Notes for:
B.Sc. Part - III
Paper - 5th
(Q. Mech)

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"Inadequacy of classical Mechanics"

The development of classical mechanics is based on Newtons three laws :- (I) The law of inertia (II) The law of force and (III) The law of action and reaction. These laws include the concepts of absolute mass, absolute space, and absolute time. Laws of thermodynamics and classical laws of electricity and magnetism provide the basis for the explanation of all phenomena in classical physics. It was the general brief of the scientists that these laws would suffice to account for any subsequently discovered phenomena. Classical mechanics explain successfully the motion of objects which are directly observable with the help of instruments, classical concepts can not be applied. This means that the classical concepts do not hold in the region of atomic dimension.

According to classical mechanics, if we consider the case of an electron moving round the nucleus, its energy should decrease because the accelerated charged particle loses energy in the form of electromagnetic radiation and therefore its velocity should decrease continuously. The ultimate result is that the electron comes closer and closer to the nucleus until it collapses. This shows the instability of atom which is an contradiction to the observed fact of the stability of atom. Thus the classical mechanics fails to explain the stability of atom. →

(P.T.O)

→ The classical mechanics also fails

→ spectrum of hydrogen atom. According to classical theory the exited atom of hydrogen emit electromagnetic radiations of all wavelengths continuously. where it is observed that they emit radiation of certain wavelengths only. Another blow to the classical concepts of continuous variations of physical quantities came from the study of black body radiation. It could be explained only by assuming that every radiating atom in a solid emits energy only discretely. It is now a well known fact that certain physical quantities related to the microparticles may assume only certain discrete values. These quantities are said to be quantified. The idea of quantisation is one of the fundamental ideas of the physics of microparticles.

The Principle of classical determinism is considered to be one of the basic concepts of classical physics and this too is not beyond objection. In 1820. Laplace called it an "Idea of fatalism and hence rejection.

We also note that the classical Principle of analyse is based on mutual independence of the objects of observation and measuring instruments. This contention becomes untenable in the microworld.

In spite of this classical mechanics also fails to explain a large number of observed phenomena like photoelectric effect, compton effect, Raman effect. Observed variation of specific heats of metals and gasses etc. The inadequacy of classical mechanics led to the need of - quantum mechanics.

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