No. 19 $P2_12_12_1$ D_2^4

$$\mathcal{G} = P2_12_12_1$$

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**	$P2_12_12_1$	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p2_111$ $(\mathbf{b}'/4)$	L09
(100)	**b**	**c**	**a**		$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$p12_11$	L09
(010)	**c**	**a**	**b**		$[\pm s\mathbf{d}, (\pm s + \frac{1}{2})\mathbf{d}]$	$p1$	L01

No. 20 $C222_1$ D_2^5

$$\mathcal{G} = C222_1$$

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**	$C222_1$	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$c211$	L10
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$c121$	L10
					$[\pm s\mathbf{d}, (\pm s + \frac{1}{2})\mathbf{d}]$	$\widehat{p}1$	L01
(100)	**b**	**c**	**a**	$B22_12$	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p22_12$	L20
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$p2_12_12$	L21
					$[\pm s\mathbf{d}, (\pm s + \frac{1}{2})\mathbf{d}]$	$p112$	L03
(010)	**c**	**a**	**b**	$A2_122$	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p2_122$ $(\mathbf{a}'/4)$	L20
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$p2_12_12$ $(\mathbf{a}'/4)$	L21
					$[\pm s\mathbf{d}, (\pm s + \frac{1}{2})\mathbf{d}]$	$p112$ $(\mathbf{a}'/4)$	L03

No. 21 $C222$ D_2^6

$$\mathcal{G} = C222$$

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**	$C222$	$0\mathbf{d}, \frac{1}{2}\mathbf{d}$	$c222$	L22
					$[s\mathbf{d}, -s\mathbf{d}]$	$\widehat{p}112$	L03
(100)	**b**	**c**	**a**	$B222$	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p222$	L19
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$p2_122$	L20
					$[\pm s\mathbf{d}, (\pm s + \frac{1}{2})\mathbf{d}]$	$p112$	L03
(010)	**c**	**a**	**b**	$A222$	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$p222$	L19
					$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$p22_12$	L20
					$[\pm s\mathbf{d}, (\pm s + \frac{1}{2})\mathbf{d}]$	$p112$	L03

No. 22 $F222$ D_2^7

$$\mathcal{G} = F222$$

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**	$F222$	$[0\mathbf{d}, \frac{1}{2}\mathbf{d}]$	$c222$	L22
(100)	**b**	**c**	**a**		$[\frac{1}{4}\mathbf{d}, \frac{3}{4}\mathbf{d}]$	$c222$ $[(\mathbf{a}' + \mathbf{b}')/4]$	L22
(010)	**c**	**a**	**b**		$[\pm s\mathbf{d}, (\pm s + \frac{1}{2})\mathbf{d}]$	$\widehat{p}112$	L03

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. Group type Group	20 D_2^5 $C222_1$	21 D_2^6 $C222$	35 C_{2v}^{11} $Cmm2$	36 C_{2v}^{12} $Cmc2_1$	37 C_{2v}^{13} $Ccc2$
$(hk0)$ $(\overline{h}k0)$	$P112_1$	$P112$	$P112$	$P112_1$	$P112$
$(0mn)$ $(0\overline{m}n)$	$B112$	$B112$	$B11m$	$B11m$	$B11b$
$(n0m)$ $(n0\overline{m})$	$A112$ $(\mathbf{c}/4)$	$A112$	$A11m$	$A11a$	$A11a$

Arithmetic class *mmmC*

Serial No. Group type Group	63 D_{2h}^{17} $Cmcm$	64 D_{2h}^{18} $Cmce$	65 D_{2h}^{19} $Cmmm$	66 D_{2h}^{20} $Cccm$	67 D_{2h}^{21} $Cmme$	68 D_{2h}^{22} $Ccce$	
						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 $\widehat{\mathbf{a}}$	$\widehat{\mathbf{b}}$	$\widehat{\mathbf{c}}$
$(mn0)$	$\mathbf{c}$	$n\mathbf{a}-m\mathbf{b}$	$p\mathbf{a}+q\mathbf{b}$	$\mathbf{a}$	$\mathbf{b}$	$\mathbf{c}$
$(\overline{m}n0)$	$\mathbf{c}$	$n\mathbf{a}+m\mathbf{b}$	$-p\mathbf{a}+q\mathbf{b}$			
$(0kl)$	$\mathbf{a}$	$n\widehat{\mathbf{a}}-m\widehat{\mathbf{b}}$	$p\widehat{\mathbf{a}}+q\widehat{\mathbf{b}}$	$(\mathbf{b}-\mathbf{c})/2$	$(\mathbf{b}+\mathbf{c})/2$	$\mathbf{a}$
$(\overline{k}l0)$	$\mathbf{a}$	$n\widehat{\mathbf{a}}+m\widehat{\mathbf{b}}$	$-p\widehat{\mathbf{a}}+q\widehat{\mathbf{b}}$			
k even, l odd or k odd, l even $\Rightarrow n=k+l, m=k-l$ k, l odd $\Rightarrow n=(k+l)/2, m=(k-l)/2$						
$(n0m)$	$\mathbf{b}$	$n\mathbf{c}-m\mathbf{a}$	$p\mathbf{c}+q\mathbf{a}$	$\mathbf{c}$	$\mathbf{a}$	$\mathbf{b}$
$(n0\overline{m})$	$\mathbf{b}$	$n\mathbf{c}+m\mathbf{a}$	$-p\mathbf{c}+q\mathbf{a}$			

Arithmetic class *mm*2*A*

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