Current Electricity

Here is a comparison of Kirchhoff's Rule 1 (Junction Rule) and Kirchhoff's Rule 2 (Loop Rule) in table format:

Aspect	Kirchhoff's Rule 1 (Junction Rule)	Kirchhoff's Rule 2 (Loop Rule)
Definition	At any junction, the sum of currents entering the junction is equal to the sum of currents leaving the junction.	In any closed loop in a circuit, the algebraic sum of all the potential differences (voltage gains and drops) is zero.
Mathematical Expression	$\sum I_{\text{in}} = \sum I_{\text{out}}$	$\sum V = 0$
Application	Applied at junctions where multiple branches of the circuit meet.	Applied to any closed loop or mesh in a circuit.
Based On	Conservation of charge.	Conservation of energy.
Purpose	Ensures that the current is conserved at junctions, meaning that the amount of charge entering a junction equals the amount of charge leaving.	Ensures that the total energy gained per charge around a loop is equal to the total energy lost per charge.
Usage Example	If 3 currents I_1, I_2, and I_3 meet at a junction with I_1 and I_2 entering and I_3 leaving, then $I_1 + I_2 = I_3$.	In a loop containing a battery of voltage V and resistors R_1 and R_2, $V - IR_1 - IR_2 = 0$.
Key Points	- Useful for analyzing currents at junctions. - No accumulation of charge at junctions.	- Useful for analyzing voltage drops and gains in a loop. - Voltage gains and drops around a closed loop sum to zero.
Diagram		

Summary

- **Kirchhoff's Rule 1 (Junction Rule)** focuses on the conservation of current at circuit junctions. It is used to ensure that the sum of currents flowing into a junction equals the sum of currents flowing out.
- **Kirchhoff's Rule 2 (Loop Rule)** is based on the conservation of energy and is applied to closed loops in a circuit. It ensures that the sum of all potential differences (voltage gains and drops) around a closed loop is zero.