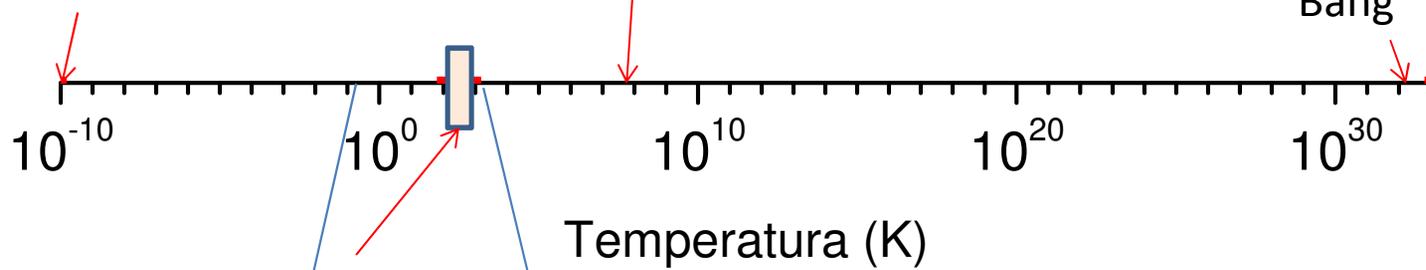


Temperatura mas
baja obtenida
artificialmente
Ordenamiento de
momentos
nucleares **100pK**

Plasma en
reactores de fusión
500 MK

Teoría, 10^{-44} s
despues del Big
Bang



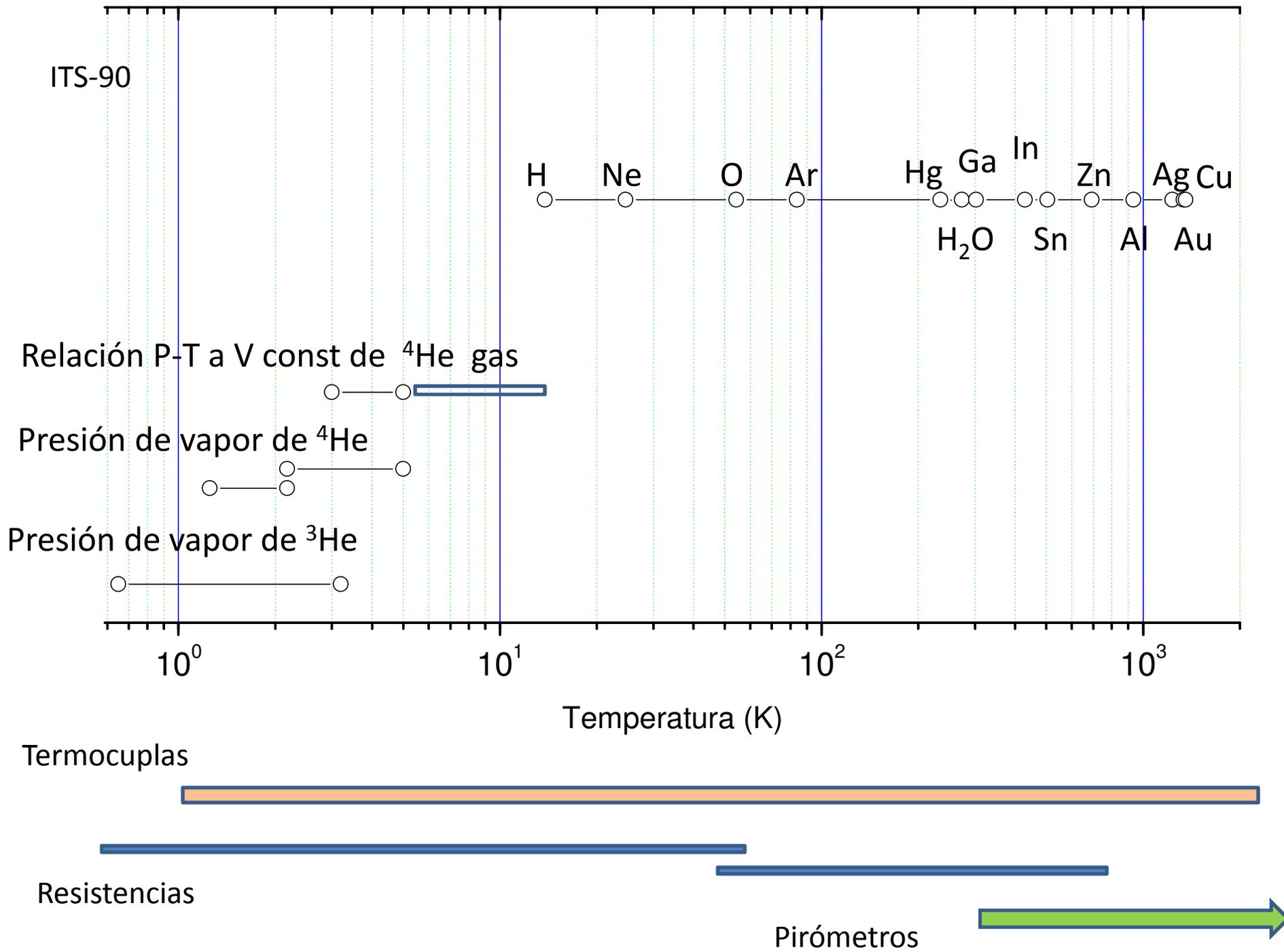
Vida cotidiana

Las convenciones para medir temperatura se basan en
fenómenos físicos y puntos fijos

0.65 K

ITS-90

1358 K



ITS-90

Relación P-T a V const de ^4He gas

Presión de vapor de ^4He

Presión de vapor de ^3He

Termocuplas

Resistencias

Pirómetros

Temperatura (K)

H Ne O Ar Hg Ga In Zn Ag Cu
H₂O Sn Al Au

10^0

10^1

10^2

10^3

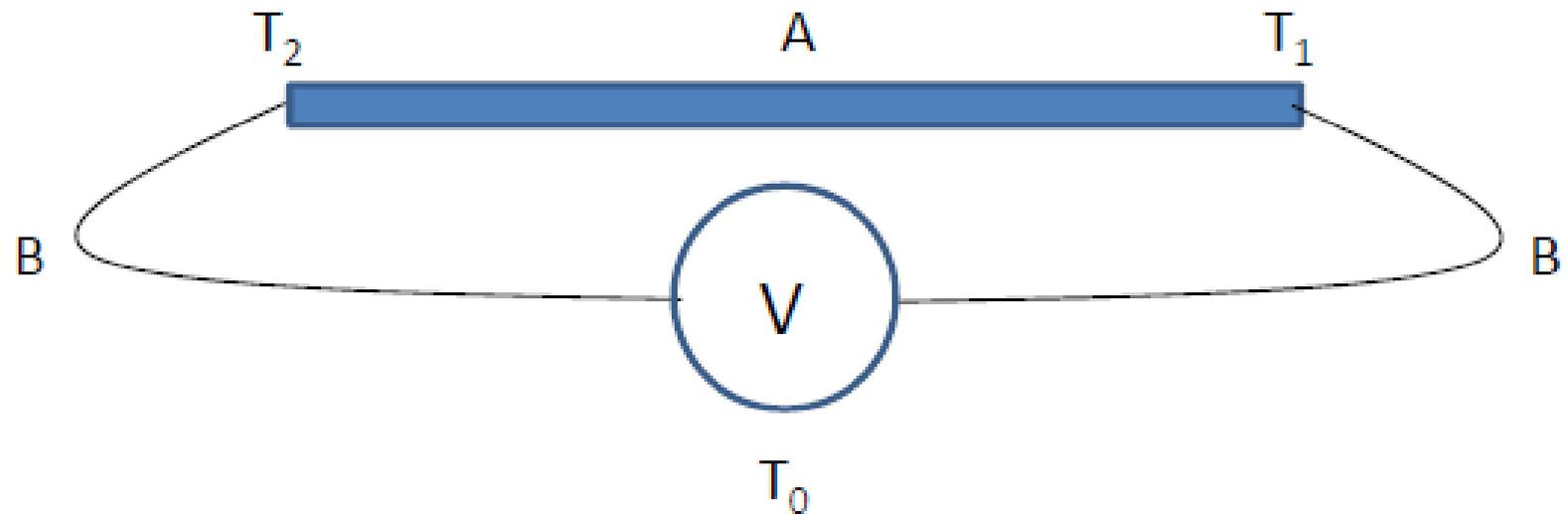
Efecto Seebeck



$$\vec{J} = \sigma \cdot \vec{E} + L_{ET} \vec{\nabla} T \qquad \vec{E} = -\frac{L_{ET}}{\sigma} \vec{\nabla} T = -S \cdot \vec{\nabla} T$$

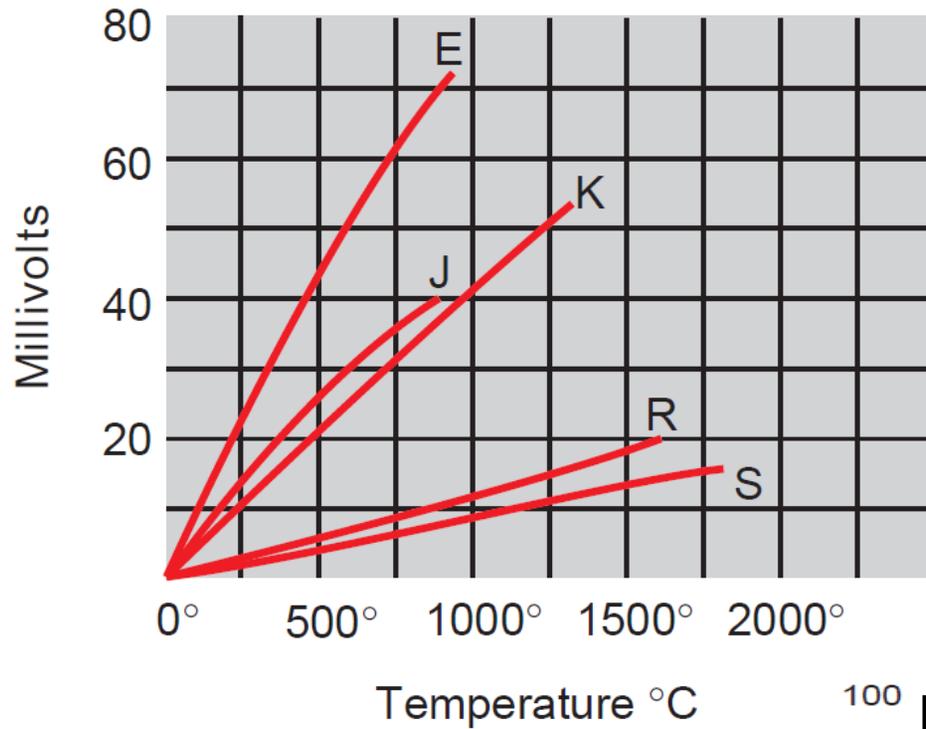
$$V = -\int_1^2 E \cdot dx = \int_1^2 S \cdot \frac{dT}{dx} \cdot dx = \int_{T_1}^{T_2} S \cdot dT$$

Termocuplas

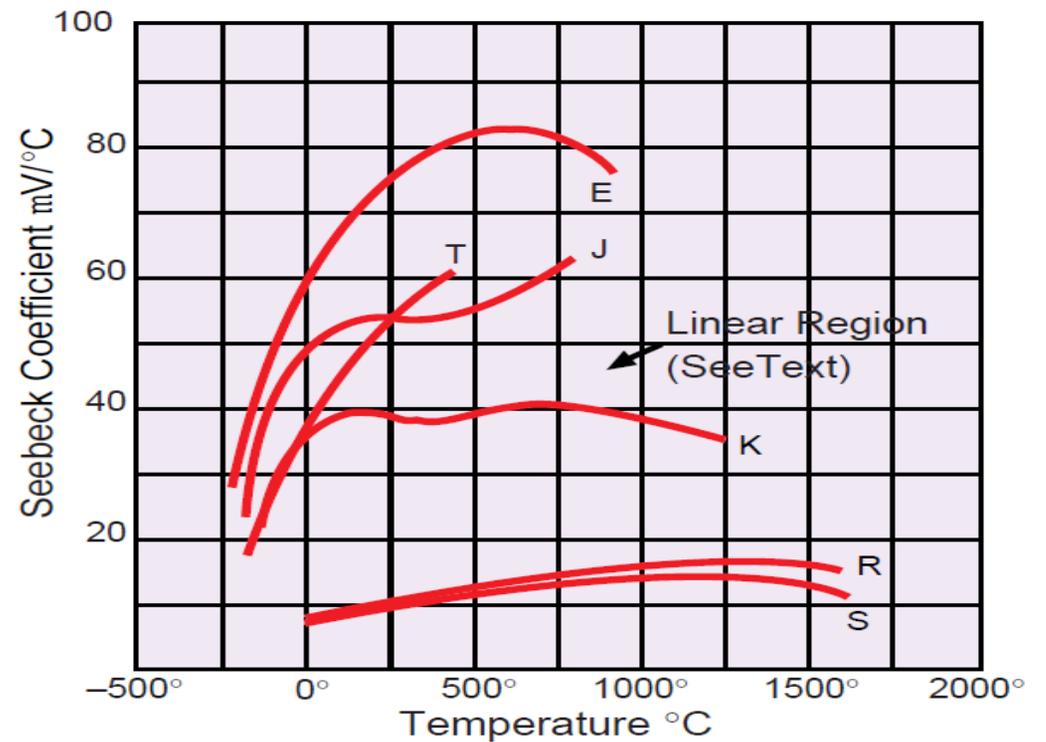


$$V = \int_{T_0}^{T_1} S_B \cdot dT + \int_{T_1}^{T_2} S_A \cdot dT + \int_{T_2}^{T_0} S_B \cdot dT = \int_{T_2}^{T_1} S_B \cdot dT + \int_{T_1}^{T_2} S_A \cdot dT$$

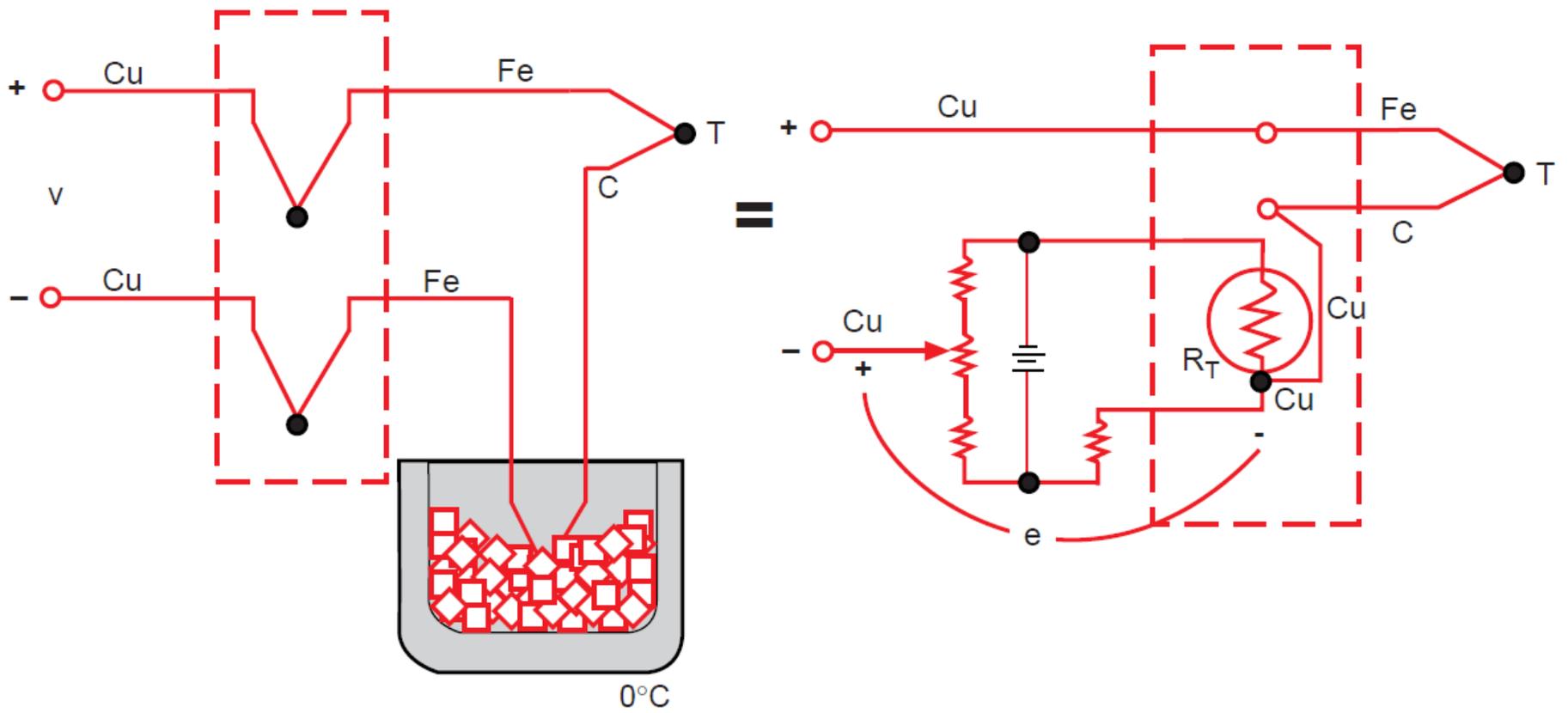
$$V = \int_{T_1}^{T_2} (S_A - S_B) \cdot dT = \Delta S \cdot (T_2 - T_1)$$

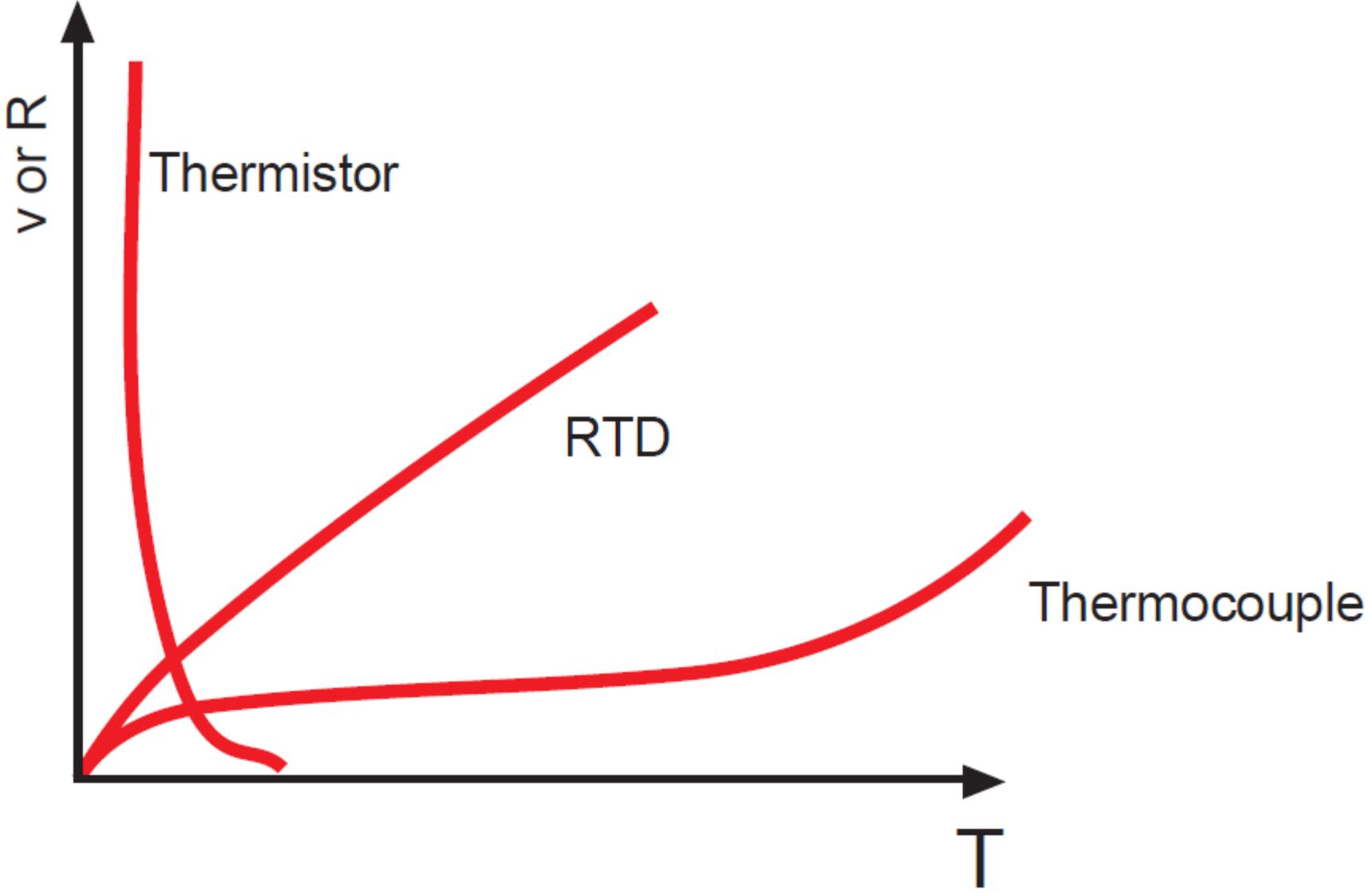


Type	Metals
	+ -
E	Chromel vs. Constantan
J	Iron vs. Constantan
K	Chromel vs. Alumel
R	Platinum vs. Platinum 13% Rhodium
S	Platinum vs. Platinum 10% Rhodium
T	Copper vs. Constantan

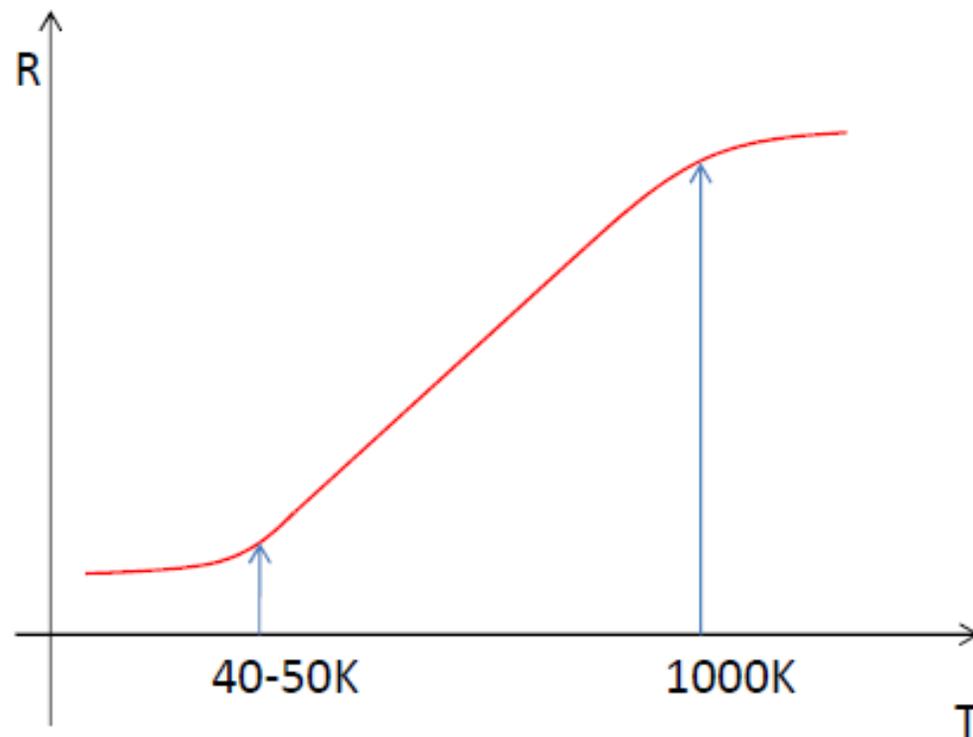
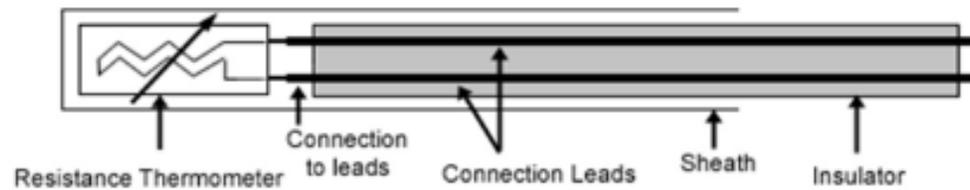


CERO ELECTRÓNICO





Resistencias de metales – (Pt100)

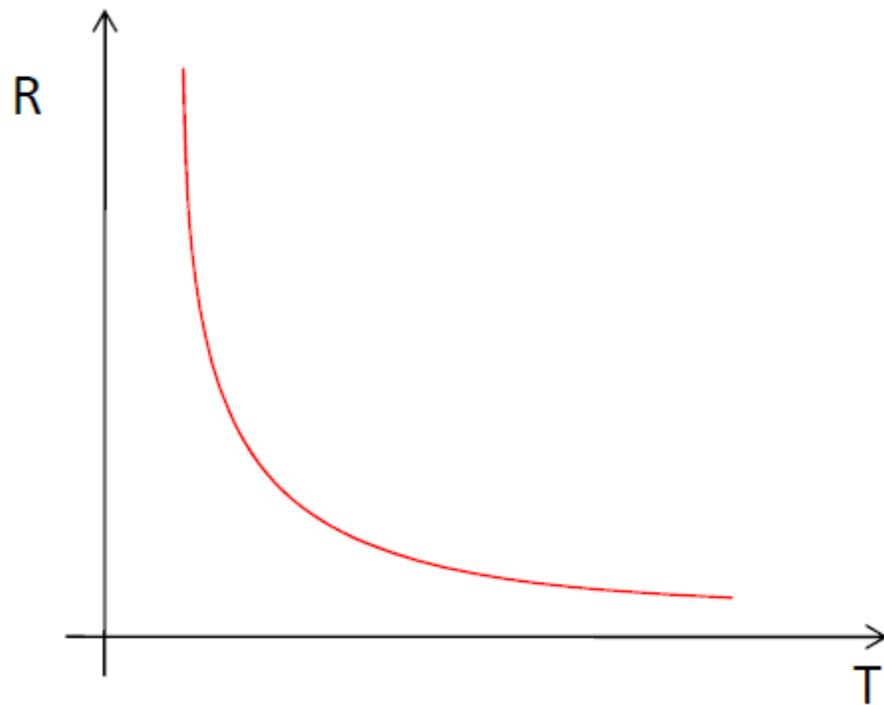


$$\rho = \rho_o (1 + \alpha \cdot T)$$

0,385Ω/°C
Standard Europeo

0,392Ω/°C
Standard Americano

Termistores



Semiconductores

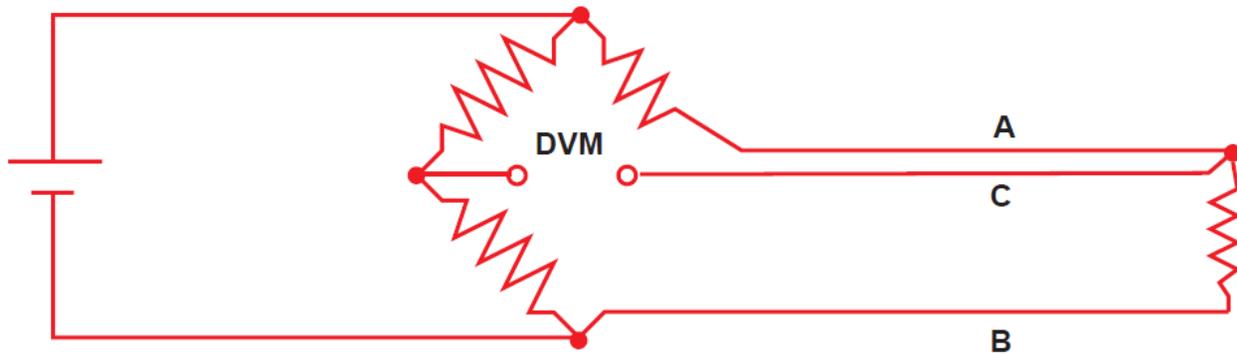
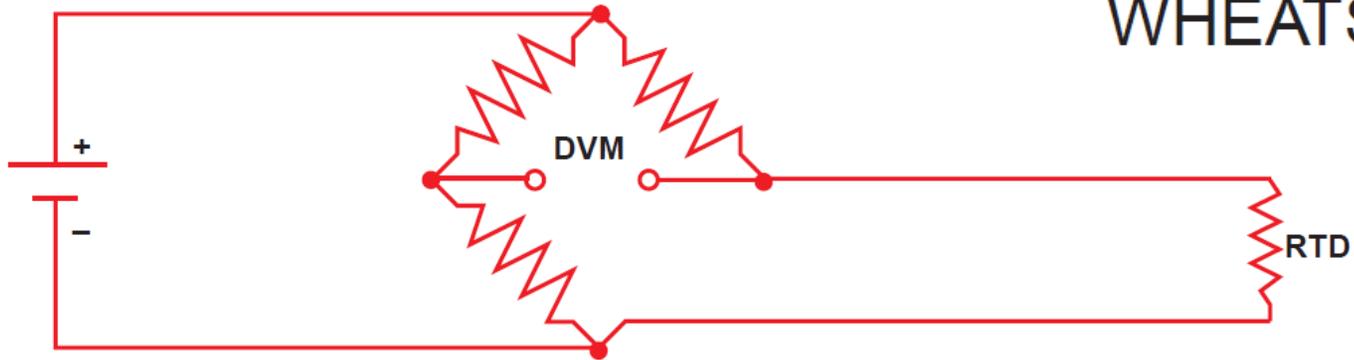
$$\frac{dR}{dT} < 0$$

Ecuación de Steinhart-Hart

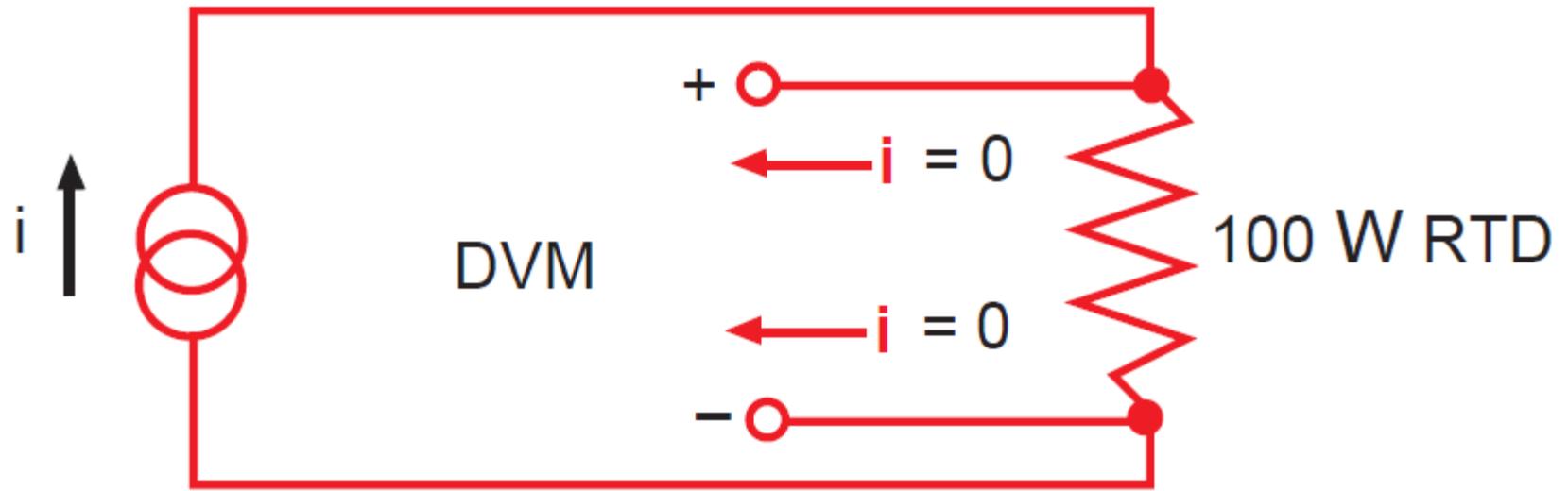
$$\frac{1}{T} = A + B \cdot \ln R + C(\ln R)^3$$



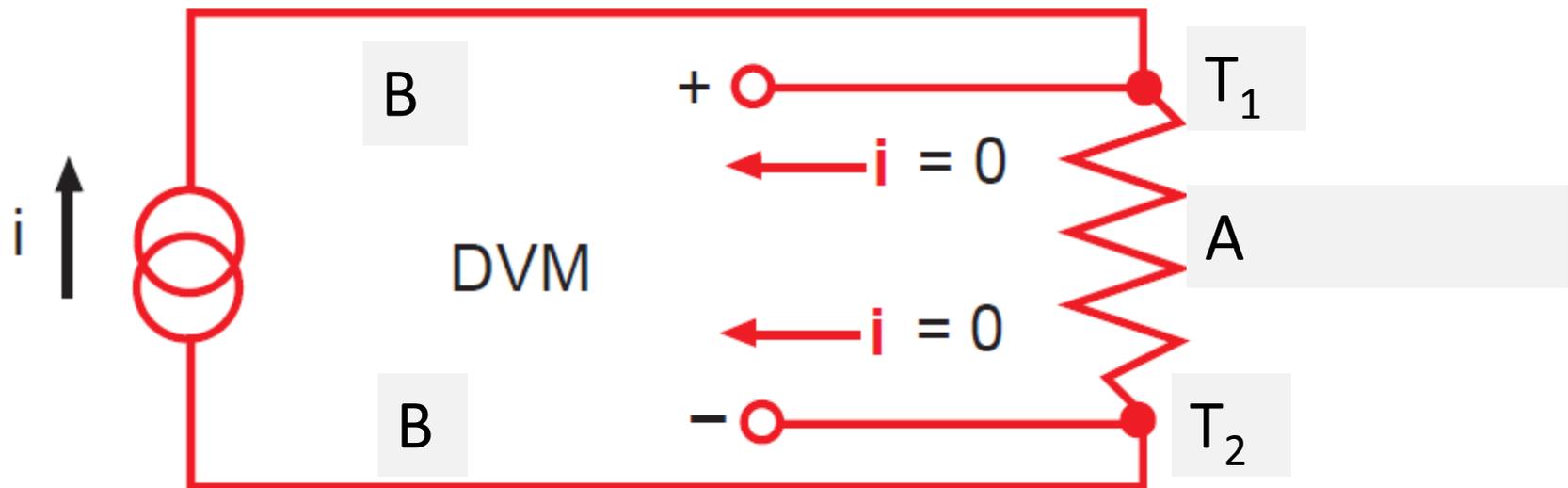
WHEATSTONE BRIDGE



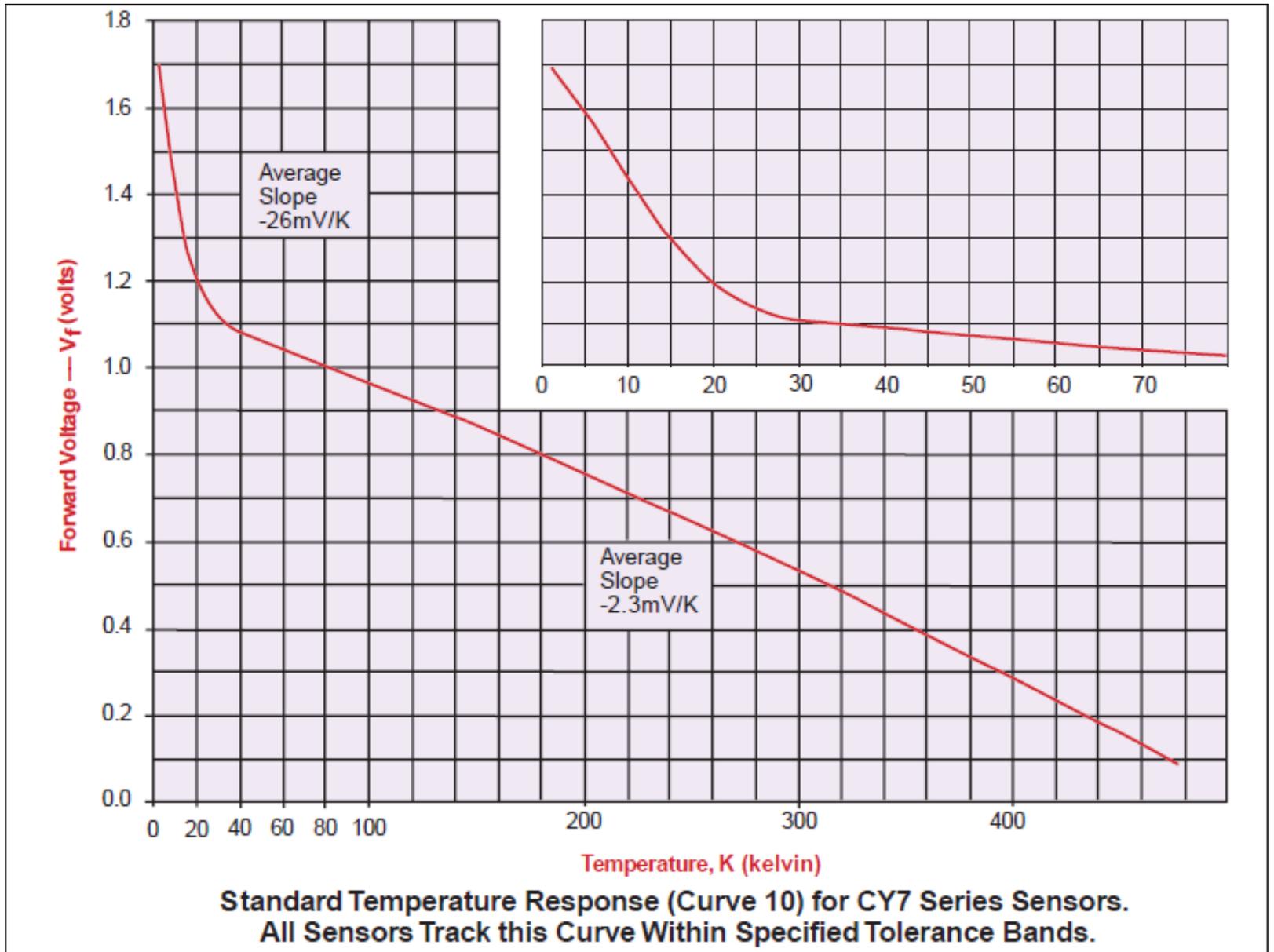
3-WIRE BRIDGE



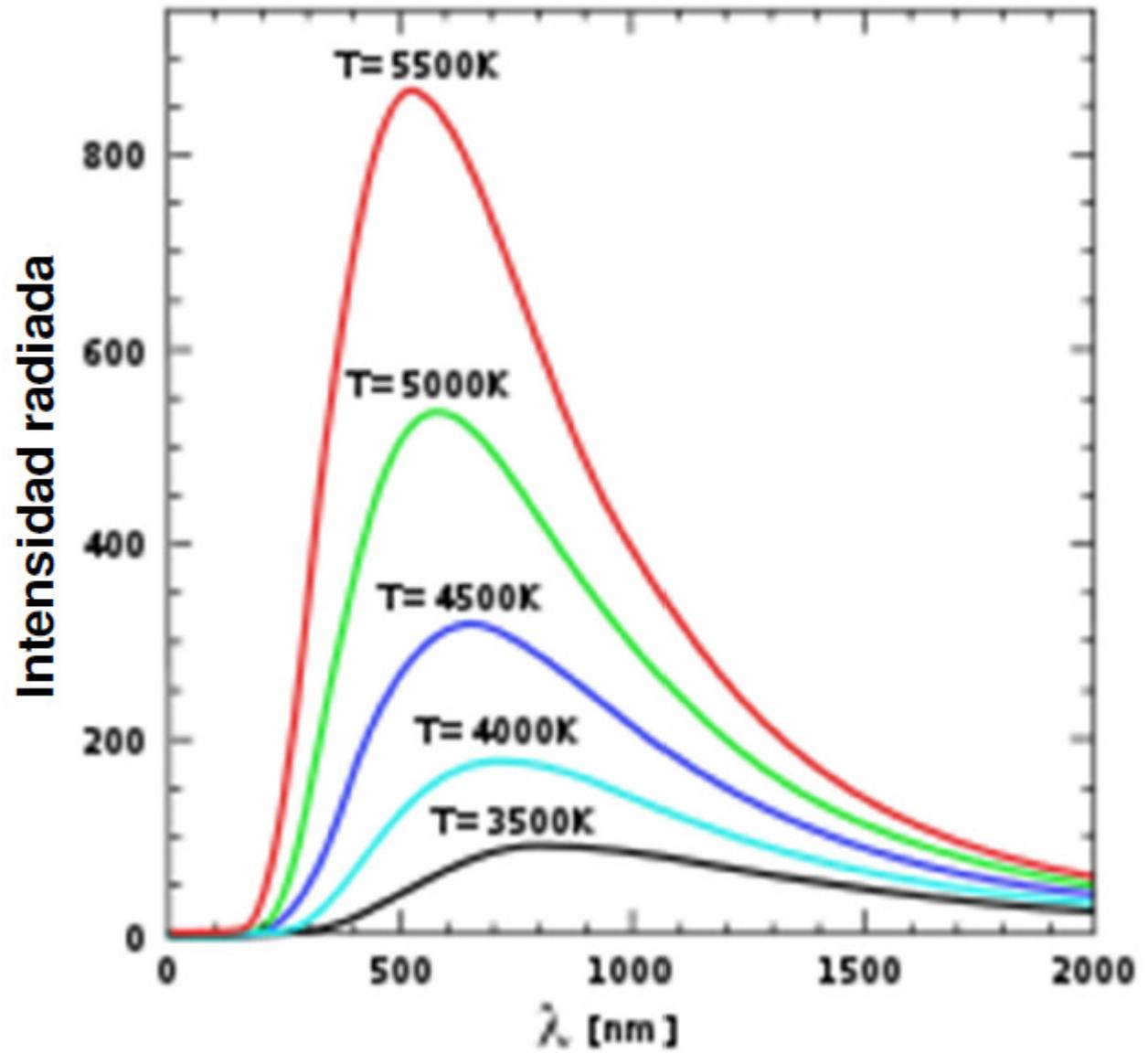
4-WIRE OHMS MEASUREMENT



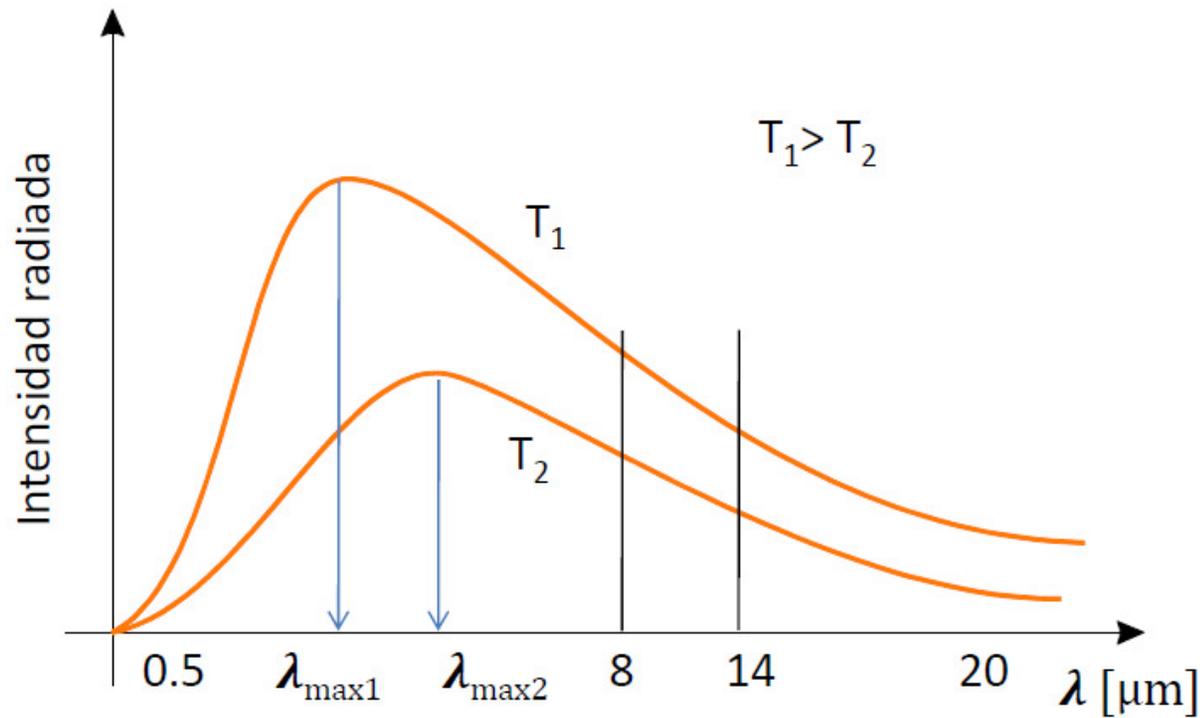
DIODO



PIRÓMETROS



Termómetros infrarrojos o Pirómetros



Supuestos: emisividad de cuerpo gris
no hay absorción en el medio