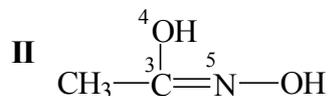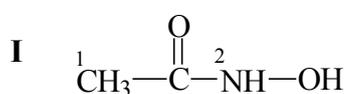**Marks**
7

- Siderophores (from the Greek meaning 'iron carriers') are organic molecules produced by microorganisms to provide essential Fe^{3+} required for growth. The functional group (the group which binds Fe^{3+}) of siderophores is shown below as tautomers **I** and **II**. Complete the table below, relating to the molecular geometry about the specified atoms in **I** and **II**.

$$\textbf{I} \quad CH_3 \overset{1}{-} \overset{\overset{\textstyle O}{\|}}{C} \overset{2}{-} NH - OH \qquad\qquad \textbf{II} \quad CH_3 \overset{3}{-} \overset{\overset{\textstyle ^4OH}{|}}{C} = \overset{5}{N} - OH$$

Atom	Geometric arrangement of the electron pairs around the atom	Hybridisation of atom	Geometry of bonding electron pairs around atom
^1C	**tetrahedral**	$\mathbf{sp^3}$	**tetrahedral**
^2N	**tetrahedral**	$\mathbf{sp^3}$	**trigonal pyramidal**
^3C	**trigonal planar**	$\mathbf{sp^2}$	**trigonal planar**
^4O	**tetrahedral**	$\mathbf{sp^3}$	**bent**
^5N	**trigonal planar**	$\mathbf{sp^2}$	**bent**

Desferal is a siderophore-based drug that is used in humans to treat iron-overload. One molecule of Desferal (molecular formula: $C_{25}H_{48}O_8N_6$) can bind one Fe^{3+} ion. A patient with iron-overload had an excess of 0.637 mM Fe^{3+} in his bloodstream. Assuming the patient has a total blood volume of 5.04 L, what mass of Desferal would be required to complex all of the excess Fe^{3+}?

In 5.04 L, the number of moles of Fe^{3+} is given by the concentration × volume:

moles of Fe^{3+} = (0.637 × 10^{-3} mol L^{-1}) × (5.04 L) = 3.2105 × 10^{-3} mol

As each desferal molecule binds one Fe^{3+}, this is also the number of moles of desferal that is required. The molar mass of desferal is:

molar mass = (25×12.01 (C) + 48×1.008 (H) + 8×16.00 (O) + 6×14.01 (N)) g mol^{-1}

= 560.964 g mol^{-1}

The mass of desferal required is then the number of moles × molar mass:

mass of desferal = (3.2105 × 10^{-3} mol) × (560.964 g mol^{-1}) = 1.80 g

ANSWER: **1.80 g**