1 Metallic platinum has the cubic close-packed structure with $a = 3.924$ Å. Explain what is meant by a *lattice* and state the lattice type of Pt. Determine the metallic radius of Pt. Draw a plan on (001) of a 2 × 2 block of unit-cells of the Pt structure and mark in the rotation tetrads parallel to [001] and the mirror planes parallel to [001]. Indicate on your plan the tetrahedral interstices in the Pt structure and state their coordinates.

The mineral *cooperite*, of composition PtS, has tetragonal symmetry with $a = 3.47$ Å, $c = 6.10$ Å. The coordinates of the atoms in this unit-cell have been determined as Pt: $0\,\frac{1}{2}\,0$; $\frac{1}{2}\,0\,\frac{1}{2}$ and S: $0\,0\,\frac{1}{4}$; $0\,0\,\frac{3}{4}$. Draw a plan on (001) of a 2 × 2 block of unit-cells of the cooperite structure and mark in the rotation axes parallel to [001] and the mirror planes parallel to [001]. Describe the coordination of Pt about S and of S about Pt and evaluate the Pt–S distance.

Show how the structure of cooperite can be regarded as a distorted ccp arrangement of Pt atoms with S in selected tetrahedral interstices. Given that the covalent radius of sulphur in 4-fold coordination is 1.02 Å, that the covalent radius of Pt in 4-fold coordination is 1.29 Å, and that in ionic compounds the radius of S^{2-} is 1.82 Å and of Pt^{2+} is 0.60 Å, comment on the Pt–S bonding in cooperite.