

## 1.3: Affine Isomorphism

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Each symmetry operation of crystallographic group in  $E^3$  may be represented by a  $3 \times 3$  matrix  $\mathbf{W}$  (the *linear part*) and a vector  $\mathbf{w}$ . Two crystallographic groups  $G_1 = \{(\mathbf{W}_{1i}, \mathbf{w}_{1i})\}$  and  $G_2 = \{(\mathbf{W}_{2i}, \mathbf{w}_{2i})\}$  are called **affine isomorphic** if there exists a non-singular  $3 \times 3$  matrix  $\mathbf{A}$  and a vector  $\mathbf{a}$  such that:

$$G_2 = \{(\mathbf{A}, \mathbf{a})(\mathbf{W}_{1i}, \mathbf{w}_{1i})(\mathbf{A}, \mathbf{a})^{-1}\}$$

Two crystallographic groups are affine isomorphic if and only if their arrangement of symmetry elements may be mapped onto each other by an **affine mapping** of  $E^3$ . Two affine isomorphic groups are always isomorphic.

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