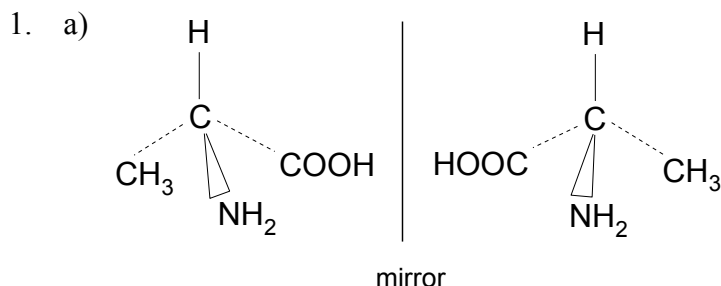


## Chemguide – answers

### OPTICAL ISOMERISM

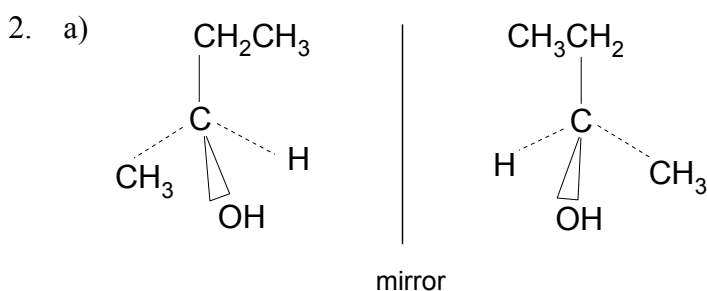


(It doesn't matter where you put the various groups in the first isomer, but the COOH group *must* be attached to the central carbon atom via the C and *not* the H. The second isomer should be a reflection of the first in the mirror. You don't have to reflect the structures of the various groups, unless it is necessary to make them join up properly (as in the case of the COOH group). This applies to all the other similar isomers you may draw on this page.)

The second isomer is a mirror image of the first. If you removed the image from the mirror, however much you rotated it, you would never be able to get it to align exactly with the structure on the left. The mirror images are therefore non-superimposable – they can't be superimposed on each other.

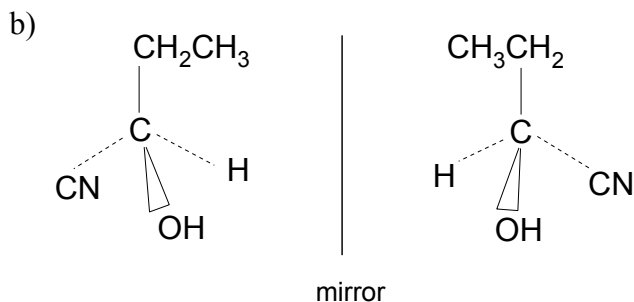
b) A chiral molecule is one that has no plane of symmetry. An asymmetric carbon atom is one which has four different groups attached.

c) It is a 50/50 mixture of the two enantiomers (optical isomers). One of these is rotating the plane of polarisation anti-clockwise, and the other is rotating it by exactly the same amount clockwise. They cancel each other out, so there is no overall effect on the light.



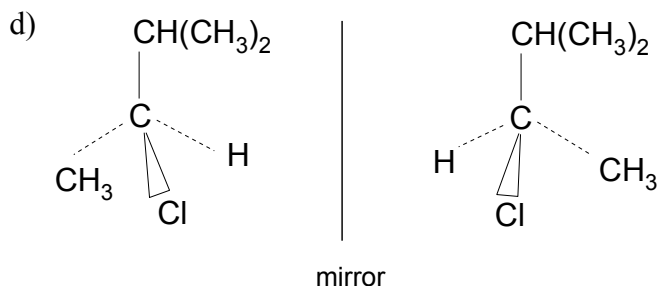
(Again, it doesn't matter which group you put where when you draw the first structure. It is actually slightly easier to write bigger groups at the top. You don't need to reverse the top group unless you want to, but you *mustn't* make the mistake of joining it to the central carbon via the CH<sub>3</sub> group.)

## Chemguide – answers



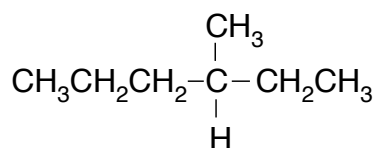
(You may well have the various groups in different positions around the central carbon. I have done it this way simply because it was easier to modify my previous diagram rather than drawing an entirely new one!)

c) There is no asymmetric carbon atom in this (one with four different groups attached, and so it doesn't have optical isomers.

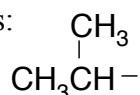


(You may feel that it is cheating to condense the top group in this way, but actually it isn't very interesting in the context of the question. I would be very surprised if you didn't get the marks in an exam by writing it this way. But if you want to be safe, draw all the bonds to the two CH<sub>3</sub> groups. Again, it doesn't matter what order you have arranged the groups in around the central carbon, as long as long as the two isomers are accurate mirror images of each other.)

3. You need a carbon atom with four different groups attached. Keep these as small as possible by having: a H atom, a CH<sub>3</sub> group, a CH<sub>3</sub>CH<sub>2</sub> group and a CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub> group:



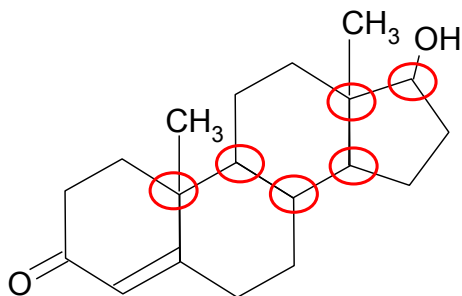
(You would normally draw the longest chain horizontally, but it doesn't matter. You just need these four groups around the central carbon. You could equally well have drawn a variation on the left-hand group here as:



Well done if you got this right!)

## Chemguide – answers

4.



You can ignore any carbon with a double bond. A carbon has to be joined to four different things in order to be asymmetric.

You can also ignore any carbon with only two skeletal bonds going away from it. Such carbons will have two hydrogens attached to make up the necessary total number of bonds, and so can't be joined to four *different* things.

All of the other carbon atoms in the molecule are asymmetric. Looked at most simply, not one of those carbon atoms has a plane of symmetry passing through it – you can't draw any plane through these carbons where one side is a simple reflection of the other. If you aren't happy about this, read the last bit of the Chemguide page again.

If you find this a major problem, check your past exam papers to see whether such questions get asked. If they don't, there isn't much point in worrying about it.

On the other hand, if you got this completely right, feel very pleased with yourself!