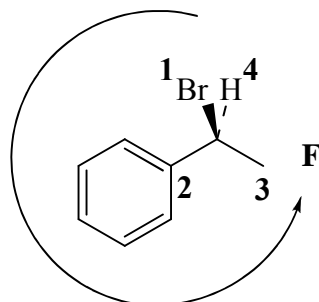


**Marks**  
**8**

- Consider compound **F** shown below.

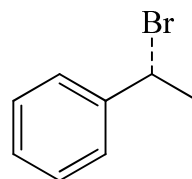


Assign the stereocentre in compound **F** as (*R*) or (*S*), explaining your reasoning.

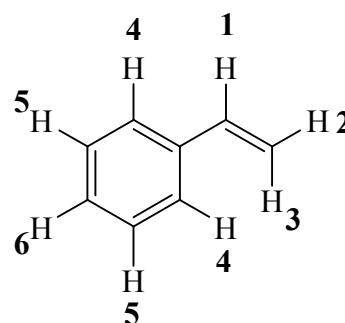
The priority of the groups around the stereocentre in **F** is shown above. Br has the highest atomic number and has the highest priority. H has the lowest atomic number and has the lowest priority. It is placed at the back. The other two groups both have carbon bonded to the stereocentre but the group on the left has a higher priority as it has C atoms attached whereas the group on the right has H atoms attached.

With the H atom at the back, the groups are arranged anti-clockwise and so the stereocentre is assigned as (*S*).

Draw the enantiomer of compound **F**.



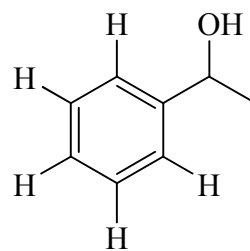
When compound **F** is reacted with hot KOH solution, a product (**G**) is formed that shows three peaks in the  $^1\text{H}$  NMR spectrum in the region 7-8 ppm and three peaks in the region 5-6 ppm. Draw the structure of this product.



The signals due to H atoms 1, 2 and 3 are all different and occur in the region 5-6 ppm. The signals due to the aromatic H atoms appear in the 7-8 ppm region and are due to the groups 4, 5 and 6.

ANSWER CONTINUES ON THE PAGE

When **G** is reacted with dilute sulfuric acid, a further product, **H**, is formed. **H** has a peak at  $3300\text{ cm}^{-1}$  in its IR spectrum. Draw the structure of product **H**.

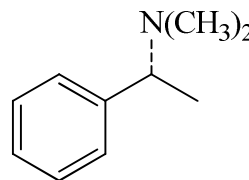


**Markovnikov addition of H-OH across double bond, with OH adding to more substituted end of double bond. IR peak at  $3300\text{ cm}^{-1}$  is due to O-H stretch.**

Is **H** formed as a single enantiomer, as a racemate, or is **H** achiral?

**The alcohol C is stereocentre but the addition reaction generates equal amounts of both enantiomers: a racemic mixture is formed.**

Assuming an  $S_N2$  mechanism, draw the product of the substitution reaction between **F** and  $(\text{CH}_3)_2\text{NH}$ , indicating stereochemistry where appropriate.



**The  $S_N2$  reaction involves attack from the back, leading to inversion of the stereochemistry.**