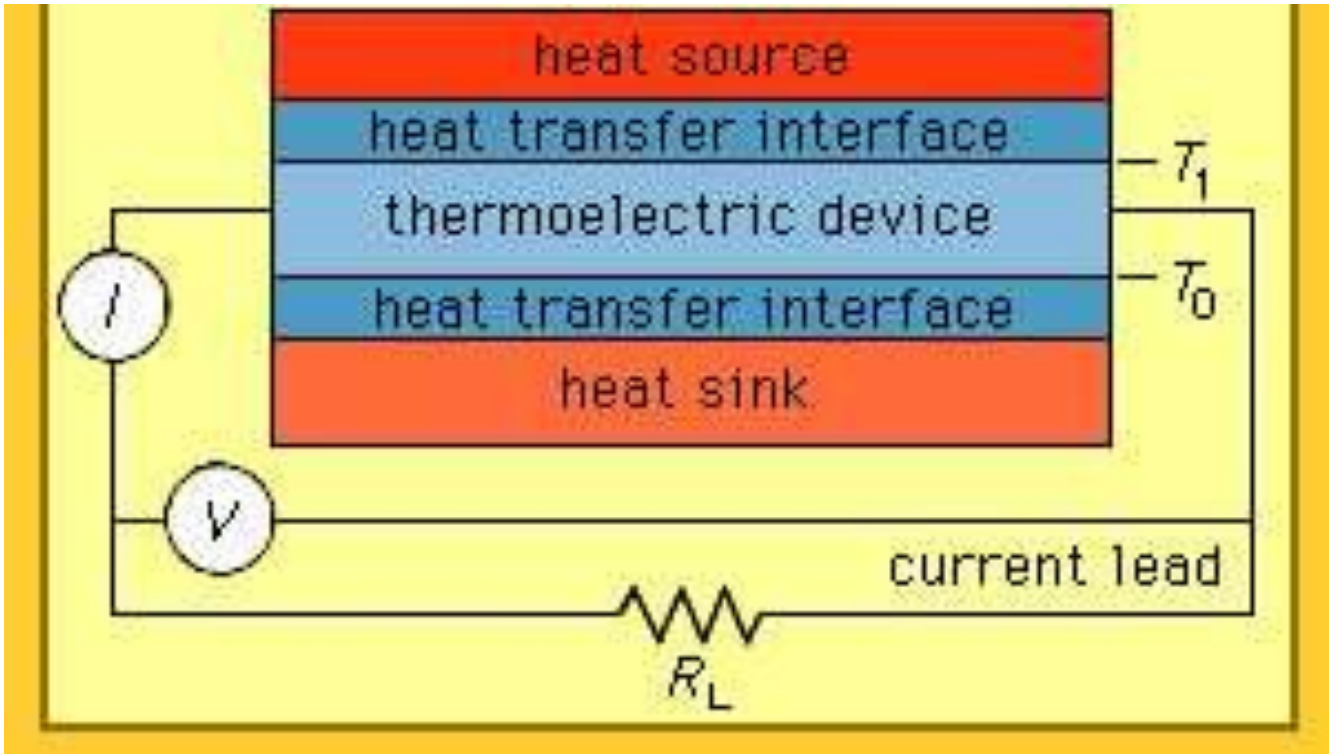
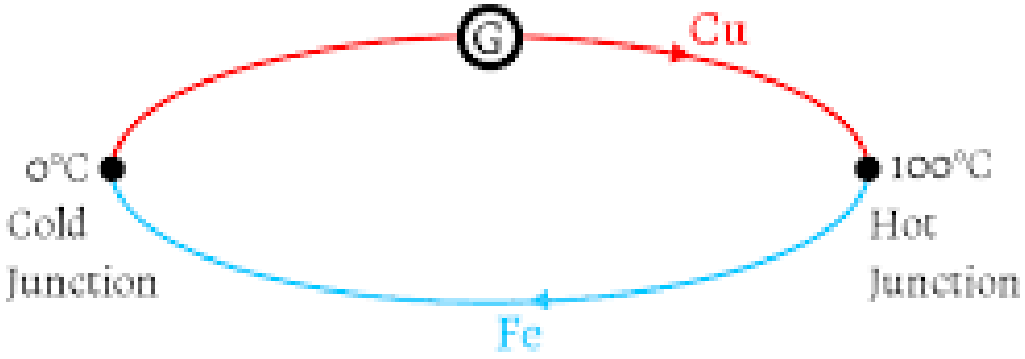
Thermoelectric Generator


heat source
heat transfer interface
thermoelectric device
heat transfer interface
heat sink
T_1
T_0
I
V
current lead
R_L

Major Heat Source Based Thermoelectric Generator

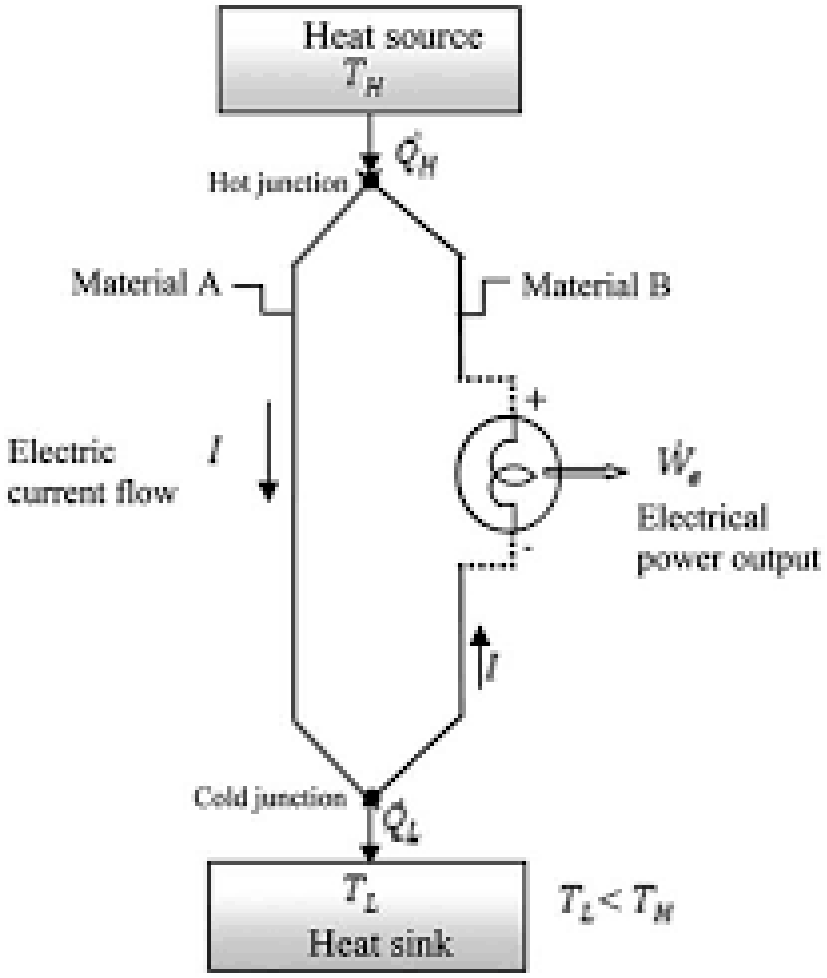
- Fossil Fuel Generator
- Solar Source Generator
- Nuclear Fuelled Generator

Seebeck Effect



Basic Metallic Thermoelectric Generator

Temp measurement



Semiconductor Thermoelectric Generator

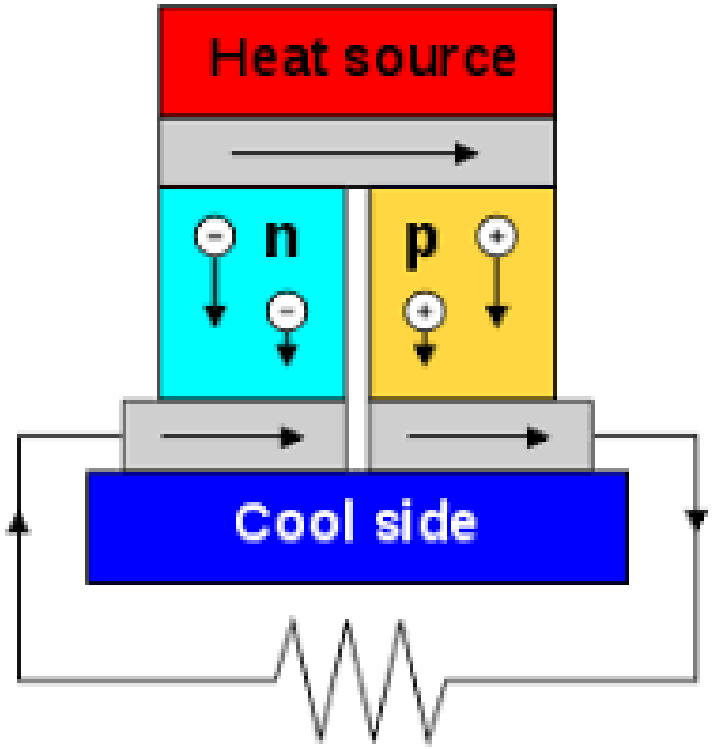


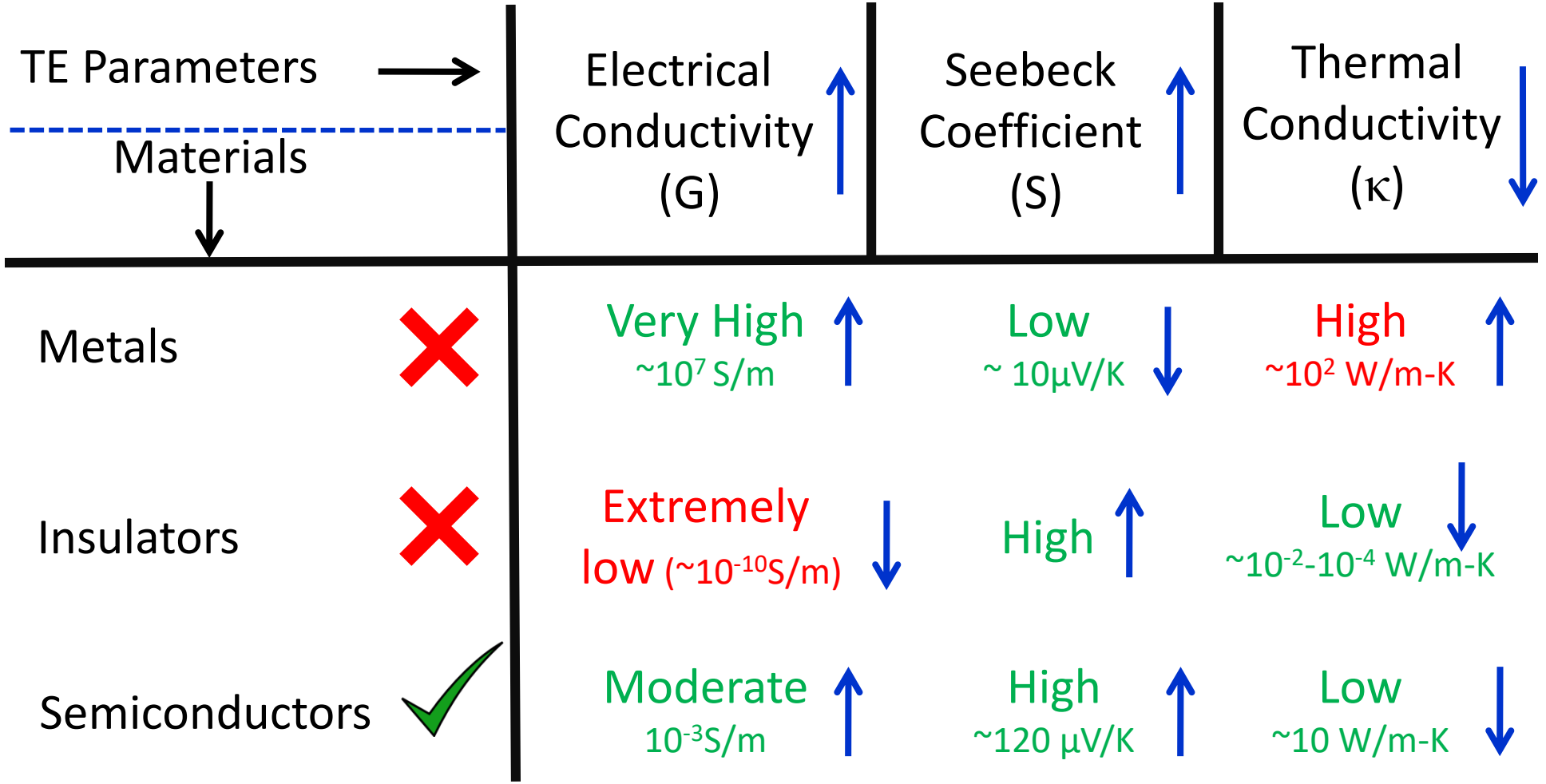
Figure of Merit

Device Efficiency

Cause of Seebeck Effect

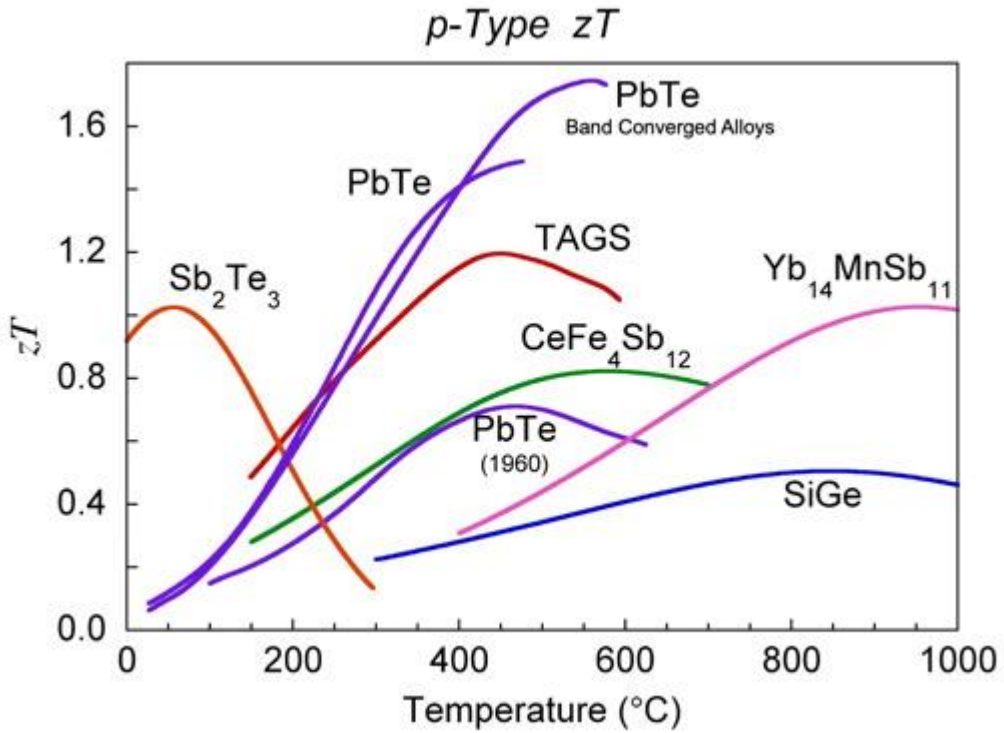
$$Z = \frac{S^2 \sigma}{k}$$

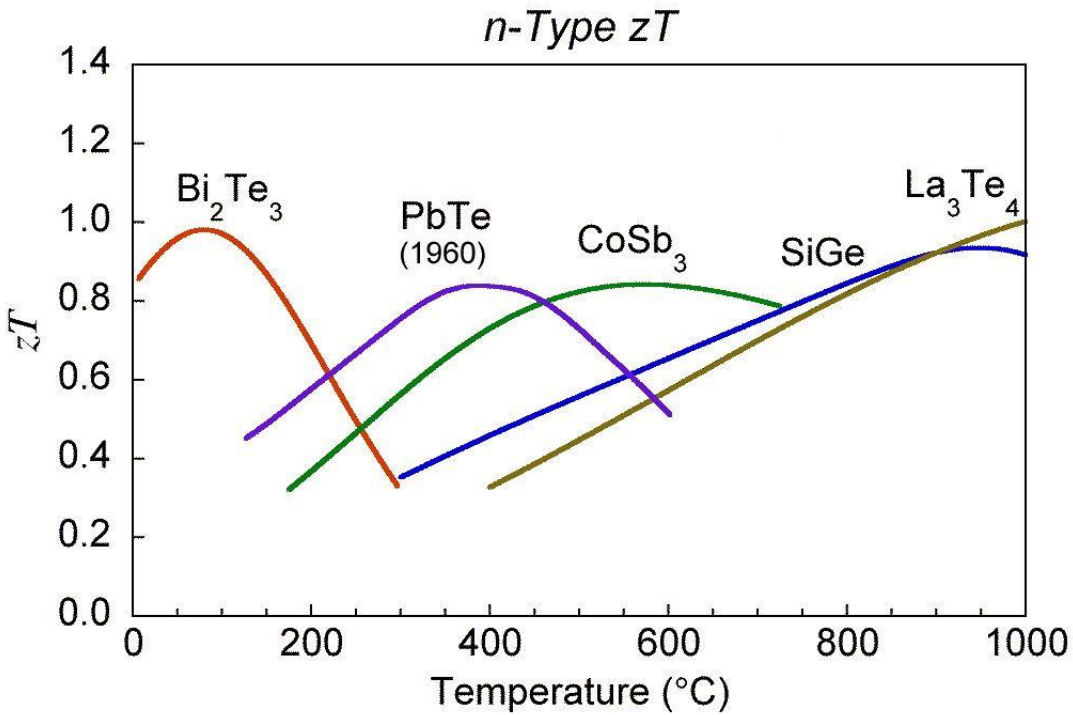
Material of choice for thermoelectricity



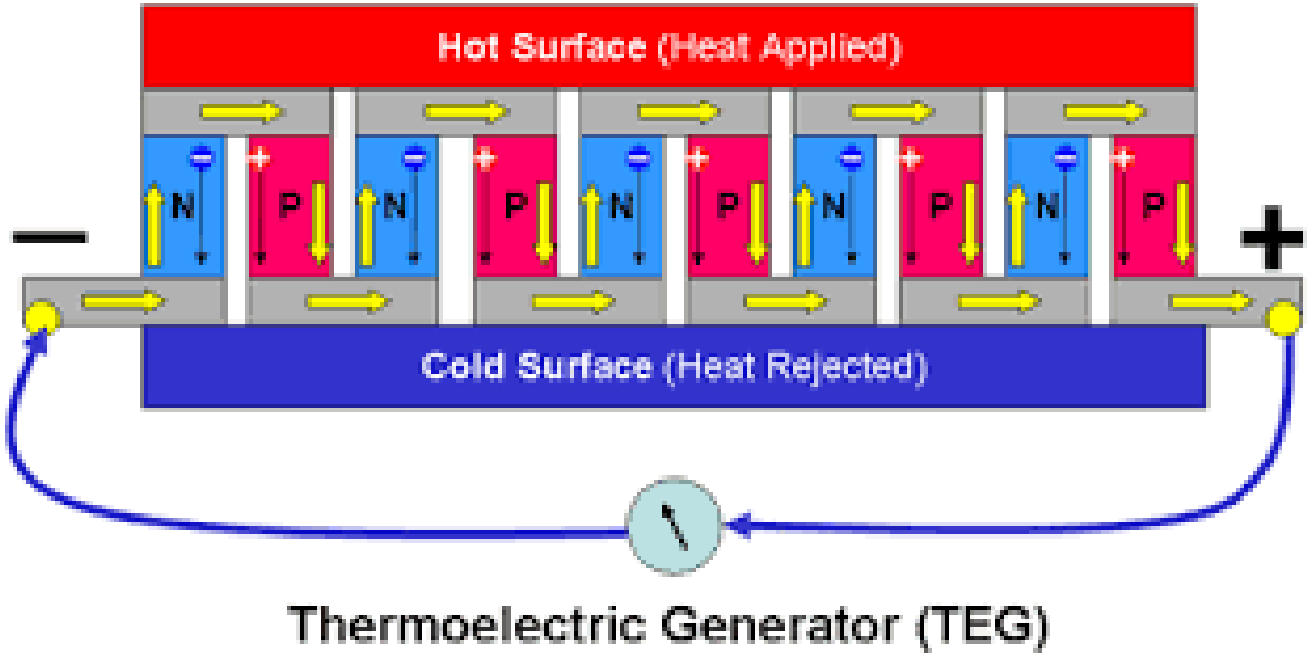
Semiconductors most suitable TE material.
Allow separate control of G (electrons) and κ (phonons).

Thermoelectric Materials





Arrangement of Semiconductor Thermoelectric Generator



Efficiency

Power output

Question 1. A thermal electric generator has the following properties

S.No	Properties	Material A	Material B
1	Seebeck Coefficient	-190×10^{-6}	-190×10^{-6}
2	Specific resistivity (ohm-cm)	1.45×10^{-3}	1.8×10^{-3}
3	Figure of Merit (z)	2×10^{-3}	1.7×10^{-3}
4	Cross-sectional Area	1	1.14
5	Length of Leg (cm)	1	1

Calculate thermal conductivity of each semiconductor and also the total resistance of both the semiconductor.

A thermoelectric generator with dimensions and properties given in previous example operated between the temperature Limits of 100 C and 300 C. Using the optimum value for the product of internal resistance and overall conductance, calculate the maximum generator efficiency for maxi. power. Further, calculate the power output for both the cases.

Thermoelectric Converter Module Application

Advantages and Disadvantages