Question:

Define Moore’s law and explain why it has now stopped being true. Be sure to describe all of the physical limitations that have prevented Moore’s law from continuing to be true.

Response:

Moore's law

As per Moore's law, the number of chips in a transistor doubles every eighteen months while the cost of transistor drops by half. The increased density of chips in a single transistor has revolutionized the industries exposed to computers in any way. Though this is now a law technically, but merely an observation.

Why it has stopped working now.

Although Moore's law has continued to work for so many years, it's not feasible to increase the density with the same pace any more. One of the reasons for this is the constraints imposed by physics on our reality, i.e. the speed of light. The information exchange cannot exceed this threshold. Transistors are characterized by their capacitance(capacity to store electrons) and resistance (how much the medium restricts the flow of electicity). As the size of the transistors shrinks, the capacitance reduces and resistance increases. In order to carry out computation with the same ease the voltage needs to increase, which as a side effect would dissipate heat. Managing heat at that scale itself would increase the cost of production and maintainance. Add to it the cost of designing and producing machineries to manufacture such chips at scale. Another way of looking at this through the lens of quantum physics. We can't possibly reduce the transistors to atomic levels. So we venture into quantum level, Heisenberg uncertainity principle would limit precision and thus limiting our computing capabilities.