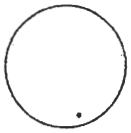
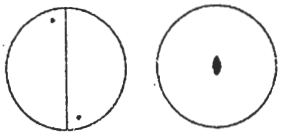
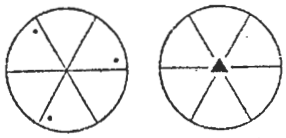
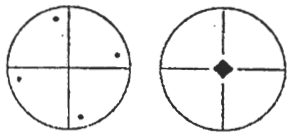
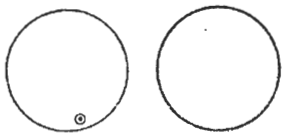
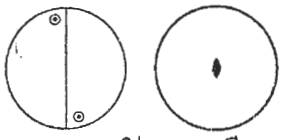
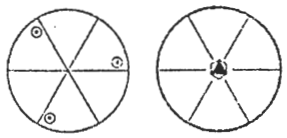
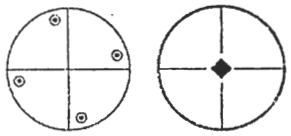
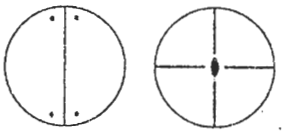
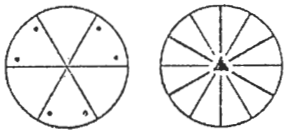
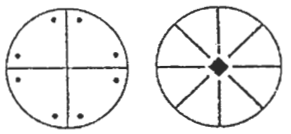
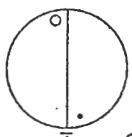
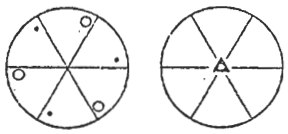
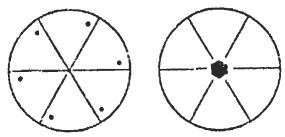
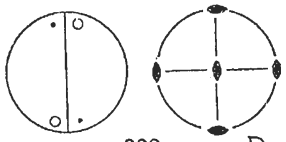
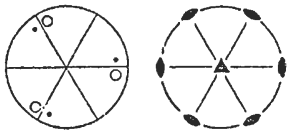
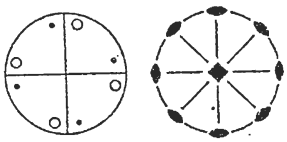
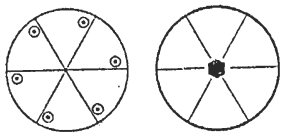
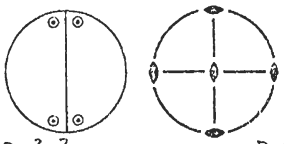
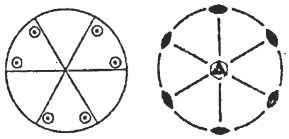
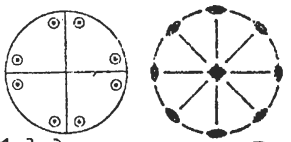
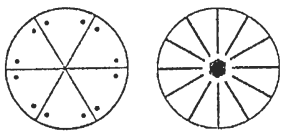
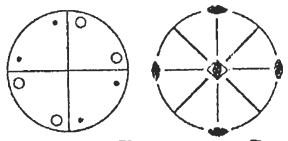
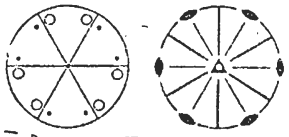
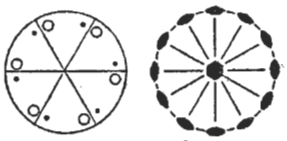
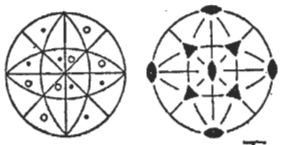
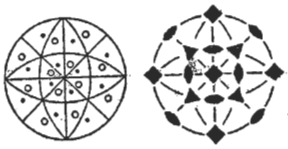
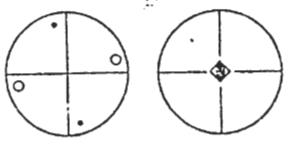
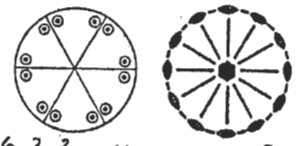
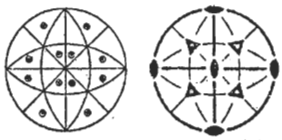
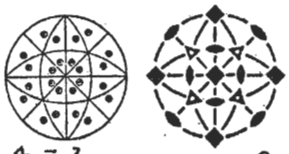
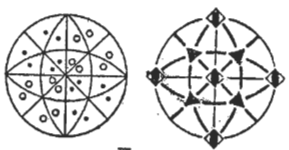
3.60 Symmetry, Structure and Tensor Properties of Materials

DERIVATION of the 32 CRYSTALLOGRAPHIC POINT GROUPS (CRYSTAL CLASSES)

ARRANGEMENT of ROTATION AXES / EXTENDER				
	 1 C_1	 2 C_2	 3. C_3	 4 C_4
HORIZONTAL MIRROR PLANE [C_{nh} D_{nh} T_h O_h]	 $m(=\bar{2})$ C_s	 $2/m$ C_{2h}	 $\bar{3}/m = \bar{6}$ C_{3h}	 $4/m$ C_{4h}
VERTICAL MIRROR PLANE [C_{nv} D_{nv} T_v O_v]	[m C_s]	 $mm2$ C_{2v}	 $3m$ C_{3v}	 $4mm$ C_{4v}
DIAGONAL MIRROR PLANE [C_{nd} D_{nd} T_d O_d]	—	—	—	—
INVERSION CENTER [C_{ni} D_{ni} T_i O_i]	 $\bar{1}$ C_i	[$2/m$ C_{2h}] $\bar{1}$ ALREADY PRESENT IN $2/m$	 $\bar{3}$ C_{3i}	[$4/m$ C_{4h}] $\bar{1}$ ALREADY PRESENT IN $4/m$

ARRANGEMENT of ROTATION AXES / EXTENDER				
	 6 C_6	 222 D_2	 32 D_3	 422 D_4
HORIZONTAL MIRROR PLANE	 $6/m$ C_{6h}	 $\frac{2}{m}\frac{2}{m}\frac{2}{m} = mmm$ D_{2h}	 $\frac{3}{m}m2 = \bar{6}m2$ D_{3h}	 $\frac{4}{m}\frac{2}{m}\frac{2}{m} = 4/mmm$ D_{4h}
VERTICAL MIRROR PLANE	 $6mm$ C_{6v}	$\left[\frac{2}{m}\frac{2}{m}\frac{2}{m}\ D_{2h}\right]$ VERTICAL MIRROR PLANE ALREADY PRESENT IN $\frac{2}{m}\frac{2}{m}\frac{2}{m}$	$\left[\bar{6}m2\ D_{3h}\right]$ VERTICAL MIRROR PLANE ALREADY PRESENT IN $\bar{6}m2$	$\left[\frac{4}{m}\frac{2}{m}\frac{2}{m}\ D_{4h}\right]$ VERTICAL MIRROR PLANE ALREADY PRESENT IN $\frac{4}{m}\frac{2}{m}\frac{2}{m}$
DIAGONAL MIRROR PLANE	—	 $\bar{4}2m$ D_{2d}	 $\bar{3}\frac{2}{m} = \bar{3}m$ D_{3d}	$\bar{8}2m$ D_{4d} POSSIBLE, BUT NON-CRYSTALLOGRAPHIC
INVERSION CENTER	$\left[\frac{6}{m}\ C_{6h}\right]$ $\bar{1}$ ALREADY PRESENT IN $\frac{6}{m}$	$\left[\frac{2}{m}\frac{2}{m}\frac{2}{m}\ D_{2h}\right]$ INVERSION CENTER ALREADY PRESENT IN $\frac{2}{m}\frac{2}{m}\frac{2}{m}$	$\left[\bar{3}\frac{2}{m}\ D_{3d}\right]$ INVERSION CENTER ALREADY PRESENT IN $\bar{3}\frac{2}{m}$	$\left[\frac{4}{m}\frac{2}{m}\frac{2}{m}\ D_{4h}\right]$ INVERSION CENTER ALREADY PRESENT IN $\frac{4}{m}\frac{2}{m}\frac{2}{m}$

ARRANGEMENT of ROTATION AXES / EXTENDER				
	 622 D_6	 23 T	 432 O	 $\bar{4}$ S_4
HORIZONTAL MIRROR PLANE	 $\frac{6}{m}\frac{2}{m}\frac{2}{m} = 6/mmm$ D_{6h}	 $\frac{2}{m}\bar{3} = m3$ T_h	 $\frac{4}{m}\bar{3}\frac{2}{m} = m3m$ O_h	$\left[\frac{4}{m}\ C_{4h}\right]$
VERTICAL MIRROR PLANE	$\left[\frac{6}{m}\frac{2}{m}\frac{2}{m}\ D_{6h}\right]$ VERTICAL MIRROR PLANE ALREADY PRESENT IN $\frac{6}{m}\frac{2}{m}\frac{2}{m}$	$\left[\frac{2}{m}\bar{3}\ T_h\right]$ VERTICAL MIRROR PLANE IS ALREADY PRESENT IN $\frac{2}{m}\bar{3}$	$\left[\frac{4}{m}\bar{3}\frac{2}{m}\ O_h\right]$ VERTICAL MIRROR PLANE ALREADY PRESENT IN $\frac{4}{m}\bar{3}\frac{2}{m}$	$\left[\bar{4}2m\ D_{2d}\right]$
DIAGONAL MIRROR PLANE	$\bar{1}2/m\ D_{6d}$ POSSIBLE AND DISTINCT, BUT NON-CRYSTALLOGRAPHIC	 $\bar{4}3m$ T_d	— IMPOSSIBLE ADJACENT ROTATION AXES ARE NOT THE SAME	—
INVERSION CENTER	$\left[\frac{6}{m}\frac{2}{m}\frac{2}{m}\ D_{6h}\right]$ INVERSION CENTER ALREADY PRESENT IN $\frac{6}{m}\frac{2}{m}\frac{2}{m}$	$\left[\frac{2}{m}\bar{3}\ T_h\right]$ INVERSION CENTER IS ALREADY PRESENT IN $\frac{2}{m}\bar{3}$	$\left[\frac{4}{m}\bar{3}\frac{2}{m}\ O_h\right]$ INVERSION CENTER IS ALREADY PRESENT IN $\frac{4}{m}\bar{3}\frac{2}{m}$	$\left[\frac{4}{m}\ C_{4h}\right]$