OR FIRST LESSONS IN NATURAL PHILOSOPHY: 2D YEAR'S COURSE

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649512072

Elementary Mechanics, Or First Lessons in Natural Philosophy: 2d Year's Course by $\,W.\,$ Jerome Harrison

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

W. JEROME HARRISON

OR FIRST LESSONS IN NATURAL PHILOSOPHY: 2D YEAR'S COURSE



o

ELEMENTARY MECHANICS;

Off,

FIRST LESSONS IN NATURAL PHILOSOPHY.

BY

W. JEROME HARRISON, F.G.S., Science Demonstrator for the Birmingham School Board.



SECOND YEAR'S COURSE.

Taondon:

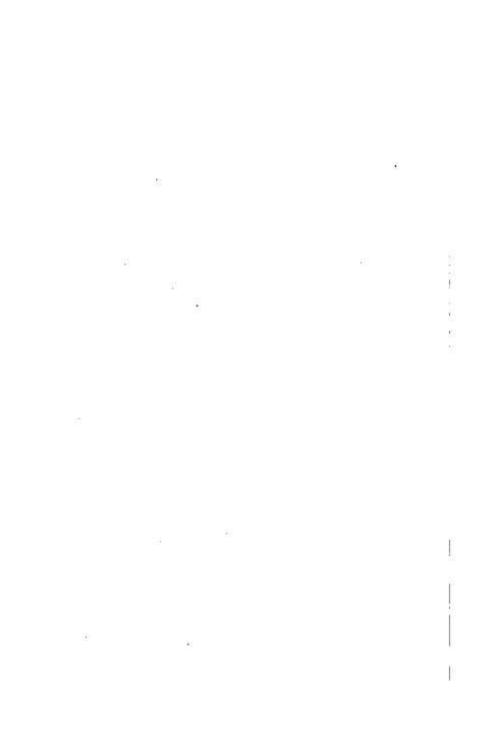
T. NELSON AND SONS, PATERNOSTER ROW. EDINBURGH; AND NEW YORK.

1884

CONTENTS.

L FORCE AND MATTER,	***	444	7994		7
II. CLASSIFICATION OF FORCES,		100	200	5340	13
IT. THE PORCE OF GRAVITY,	***	3447		200	20
IV. EFFECTS OF THE FORCE OF	GRAVIT	Υ,		\$40	28
V. FALLING BODIES,	411	244		240	38
VI. FALLING BODIES,	22	3223			44
VII, THE PIEST LAW OF MOTION:	INERT	IA OF WAT	TER AT	REST,	51
VIII. INERTIA OF MATTER IN MOT	mon,	3223	323	0.42	60
IX. FRICTION,		3225	323	3000	68
X. MASS AND MOMENTUM,	**	8003	842	-114	78
XI. COMPOSITION AND RESOLUTION	ION OF	PORCIES,	3.000	(£)	79
XII. THE SECOND LAW OF MOTIO	n,	3123	3.7	111	87
XIII. THE THIRD LAW OF MOTION	ı,	3225		(Σ_{α})	92
XIV. WORK, AND HOW TO MEASU	RE IT,	322	224	3223	96
XV. ENERGY,	***		200	272	102
XVI. POTENTIAL ENERGY,	123		2.4	3347	107
XVII. KINETIO ENERGY,	244	222		1.2	113
AVIII. INDESTRUCTIBILITY OF ENER	BGY,	747	0.0	225	118
XIX. THE NATURE OF HEAT,	-11	122		720	127
XX. HEAT AS A FORM OF ENERG	Y,	3022	100		134
_					
APPE	NDI	X.			

QUESTIONS AND EXERCISES,



ELEMENTARY MECHANICS.

L-FORCE AND MATTER.

- Introduction—2. Examples of Force—3. Definition of Force—4. Kinds of Motion—5. Molecular Motion—6. Distinction between Matter and Force—7. How Forces become known to us.
- 1. Introduction.—Let us consider what is meant by the word force, and what are the nature and character of the various forces at work around us, of which we often speak collectively under the name of the "forces of nature."

Day by day we see these forces at work, acting in various ways, and producing many and different results; but they very rarely excite our curiosity, for we have grown accustomed to them from seeing them so often. A storm excites our wonder, and we are curious to know more about that wonderful and mighty force which causes the vivid lightning and the deafening thunder. But how many of us think, even for a moment, about the everacting and far more important force which causes all substances to fall towards the ground, and which enables our bodies and all things around them to maintain their place upon the surface of the Earth?

This force of gravitation acts so constantly and so unchangingly, always producing the same unvarying results, that we do not recognize anything wonderful in it; and it is only by looking very closely into the results which this force produces, and by thinking long and deeply about them, that we are at last enabled to recognize how wonderful and beautiful even the commonest of such occurrences really is.

Examples of Force.—If we take a piece of paper, set it upon edge against some object, as a book, and then pull it by means of a piece of thread attached to it, we notice that the paper falls. To pull the paper down we had to bring into use a power—the power of the muscles of the arm; and this power, carried along by the thread, caused the paper to Or we may give the paper a push, and again it falls. This time we also use the power of our muscles, but in a different way. But we can cause the paper to fall by means of a very different power. Let us take a piece of sealing-wax, and, having well dried and warmed it, rub it with a piece of warm dry flannel or fur, and bring it within an inch or two of the paper. Now, although nothing touches the paper, we see it move towards the sealing-wax In the first case we pulled the paper over and fall. by means of the power of our muscles, which was transmitted by the string; in the next, the sealing-wax must have exercised a power to cause the paper to fall. Now, this power to set matter in motion, whether exerted by the hand or by the wax, is an instance of what we mean by the word force.

But power or force may be used for other purposes than moving a piece of paper. When a cannon is fired, the gunpowder with which it is loaded exerts force to propel the cannon-ball; and the target of iron against which the cannon-ball strikes must exert force to stop it. So also a boy playing cricket exerts force in striking the cricket-ball with his bat, causing it to fly swiftly across the field; and the boy who catches the ball exerts force in stopping it. Let us suppose, however, that the cricket-ball were a very large and very heavy one: the boy with the bat might try to move it, but fail; yet he would have exerted force in trying to move it; and were such a ball made to move, the other boy would expend force in trying to stop it, although he again might fail.

- Definition of Porce.—Thus we see that force is that which moves or tries to move a body, or which changes or tries to change the motion of a body.
- 4. Kinds of Motion.—We have seen that force frequently produces motion, and always tends to do so. We must now pause for a moment in order that we may learn something about motion. When a cannon is fired, we know that the gunpowder exerts a force which compels the cannon-ball to fly from the cannon, and to continue in motion until it comes to rest again perhaps a mile from the cannon. Here the cannon-ball as a whole moves a distance of one mile. Again, a locomotive engine may start from London, and at the end of about three hours may have arrived at Birmingham. Here again we notice that the whole body of the engine moves from one

place to another. Motion of this kind we speak of as motion of the body as a whole.

- Molecular Motion.—Let us now take the cannonball of which we have already spoken, and place it on a large fire. After a time it will become white hot, and will glow with heat. The body as a whole is perfectly still; it remains where we placed it on the fire. But is there any motion at all there? Yes, we think there is. We suppose that all bodies in the world, and the cannon-ball amongst them, are made up of an immense number of tiny pieces, too small to be seen, called molecules. When we place the cannon-ball on the fire, we think that these molecules are made to move by the heat-to swing backwards and forwards, as it were; and that the more we heat the ball the faster we make the molecules move, so that when the ball is white hot each molecule moves backwards and forwards with immense quickness. Thus, although the ball as a whole is perfectly at rest, every little molecule in it is swinging to and fro with almost inconceivable This kind of motion we call motion of rapidity. the molecules of a body. Thus we have two kinds of motion:—(1.) Motion of the body as a whole; (2.) Motion of the molecules of a body, or molecular Now, whether the piece of matter be large or small—whether it be a body or a molecule—it will never move of itself. If it be moving, something must have acted on it to set it in motion, and the power which produces that motion is called a force.
 - 6. Distinction between Matter and Porce. -- When