No. 62 *Pnma* D_{2h}^{16}

$$\mathcal{G} = P\frac{2_1}{n}\frac{2_1}{m}\frac{2_1}{a}$$

Orientation orbit (hkl)	Conventional basis of the scanning group $\mathbf{a}'$	$\mathbf{b}'$	$\mathbf{d}$	Scanning group $\mathcal{H}$	Linear orbit $s\mathbf{d}$	Sectional layer group $\mathcal{L}(s\mathbf{d})$	
(001)	**a**	**b**	**c**	*Pnma*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p12_1/m1$	L15
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$p2_1ma$ $(\mathbf{b}/4)$	L28
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$p1m1$ $(\mathbf{b}/4)$	L11
(100)	**b**	**c**	**a**	*Pmcn*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p2_1/m11$	L15
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$pm2_1n$ $(\mathbf{a}'/4)$	L32
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$pm11$ $(\mathbf{a}'/4)$	L11
(010)	**c**	**a**	**b**	*Pbnm*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p2_1/b11$	L17
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$pb2_1m$ $(\mathbf{a}'/4)$	L29
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$pb11$ $(\mathbf{a}'/4)$	L12

No. 63 *Cmcm* D_{2h}^{17}

$$\mathcal{G} = C\frac{2}{m}\frac{2}{c}\frac{2_1}{m}$$

Orientation orbit (hkl)	Conventional basis of the scanning group $\mathbf{a}'$	$\mathbf{b}'$	$\mathbf{d}$	Scanning group $\mathcal{H}$	Linear orbit $s\mathbf{d}$	Sectional layer group $\mathcal{L}(s\mathbf{d})$	
(001)	**a**	**b**	**c**	*Cmcm*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$c2/m11$	L18
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$cm2m$	L35
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$cm11$	L13
(100)	**b**	**c**	**a**	*Bbmm*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$pbmm$	L40
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$pbma$ $(\mathbf{a}'/4)$	L45
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$pbm2$	L24
(010)	**c**	**a**	**b**	*Amma*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$pmma$	L41
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$pmmn$ $(\mathbf{b}'/4)$	L46
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$pmm2$ $(\mathbf{a}'/4)$	L23

No. 64* *Cmce* D_{2h}^{18}

$$\mathcal{G} = C\frac{2}{m}\frac{2}{c}\frac{2_1}{a}$$

Orientation orbit (hkl)	Conventional basis of the scanning group $\mathbf{a}'$	$\mathbf{b}'$	$\mathbf{d}$	Scanning group $\mathcal{H}$	Linear orbit $s\mathbf{d}$	Sectional layer group $\mathcal{L}(s\mathbf{d})$	
(001)	**a**	**b**	**c**	*Cmca*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$c2/m11$	L18
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$cm2e$ $(\mathbf{a}/4)$	L36
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$cm11$	L13
(100)	**b**	**c**	**a**	*Bbcm*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$pbam$	L44
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$pbaa$ $(\mathbf{a}'/4)$	L43
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$pba2$	L25
(010)	**c**	**a**	**b**	*Abma*	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$pbmn$	L42
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$pbma$ $(\mathbf{b}'/4)$	L45
					$[\pm s\mathbf{d}, (\pm s+\frac{1}{2})\mathbf{d}]$	$pbm2$ $[(\mathbf{a}'+\mathbf{b}')/4]$	L24

*New symbol. Old symbol: *Cmca*.

Arithmetic class *mmmP*

Serial No. Group type Group	47 D_{2h}^{1} *Pmmm*	48 D_{2h}^{2} *Pnnn*		49 D_{2h}^{3} *Pccm*	50 D_{2h}^{4} *Pban*	
		Origin 1	Origin 2		Origin 1	Origin 2
$(mn0)$ $(\overline{m}n0)$	$P112/m$	$P112/n$ $[(\mathbf{a}+\mathbf{b}+\mathbf{c})/4]$	$P112/n$	$P112/m$	$P112/n$ $[(\mathbf{a}+\mathbf{b})/4]$	$P112/n$
$(0mn)$ $(0\overline{m}n)$				$P112/b$	$P112/a$ $[(\mathbf{a}+\mathbf{b})/4]$	$P112/a$
$(n0m)$ $(n0\overline{m})$				$P112/a$	$P112/b$ $[(\mathbf{a}+\mathbf{b})/4]$	$P112/b$

Serial No. Group type Group	51 D_{2h}^{5} *Pmma*	52 D_{2h}^{6} *Pnna*	53 D_{2h}^{7} *Pmna*	54 D_{2h}^{8} *Pcca*	55 D_{2h}^{9} *Pbam*	56 D_{2h}^{10} *Pccn*
$(mn0)$ $(\overline{m}n0)$	$P112/a$	$P112/a$	$P112_1/a$	$P112/a$	$P112/m$	$P112/n$
$(0mn)$ $(0\overline{m}n)$	$P112_1/m$	$P112/n$	$P112/m$	$P112_1/b$	$P112_1/a$	$P112_1/b$
$(n0m)$ $(n0\overline{m})$	$P112/m$	$P112_1/n$	$P112/n$	$P112/a$	$P112_1/b$	$P112_1/a$

Serial No. Group type Group	57 D_{2h}^{11} *Pbcm*	58 D_{2h}^{12} *Pnnm*	59 D_{2h}^{13} *Pmmn*		60 D_{2h}^{14} *Pbcn*	61 D_{2h}^{15} *Pbca*	62 D_{2h}^{16} *Pnma*
			Origin 1	Origin 2			
$(mn0)$ $(\overline{m}n0)$	$P112_1/m$	$P112/m$	$P112/n$ $[(\mathbf{a}+\mathbf{b})/4]$	$P112/n$	$P112_1/n$	$P112_1/a$	$P112_1/a$
$(0mn)$ $(0\overline{m}n)$	$P112/a$	$P112_1/n$	$P112_1/m$ $[(\mathbf{a}+\mathbf{b})/4]$	$P112_1/m$	$P112_1/a$		$P112_1/n$
$(n0m)$ $(n0\overline{m})$	$P112_1/a$				$P112/a$		$P112_1/m$

Centring type *C*

Orientation orbit (hkl)	Conventional basis of the scanning group $\mathbf{a}'$	$\mathbf{b}'$	$\mathbf{d}$	Auxiliary basis of the scanning group $\widehat{\mathbf{a}}$	$\widehat{\mathbf{b}}$	$\widehat{\mathbf{c}}$
$(hk0)$ $(\overline{h}k0)$	$\mathbf{c}$ $\mathbf{c}$	$n\widehat{\mathbf{a}}-m\widehat{\mathbf{b}}$ $n\widehat{\mathbf{a}}+m\widehat{\mathbf{b}}$	$p\widehat{\mathbf{a}}+q\widehat{\mathbf{b}}$ $-p\widehat{\mathbf{a}}+q\widehat{\mathbf{b}}$	$(\mathbf{a}-\mathbf{b})/2$	$(\mathbf{a}+\mathbf{b})/2$	$\mathbf{c}$
h even, k odd or h odd, k even $\Rightarrow n=h+k, m=h-k$ h, k odd $\Rightarrow n=(h+k)/2, m=(h-k)/2$						
$(0mn)$ $(0\overline{m}n)$	$\mathbf{a}$ $\mathbf{a}$	$n\mathbf{b}-m\mathbf{c}$ $n\mathbf{b}+m\mathbf{c}$	$p\mathbf{b}+q\mathbf{c}$ $-p\mathbf{b}+q\mathbf{c}$	$\mathbf{b}$	$\mathbf{c}$	$\mathbf{a}$
$(n0m)$ $(n0\overline{m})$	$\mathbf{b}$ $\mathbf{b}$	$n\mathbf{c}-m\mathbf{a}$ $n\mathbf{c}+m\mathbf{a}$	$p\mathbf{c}+q\mathbf{a}$ $-p\mathbf{c}+q\mathbf{a}$	$\mathbf{c}$	$\mathbf{a}$	$\mathbf{b}$

Arithmetic classes 222*C* and *mm*2*C*

Serial No.	20	21	35	36	37
Group type	D_2^5	D_2^6	C_{2v}^{11}	C_{2v}^{12}	C_{2v}^{13}
Group	$C222_1$	$C222$	$Cmm2$	$Cmc2_1$	$Ccc2$
$(hk0)$ $(\overline{h}k0)$	$P112_1$	$P112$	$P112$	$P112_1$	$P112$
$(0mn)$ $(0\overline{m}n)$	$B112$	$B112$	$B11m$	$B11m$	$B11b$
$(n0m)$ $(n0\overline{m})$	$A112$ $(\mathbf{c}/4)$	$A112$	$A11m$	$A11a$	$A11a$

Arithmetic class *mmm*C

Serial No.	63	64	65	66	67	68	
Group type	D_{2h}^{17}	D_{2h}^{18}	D_{2h}^{19}	D_{2h}^{20}	D_{2h}^{21}	D_{2h}^{22}	
Group	$Cmcm$	$Cmce$	$Cmmm$	$Cccm$	$Cmme$	$Ccce$	
						Origin 1	Origin 2
$(hk0)$ $(\overline{h}k0)$	$P112_1/m$	$P112_1/n$	$P112/m$	$P112/m$	$P112/n$	$P112/n$ $[(\mathbf{b}+\mathbf{c})/4]$	$P112/n$
$(0mn)$ $(0\overline{m}n)$	$B112/m$	$B112/m$	$B112/m$	$B112/b$	$B112/m$	$B112/n$ $[(\mathbf{a}+\mathbf{c})/4]$	$B112/n$
$(n0m)$ $(n0\overline{m})$	$A112/a$	$A112/n$	$A112/m$	$A112/a$	$A112/m$ $[(\mathbf{a}+\mathbf{b})/4]$	$A112/a$ $[(\mathbf{b}+\mathbf{c})/4]$	$A112/a$

Centring type *A*

Orientation orbit (hkl)	Conventional basis of the scanning group $\mathbf{a}'$ $\mathbf{b}'$ $\mathbf{d}$	Auxiliary basis of the scanning group $\widehat{\mathbf{a}}$ $\widehat{\mathbf{b}}$ $\widehat{\mathbf{c}}$
$(mn0)$ $(\overline{m}n0)$	$\mathbf{c}$ $n\mathbf{a}-m\mathbf{b}$ $p\mathbf{a}+q\mathbf{b}$ $\mathbf{c}$ $n\mathbf{a}+m\mathbf{b}$ $-p\mathbf{a}+q\mathbf{b}$	$\mathbf{a}$ $\mathbf{b}$ $\mathbf{c}$
$(0kl)$ $(\overline{k}l0)$	$\mathbf{a}$ $n\widehat{\mathbf{a}}-m\widehat{\mathbf{b}}$ $p\widehat{\mathbf{a}}+q\widehat{\mathbf{b}}$ $\mathbf{a}$ $n\widehat{\mathbf{a}}+m\widehat{\mathbf{b}}$ $-p\widehat{\mathbf{a}}+q\widehat{\mathbf{b}}$	$(\mathbf{b}-\mathbf{c})/2$ $(\mathbf{b}+\mathbf{c})/2$ $\mathbf{a}$
k even, l odd or k odd, l even $\Rightarrow n=k+l, m=k-l$ k, l odd $\Rightarrow n=(k+l)/2, m=(k-l)/2$		
$(n0m)$ $(n0\overline{m})$	$\mathbf{b}$ $n\mathbf{c}-m\mathbf{a}$ $p\mathbf{c}+q\mathbf{a}$ $\mathbf{b}$ $n\mathbf{c}+m\mathbf{a}$ $-p\mathbf{c}+q\mathbf{a}$	$\mathbf{c}$ $\mathbf{a}$ $\mathbf{b}$

Arithmetic class *mm*2*A*

Serial No.	38	39	40	41
Group type	C_{2v}^{14}	C_{2v}^{15}	C_{2v}^{16}	C_{2v}^{17}
Group	$Amm2$	$Aem2$	$Ama2$	$Aea2$
$(mn0)$ $(\overline{m}n0)$	$A112$	$A112$	$A112$	$A112$
$(0kl)$ $(0\overline{k}l)$	$P11m$	$P11n$	$P11m$ $(\mathbf{a}/4)$	$P11n$ $(\mathbf{a}/4)$
$(n0m)$ $(n0\overline{m})$	$B11m$	$B11m$ $(\mathbf{b}/4)$	$B11b$	$B11b$ $(\mathbf{b}/4)$