

ANALYTICAL MECHANICS 1. The second is, by definition, the amount of time required for exactly 9,192,631,770 oscillations of a particular atomic transition of the cesium isotope of mass number 133. In our initial study of the science of motion, mechanics, we shall assume that the physical space of ordinary experience is adequately described by the three-dimensional mathematical space of Euclidean geometry. VECTORS the particle is an idealization that does not exist—even an electron has a finite size but the idea is useful as an approximation of a small body, or rather, one whose size is relatively unimportant in a particular discussion. The position of a point in such a coordinate system is specified by three numbers or coordinates, x , y , and z . The coordinates of a moving point change with time; that is, they are functions of the quantity t as measured on our time scale. Physical Quantities and Units The observational data of physics are expressed in terms of certain fundamental entities called physical quantities—for example, length, time, force, and so forth. The meter is now defined as the distance occupied by exactly 1,650,763.73 wavelengths of light of the orange spectrum line of the isotope krypton 86. The basic type of coordinate system for our purpose is the Cartesian or rectangular coordinate system, a set of three mutually perpendicular straight lines or axes. The meter was formerly the distance between two scratches on a platinum bar kept at the International Bureau of Metric Standards, Sevres, France. Vectors In any scientific theory, and in mechanics in particular, it is necessary to begin with certain primitive concepts. A very useful concept in mechanics is the particle or mass point, an entity that has mass but does not have spatial extension. We shall further assume that space and time are distinct and independent entities. The meter was formerly the platinum iridium also kept at the International Bureau. Fundamental Concepts. 1. 1.