

**THE ELEMENTS OF
LABORATORY
WORK: A COURSE
OF NATURAL SCIENCE**

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The elements of laboratory work: a course of natural science by A. G. Earl

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LOWER DIVISION

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WITH THE PUBLISHERS COMPLIMENTS.

THE ELEMENTS

OF

LABORATORY WORK

A COURSE OF NATURAL SCIENCE

BY

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P R E F A C E

THE course of work described in the following pages forms an introduction to all branches of Natural Science. The elementary nature of the book has caused me to pay more attention to method than to detail. Every student will need to follow closely and thoughtfully the performance of each experiment, in nearly all cases making his own observations and measurements, in order that the capacity for independent judgment, as well as an interest in original research, may be awakened at the outset. When a fact or law, discovered by means of a student's own personal observation and intelligence, turns out to be very familiar to others more advanced, the value of the research to the student himself is but slightly impaired.

Each section conveys a definite lesson, and care has been taken that they may follow in inductive sequence. It is important that each experiment and each stage of the course be described and reviewed at length in the student's notebook, which should contain many practical details omitted from the text-book, not only lest they should obscure the more important outlines of work, but also because it is intended that some freedom and originality in manipulation should be encouraged. The trials and practical difficulties of the laboratory are too valuable educationally to be set aside by over-help, though it is essential that they should not be too

severe. It may be noticed that while tables are added to show the results of accurate observers, and to give information as to relative magnitudes, the numerical values resulting from the selected experiments have been generally left to be worked out by the students themselves from their own observations. The word *speed* has been used to denote the rate of motion of a particle along its path, in preference to the term *velocity*, which is now generally reserved to designate a quantity having both magnitude and direction, *i.e.* a vector. The sections numbered 3, 7, 12, 13, 14, 15, 24, 25, and 26, together with many of the additional exercises, may be omitted by beginners.

Rooms devoted to practical science, and well equipped, are nowadays considered a necessary part of all public schools and colleges, and this book is simply intended to be used as a handbook in such laboratories. An effort has been made to arrange a practical and progressive course which shall touch upon the chief problems, and point out the main lines of investigation in Natural Science, in preference to an attempt at explaining any one branch in detail. It is also hoped that the course may give some training in that habit of directly appealing to nature, rather than to theories, which is the root of all scientific progress, although unfortunately it is not always made the basis of scientific education, partly from want of time and partly from want of appliances.

A. G. EARL.

CONTENTS

CHAPTER I

MEASUREMENT OF QUANTITY OF MATTER

	PAGE
1. To find equal quantities of matter	1
2. To compare two quantities of matter	2
3. To test the accuracy of a set of weights by the balance	3
4. To investigate the construction of an accurate balance	3
Additional exercises and questions	4
5. Measurement of length and volume	5
Additional exercises and questions	6
6. Relative quantities of matter in equal volumes of different substances	7
Additional exercises and questions	8
7. Principles of systematic measurement	8
8. Table showing relation of areas to linear dimensions	12
9. Table showing relation of areas to one another	13
10. Table showing relation of volumes to linear dimensions	13
11. Table showing relation of volumes to one another	13
12. Method of measuring very small quantities of matter	14
13. Methods of measuring very small distances. The vernier	14
14. The micrometer screw, and spherometer	15
15. Other methods of measuring density and table of densities	16
Additional exercises and questions	18

CHAPTER II

OBSERVATIONS OF CHANGE OF POSITION

16. Relative position	19
17. Means of defining position with regard to a fixed point	20
18. Observation of change of position	21
19. Further observations of position and displacement	22

	PAGE
20. Practical measurement of the paths of moving bodies	23
21. Observation of rotation	24
Additional exercises and questions	26
22. Rate of change of position	26
23. Change of speed or acceleration	27
24. Measurement of time	27
25. Resultant of two simultaneous displacements	28
26. Further consideration of simultaneous displacements	29
Additional exercises and questions	30
27. Examples of mechanical constraint of motion	31
28. Conversion of circular into rectilinear motion	32
Additional exercises and questions	34

CHAPTER III

OBSERVATIONS OF CHANGES OF TEMPERATURE

29. Change of temperature causes change of density	35
30. Standard temperatures	36
31. Relation of temperature-changes to quality and quantity of matter	38
32. Equal quantities of ice melted during equal temperature-changes in equal quantities of the same kind of matter	39
33. To measure the corresponding temperature-changes in water and copper	40
Tables of numbers expressing the relative quantities of various kinds of matter which are equivalent in thermal change	43
34. To measure the numerical value of the temperature-change occurring in surrounding bodies when one gram of ice liquefies	43
35. To measure the numerical value of the temperature-change involved in changing 1 gram of water at 100° into steam at 100°	45
Table showing the number of grams of water which would be changed from 1° C. to 0° C. by the fusion and also by the vaporisation of 1 gram of various kinds of matter	46
Table of melting-points of various solids	47
Table of boiling-points of various liquids	47
Table showing the density and volume of mercury at various temperatures	47
Table showing the density and volume of water at various temperatures	48
Table of mean coefficients of cubical expansion	48
Additional exercises and questions	49

CHAPTER IV

OBSERVATIONS OF CERTAIN MUTUAL CHANGES, COMMON TO
ALL KINDS OF MATTER

	PAGE
36. Bodies displaced equally from the earth, reach it again simultaneously, if allowed to fall	52
37. Time of fall	53
38. A body returns to the earth with a uniformly accelerated speed in a straight line	53
39. Meaning of term 'force'	54
40. The moveable pulley	55
41. The lever	56
42. The pressure of liquids	58
43. The equilibrium of two liquid columns in communication	59
44. The internal stress of liquids	61
45. The relation between mutual displacements	64
46. New test for equal quantities of matter	66
Additional exercises and questions	68

CHAPTER V

OBSERVATIONS OF CERTAIN MUTUAL CHANGES EXHIBITED
BY CERTAIN KINDS OF MATTER

47. Changes observable when certain bodies are rubbed together and separated	70
48. Communication of the property to other bodies	71
49. Investigation of the electric field	71
Additional exercises and questions	73
50. Existence of electric stress indicated by the electroscope	73
51. The quadrant electrometer	74
52. Exploration of the electric field by two discs	77
Additional exercises and questions	78
53. Electric phenomena produced by another method	79
54. Processes by which electric equilibrium is effected	80
55. An electric circuit, conditions necessary for	81
56. The existence of magnetic stress indicated	82
57. Deflection of a magnet by a substance forming part of an electric circuit	84
58. Construction of a galvanometer	85
59. Meaning of conductivity	86