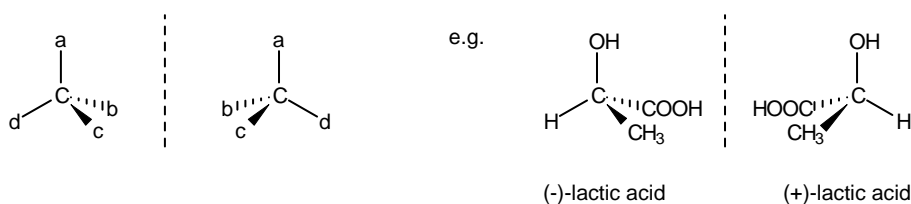




## b) Optical isomerism

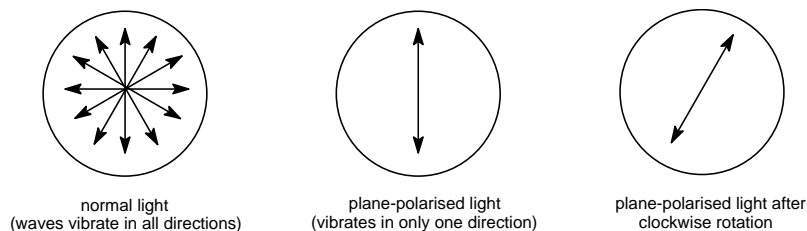
- All molecules have a mirror image but often the mirror image is the same molecule. However, sometimes the mirror image is a different molecule. Molecules have optical isomers if their mirror images are non-superimposable.
- Molecules containing a C with four different groups attached to it exhibit optical isomerism. A carbon atom that has four different groups attached is called a **chiral** (asymmetric) carbon atom.



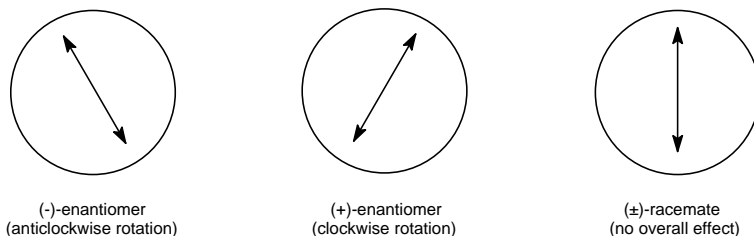
**TASK 2** Decide which of the following alkenes exhibit geometric isomerism. For those that do, sketch the two stereoisomers to show the isomerism clearly.

propan-2-ol	2-chlorobutane	1-chlorobutane	3-methylhexane
butanone	2-methylbutanoic acid	butan-2-ol	1-chloro-3-methylpentane

- Two compounds that are optical isomers of each other are called **enantiomers**.
- A mixture containing a 50/50 mixture of the two isomers (enantiomers) is described as being a **racemate** or **racemic mixture**.
- Many naturally occurring molecules contain chiral C atoms, but are usually found in nature as a pure enantiomer.
- Optical isomers have the same chemical and physical properties as each other, except for their effect on plane polarised light.
- Light is a form of electromagnetic radiation and so consists of waves that vibrate in many directions perpendicular to the direction of travel. Some substances have the ability to remove from normal light all the light waves except those vibrating in a single plane - producing plane-polarised light (in the diagrams below, the arrows show the plane in which the light waves are vibrating, with the light waves coming out of the plane of the paper).



- Optical isomers can rotate the plane of polarised light (and so these compounds are said to be **optically active**).
- One enantiomer rotates it in one direction and the other enantiomer rotates it by **the same amount in the opposite direction**.
- Different systems of nomenclature exist for optical isomers. D/L or +/- are commonly used, but both have been superseded by the more useful and informative R/S system.
- A racemate will have no effect on the plane of the light - it is optically inactive (each enantiomer cancels out the effect of the other).



- Many naturally occurring compounds contain chiral C atoms and occur as one pure enantiomer only.
- Many drugs contain chiral C atoms and occur as enantiomers. Often, only one of the enantiomers has the desired effect (in the same way a left hand only fits a left handed glove). With some drugs, the opposite enantiomer can have an unwanted effect and so the drug must be produced as one enantiomer only.