Question 20944

A swinging pendulum eventually comes to rest. Is this violation of law of conservation of energy ?

No, it is not. Total energy of pendulum is dissipated through friction of pendulum with air (or other substance).

In ideal variant of pendulum (where we ignore the friction), the one-dimensional solution is $x = A\cos(wt + a)$, and corresponding energy is $E = m\frac{\dot{x}^2}{2} + \frac{k x^2}{2} = \frac{m w^2 a^2}{2}$, and it doesn't change with time (the pendulum swings for infinitely long time).

But, pendulum with friction has a solution $x = A e^{-\lambda t}\cos(wt + a)$, and it comes to rest with time. Total energy is then a function of time, and it goes to zero for high times. Approximately, the picture for total energy looks like this: