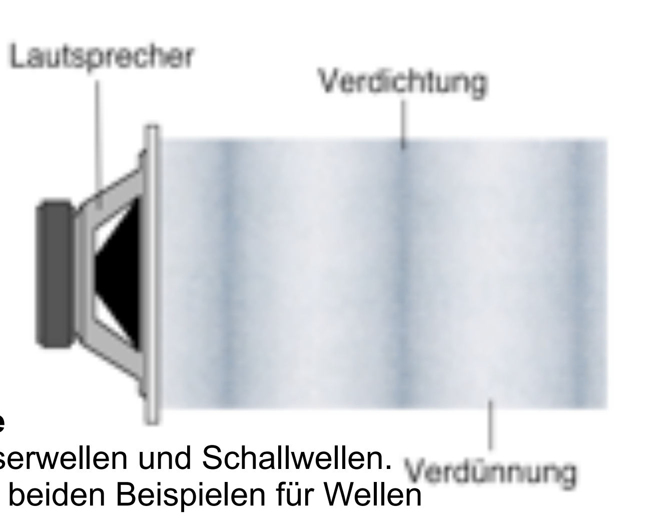
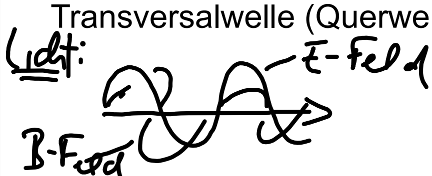
Aufgabe 2: Wasserwelle
a) Eine Meereswelle besitzt eine Wellenlänge von 200 m und eine Schwingungsdauer von 10 s.
Wie groß ist ihre Ausbreitungsgeschwindigkeit?
b) Was geschieht, wenn die Meereswelle auf die seichte Uferzone bzw. das Ufer aufläuft?

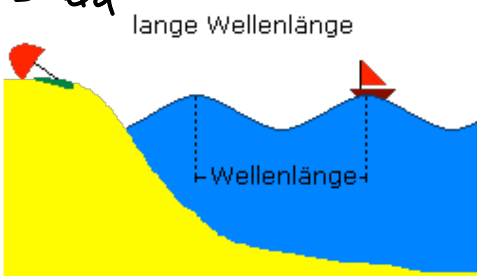
$c = \lambda \cdot f \qquad f = \frac{1}{T} = \frac{1}{10}\,\frac{1}{s} \qquad \lambda = 200\,m$

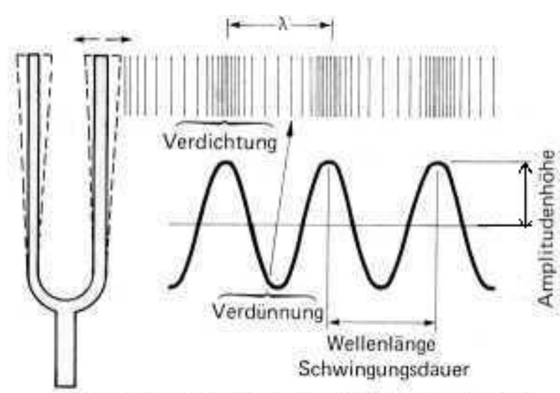
$c = 200\,m \cdot \frac{1}{10}\,\frac{1}{s} = 20\,\frac{m}{s}$



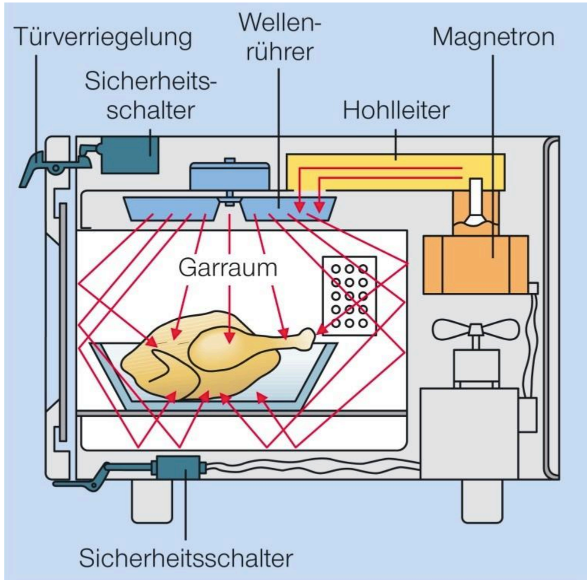
Aufgabe 3: Schallwelle
a) Vergleichen Sie Wasserwellen und Schallwellen.
b) Stellen Sie an diesen beiden Beispielen für Wellen mit Hilfe von Skizzen den Unterschied zwischen Transversalwelle (Querwelle) und Longitudinalwelle (Längswelle) dar.

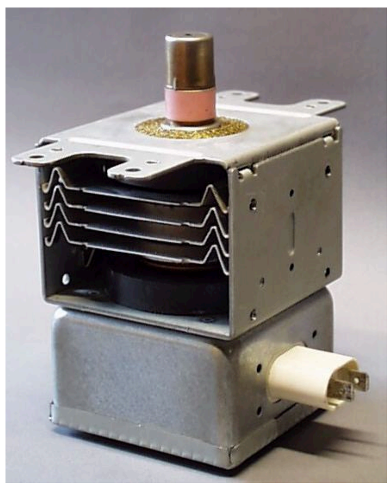


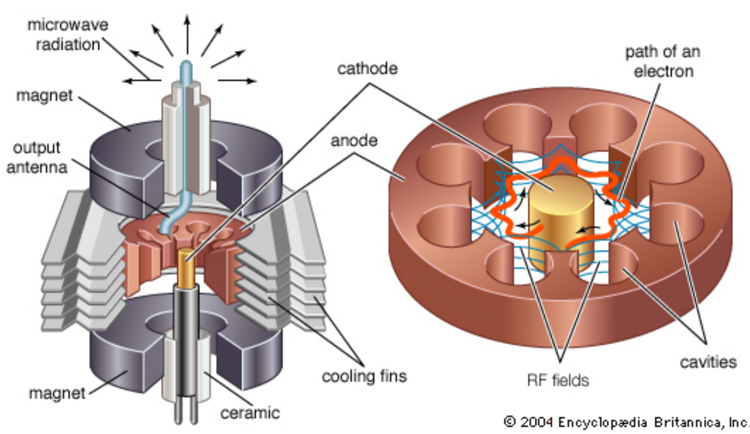




Darstellung eines einfachen Schwingungsvorgangs


Türverriegelung
Wellen-
rührer
Magnetron
Sicherheits-
schalter
Hohlleiter
Garraum
Sicherheitsschalter




microwave
radiation
magnet
output
antenna
magnet
ceramic
cathode
anode
cooling fins
path of an
electron
RF fields
cavities
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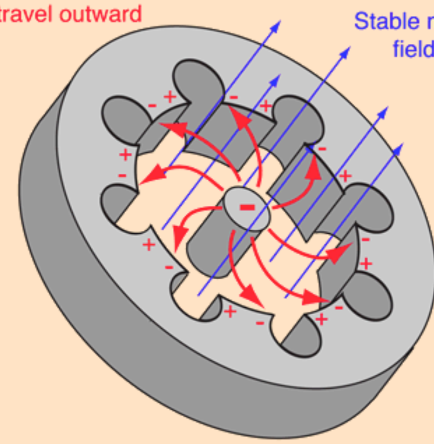
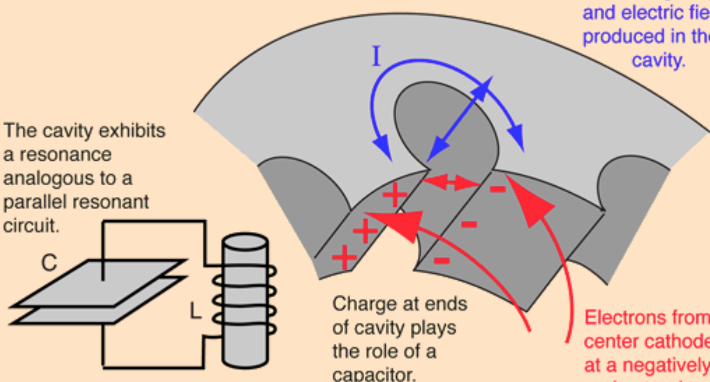
The Magnetron

The microwave radiation of microwave ovens and some radar applications is produced by a device called a magnetron.



The magnetron is called a "crossed-field" device in the industry because both magnetic and electric fields are employed in its operation, and they are produced in perpendicular directions so that they cross. The applied magnetic field is constant and applied along the axis of the circular device illustrated. The power to the device is applied to the center cathode which is heated to supply energetic electrons which would, in the absence of the magnetic field, tend to move radially outward to the ring anode which surrounds it.



$$f_{resonance} \approx \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$$

Electrons are released at the center hot cathode by the process of thermionic emission and have an accelerating field which moves them outward toward the anode. The axial magnetic field exerts a magnetic force on these charges which is perpendicular to their initially radial motion, and they tend to be swept around the circle. In this way, work is done on the charges and therefore energy from the power supply is given to them. As these electrons sweep toward a point where there is excess negative charge, that charge tends to be pushed back around the cavity, imparting energy to the oscillation at the natural frequency of the cavity. This driven oscillation of the charges around the cavities leads to radiation of electromagnetic waves, the output of the magnetron.

Energie der Mikrowelle

$P = 600\,W \qquad t = 6\,min$

$W = ?$

$\boxed{Ws = J = V \cdot A \cdot s}$

$W = P \cdot t$

$= 600 \cdot 6 \cdot 60\ Ws$

$= 216\,000\ J$

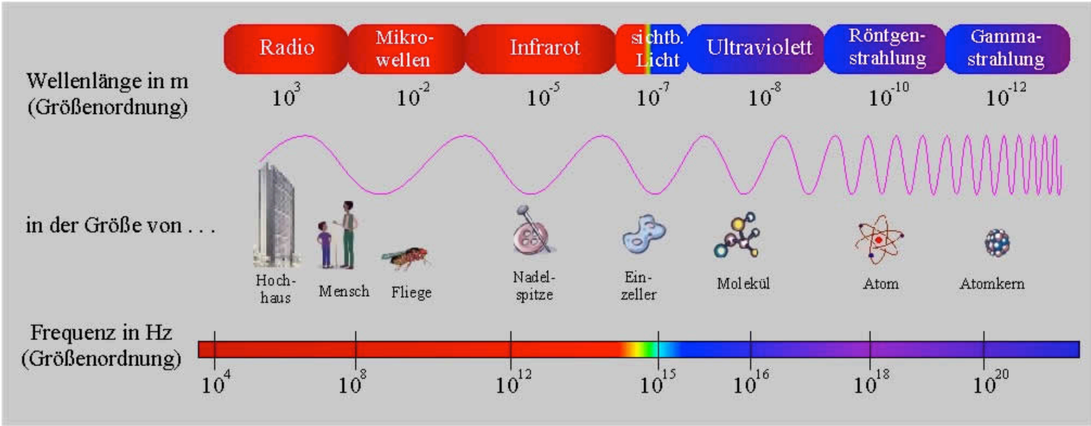
Handy: SAR-Wert $0{,}6\ \frac{W}{kg}$

Ohr: $m = 100\ g = 0{,}1\ kg$

6 min telefonieren

$W = 0{,}6\ \frac{W}{kg} \cdot 0{,}1\ kg \cdot 6 \cdot 60\ s$

$= 21{,}6\ J$



Ein Mikrowellenherd erhitzt zunächst die Wassermoleküle im Essen.

Quelle: Dirk Rathje/Welt der Physik