
- ④ 实验方法的有关说明,必要时可画出图表,做电学实验要画出电路图;
- ⑤ 实验结果,包括标准不确定度。

下面我们依次说明这5个部分。

① 标题应就实验目的作简明的叙述,间或指明所用方法。必须写上实验日期。

② 得到观测数据后,立即用钢笔记在记录本上。这点很重要。绝不能使用零散纸张和铅笔,理由如下。

(a) 那样做浪费时间,因为所有观测数据最终要记到固定的记录本中。

(b) 那样做显得潦草,可能导致混乱。

(c) It may lead to non - scientific methods of working, by giving you the opportunity to select observations which you think superior to those you reject—without giving any reason for this selection. Usually the motive for this is to “get the right answer”—whatever that may mean. Remember that there is no “right answer”. Kaye and Laby’s tables tell you what more experienced experimenters have found for the values of many important quantities; and it is certainly worth while to see how your answer compares with the generally accepted value. But if you should happen to “agree with it” you are more likely to have been lucky than clever. What you should do is to see whether the accepted result lies within the range of values which you obtained, by considering the error of your experiment.

Do not omit to record the standard uncertainty of each observation and to state the units in which you are working.

③ The calculation should be neatly set out and intelligible, so that if necessary it can be checked without your being present to decipher

(c) 那样做可能导致不科学的工作方法。因为它使你有机会为了要“得到正确的答案”——不管其含义如何,而去选用你认为较优的某些数据,舍弃你认为较劣的某些数据——而不阐述取舍的理由。要记住,不存在什么“正确答案”,通常在教材和资料中引用的重要物理量的公认值,是由许多有经验的实验工作者反复测定的。把你的实验结果与公认值作比较,无疑是有意義的。但是,如果你的结果和它“完全一致”,那多半是碰巧而不是你的高明,应该考虑你的实验结果的标准不确定度,从而弄清公认值是否在你得到的结果的标准不确定度之内。

记录中不要遗漏每个观测数据的标准不确定度,也不要忘记标明所用的单位。

③ 简洁明了地表述计算过程,以便必要时无须解释就能验算。不要混淆