

**THE ELEMENTS OF  
EXPERIMENTAL PHYSICS,  
ACOUSTICS, LIGHT AND HEAT,  
MAGNETISM AND ELECTRICITY**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649571499

The Elements of Experimental Physics, Acoustics, Light and Heat, Magnetism and Electricity by  
J. C. Buckmaster

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.  
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

[www.triestepublishing.com](http://www.triestepublishing.com)

**J. C. BUCKMASTER**

**THE ELEMENTS OF  
EXPERIMENTAL PHYSICS,  
ACOUSTICS, LIGHT AND HEAT,  
MAGNETISM AND ELECTRICITY**



THE ELEMENTS  
OF  
EXPERIMENTAL PHYSICS

ACOUSTICS, LIGHT AND HEAT  
MAGNETISM AND ELECTRICITY

BY  
J. C. BUCKMASTER



LONDON  
LONGMAN, GREEN, LONGMAN, ROBERTS, & GREEN  
—  
MDCCLXIV

196. g. 2.

## P R E F A C E

---

THE following elementary work has been written with a desire to facilitate the study of Experimental Science. It is not intended as an elaborate treatise, but as a compact Text-Book.

The principles of Science are now so intimately associated with the arts and occupations of every-day life, that the importance of scientific knowledge, as a part of general education, can no longer be disregarded, and every facility should be given to systematic courses of instruction in Science, either in schools or evening classes, as full and complete as time and opportunity will permit.

The attention of Parliament was directed to this question immediately after the Exhibition of 1851 and recently in the Report of the Royal Commission on Public Schools.

The Science examinations of the Department of Science and Art have led, in four years, to the formation of more than one hundred local classes ; and it

is chiefly with a view to the instruction given in these classes that I have been induced to prepare this work. In the arrangement of the subjects I have followed, in all important matters, the syllabus of Professor Tyndall.

For several years I was occupied as a teacher of chemistry and physics in a large Training College, and no one who has had any experience as a teacher of either boys or men can fail to have observed the interest which always attaches to instruction in these subjects.

The death of the late Lord Ashburton, and the retirement of Canon Moseley and Dr. Temple from all official interest in schools aided by the State, has been attended with a decline in Elementary Science as a part of Primary education.

When the natural and experimental sciences take equal rank with the classics in the endowed schools and Universities, the character of our education will be so modified as not only to be a means of mental training, but also adapted to the practical purposes of every-day life. The men who have given us the steam-engine, the railroad, and the telegraph, are under little obligation to a Latin grammar or a Greek Lexicon.

Dr. Faraday, in his evidence before the Royal Commission on Public Schools, says, "I would teach

a boy of eleven years of age, of ordinary intelligence, the elements of all those sciences (acoustics, light, heat, magnetism, electricity, and chemistry) which come before classics in the programme of the London University. With a candle, a lamp, and a lens or two, an intelligent person might teach, in a very short time, the elements of optics; and so with chemistry and the other sciences. In the management of the electric light the Trinity Board have had to remove keeper after keeper from the lighthouses under their direction, because it was difficult to find men of sufficient intelligence to manage the light, arrange a common lamp, or observe those proceedings necessary for its security, or any attempt to make notes of what they ought to observe. Their profound ignorance of the most elementary principles of Science is continually manifest. In France I find an intelligent class of men, able to give a reason, supply any corrections, make careful observations, and act for themselves if necessity require it. I can find no such men here." Sir Charles Lyell, Dr. Carpenter, and others, give similar evidence; but to no one are these truths more evident than to him who has felt the wearisome monotony of ignorant labour.

An Elementary work on Experimental Science can have little claim to originality. In this respect I make no pretensions. I think it right to mention the assist-

ance I have derived from a perusal of the works of Ganot, Müller, and Faraday. If I have produced a book suitable to the requirements of those engaged in teaching or learning Science, I have accomplished my object, and I now leave the work to make its own way.

*St. John's Hill, Wandsworth, S.W.,  
December, 1864.*

---

THE ELEMENTS  
OF  
EXPERIMENTAL PHYSICS.

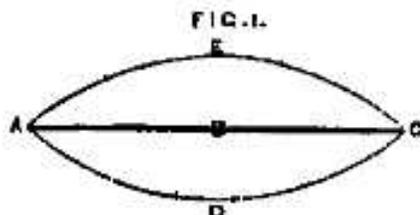
---

ACOUSTICS.

**Acoustics** is that branch of physics which treats of the nature of sound, and the laws which relate to its production and propagation.

**Sound** is caused by the mechanical vibrations of an elastic body, which are transmitted by undulations through the atmosphere to the ear. Every noise or sound is accompanied by some action of this kind. The report of a cannon causes a tremulous motion of the ground for some distance. Sounds of a softer nature, proceeding from musical instruments, such as those of a piano or harp, are all accompanied with a sensible tremor or vibration of the floor. The vibratory body is said to be sonorous, and the body through which the sound is transmitted is called the medium. If a glass tumbler be gently struck with any hard body a tremulous agitation is communicated to the entire mass. The air surrounding the glass is thrown into corresponding undulations, which strike on a delicate membrane stretched across the interior of the ear, called the *tympanum*, or drum of the ear, and in this way the sensation of sound is excited.

Suppose a stretched cord, represented by the line A B C, *Fig. 1*, to be drawn aside to D; in returning to its original position it does so with a momentum



which carries it past the line *A B C* to *A E C*, from which it returns again *nearly* to *A D C*, and so backward and forward until, after a number of oscillations, it comes to a state of rest. The space through which the cord oscillates, or the amplitude of the oscillations, diminishes, but the time required for a small oscillation is the same as that required for a large one. The oscillations of sonorous bodies are too rapid to be either seen or counted, but by a simple experiment we can make these manifest to the eye.

**Nodal Lines and Points.**—Sprinkle some fine dry sand on a plate of thin metal or glass, holding the plate firmly with the hand, or better, with a pair of pincers; then draw a violin bow over one of its edges; the particles of sand will be seen to dance up and down, and finally arrange themselves in curious figures. Now this motion is due to the vibrations of the plate. If we strike a tuning-fork, and then touch the surface of some mercury, the undulations or waves are distinctly visible.

By experiments made by Chaldni the following laws were detected:—

1. Any particular sound always produces the same figure, held in the same position. If the sound be changed, the figure disappears at once and a new one is formed.

2. The gravest sound is accompanied by the simplest figure, and the more acute the sound the more com-