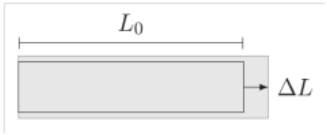
Heat and Temperature

Of the many possible temperature scales, the Celsius and Kelvin scales are preferred

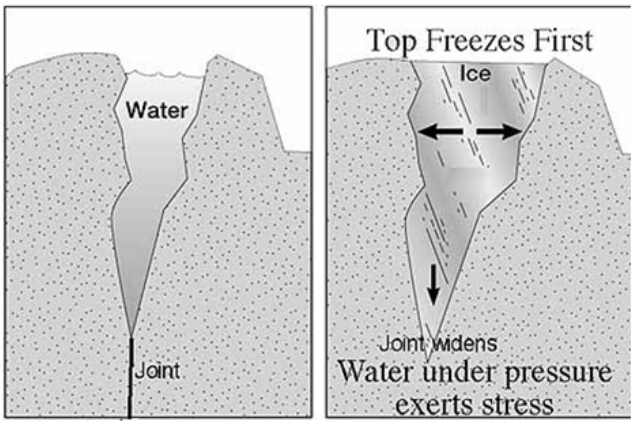
$$F = (9/5)C + 32 \qquad K = C + 273.15$$

$$C = (5/9)(F - 32) \qquad C = K - 273.15$$

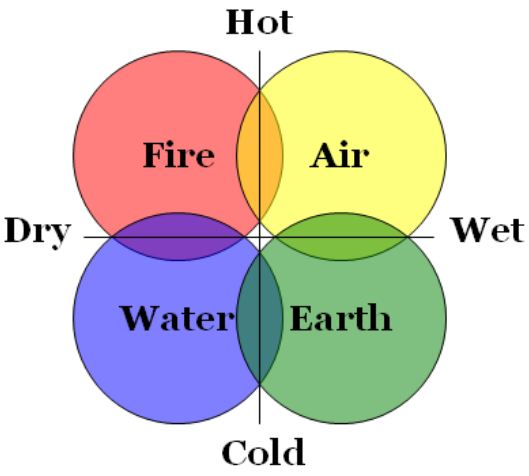
Thermometric properties are linear in small increments; simplest is thermal expansion



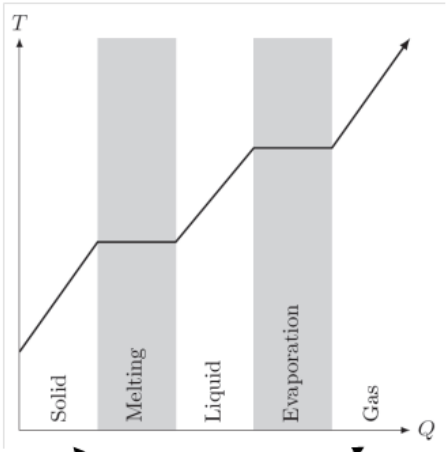
$$\frac{\Delta L}{L_0} = \alpha \Delta T$$



The difference between temperature and heat: heat capacity and internal energy

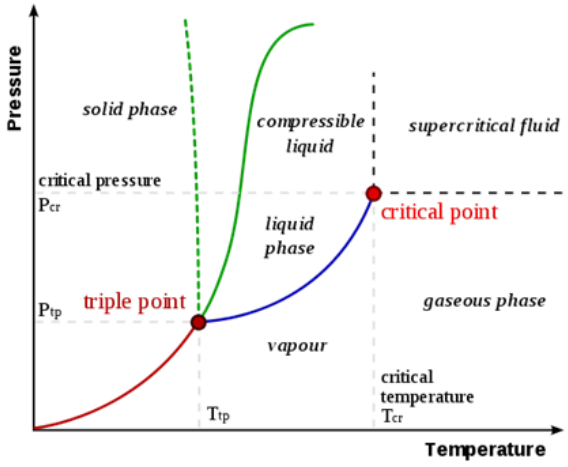


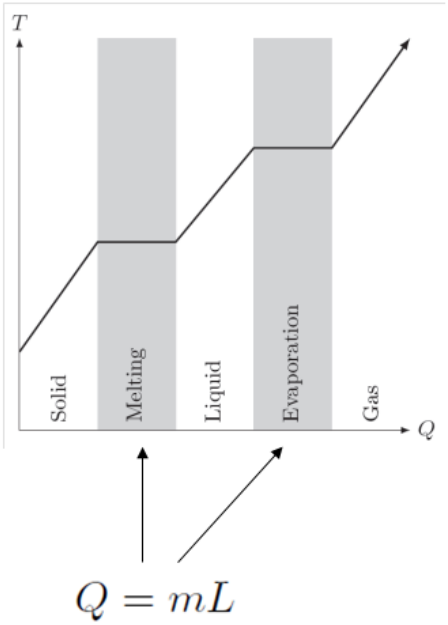
$1 \text{ cal} = 4.186 \text{ J}$



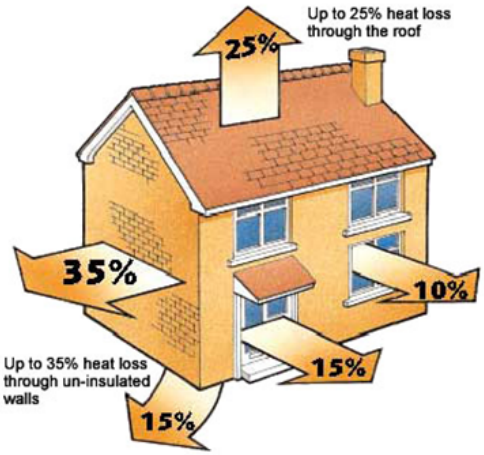
$$Q = C\Delta T$$
$$Q = cm\Delta T$$

Phase changes also show the distinction between heat energy and temperature



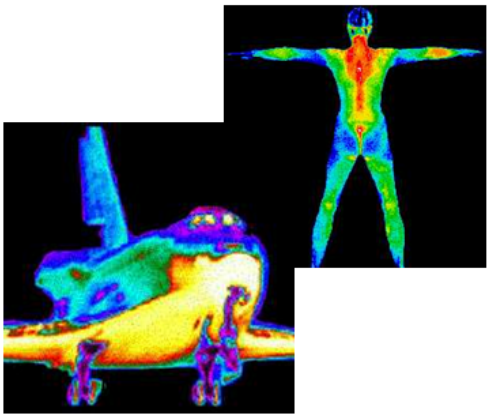


Heat energy is transported via conduction (solids) and convection (fluids)



$$P = \frac{Q}{t} = \frac{kA}{L}(\Delta T) \qquad R = \frac{L}{k}$$

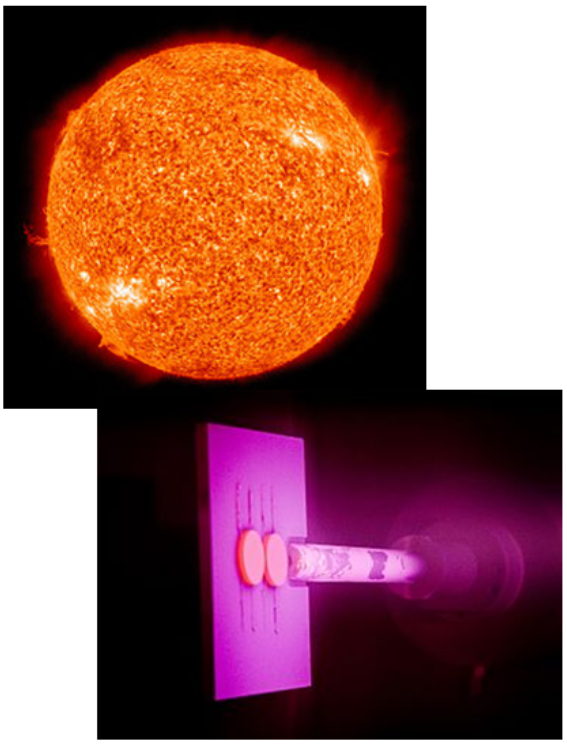
The electromagnetic field is also able to transport heat energy via radiation

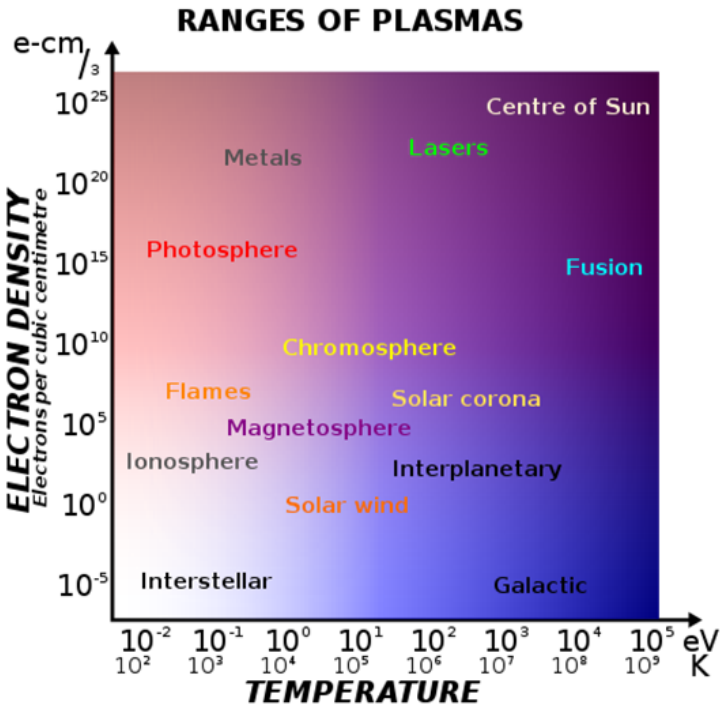


$$P = \frac{Q}{t} = \epsilon \sigma A T^4$$

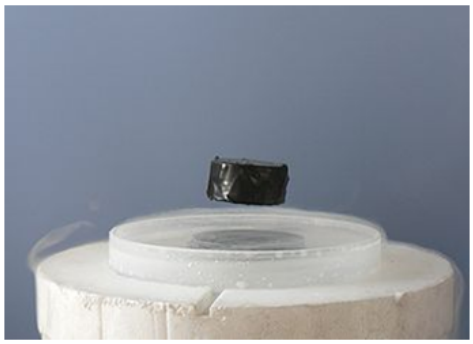
5.67×10^{-8}

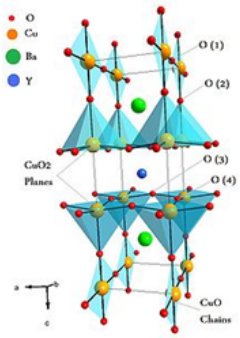
Very high temperatures can rip apart the atoms in a gas to create plasma

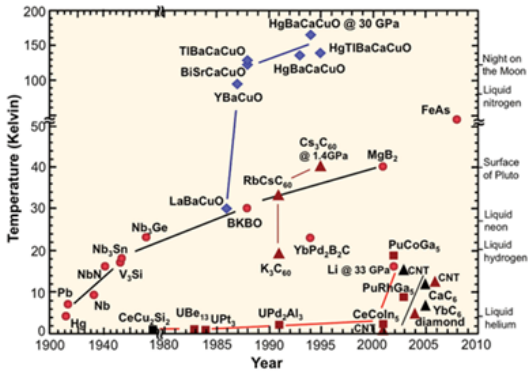


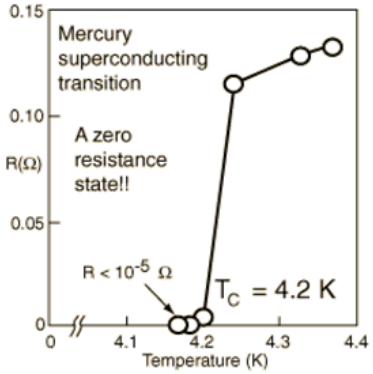


Very low temperatures reveal a new world of superconductivity and other effects









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