

Introduction to Chapters 2, 3, 4, 5 and 6

Physics concerns itself with things that happen within the enormous range of sizes discussed in Chapter 1. Fortunately laws of physics work over large ranges of size. The science of the way things move and the forces that make them move is one such set of laws. These are the laws of dynamics and it was Isaac Newton who first proposed these laws and worked out how to use them. It is these laws of so-called “Classical Mechanics” that form the subject matter of Chapters 2 to 5, expanding into the idea of what a theory means in Chapter 6.

To work out all the consequences of these laws and how to use them, Newton also invented the mathematics of calculus. We shall not go there, but try to make the ideas clear with some examples of what the laws can be used to explain.

Newton’s laws do break down at very small sizes, which is where modern Quantum Mechanics (QM) is needed. They also break down at speeds near the speed of light with is the subject of Special Relativity (SR) and at the very large astronomical level where General Relativity (GR) rules the roost. But no sane scientist would try to use QM or GR to use and calculate results for the vast range of things where classical mechanics works to a great degree of precision. (There is also no possibility of undergraduates understanding QM and GR without first understanding classical mechanics.)

So in these chapters I have made an attempt made to explain the ideas to just about anybody who has the interest. A key difficulty comes in the use of words. Science uses words in a precise way, and that way does not always correspond to the way those same words are used in everyday parlance. Take, for example, speed and velocity. These are used interchangeably in common speech. But their scientific meanings are different. Another example is mass and weight. These are totally different from a scientific point of view.

So you will need to put aside pre-conceived notions and be prepared to follow the discussion using the terms with their scientific meaning. This will all be explained but it does not make it any easier to do. Apart from words there may be ideas which have become ingrained and these may be challenged also.