IUCrData

ISSN 2414-3146

Tris(3,5-diaza-1-azonia-7-phosphaadamant-7-yl)(1,3,5-triaza-7-phospha-adamantane)silver(I) dicarbonate

Sizwe J. Zamisa,* Adesola A. Adeleke, Olatunde S. Olatunji and Bernard Omondi

School of Agriculture and Science, Discipline of Chemistry, University of KwaZulu-Natal, Private Bag X54001, Durban, 4000, South Africa. *Correspondence e-mail: Zamisas@ukzn.ac.za

Received 29 July 2026
Accepted 3 August 2026

Edited by W. T. A. Harrison, University of Aberdeen, United Kingdom

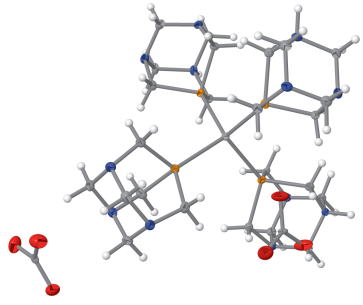
Keywords: crystal structure; neutral 1,3,5-triaza-7-phosphaadamantane (PTA); monoprotonated PTAH; carbonate ion; silver ion.

CCDC reference: 2578472

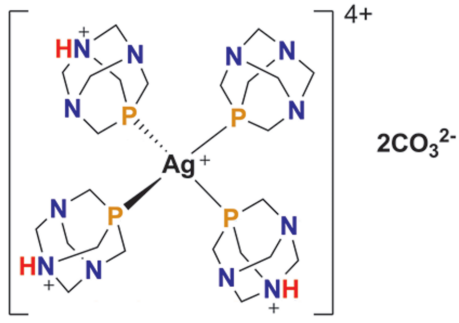
Structural data: full structural data are available from iucrdata.iucr.org

The title compound, $[Ag(C_6H_{13}N_3P)_4(C_6H_{12}N_3P)](CO_3)_2$ or $[Ag(PTAH)_3(PTA)](CO_3)_2$, is a discrete cationic silver(I) complex composed of one neutral 1,3,5-triaza-7-phosphaadamantane ($C_6H_{12}N_3P$; PTA) ligand and three monoprotonated PTAH$^+$ ($C_6H_{13}N_3P^+$) ligands coordinated to the silver center, resulting in an overall +4 charge balanced by two carbonate anions. The compound crystallizes in the rhombohedral *R*3 space group with the silver ion and PTA P atom lying on a crystallographic threefold axis, as does one of the carbonate C atoms. The silver ion adopts a tetrahedral geometry with P—Ag—P bond angles near the ideal 109°, and silver–phosphorus bond distances of 2.4699 (6) and 2.4683 (11) Å for Ag—P_{PTA} and Ag—P_{PTAH}, respectively. The crystal packing features N—H···O hydrogen bonds between the protonated N atoms of the PTAH ligands and the non-coordinating carbonate anions.

3D view



Chemical scheme



Structure description

The phosphine ligand 1,3,5-triaza-7-phosphaadamantane ($C_6H_{12}N_3P$; PTA) has garnered growing interest because of its water solubility and distinctive coordination properties arising from a soft phosphorus donor and three nitrogen atoms (Krogstad *et al.*, 2007). While PTA mainly binds to metals *via* the phosphorus atom, its nitrogen atoms can enable diverse coordination modes, impacting complex stability and functionality (Darensbourg *et al.*, 1997). Silver(I) complexes with PTA display enhanced solubility and stability useful in catalysis and biomedical fields (Jimenez *et al.*, 2017; Armstrong *et al.*, 2018).

As part of our studies in this area, this work reports the synthesis and crystal structure of the title salt $[Ag(PTAH)_3(PTA)](CO_3)_2$ (**I**), illustrating the coordination of silver(I) with both neutral PTA and protonated PTAH ligands in the presence of carbonate counter-ions.

Table 1
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
N2—H2···O6^{i}	1.00	1.73	2.731 (3)	176

Symmetry code: (i) $-x+y+\frac{1}{3}, -x+\frac{2}{3}, z-\frac{1}{3}$.

The asymmetric unit of (**I**) consists of an Ag ion (site symmetry 3), a complete PTAH ligand, a fragment of PTA (P site symmetry 3), a complete carbonate anion and a fragment of a carbonate ion (C site symmetry 3), as shown in Fig. 1. The complete cation is constructed through symmetry code $1-y$, $x-y$, z, which results in the silver atom coordinated with one neutral PTA and three monoprotonated PTA ligands, forming a cationic complex with a +4 charge balanced by two carbonate anions. The Ag center again exhibits tetrahedral geometry, with bond angles averaging close to the ideal tetrahedral angle of 109°. The Ag—P1 and Ag—P2 bond distances are 2.4699 (6) and 2.4683 (11) Å, respectively. The P—Ag—P bond angles are comparable to those of other tetracoordinated metal phosphine complexes such as $[Cu(PTA)_4][BF_4]\cdot 6H_2O$ and $[Cu(PTAH)_4][NO_3]_5$ with an average P—Cu—P bond angle of 109.5° (Kirillov *et al.*, 2007, Porchia *et al.*, 2009). In the extended structure of (**I**), the carbonate ions accept strong N—H···O hydrogen bonds arising from the protonated nitrogen atoms of the HPTA ligands (Fig. 2). These hydrogen bonds are characterized by an N···O distance

Table 2
Experimental details.

Crystal data	
Chemical formula	$[Ag(C_6H_{13}N_3P)_4(C_6H_{12}N_3P)](CO_3)_2$
M_r	859.52
Crystal system, space group	Trigonal, *R*3
Temperature (K)	173
a, *c* (Å)	15.7992 (12), 13.1502 (18)
V (Å^3)	2842.7 (6)
Z	3
Radiation type	Mo *Kα*
μ (mm^{-1})	0.78
Crystal size (mm)	0.36 × 0.24 × 0.22
Data collection	
Diffractometer	Bruker APEXII CCD
Absorption correction	Multi-scan (*SADABS*; Krause *et al.*, 2015)
T_{min}, T_{max}	0.767, 0.847
No. of measured, independent and observed [$I > 2\sigma(I)$] reflections	18709, 3005, 2981
R_{int}	0.022
(sin $\theta/\lambda)_{max}$ (Å^{-1})	0.668
Refinement	
$R[F^2 > 2\sigma(F^2)]$, $wR(F^2)$, *S*	0.019, 0.048, 1.08
No. of reflections	3005
No. of parameters	172
No. of restraints	13
H-atom treatment	H-atom parameters constrained
$\Delta\rho_{max}$, $\Delta\rho_{min}$ (e Å^{-3})	0.77, −0.32
Absolute structure	Flack *x* determined using 1393 quotients $[(I^+)-(I^-)]/[(I^+)+(I^-)]$ (Parsons et al., 2013)
Absolute structure parameter	−0.013 (5)

Computer programs: *APEX2* and *SAINT* (Bruker, 2014), *SHELXS97* (Sheldrick, 2008), *SHELXL2018/3* (Sheldrick, 2015) and *OLEX2* (Dolomanov *et al.*, 2009).

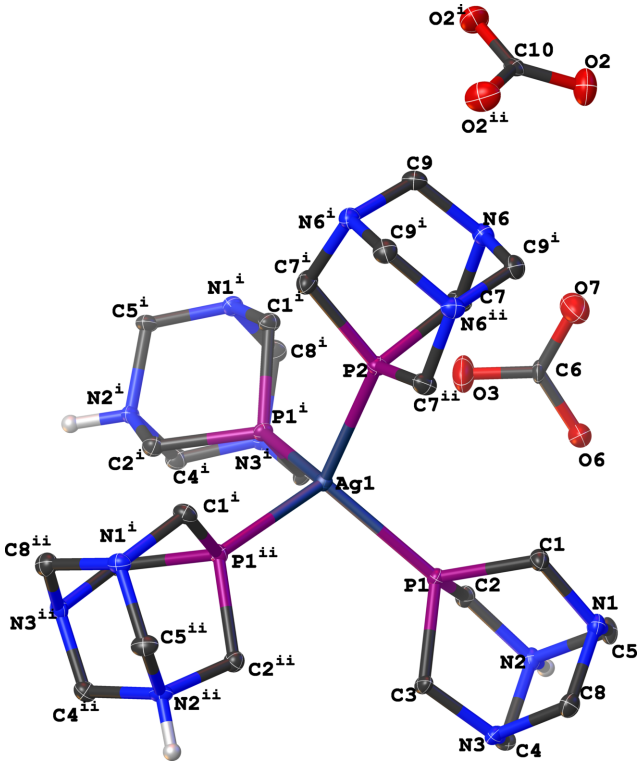


Figure 1
The molecular structure of (**I**) shown with displacement ellipsoids at the 50% probability level. All C-bound hydrogen atoms are omitted for clarity. Symmetry codes: (i) $1-y, x-y, z$; (ii) $1+y-x, 1-x, z$.

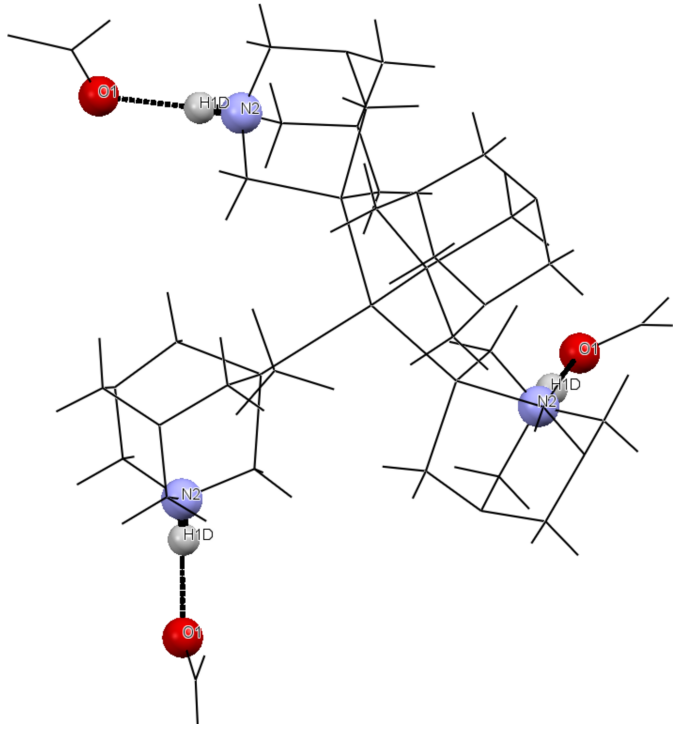


Figure 2
Representation of N—H···O hydrogen bonds in the crystal structure of (**I**) (blue and red dotted bonds).

of 2.731 (3) Å and an N—H···O angle of 176°, indicating strong and directional intermolecular interactions (Table 1).

Synthesis and crystallization

Formic acid (0.3 ml, 8.0 mmol) was added slowly to silver(I) oxide (0.93 g, 4.0 mmol) in water (10 ml), generating silver(I) formate, which was filtered to remove unreacted material. PTA (1.26 g, 8.0 mmol) dissolved in acetone (20 ml) was added dropwise to the filtrate, yielding a cloudy solution. Slow evaporation of the filtered solution afforded X-ray quality crystals of (**I**) suitable for analysis. The carbonate ions in the product may have arisen from CO_2 absorbed from the atmosphere in the presence of silver ions (Barnes *et al.*, 1971; Kong *et al.*, 2005).

Refinement

Crystal data, data collection and structure refinement details are summarized in Table 2.

Acknowledgements

We thank the University of KwaZulu-Natal for its support of this research.

References

Armstrong, D., Kirk, S. M., Murphy, C., Guerriero, A., Peruzzini, M., Gonsalvi, L. & Phillips, A. D. (2018). *Inorg. Chem.* **57**, 6309–6323.
Barnes, P. A., O'Connor, M. F. & Stone, F. S. (1971). *J. Chem. Soc. A* pp. 3395.
Bruker (2014). *APEX2* and *SAINT*. Bruker AXS Inc., Madison, Wisconsin, USA.
Darensbourg, D. J., Decuir, T. J., Stafford, N. W., Robertson, J. B., Draper, J. D., Reibenspies, J. H., Kathó, A. & Joó, F. (1997). *Inorg. Chem.* **36**, 4218–4226.
Dolomanov, O. V., Bourhis, L. J., Gildea, R. J., Howard, J. A. K. & Puschmann, H. (2009). *J. Appl. Cryst.* **42**, 339–341.
Jimenez, J., Chakraborty, I., Rojas-Andrade, M. & Mascharak, P. K. (2017). *J. Inorg. Biochem.* **168**, 13–17.
Kirillov, A. M., Smoleński, P., Guedes da Silva, M. F. C. & Pombeiro, A. J. (2007). Wiley Online Library.
Kong, L.-Y., Zhang, Z.-H., Zhu, H.-F., Kawaguchi, H., Okamura, T.-A., Doi, M., Chu, Q., Sun, W.-Y. & Ueyama, N. (2005). *Angew. Chem. Int. Ed.* **44**, 4352–4355.
Krause, L., Herbst-Irmer, R., Sheldrick, G. M. & Stalke, D. (2015). *J. Appl. Cryst.* **48**, 3–10.
Krogstad, D. A., Ellis, G. S., Gunderson, A. K., Hammrich, A. J., Rudolf, J. W. & Halfen, J. A. (2007). *Polyhedron* **26**, 4093–4100.
Parsons, S., Flack, H. D. & Wagner, T. (2013). *Acta Cryst.* B**69**, 249–259.
Porchia, M., Benetollo, F., Refosco, F., Tisato, F., Marzano, C. & Gandin, V. (2009). *J. Inorg. Biochem.* **103**, 1644–1651.
Sheldrick, G. M. (2008). *Acta Cryst.* A**64**, 112–122.
Sheldrick, G. M. (2015). *Acta Cryst.* C**71**, 3–8.

full crystallographic data

IUCrData (2026). **11**, x260793 [https://doi.org/10.1107/S2414314626007935]

Tris(3,5-diaza-1-azonia-7-phosphaadamant-7-yl)(1,3,5-triaza-7-phosphaadamantane)silver(I) dicarbonate

Sizwe J. Zamisa, Adesola A. Adeleke, Olatunde S. Olatunji and Bernard Omondi

(I)

Crystal data

$[Ag(C_6H_{13}N_3P)_4(C_6H_{12}N_3P)](CO_3)_2$
M_r = 859.52
Trigonal, *R*3
a = 15.7992 (12) Å
c = 13.1502 (18) Å
V = 2842.7 (6) Å^3
Z = 3
F(000) = 1518
D_x = 1.506 Mg m^{-3}
Mo *Kα* radiation, λ = 0.71073 Å
Cell parameters from 9969 reflections
θ = 2.6–28.3°
μ = 0.78 mm^{-1}
T = 173 K
Block, colourless
0.36 × 0.24 × 0.22 mm

Data collection

Bruker APEXII CCD diffractometer
Graphite monochromator
φ and ω scans
Absorption correction: multi-scan (SADABS; Krause *et al.*, 2015)
T_{min} = 0.767, T_{max} = 0.847
18709 measured reflections
3005 independent reflections
2981 reflections with $I > 2\sigma(I)$
R_{int} = 0.022
θ_{max} = 28.3°, θ_{min} = 2.2°
h = −21→17
k = −15→21
l = −17→17

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)]$ = 0.019
$wR(F^2)$ = 0.048
S = 1.08
3005 reflections
172 parameters
13 restraints
Primary atom site location: dual
Hydrogen site location: inferred from neighbouring sites
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.031P)^2 + 1.7576P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max}$ = 0.001
$\Delta\rho_{max}$ = 0.77 e Å^{-3}
$\Delta\rho_{min}$ = −0.32 e Å^{-3}
Absolute structure: Flack *x* determined using 1393 quotients $[(I^+)-(I^-)]/[(I^+)+(I^-)]$ (Parsons et al., 2013)
Absolute structure parameter: −0.013 (5)

Special details

Geometry. All esds (except the esd in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell esds are taken into account individually in the estimation of esds in distances, angles and torsion angles; correlations between esds in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell esds is used for estimating esds involving l.s. planes.

Refinement. Refinement of F^2 against ALL reflections. The weighted R-factor wR and goodness of fit S are based on F^2, conventional R-factors R are based on F, with F set to zero for negative F^2. The threshold expression of $F^2 > 2\text{sigma}(F^2)$ is used only for calculating R-factors(gt) etc. and is not relevant to the choice of reflections for refinement. R-factors based on F^2 are statistically about twice as large as those based on F, and R- factors based on ALL data will be even larger.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å²)

	x	*y*	*z*	U_{iso}*/U_{eq}
C7	0.54971 (19)	0.2863 (2)	0.48563 (19)	0.0157 (5)
H7A	0.518427	0.324777	0.465991	0.019*
H7B	0.505181	0.217503	0.465855	0.019*
C8	0.5965 (2)	0.6287 (2)	0.1338 (2)	0.0154 (5)
H8A	0.657144	0.668832	0.173223	0.018*
H8B	0.573099	0.672593	0.108986	0.018*
C9	0.6073 (2)	0.2336 (2)	0.6302 (2)	0.0157 (5)
H9A	0.605558	0.230630	0.705424	0.019*
H9B	0.567006	0.166064	0.604429	0.019*
N6	0.56354 (17)	0.29178 (17)	0.59648 (17)	0.0146 (4)
C1	0.55921 (19)	0.4978 (2)	0.25461 (19)	0.0134 (5)
H1A	0.508041	0.450520	0.301041	0.016*
H1B	0.616570	0.542448	0.296270	0.016*
C2	0.48116 (19)	0.37213 (18)	0.08897 (18)	0.0128 (5)
H2A	0.490640	0.340303	0.028633	0.015*
H2B	0.427627	0.320959	0.130269	0.015*
C3	0.66953 (18)	0.53329 (18)	0.07806 (18)	0.0114 (5)
H3A	0.731342	0.579620	0.112530	0.014*
H3B	0.686222	0.507770	0.017146	0.014*
C4	0.53229 (19)	0.5242 (2)	−0.01127 (19)	0.0136 (5)
H4A	0.548519	0.492784	−0.067233	0.016*
H4B	0.507300	0.564661	−0.041889	0.016*
C5	0.4345 (2)	0.4943 (2)	0.14521 (19)	0.0149 (5)
H5A	0.406948	0.534767	0.120457	0.018*
H5B	0.385635	0.443460	0.190774	0.018*
N1	0.52210 (16)	0.55474 (17)	0.20140 (16)	0.0134 (4)
N2	0.45315 (15)	0.44554 (16)	0.05507 (16)	0.0120 (4)
H2	0.391704	0.410798	0.014182	0.014*
N3	0.61909 (16)	0.58570 (16)	0.04598 (16)	0.0124 (4)
P1	0.59476 (5)	0.43083 (5)	0.16489 (5)	0.01082 (13)
P2	0.666667	0.333333	0.41562 (8)	0.0119 (2)
Ag1	0.666667	0.333333	0.22792 (2)	0.00986 (8)
C6	0.34261 (19)	0.22240 (19)	0.32803 (19)	0.0118 (5)
O3	0.3890 (2)	0.1866 (2)	0.28981 (18)	0.0361 (6)
O6	0.32156 (19)	0.27601 (18)	0.27414 (18)	0.0295 (5)
O7	0.31591 (19)	0.2064 (2)	0.41785 (18)	0.0316 (5)
C10	0.666667	0.333333	0.8982 (3)	0.0112 (7)
O2	0.60792 (17)	0.36433 (18)	0.89697 (18)	0.0279 (5)

Atomic displacement parameters (Å²)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
C7	0.0127 (12)	0.0189 (13)	0.0139 (11)	0.0068 (11)	0.0001 (9)	0.0023 (10)
C8	0.0170 (13)	0.0140 (12)	0.0176 (12)	0.0096 (11)	−0.0013 (10)	−0.0017 (10)
C9	0.0171 (13)	0.0143 (12)	0.0137 (11)	0.0064 (10)	0.0015 (9)	0.0028 (9)
N6	0.0129 (11)	0.0176 (12)	0.0127 (10)	0.0071 (9)	0.0005 (8)	−0.0002 (9)
C1	0.0140 (12)	0.0174 (13)	0.0110 (10)	0.0096 (10)	−0.0006 (9)	−0.0007 (9)
C2	0.0131 (12)	0.0124 (12)	0.0136 (11)	0.0068 (10)	0.0005 (9)	−0.0007 (9)
C3	0.0092 (11)	0.0126 (11)	0.0136 (10)	0.0063 (10)	0.0004 (9)	0.0023 (9)
C4	0.0151 (12)	0.0156 (12)	0.0113 (10)	0.0086 (10)	0.0003 (9)	0.0011 (10)
C5	0.0145 (12)	0.0190 (13)	0.0144 (11)	0.0108 (11)	−0.0003 (9)	−0.0046 (9)
N1	0.0132 (10)	0.0153 (11)	0.0147 (10)	0.0094 (9)	−0.0015 (8)	−0.0021 (8)
N2	0.0111 (10)	0.0153 (11)	0.0112 (9)	0.0078 (9)	−0.0020 (8)	−0.0031 (8)
N3	0.0152 (10)	0.0109 (10)	0.0132 (9)	0.0081 (9)	0.0004 (8)	0.0013 (8)
P1	0.0116 (3)	0.0115 (3)	0.0113 (3)	0.0072 (3)	0.0004 (2)	0.0008 (2)
P2	0.0129 (3)	0.0129 (3)	0.0098 (4)	0.00647 (16)	0.000	0.000
Ag1	0.00977 (10)	0.00977 (10)	0.01003 (12)	0.00489 (5)	0.000	0.000
C6	0.0129 (11)	0.0140 (11)	0.0131 (10)	0.0102 (9)	0.0013 (8)	−0.0025 (8)
O3	0.0494 (14)	0.0499 (14)	0.0311 (11)	0.0413 (12)	0.0055 (10)	−0.0026 (10)
O6	0.0389 (14)	0.0341 (13)	0.0288 (12)	0.0283 (12)	0.0167 (10)	0.0141 (10)
O7	0.0349 (13)	0.0448 (15)	0.0234 (11)	0.0260 (12)	0.0044 (10)	0.0044 (10)
C10	0.0140 (11)	0.0140 (11)	0.0055 (15)	0.0070 (5)	0.000	0.000
O2	0.0252 (11)	0.0325 (12)	0.0327 (12)	0.0194 (10)	−0.0028 (9)	−0.0079 (9)

Geometric parameters (Å, º)

C7—H7A	0.9900	C3—H3B	0.9900
C7—H7B	0.9900	C3—N3	1.469 (3)
C7—N6	1.470 (3)	C3—P1	1.846 (3)
C7—P2	1.855 (3)	C4—H4A	0.9900
C8—H8A	0.9900	C4—H4B	0.9900
C8—H8B	0.9900	C4—N2	1.521 (3)
C8—N1	1.471 (3)	C4—N3	1.435 (3)
C8—N3	1.472 (3)	C5—H5A	0.9900
C9—H9A	0.9900	C5—H5B	0.9900
C9—H9B	0.9900	C5—N1	1.433 (3)
C9—N6^{i}	1.463 (4)	C5—N2	1.521 (3)
C9—N6	1.468 (4)	N2—H2	1.0000
C1—H1A	0.9900	P1—Ag1	2.4699 (6)
C1—H1B	0.9900	P2—Ag1	2.4683 (11)
C1—N1	1.473 (3)	C6—O3	1.235 (3)
C1—P1	1.849 (3)	C6—O6	1.269 (3)
C2—H2A	0.9900	C6—O7	1.237 (3)
C2—H2B	0.9900	C10—O2^{ii}	1.247 (2)
C2—N2	1.501 (3)	C10—O2	1.247 (2)
C2—P1	1.848 (3)	C10—O2^{i}	1.247 (2)
C3—H3A	0.9900		

H7A—C7—H7B	107.9	N3—C4—N2	111.7 (2)
N6—C7—H7A	109.1	H5A—C5—H5B	107.9
N6—C7—H7B	109.1	N1—C5—H5A	109.3
N6—C7—P2	112.30 (18)	N1—C5—H5B	109.3
P2—C7—H7A	109.1	N1—C5—N2	111.8 (2)
P2—C7—H7B	109.1	N2—C5—H5A	109.3
H8A—C8—H8B	107.8	N2—C5—H5B	109.3
N1—C8—H8A	109.0	C8—N1—C1	111.6 (2)
N1—C8—H8B	109.0	C5—N1—C8	109.9 (2)
N1—C8—N3	112.9 (2)	C5—N1—C1	112.7 (2)
N3—C8—H8A	109.0	C2—N2—C4	111.21 (19)
N3—C8—H8B	109.0	C2—N2—C5	111.54 (19)
H9A—C9—H9B	107.6	C2—N2—H2	108.4
N6—C9—H9A	108.7	C4—N2—C5	108.8 (2)
N6^{i}—C9—H9A	108.7	C4—N2—H2	108.4
N6^{i}—C9—H9B	108.7	C5—N2—H2	108.4
N6—C9—H9B	108.7	C3—N3—C8	111.1 (2)
N6^{i}—C9—N6	114.1 (2)	C4—N3—C8	110.8 (2)
C9^{ii}—N6—C7	111.4 (2)	C4—N3—C3	111.9 (2)
C9—N6—C7	111.4 (2)	C1—P1—Ag1	120.57 (8)
C9^{ii}—N6—C9	108.4 (2)	C2—P1—C1	97.77 (12)
H1A—C1—H1B	107.9	C2—P1—Ag1	120.17 (8)
N1—C1—H1A	109.2	C3—P1—C1	97.89 (12)
N1—C1—H1B	109.2	C3—P1—C2	98.11 (11)
N1—C1—P1	111.95 (16)	C3—P1—Ag1	117.54 (8)
P1—C1—H1A	109.2	C7^{i}—P2—C7	97.50 (11)
P1—C1—H1B	109.2	C7^{i}—P2—C7^{ii}	97.50 (11)
H2A—C2—H2B	108.0	C7^{ii}—P2—C7	97.50 (11)
N2—C2—H2A	109.4	C7^{ii}—P2—Ag1	119.75 (8)
N2—C2—H2B	109.4	C7^{i}—P2—Ag1	119.75 (8)
N2—C2—P1	111.12 (17)	C7—P2—Ag1	119.75 (8)
P1—C2—H2A	109.4	P1^{i}—Ag1—P1	109.333 (15)
P1—C2—H2B	109.4	P1^{ii}—Ag1—P1	109.332 (15)
H3A—C3—H3B	107.8	P1^{ii}—Ag1—P1^{i}	109.337 (15)
N3—C3—H3A	109.1	P2—Ag1—P1^{ii}	109.608 (15)
N3—C3—H3B	109.1	P2—Ag1—P1	109.608 (15)
N3—C3—P1	112.47 (17)	P2—Ag1—P1^{i}	109.608 (15)
P1—C3—H3A	109.1	O3—C6—O6	119.5 (2)
P1—C3—H3B	109.1	O3—C6—O7	121.0 (3)
H4A—C4—H4B	107.9	O7—C6—O6	119.5 (2)
N2—C4—H4A	109.3	O2^{i}—C10—O2	119.982 (11)
N2—C4—H4B	109.3	O2^{i}—C10—O2^{ii}	119.983 (11)
N3—C4—H4A	109.3	O2^{ii}—C10—O2	119.984 (11)
N3—C4—H4B	109.3		

N6—C7—P2—C7^{i}	49.24 (17)	N2—C5—N1—C8	57.1 (3)
N6—C7—P2—C7^{ii}	−49.39 (16)	N2—C5—N1—C1	−68.1 (3)

N6—C7—P2—Ag1	179.93 (15)	N3—C8—N1—C1	68.4 (3)
N6^{i}—C9—N6—C7	67.4 (3)	N3—C8—N1—C5	−57.3 (3)
N6^{i}—C9—N6—C9^{ii}	−55.5 (3)	N3—C3—P1—C1	−49.28 (19)
N1—C8—N3—C3	−68.3 (3)	N3—C3—P1—C2	49.79 (19)
N1—C8—N3—C4	56.7 (3)	N3—C3—P1—Ag1	−179.92 (14)
N1—C1—P1—C2	−50.6 (2)	N3—C4—N2—C2	−68.5 (3)
N1—C1—P1—C3	48.8 (2)	N3—C4—N2—C5	54.7 (3)
N1—C1—P1—Ag1	177.40 (14)	P1—C1—N1—C8	−60.9 (2)
N1—C5—N2—C2	67.2 (3)	P1—C1—N1—C5	63.3 (2)
N1—C5—N2—C4	−55.8 (3)	P1—C2—N2—C4	60.7 (2)
N2—C2—P1—C1	50.14 (19)	P1—C2—N2—C5	−60.9 (2)
N2—C2—P1—C3	−49.03 (18)	P1—C3—N3—C8	61.3 (2)
N2—C2—P1—Ag1	−177.56 (12)	P1—C3—N3—C4	−63.1 (2)
N2—C4—N3—C8	−55.4 (3)	P2—C7—N6—C9^{ii}	60.8 (3)
N2—C4—N3—C3	69.2 (3)	P2—C7—N6—C9	−60.4 (3)

Symmetry codes: (i) −*y*+1, *x*−*y*, *z*; (ii) −*x*+*y*+1, −*x*+1, *z*.

Hydrogen-bond geometry (Å, º)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
N2—H2···O6^{iii}	1.00	1.73	2.731 (3)	176

Symmetry code: (iii) −*x*+*y*+1/3, −*x*+2/3, *z*−1/3.