Answers to Problem Sheet 5

1. Mark each stereogenic centre in the following compounds with an asterisk (*).

   ![4-chlorocyclopent-1-ene](image)
   No stereogenic centre - ring is symmetrical about substituted carbon

   ![Cl H](image)
   (R)-3-chlorocyclopent-1-ene
   One stereogenic centre - ring is unsymmetrical about substituted carbon

   ![OH](image)
   2-isopropyl-5-methylcyclohexanol
   Three stereogenic centres – each has a hydrogen and three different groups around it. These hydrogens are not drawn in the stick representation.

2. (a) 2,4-pentanediol

   Two chiral centres would seem to give $2 \times 2$ combinations. However, only three isomers are possible.

   The $(2R, 4R)$ and $(2S, 4S)$ forms pictured below are enantiomers of each other.
The third combination of chiral centres gives a form which is superimposable on the fourth combination, its mirror image. This is called the \textit{meso} isomer which possesses a plane of symmetry through the centre of the molecule.

\begin{center}
\begin{tikzpicture}
\node at (0,0) {\includegraphics[width=0.4\textwidth]{pentane_24_diol.png}};
\node at (2,0) {\includegraphics[width=0.4\textwidth]{pentane_24_diol.png}};
\end{tikzpicture}
\end{center}

\textit{meso}-pentane-2,4-diol

(b) 2,3,4-pentanetriol

Two chiral centres would seem to give $2 \times 2 \times 2$ combinations. However, only 4 isomers are possible.

The (2\textit{R}, 4\textit{R}) and (2\textit{S}, 4\textit{S}) forms pictured below are enantiomers of each other:

\begin{center}
\begin{tikzpicture}
\node at (0,0) {\includegraphics[width=0.4\textwidth]{pentane_234_triol.png}};
\node at (2,0) {\includegraphics[width=0.4\textwidth]{pentane_234_triol.png}};
\end{tikzpicture}
\end{center}

\textit{(2R,4R)}-pentane-2,3,4-triol \hspace{1cm} \textit{(2S,4S)}-pentane-2,3,4-triol

There are also two \textit{meso} forms:
Any other form that is drawn down is actually identical to one of these.
4. 

\[(3R,5Z)-2\text{-methylcyclooct-5-en-3-ol}\]

anticlockwise - (S)

clockwise - (R)

higher priority group on the same side - (Z)

5.

(a) \[\text{Reaction proceeds via NH}_2^- \text{ ion removing H}^+ \text{ from } -\text{OH group so chiral centre is not affected.}\]