- Newton did not give the Second Law of Motion as F =ma.
- Swiss Leonhard Euler gave, F =ma in 1776 in paper E479 on pages 222-224.
- Institute of Physics England, has accepted this fact in literature.
- Euler should get the credit of F=ma, as he has given the equation.

Discussion available on U-Tube

Newton's second law of motion as taught in schools to students, was not given by Newton. Newton gave a different definition in the Principia in 1686. The definition that is taught to students is a changed form of the Principia's second law of motion. However, definitions of first and third laws of motion, taught in textbooks are taught in the same form. Only the definition of the second law is changed.

Newton's law is taught in the form of equation F =ma i.e. Force = Mass x Acceleration, this equation was given by Swiss polymath Euler in 1776 after Newton's death. The scientific community is silent on the issue. Why?

The details of the discussion are available on www.Newton99.com in research papers, articles, in interviews. The E-Book

Newton's Laws of Motion in the 21st Century.

is at the final stages.

Part I General Discussion about Newton's Second Law.

Q1. What is Newton's Second Law of Motion?

Ajay Sharma: Newton wrote an epoch-making masterpiece Principia in 1686 while he was a Professor at the University of Cambridge, England. The law was given in the Principia on page 19 as

"*The alteration of motion is ever proportional to the motive force impressed, and is made in the direction of the right line in which that force is impressed.*"

Q.2 What is your basic objection to this law?

Ajay Sharma: The textbook definition of the law is "The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction in which force acts.".

It is different from the definition given by Newton in the Principia. My simple question is why has the definition of Newton's second law is changed i.e. Newton gave an original definition and a different definition is taught in textbooks? Who changed it? When it is changed? There are no direct answers to these questions.

Such issues require deep discussion by scientists all over the world. So I have raised this issue at international conferences, in my research papers, books which can be seen on the website www.Newton99.com freely without any password for ready references

Q.3 What is the equation for the Second Law of Motion?

Ajay Sharma: Newton did not give any equation for the Second Law of Motion. This is main problem. Now mathematically, Newton's **Second Law of Motion** is expressed as

$$\text{Force} \propto \text{change in motion}$$

Now motion is understood or described in terms of velocity.

Force = Constant x change in motion or $F = KdV$ (1)

But neither this equation nor its original definition is taught in textbooks.

Q.4 But in the standard textbooks, F =ma or Force = mass x acceleration is taught as the equation for the Second Law of Motion.

Ajay Sharma: Again, Newton did not give equation F =ma. The Equation F =ma was given by Swiss Leonhard Euler in 1776, in paper E479 on pages 222-224. For ready reference, this equation can be seen at the website http://eulerarchive.maa.org

Q.5 What do scientists say about the fact F =ma was given by Euler, not by Newton?

Ajay Sharma " In the standard textbooks, the name of Euler is not mentioned at all. However, the **Institute of Physics,** England has quoted in its website

"*Newton did not include an explicit numerical measure or symbol for acceleration in his work; the expression of his second law as F=ma first emerged more than half a century after the Principia was published, in a paper by Euler".*

https://spark.iop.org/development-newtons-first-law

Its simple meaning is Newton did not give equation F =ma and direct equation for acceleration. F =ma was given by Euler after 50 years when Newton published the Principia, the last edition of the Principia was published in 1726, and the legend died a year after it . Now there are many examples that scientists agree Newton has no contributions regarding the F =ma. But this issue requires elaborated discussion as mentioned in documents www.Newton99.com

Q6 . How do scientists associate F =ma with Newton's second law?

Ajay Sharma: F =ma is associated with **Newton's Second Law of Motion** arbitrarily and unscientifically. Even Euler's name is not mentioned in textbooks. I quote from an authenticated reference. For example, Raman quoted the theme of existing literature in journal The *Physics Teacher* published by the *American Institute of Physics* in March 1972 at pages 136-137.

Arbitrary assumptions by scientists.

Scientists have made some assumptions but these assumptions are not scientifically valid.

Firstly, scientists assume that 'change in motion' is the same change in 'quantity of motion or momentum'

When this assumption is used in Principia's definition of the second law, then we get the equation

F = KmdV

it is not F =ma, which scientists wanted to achieve.
As the desired equation is not achieved, then secondly scientists made another assumption that 'change in motion' is the same as 'rate of change of quantity momentum'. Then scientists get

F =Kma

Now further value of K is regarded as unity, to get F =ma.

Q7. If scientists get F =ma by the method you cited above. Then what is the scientific problem? Be specific to illustrate your point of view.

Ajay Sharma, The specific reply is equating the above terms in the above assumptions are completely arbitrary and unscientific. The quantities, 'change in motion', 'change in the quantity of motion or momentum', 'rate of change of the quantity of motion or momentum)' are entirely different. These cannot be scientifically and logically equated.

These quantities have different units (m/s , kgm/s , kgm/s^2) . Further, these quantities have different dimensions (M^0LT^{-1}, MLT^{-1}, MLT^{-2}). In physics, only these quantities are equated with have same units and dimensions.
These norms are followed in basic physics and established by the International Union of Pure and Applied Physics. Due to these reasons, scientists have changed the Principia's second law of motion in the textbooks and it is never mentioned that Euler had given F =ma.
I am pointing out the truths scientifically after studying the facts for years.

Q.8 Also at some stage, some scientists might have realized the truth, that neither acceleration nor F =ma was given by Newton. Who was that scientist?

Ajay Sharma: First of all an American Historian of science C. Truesdell published a detailed paper in the journal *Archive for History of Exact Sciences* in 1960 that F =ma was given by Euler

in 1752 and never by Newton. Euler precisely gave F =ma in 1776 when he was a professor at the St. Petersburg Academy of Sciences. Euler gave many other equations of force.

Q.9 Thus, Truesdell pointed out the truth that F =ma was given by Euler and not by Newton. What was the effect of this revelation on the scientific community?

Ajay Sharma: In 1972, in the journal *The Physics Teacher* (published by the *American Institute of Physics*), Raman inquired why Euler's name is not associated with F =ma in textbooks. Raman specifically quoted that Truesdell had pointed out, more than a decade ago, that Euler gave F =ma.

Q. 10 If scientists agree that F =ma was not given by Newton. Why do scientists not state the same in standard textbooks?

Ajay Sharma: F =ma is the equation for Newton's Second Law of Motion, it is established over 200-300 years in textbooks, research notes, other documents, etc. It is correct that Truesdell and Raman have raised the point, but just a single sentence is not sufficient. This issue requires global interactions at various scientific institutions. I am pointing out the various aspects of the history of science.

We should remember that we taught for about 1500-1600 years that the Sun revolves around the Earth. However, the modes of communication are faster nowadays, so people can understand even different scientific opinions quickly. Further rest depends on the scientific community.

The papers and scientific discussion regarding Newton's all three laws of motion are available on the website www.Newton99.com. My eBook

Newton's Laws of Motion in the 21st Century

is at the final stages.

Contact: Ajay Sharma (Former Lecturer of Physics at DAV College Chandigarh & Retired Assistant Director of Education)
Mobile & WhatsApp 94184 50899 Email ajoy.plus@gmail.com
Website **www.Newton99.com**

Forthcoming book: **Newton's Laws of Motion in the 21st Century**