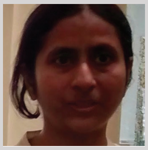
References:

1. 'The Blind Spot'. Chudler, Eric H., Neuroscience for Kids – Vision Exp. URL: http://faculty.washington.edu/chudler/chvision.html.
2. 'Filling-In'. Wikipedia, Wikimedia Foundation. 18 Apr., 2018. URL: https://en.wikipedia.org/wiki/Filling-in.
3. 'The Historians Toy box – Children's toys from the past you can make yourself'. Provenzo Jr, Eugene F, et al. Prentice Hall, 1979. Retrieved from the URL: https://archive.org/details/TheHistoriansToyBox/page/n55.
4. 'How to make a flipbook'. Andymation, YouTube. Uploaded on 19 Jan., 2018. URL: https://www.youtube.com/watch?v=Un-BdBSOGKY.



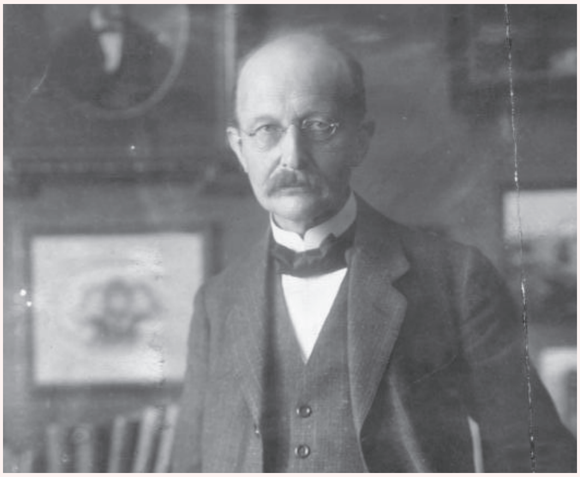
Kavita Krishna graduated from IIT Madras and worked as an engineer for 10 years. She retrained as a teacher and has over 15 years of experience in teaching, curriculum development, and teacher education in rural and urban schools. She can be reached at kavitak2006@gmail.com.

SNIPPETS

THE EXACT MASS OF A KILOGRAM: PLANCK'S CONSTANT

In 2011, the International Committee for Weights and Measures formalized an approach to redefine the International Prototype of the Kilogram (IPK) in terms of Planck's constant.

The Planck's constant (denoted as *h*) is named after Karl Ernst Ludwig Max Planck – a German theoretical physicist who was awarded the 1918 Nobel Prize for physics for his contributions to quantum theory.



The Planck's constant is named after the theoretical physicist Max Planck.

Credits: Bundesarchiv, Bild 183-R0116-504, Wikimedia Commons. URL:https://commons.wikimedia.org/wiki/File:Bundesarchiv_Bild_183-R0116-504,_Max_Planck.jpg. License: CC-BY-SA.

This constant is related to the kilogram through two very famous equations:

- According to the Planck-Einstein relation, the Planck's constant relates a photon's energy (E) with the frequency of its electromagnetic oscillation (ν): $E = h\nu$
- According to Einstein's mass-energy equivalence, any object with mass (m) has an equivalent amount of energy (E) through the speed of light in a vacuum (c): $E = mc^2$

Viewing the two relationships together:

$$h\nu = mc^2$$

Max Planck used experimental data on black body radiation to calculate the value of Planck's constant to be = 6.55×10^{-34} J/s. We also know that if the energy of a photon with a frequency of 1 Hertz (Hz) were to be transformed into matter (mass), the amount of mass that could be recovered = 7.375×10^{-31} kg.

Is this enough to redefine the kilogram? Not really. The Planck's constant is such a small value that it is often described as being 'the zero of classical physics'. Consequently, it has been difficult to measure this constant with the precision required to redefine the kilogram.

Is this the only constant that could be used to redefine the kilogram? Find out on page 87.

Siddharth Setlur is a Grade XII student & founder of the non-profit peer-to-peer learning platform (www.vlearn.xyz) who aims to pursue an academic career in theoretical physics and mathematics. He can be contacted at: siddharth.setlur@gmail.com.

Chitra Ravi works at Azim Premji University, Bengaluru.