

**HL** Paper 3 Section A Data Response (9)



Cis-platin,  $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$ , is used to treat a variety of cancers including testicular and ovarian cancer. The compound was discovered in 1845. It is manufactured from potassium tetrachloroplatinate,  $\text{K}_2\text{PtCl}_4$ . The process goes through several stages to give an overall yield of cis-platin of 63%.

- (a) Calculate the mass of potassium tetrachloroplatinate required to produce 100.0 g of cis-platin. **[2]**
- (b) Cis-platin contains four monodentate ligands.
- (i) Deduce the oxidation state of platinum in cis-platin. **[1]**
- (ii) State the meaning of the term *monodentate ligand* with reference to cis-platin. **[2]**
- (iii) Show how the name cis-platin leads to the deduction that the shape of the compound is square planar. **[1]**
- (c) The pharmaceutical properties of cis-platin were only discovered accidentally in 1965 when scientists at Michigan State University were investigating the effect of electric fields on bacteria cell division. They realised that when a platinum electrode was used a compound was formed (later shown to be cis-platin) that stopped the bacteria dividing.
- State the single word used to describe a chance happening that leads to a discovery. **[1]**

- (d) Cis-platin has no overall charge so it can diffuse through the membrane of cancer cells. Once inside the cell it exchanges a chloride ion for a water molecule to form a new square planar species. This new species can enter the cell nucleus where it exchanges another chloride ion and also the water molecule so that it can bind to the nitrogen atoms on two different guanine molecules in the cell's DNA. This alters the cancer cell's DNA and prevents it from reproducing.
- (i) Deduce the formula of the new square planar species formed when one of the chloride ions on cis-platin is exchanged for a water molecule. **[1]**
- (ii) Suggest one reason why trans-platin is ineffective as a treatment against cancer. **[1]**