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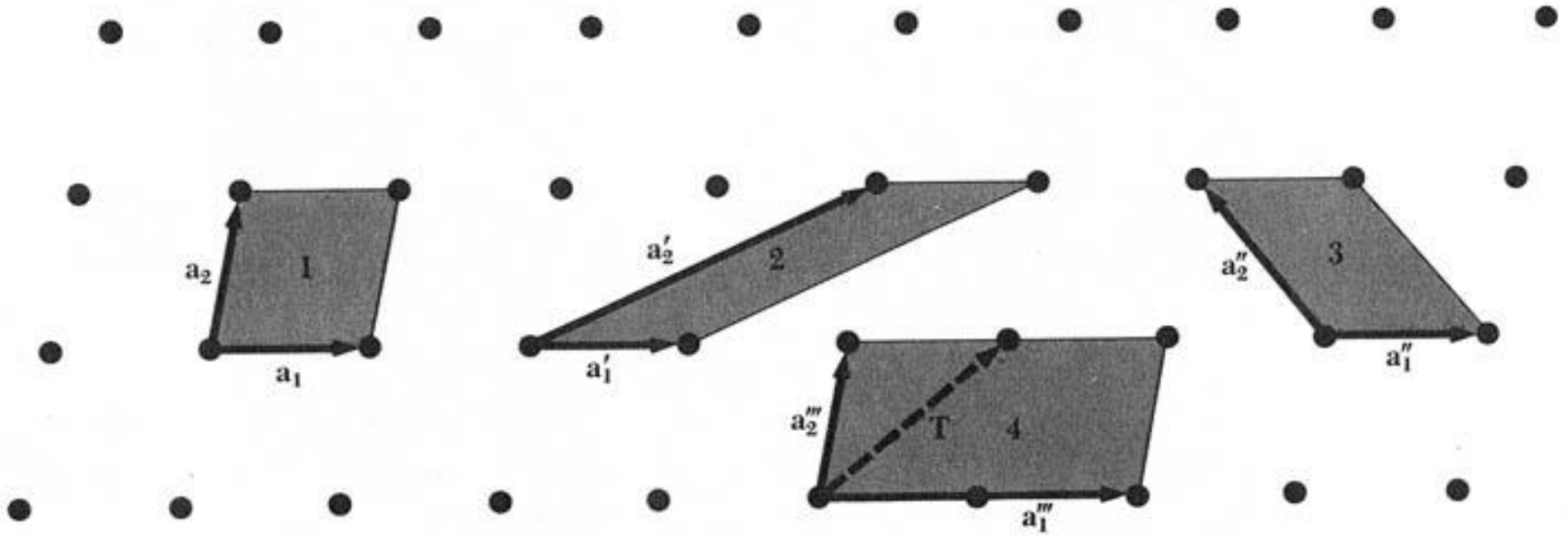
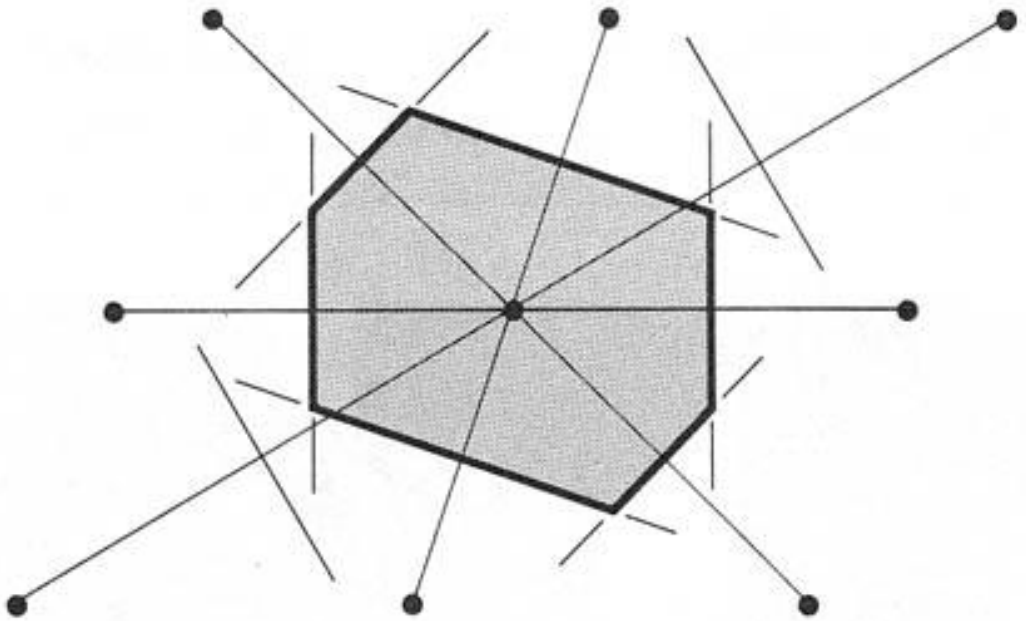
# Kristallstrukturen im Ortsraum




Nichteindeutigkeit der (primitiven) Einheitszelle – 2D Gitter

aus Kittel



Konstruktion der Wigner-Seitz-Zelle

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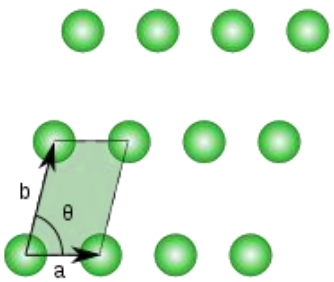
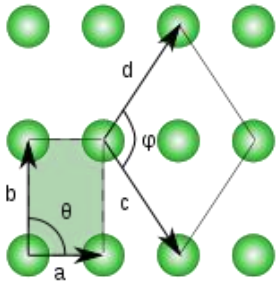
# 2D Kristallsysteme

4 Kristallsysteme - 5 Bravais-Gitter

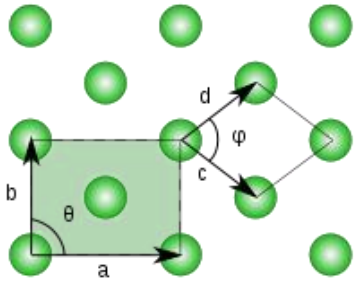
wikipedia.org



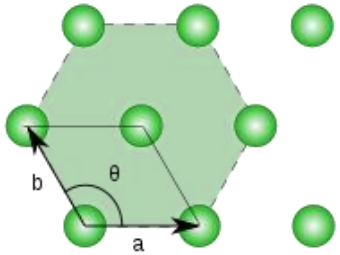

1



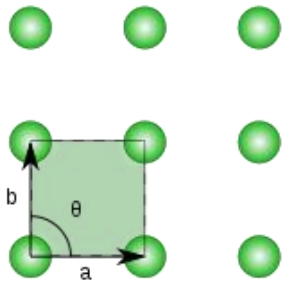

2




3

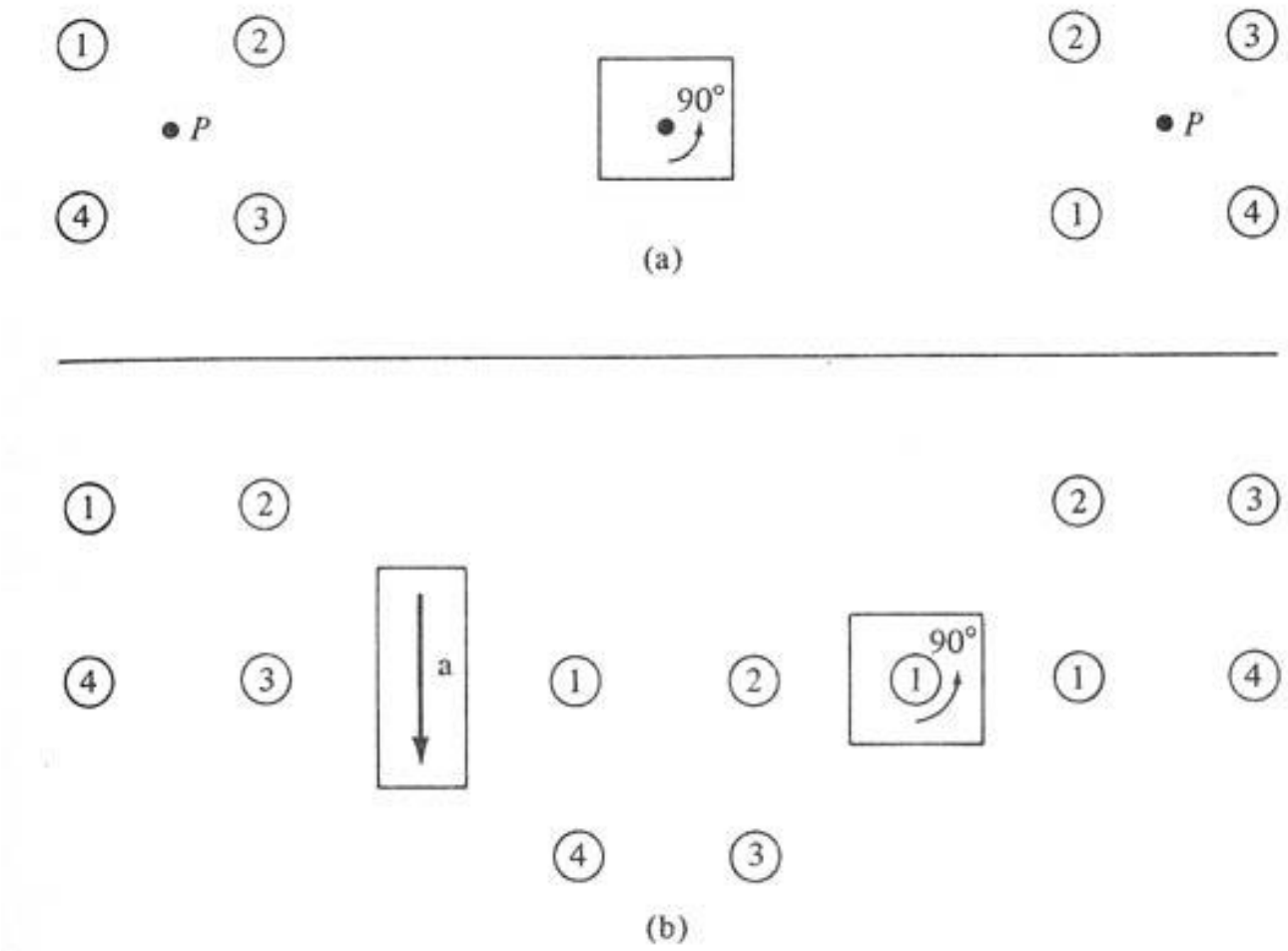



4




5

| | | | |
|---|---|---|---|
| $\lvert a\rvert \neq \lvert b\rvert$, $\theta \neq 90°$ | $\lvert a\rvert \neq \lvert b\rvert$, $\theta = 90°$<br>$\lvert c\rvert = \lvert d\rvert$, $\varphi \neq 90°$ | $\lvert a\rvert = \lvert b\rvert$, $\theta = 120°$ | $\lvert a\rvert = \lvert b\rvert$, $\theta = 90°$ |
| m | o | h | t |




Konstruktion einer Symmetrieoperation aus
einer Translation und einer Punkttransformation (nach Kittel)

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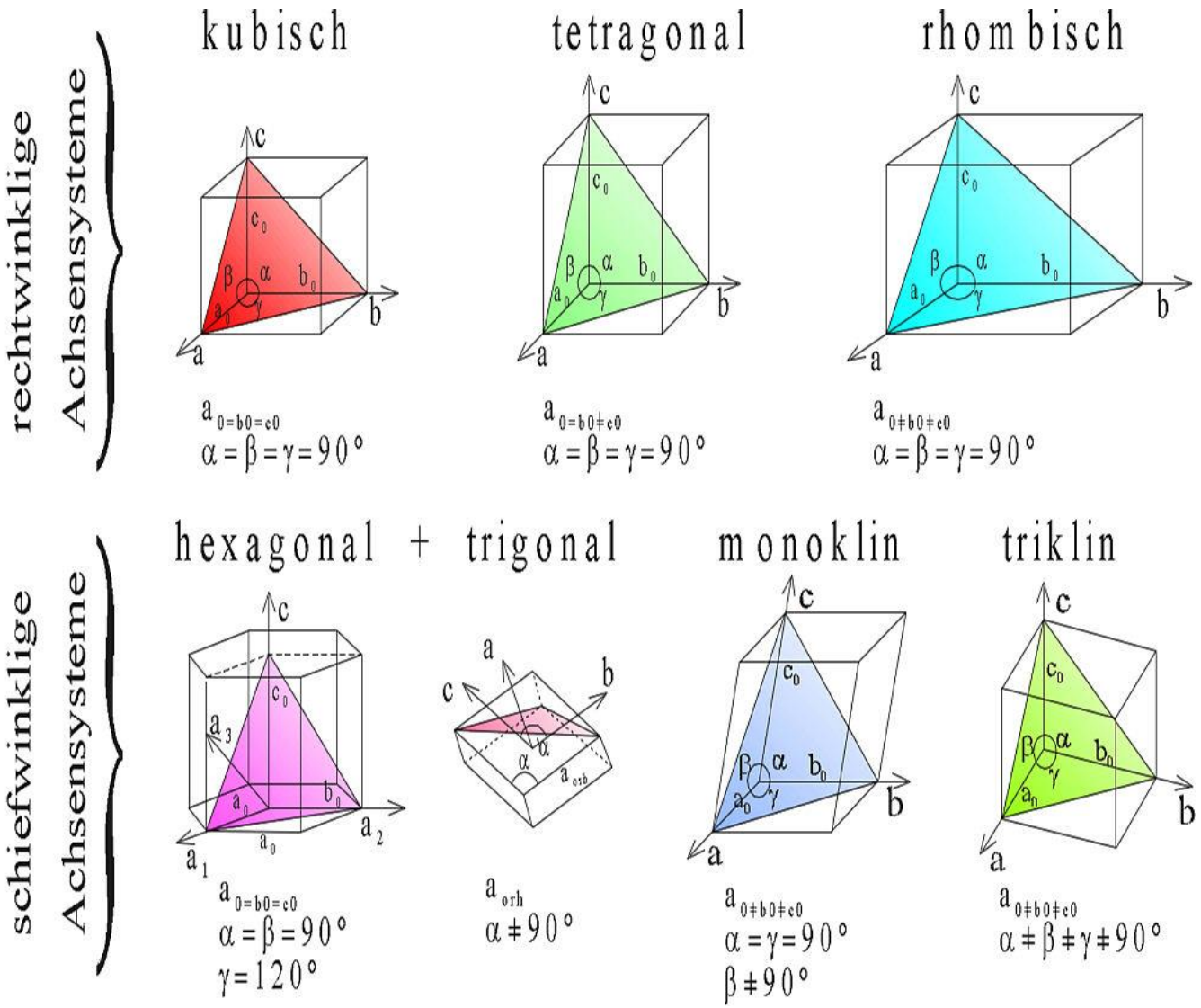
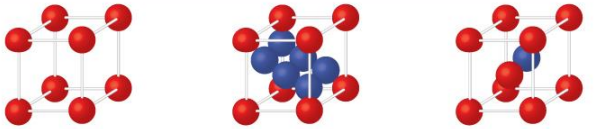
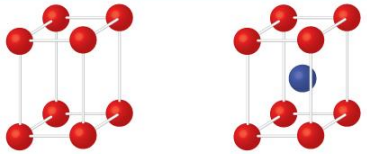
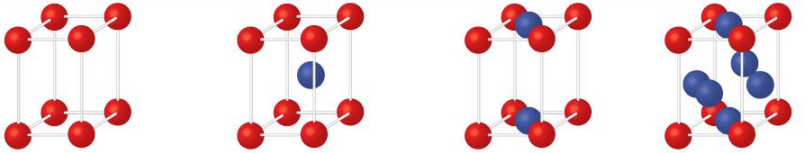
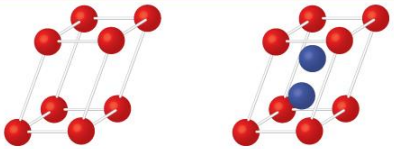
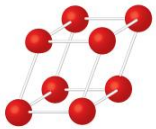
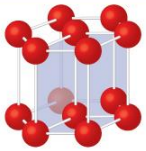
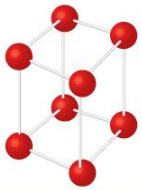
# 3D Kristallsysteme

wikipedia.org

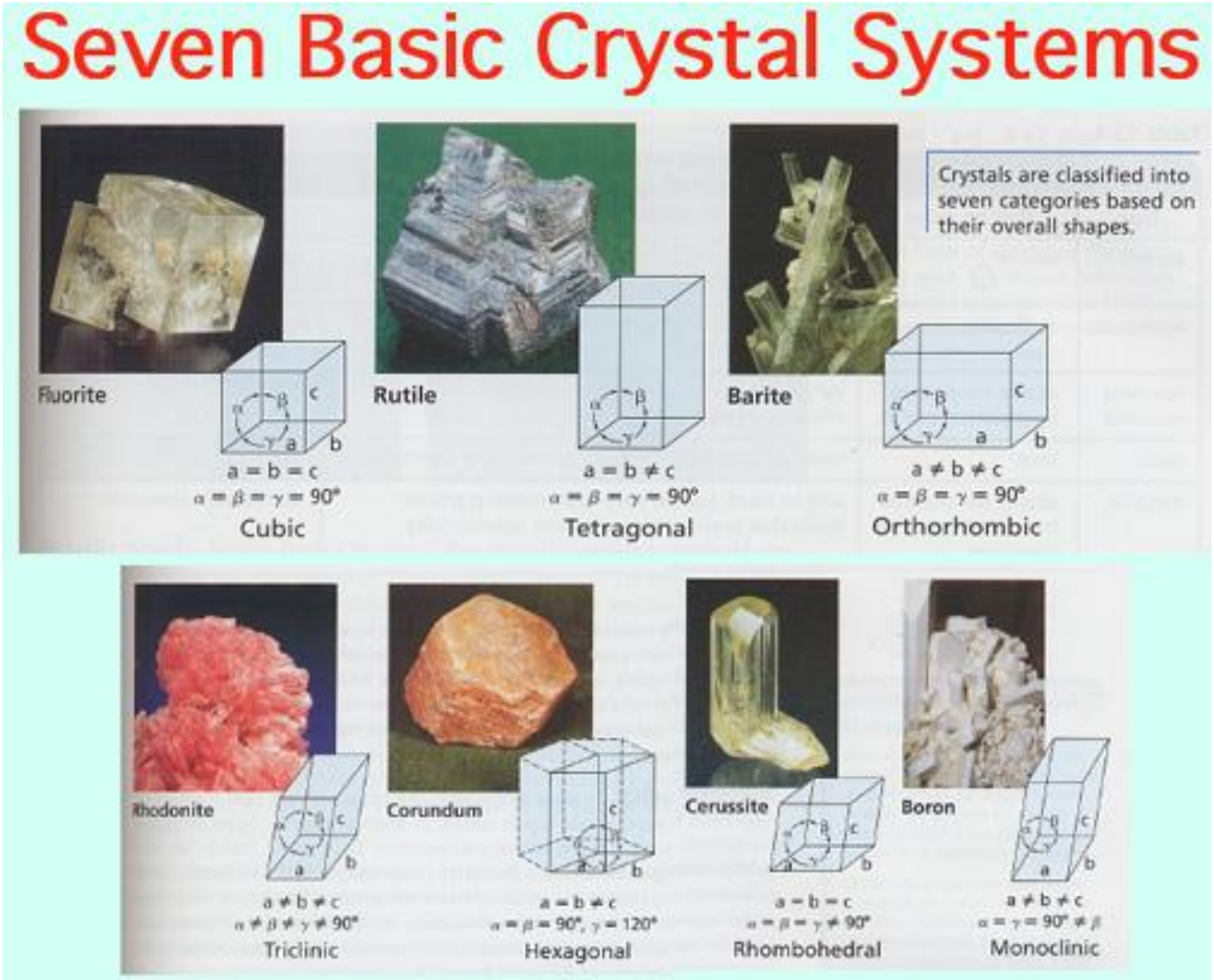


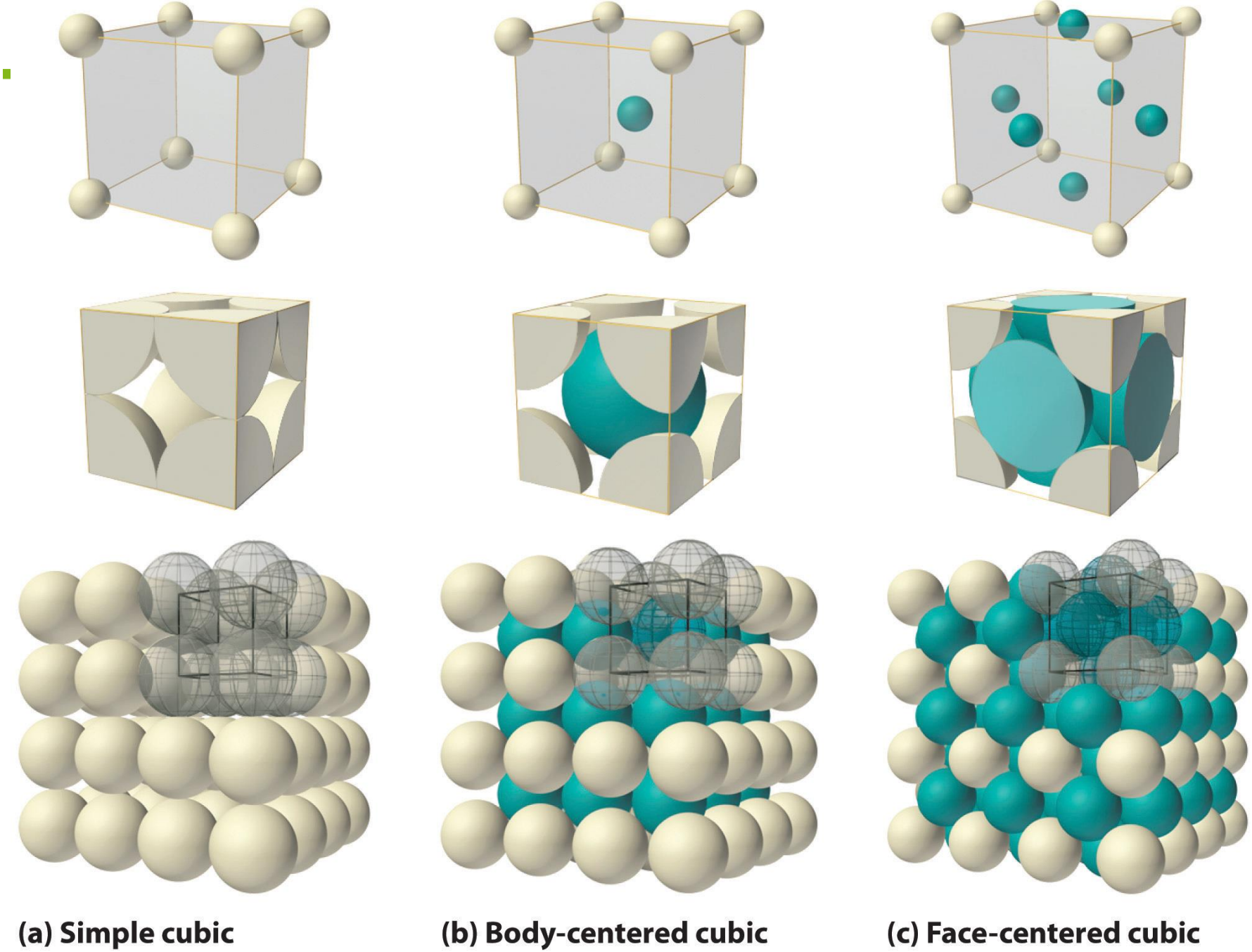
| System/Axes/Angles | Unit Cells |
|---|---|
| Cubic<br>$a = b = c$<br>$\alpha = \beta = \gamma = 90^\circ$ |  <br>Simple Face-centered Body-centered |
| Tetragonal<br>$a = b \neq c$<br>$\alpha = \beta = \gamma = 90^\circ$ |  <br>Simple Body-centered |
| Orthorhombic<br>$a \neq b \neq c$<br>$\alpha = \beta = \gamma = 90^\circ$ |  <br>Simple Body-centered Base-centered Face-centered |
| Monoclinic<br>$a \neq b \neq c$<br>$\alpha = \gamma = 90^\circ; \beta \neq 90^\circ$ |  <br>Simple Base-centered |
| Triclinic<br>$a \neq b \neq c$<br>$\alpha \neq \beta \neq \gamma \neq 90^\circ$ |  |
| Hexagonal<br>$a = b \neq c$<br>$\alpha = \beta = 90^\circ; \gamma = 120^\circ$ |  |
| Rhombohedral<br>$a = b = c$<br>$\alpha = \beta = \gamma \neq 90^\circ$ |  |

https://opentextbc.ca/chemistry/chapter/10-6-lattice-structures-in-crystalline-solids/

**3D Bravais-Gitter**

https://www.pinterest.com/seekerkat/crystal-systems/





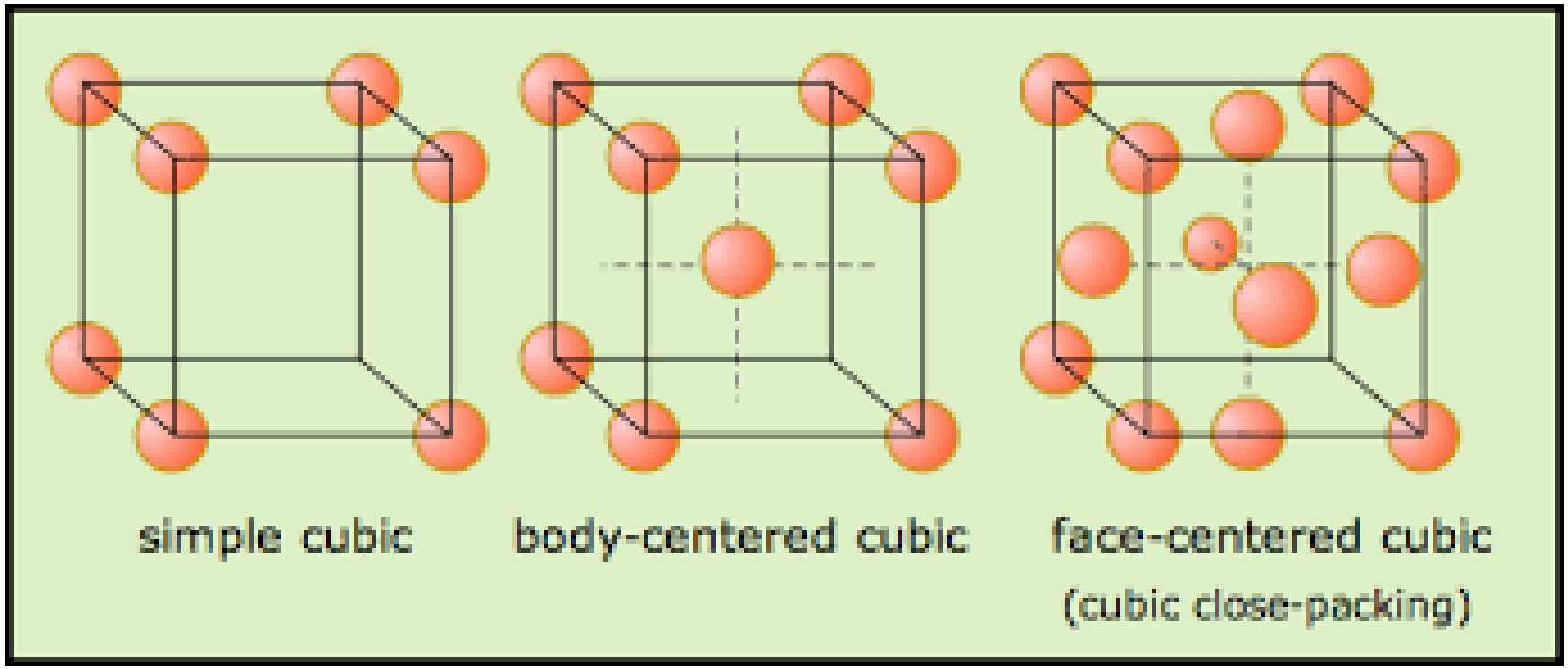

https://chem.libretexts.org/LibreTexts/University_of_Arkansas_Little_Rock/Chem_1403%3A_General_Chemistry_2/Chapters/12%3A_Solids/12.1_Crystal_Lattices_and_Unit_Cells

Verhältnis konventionelle Einheitszelle - primitive Einheitszelle

sc Kristall: kubische Einheitszelle ≠ primitive Einheitszelle

Kubische Einheitszelle: 2 Atome

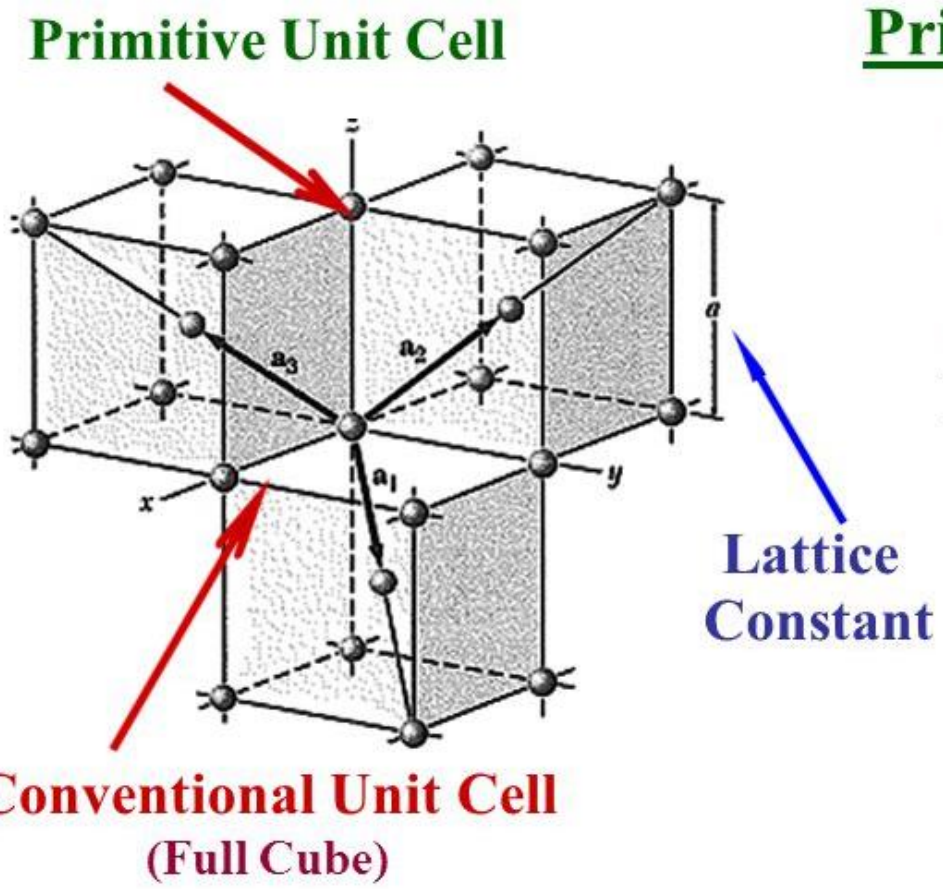
Primitive Einheitszelle: 1 Atom




socratic.org

bcc Kristall: kubische Einheitszelle ≠ primitive Einheitszelle

Kubische Einheitszelle: 2 Atome
Primitive Einheitszelle: 1 Atom




**Primitive Lattice Vectors**

$\mathbf{a}_1 = (\frac{1}{2})a(1,1,-1)$

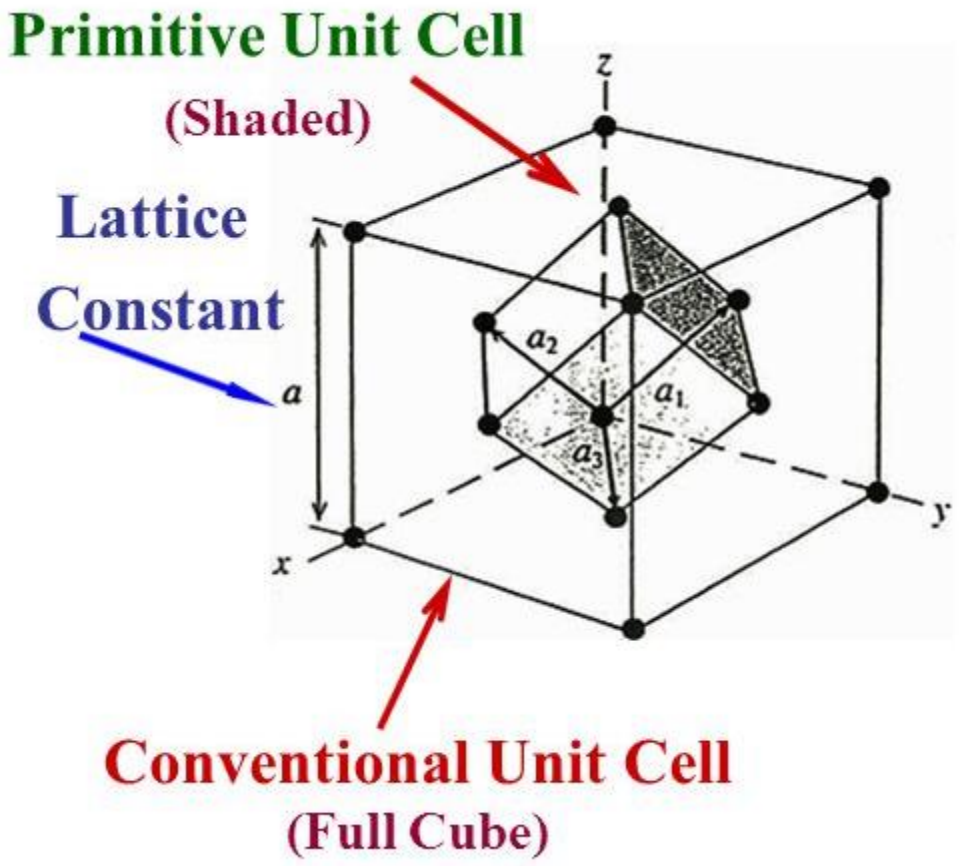
$\mathbf{a}_2 = (\frac{1}{2})a(-1,1,1)$

$\mathbf{a}_3 = (\frac{1}{2})a(1,-1,1)$

Note that the $\mathbf{a}_i$'s are ***NOT mutually orthogonal!***

fcc Kristall: kubische Einheitszelle ≠ primitive Einheitszelle

Kubische Einheitszelle: 4 Atome
Primitive Einheitszelle: 1 Atom




**Primitive Lattice Vectors**

$$\mathbf{a}_1 = (\tfrac{1}{2})a(0,1,0)$$

$$\mathbf{a}_2 = (\tfrac{1}{2})a(1,0,1)$$

$$\mathbf{a}_3 = (\tfrac{1}{2})a(1,1,0)$$