Define Moore's Law:

Moore's Law is the observation and prediction, not physical or natural law, that transistor density would double every two years. This law asserts that an exponential increase in transistor density leads to an exponential increase in speed.

Physical Limitations on Moore's Law:

Moore's Law has in recent years(5-7 years) stopped being true due to physical limitations of the devices themselves. The main issues causing this are power, temperature, and voltage.

- **Power:** Transistors consume power then they switch. If the transistor density continually increases the power consumption will also continually increase. This leads to a "power wall".

- **Temperature:** The increase of power consumption directly correlates to increase in temperature. If the power keeps increasing the temperature needed to be dissipated from the chips will also increase. At a certain point the chips will just melt due to the extreme heat.

- **Voltage:** Due to the Dynamic Power equation P = ***α****CF(V^2), voltage plays an important role in the amount of power needed. Therefore the voltage swing in the microchips needs to stay low in order to keep power low.

- **Dennard Scaling:** There should be a direct scaling between voltage swing and transistor size. As transistors get smaller we want the voltage to get smaller as well. This would keep power consumption, and therefore temperature low. However voltage can not continually become smaller and smaller.

- **Threshold Voltage:** Transistors require a minimum voltage in order to switch, therefore voltage must stay about the transistor's voltage threshold.

- **Noise:** There is also another issue with lower voltage swings in terms of noise or error issues. If the voltage swing is too low it is much harder to tell whether you are dealing with noise or the actual signal, your error is much greater. This leads to becoming less noise tolerant and that is an issue because there is always noise in a system.

- **Power Leakage:** Lastly there is a power leakage issue as transistors and chips become smaller and smaller. As these chips shrink in size and increase in density, the insulators in them also must become smaller and therefore do not work as well. This leads to a power leakage between transistors.