

Physics of sterilization

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Frequently used Physical terms and conditions

- Sterilization conditions
- Temperature
- Pressure
- Saturated
- Concentration
- Condensation
- Humidity
- Relations between:
 - Pressure - temperature
 - Pressure – humidity

Sterilization conditions

- Steam
- Gas
- Irradiation
- Dry heat

Physical parameters

- Concentration
- Temperature
- Pressure
- Humidity
- Displacement

Temperature

- Different scales
 - Fahrenheit (°F)
 - Celsius (°C)
 - Freezing point water is 0 °C by definition
 - Boiling water is 100 °C by definition
 - Scale divided in 100 equal portions
 - Kelvin (K)

Fahrenheit (°F)

- Coldest possible temperature of Fahrenheit to avoid negative numbers
 - measured temperature outside in Gdansk (Poland) In the winter from 1708 / 1709
 - Coldest fluid he could make
- Divided the temperature between his minimum and maximum temperature in 12 sections.

Celsius ($^{\circ}\text{C}$)

- Freezing point water is 0°C by definition
- Boiling water is 100°C by definition
- Scale divided in 100 equal portions

Kelvin (K)

- Same scale partitions as Celsius
- Absolute zero point (0 K)
- $0\text{ K} = -273.15\text{ }^{\circ}\text{C}$

Temperature and energy

- Temperature is a form of energy (thermodynamic energy)
- Molecules moves
- At 0 K Molecules stop moving
- The absolute zero point (0 K) is not yet reached

Pressure

- Molecules
- Collapsing
- Number of molecules
- Collision

Different measures

- PSI
- Bar
- Atm(a) relative / absolute
- kPa
- Torr

Temperature and pressure

- Same number of molecules
 - Temperature
 - The higher the temperature the faster the molecules
 - The higher the impact
 - The higher the pressure
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- Same temperature
 - The more molecules
 - the more impacts
 - The higher the pressure

Universal gas law

$$\frac{p_1 \times V_1}{T_1} = \frac{p_2 \times V_2}{T_2}$$

Why pressure boiling point

- Only water molecules

Pressure temperature relation

- Only water molecules
- Relation know

Vacuum

- No molecules
- No collisions
- Pressure 0 (kPa)

Concentration

- Salt in water

Saturation

- Salt in water and more salt

Diffusion candle

- Bottle of perfume

Convection

- Candle with aluminium paper
- Fan

Condensation

- When
- Mirror test

Gravity

- Newton

Displacement

- Oil and water
- Caption of water in bowls

Differences in processes

- Atmospheric
- Super atmospheric
- Sub atmospheric
- Cross atmospheric

Fractionated vacuum/ washing

- Water and wine

Mixing steam and air

- Sand in water

Conclusion

Physics together with Microbiology is
the basis of sterilization